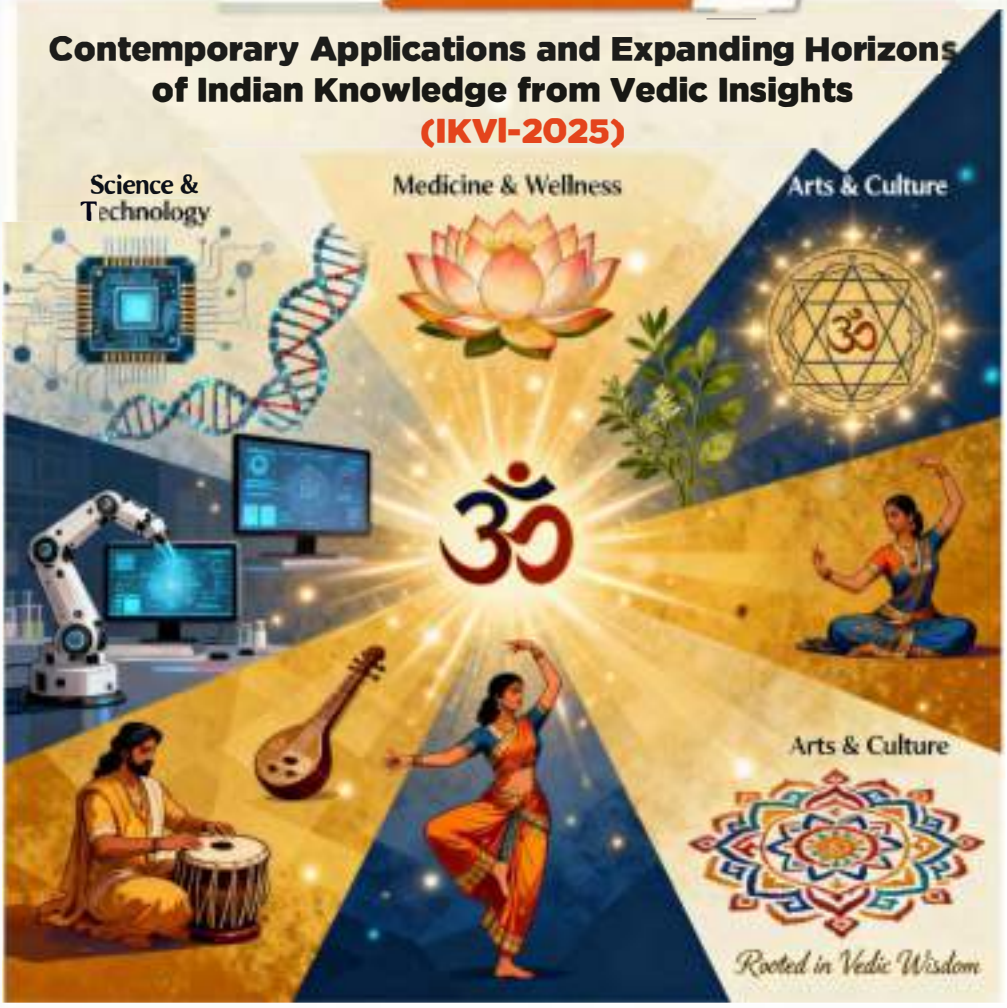
SHOBHIT DEEMED TO BE UNIVERSITY
Shobhit Institute of Engineering & Technology
NAAC A

Proceedings of

Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025)



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सत्यमेव जयते





Shobhit Kumar
Chairman

MESSAGE

It's a pleasure to know that **IKVI-2025** has emerged as a vibrant meeting ground for thinkers, seekers, and scientists committed to rediscovering the eternal spirit of Indian Knowledge.

At **Shobhit University**, our vision has always been to nurture minds that seek truth, create knowledge that serves humanity, and build a future rooted in wisdom, compassion, and innovation. Education, in its highest form, is not merely the transmission of information but the awakening of consciousness, a journey from knowing to understanding, and from understanding to realization.

In a world often driven by speed and competition, the rediscovery of India's knowledge traditions reminds us that true progress must harmonize material advancement with spiritual depth. **IKVI-2025** embodies this idea that learning becomes meaningful only when it elevates both intellect and insight.

May this gathering inspire all participants to become torchbearers of knowledge that enlightens, empowers, and unites.

With warm blessings and best wishes for the success of this noble initiative.

Shobhit Kumar
Dr. Shobhit Kumar



Kunwar Shekhar Vijendra
Chancellor

Message

It fills me with joy to convey my greetings to all scholars, scientists, and seekers gathered for **IKVI-2025** at **Shobhit Institute of Engineering & Technology, Meerut**.

This conference, exploring *Contemporary Applications and the Expanding Horizons of Indian Knowledge from Vedic Insights*, reaffirms the timeless truth that **Bharat has always been a knowledge civilization** - where wisdom was not borrowed, but born from the depths of consciousness.

The Hon'ble Prime Minister's vision of **NEP 2020** calls for reviving this spirit - blending ancient insights with modern innovation, and nurturing learners who think globally yet remain rooted in dharmic values.

At **Shobhit University**, we are striving to translate this vision into practice - from **Rudraksha research** to **Ayurveda, Yoga, and Naturopathy**, from the exploration of **Vedic Mathematics** to initiatives in **tribal agriculture and sustainable living**. Each of these efforts reflects our belief that Indian Knowledge is not confined to the past; it is a living force shaping a conscious and compassionate future.

Indian Knowledge Systems are not remnants of history; they are **living streams of awareness** that continue to inspire science, wellness, and social harmony across the world. From the rhythm of the Vedas to the logic of Nyaya and the compassion of Ayurveda, India's wisdom has always sought balance between matter and spirit.

The parallel **Swadeshi Mela** beautifully echoes this idea that true self-reliance is not merely economic, but cultural and intellectual.

I congratulate the organizers and participants for shaping IKVI-2025 into a confluence of wisdom and action. May it awaken in every mind the courage to think originally, live consciously, and serve selflessly as envisioned in the journey of **Viksit Bharat @ 2047**

With good wishes,

Kunwar Shekhar Vijendra

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प्रो० के० के० पंत
निदेशक
Prof. K. K. Pant
Director



MESSAGE

It gives me immense pleasure to extend my heartfelt greetings and best wishes to the organizers and participants of the National Conference on 'Contemporary Applications and the Expanding Horizons of Indian Knowledge from Vedic Insights' (IKVI-2025) organized by Shobhit Institute of Engineering and Technology (Deemed to be University), Meerut. The theme of this event resonates deeply with India's ongoing educational and cultural renaissance, emphasizing the integration of our ancient wisdom with the demands of modern science and technology.

The Indian Knowledge System (IKS) is not merely a collection of past achievements but a living tradition of inquiry, innovation, and interconnectedness. Rooted in centuries of scientific, philosophical, and artistic exploration, it encompasses a holistic vision that unites intellect with ethics, and progress with purpose. In today's rapidly evolving world, where technology often races ahead of values, the rediscovery of our civilizational knowledge provides a guiding light for sustainable and humane development.

As an academician and technologist, I firmly believe that the future of innovation lies in interdisciplinary thinking — where ancient principles inspire new discoveries, and modern tools refine age-old practices.

I commend the organizing committee, faculty members, and students for their vision and dedication in conceptualizing this meaningful event. I extend my warmest wishes for the grand success of the conference.

May this initiative continue to inspire hope, creativity, and collaboration — guiding us toward a future where India's timeless wisdom shapes global innovation and sustainable progress.

(K K Pant)

भाकृअनुप-भारतीय पशु-चिकित्सा अनुसंधान संस्थान
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डॉ त्रिवेणी दत्त
निदेशक
Dr Triveni Dutt
Director

MESSAGE

The Vedic civilization of India has long been recognized as a cradle of holistic wisdom, where knowledge encompassed every aspect of life—including the welfare of animals. Rooted in compassion and harmony with nature, Vedic insights emphasized the interconnectedness of all living beings, encapsulated in the ideal of *Sarve Bhavantu Sukhinah* "May all beings be happy." This profound vision laid the foundation for early veterinary science, where animal health, ethics, and sustainable coexistence were integral to human progress.

Texts such as the *Ashva Ayurveda*, *Gaja Shastra*, and *Pashu Tantra* reflect an advanced understanding of animal physiology, medicine, and behavior. Ancient scholars like Shalihotra—revered as the father of veterinary science—developed detailed treatises on equine and bovine health that resonate with modern veterinary principles. Their approach combined empirical observation with a deep sense of respect for animal life, offering a model for sustainable and ethical veterinary practice today. In contemporary times, these Vedic insights are finding renewed relevance. The principles of Ayurveda are being explored for developing herbal veterinary formulations, natural disease management, and eco-friendly livestock care. Concepts of preventive medicine, dietetics, and environmental balance from ancient Indian texts are aligning with modern approaches to animal welfare, zoonotic disease control, and One Health initiatives that link human, animal, and ecosystem health.

As we expand the horizons of Indian knowledge, integrating Vedic wisdom with modern veterinary science, we create pathways toward compassionate innovation—where traditional insight and scientific inquiry together ensure the well-being of all species. The rediscovery of this ancient wisdom invites us to embrace a holistic vision of veterinary care that not only heals but also harmonizes life in all its forms.

It gives me immense pleasure to know that Shobhit Institute of Engineering & Technology (Deemed to-be University), Meerut, U.P. is organizing a National Conference on *Indian Knowledge Systems* entitled "Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights" (IKVI-2025) on 14-15 November 2025

I am convinced that this conference will lead to pioneer ideas and approaches to solve the impending problems in the horizons of Indian knowledge, integrating Vedic wisdom.

I congratulate the organizers of the conference and wish the **IKVI - 2025**, a grand success.

[Triveni Dutt]

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क्रमांक: V.C.O/142/05/2025-026

दिनांक: 06.11.2025

Message

It gives me immense pleasure to convey my heartfelt best wishes to the organizers, participants, and delegates of the **ICSSR & ANRF-Sponsored National Conference on "Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights"** being organized by **Shobhit Institute of Engineering & Technology (Deemed-to-be University), Meerut** on **14–15 November 2025**.

The theme of this conference is highly relevant in the present era, as it focuses on rediscovering and integrating the timeless wisdom of our Indian Knowledge Systems (IKS) with contemporary research and innovation. The vision of reviving Vedic insights in light of the **National Education Policy (NEP) 2020** is indeed commendable and essential for nurturing holistic education rooted in our cultural ethos.

I am confident that this academic congregation will serve as a vibrant platform for scholars, researchers, and academicians to engage in meaningful deliberations and share valuable perspectives that will enrich the academic and intellectual landscape of our nation.

I extend my best wishes for the grand success of this conference and pray that it may inspire all participants to continue contributing to the growth of knowledge, harmony, and wisdom for the benefit of society.

With warm regards and best wishes,

(Prof.Vimala Y.)
Vice Chancellor

Prof. V. K. Tyagi
(Vice Chancellor)
Shobhit Institute of Engineering & Technology
(Deemed to-be University), Meerut, U.P.

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I am delighted to learn that Shobhit Institute of Engineering and Technology (Deemed to-be University), Meerut is organizing a National Conference on "Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights." This is indeed a commendable initiative that seeks to revive and reinterpret the profound intellectual and spiritual heritage of our nation within the context of modern academic inquiry.

The Indian Knowledge System is a treasure house of timeless wisdom, encompassing science, philosophy, ethics, art, and ecology. In an era driven by rapid technological transformation, it is essential that our education and research remain anchored in such foundational principles that promote both innovation and integrity. By providing a platform for scholars, researchers, and practitioners to exchange ideas and explore new dimensions of Vedic thought, this conference is contributing meaningfully to the national discourse on integrating tradition with modernity. It also reaffirms the vital role of universities as custodians of culture and catalysts of intellectual growth. I am confident that the deliberations during the conference will open new avenues for interdisciplinary research and inspire educators to incorporate the essence of Indian Knowledge Systems into contemporary curricula. The collective reflections emerging from this forum will undoubtedly enrich our understanding of India's intellectual legacy and its relevance to global challenges.

I congratulate the organizing committee for their vision, dedication, and scholarly spirit in conceptualizing this significant event. I extend my warm wishes for the success of the conference and for the continued academic excellence of Shobhit Institute of Engineering and Technology (Deemed to-be University), Meerut

May this initiative continue to illuminate the path of knowledge, harmony, and holistic progress.

Prof.(Dr.) Ranjit Singh
(Vice Chancellor)
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Message from the Vice Chancellor
Shobhit Institute of Engineering & Technology (Deemed-to-be University)

The journey of knowledge is not confined to time — it is a continuum of ideas, reflections, and realizations that transcend generations. The National Conference on "Contemporary Applications and the Expanding Horizons of Indian Knowledge from Vedic Insights" scheduled during November 14-15, 2025 at Shobhit Institute of Engineering & Technology (Deemed to-be University) Meerut, U.P. India, is a meaningful endeavor to revisit this continuum and to interpret it in the light of present and future challenges.

In an age characterized by technological acceleration and information abundance, the rediscovery of such timeless insights is vital. Integrating these principles into our education, research, and innovation ecosystems enables us to build a knowledge society grounded in values, inclusivity, and wisdom. The conference theme, focusing on contemporary applications of Vedic insights, beautifully captures this vision of synthesis — where tradition does not resist change but enriches it.

Universities today bear a profound responsibility: to nurture minds that are not only competent but also conscious, not only skilled but also sensitive to the ethical and cultural dimensions of knowledge. I believe that forums like this conference encourage reflection, dialogue, and collaboration — essential elements for academic excellence and nation-building alike.

I deeply appreciate the initiative of the organizers, faculty, and scholars who have come together to make this event possible. May the deliberations of this conference inspire participants to explore new dimensions of research, teaching, and innovation through the lens of India's timeless wisdom.

Let this platform serve as a reminder that education, when rooted in heritage and directed toward humanity, becomes the highest form of service to society.

My best wishes for the grand success of the event

V.K. Tyagi

Prof. (Dr.) V.K. Tyagi
(Vice Chancellor)
Shobhit Institute of Engineering & Technology
(NAAC 'A' Grade Accredited Deemed-to-be University)
Meerut, U.P. (INDIA)

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MESSAGE FROM PRO VICE CHANCELLOR

It gives me immense pleasure to extend my warm greetings to all the distinguished delegates, academicians, and researchers participating in the **National Conference on "Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025)"**, organized by **Shobhit Institute of Engineering & Technology (Deemed to-be-University), Meerut**.

The National Conference on *"Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025)"* encompasses diverse research themes including **Applied Science & Technology**, **Education & Pedagogy**, **Management & Leadership**, **Law & Governance**, **Yoga & Meditation**, **Ayurveda & Holistic Health**, and **Environment & Sustainable Development**, along with other interdisciplinary domains. These themes collectively aim to explore the integration of ancient Indian wisdom with modern scientific, educational, and socio-economic frameworks, emphasizing sustainable development, holistic health, ethical governance, and human values inspired by India's timeless knowledge traditions.

The deliberations of IKVI-2025 promise to inspire a deeper understanding of how ancient Indian wisdom can harmoniously integrate with contemporary knowledge systems. By bridging the past with the future, such endeavors not only preserve our civilizational ethos but also contribute to realizing the vision of the **National Education Policy (NEP) 2020**, which emphasizes the inclusion of IKS as a cornerstone for a self-reliant and globally competent India.

I convey my heartfelt congratulations to the organizing team for their commendable efforts and extend my best wishes for the grand success of IKVI-2025. May the souvenir of this conference inspire every participant to contribute meaningfully toward the rediscovery and application of Vedic insights for the betterment of humanity.

Prof. (Dr.) Jayanand
Pro-Vice Chancellor & Co-Chairman, IKVI-2025
Shobhit Institute of Engineering & Technology (Deemed to-be-University),
Meerut (U.P.), India

MESSAGE FROM THE CONVENERS

It is a great pleasure to welcome all of you to this National Conference on Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights organized by Shobhit Institute of Engineering & Technology (Deemed to be University) Meerut which is supported by Indian Council of Social Science Research (ICSSR) and Anusandhan National Research Foundation (ANRF). This conference aims to create an intellectual platform for scholars, academicians, practitioners, and students to explore the vast potential of ancient Indian wisdom and its relevance in addressing the contemporary challenges of our times. India's Vedic knowledge system is a timeless repository of science, philosophy, medicine, mathematics, and spirituality. This is an opportunity to revisit and reinterpret such ancient insights in the light of modern science and technology for sustainable and holistic solutions in the modern world. The main purpose of the conference is to bring together experts and researchers from various fields to deliberate on how the Vedic principles can be applied in today's evolving areas like health and well-being, environmental sustainability, management, governance, education, and innovation.

This is an academic congregation supported by eminent scholars and research enthusiasts for the cause of collaboration and dialogue among its members and the pursuit of interdisciplinary research with roots in Indian knowledge systems. The sessions shall aim at rediscovery, re-evaluation of the presently existing body of traditional wisdom, formulation of new frameworks that conform to contemporary scientific understanding, and adjustment according to India's cultural ethos.

We feel highly obliged to all the distinguished guests, speakers, and participants who have joined this initiative. We would like to extend our heartfelt thanks to the management of Shobhit Institute of Engineering & Technology for continuous guidance and support in organizing this national conference. We also deeply appreciate the efforts of the members of the Organizing Committee for their tireless work and dedication to the success of this event.

We sincerely hope that this conference will inspire new perspectives, encourage meaningful research, and strengthen our collective understanding of how the profound insights from the Vedic era can illuminate the path toward a balanced and progressive future.

Dr. Neha Tyagi

Dr. Shail Dhaka

Message from Co-conveners

It is our privilege to welcome all participants to the National Conference IKVI 2025 at Shobhit institute of Engineering and Technology (Deemed to be University), Meerut, a landmark event that bridges ancient wisdom with modern technological innovation. This year's conference is designed to foster interdisciplinary dialogue, bringing together scholars, researchers, and practitioners from diverse fields to explore the contemporary applications of Indian knowledge systems, especially those rooted in Vedic insights. The event will feature a robust technical program, including sessions on artificial intelligence, engineering, sustainable development, governance, and holistic approaches to science and technology. These tracks are curated to encourage critical thinking and the exchange of cutting-edge research, with a special emphasis on how traditional knowledge can inform and enrich modern scientific and technological advancements.

Complementing the academic rigor is the vibrant Swadeshi Mela, a celebration of indigenous craftsmanship and self-reliance highlighting the region's rich heritage and creative spirit. The Swadeshi Mela serves as a platform for networking, collaboration, and the promotion of sustainable livelihoods.

Participants have the opportunity to engage with a diverse range of themes, including the integration of Vedic principles in AI and machine learning, sustainable engineering solutions, ethical governance, and the application of traditional wellness practices in modern healthcare. The conference also features technical workshops, panel discussions, and poster presentations, providing a dynamic environment for knowledge sharing and innovation. Shobhit University's commitment to interdisciplinary research and practical learning is reflected in the conference's structure, which encourages collaboration across disciplines and sectors.

We extend our heartfelt gratitude to all contributors, organizing members, and supporting institutions whose dedication has made IKVI 2025 possible. We look forward to an enriching and memorable event that inspires new ideas, fosters collaboration, and celebrates the enduring relevance of Indian knowledge traditions.

Dr. Jayanta Kumar Mahato

Dr. Aniket Kumar

Message from the Organizing Secretary

It is with great honor and immense pleasure that I welcome all esteemed scholars, academicians, researchers, industry experts, and participants to the National Conference on Contemporary Applications and the Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025), hosted by Shobhit Institute of Engineering & Technology, Meerut, a NAAC 'A' Grade accredited deemed-to-be university.

The central theme of this conference reflects our collective pursuit of bridging the timeless knowledge contained within ancient Vedic scriptures with the dynamic demands of the modern world. Indian Knowledge Systems (IKS) are rooted in profound philosophical, scientific, technological, and cultural insights that have shaped civilizations for thousands of years. Today, as the global community seeks sustainable, ethical, and holistic solutions, revisiting this heritage becomes not only relevant but necessary.

This Abstract Book is a testament to the intellectual curiosity, diverse research interests, and scholarly commitment of contributors across disciplines. The abstracts showcased here represent explorations in fields such as Vedic mathematics, Ayurveda, linguistics, environmental studies, psychology, computing, management, architecture, philosophy, and emerging interdisciplinary domains. Together, they highlight how ancient wisdom can complement contemporary scientific frameworks, inspire innovation, and contribute meaningfully to national development.

We deeply value the efforts of all authors who have enriched this conference with their research. Their contributions reflect the spirit of inquiry, originality, and academic rigor. I would also like to extend heartfelt appreciation to our publication partner, review committee, session chairs, and subject experts whose careful evaluation and constructive feedback have helped in maintaining the quality of academic content in this compilation.

Our sincere gratitude goes to the Indian Council of Social Science Research (ICSSR) and all supporting bodies for their guidance and encouragement. The visionary leadership of our Hon'ble Chancellor, Vice-Chancellor, and institutional advisory teams has been instrumental in conceptualizing and executing this scholarly platform. The enthusiastic involvement of faculty members, student volunteers, and administrative staff is also highly commendable.

Conferences such as IKVI-2025 play a pivotal role in fostering dialogue, encouraging research collaborations, and offering young scholars a platform to engage with experienced academicians. We are confident that the ideas shared and connections formed during this event will lead to further publications, projects, and innovations.

As you explore the abstracts compiled in this volume, I encourage you to approach them with curiosity and an open mind. May they inspire thoughtful debate, interdisciplinary research, and a deeper appreciation of India's intellectual legacy.

We hope this conference experience proves academically enriching, professionally rewarding, and personally memorable for each one of you.

Dr. Surbhi Saroha

Dr. Shiva Sharma

ABOUT THE UNIVERSITY

Shobhit Institute of Engineering & Technology (popularly known as Shobhit University), a NAAC 'A' Grade accredited Deemed-to-be University, is located in Meerut and established under Section 3 of the UGC Act, 1956. As a research-intensive and multi-disciplinary institution, it fosters high-quality education and innovative research in a globally competitive environment. With over 50.000 alumni excelling across industries, including Fortune 500 companies, the university has
nurtured engineers, managers, researchers, and entrepreneurs of global repute.

Aligned with the national vision of "Viksit Bharat" under the leadership of Hon'ble Prime Minister Shri Narendra Modi Ji, Shobhit University is dedicated to empowering communities through education, innovation, and skill development. By shaping changemakers, it contributes to India's mission of becoming a developed nation by 2047, embodying a vision of self-reliance and excellence.

Legacy of Excellence
With over 100 years of educational heritage in Gangoh and established as a deemed-to-be university in 2006, Shobhit University embodies a rich tradition of academic and cultural excellence.

Innovative Academic Programs
The University offers a wide array of industry-oriented programs, including specialized fields like Industry Oriented Business Studies, Legal Studies, Biomedical Engineering, Agri-Tech, and Emerging Technologies like AI, ML, and Cloud Computing.

Cutting-Edge Research and Innovation
Recognized for its contributions to research, the University actively works on Sustainable Development Goals (SDGs) and innovations addressing real-world challenges.

Global Alumni Network
Shobhit University alumni are working globally across industries, embodying the institution's vision of producing leaders and changemakers.

State-of-the-Art Infrastructure
Modern facilities, including smart classrooms, high-tech laboratories, a digital library, and green campuses, provide an ideal environment for learning and innovation.

Student-Centric Excellence
Shobhit University fosters holistic development through mentorship, personalized career counseling, and 20+ vibrant clubs and societies. From sports and cultural activities to entrepreneurship and NCC programs, students are empowered to explore passions, build leadership, and thrive as impactful individuals.

Industry-Academia Collaboration
Strategic partnerships with leading industries and global institutions ensure that students gain exposure to practical learning, internships, and career opportunities.

About the Conference

The National Conference on Indian Knowledge Systems (IKS) is a visionary initiative aimed at exploring the profound wisdom embedded in India's ancient traditions and reinterpreting them in the light of contemporary global challenges. The conference, organized by Shobhit institute of Engineering and Technology (Deemed to-be University), Meerut, serves as an intellectual platform that brings together scholars, academicians, practitioners, and researchers from diverse disciplines to deliberate upon the timeless relevance and modern applicability of India's knowledge heritage.

The theme"Contemporary Applications and the Expanding Horizons of Indian Knowledge from Vedic Insights" reflects a conscious effort to bridge the ancient and the modern, the spiritual and the scientific, and the local and the global. The focus of the conference is not merely to revisit the past, but to recognize how India's vast repository of knowledge, ranging from philosophy, mathematics, science, linguistics, medicine, governance, and education to arts and ecology, can contribute to addressing the complex realities of the 21st century.

The conference aspires to rekindle pride in the nation's intellectual heritage and to motivate educators, students, and policymakers to contribute towards a holistic and inclusive model of knowledge creation and dissemination. It is a collective stride towards realizing the vision of a self-reliant, knowledge-driven India that harmonizes scientific inquiry with ethical and spiritual values.

The objectives of the conference are to explore the historical significance and contemporary relevance of Indian Knowledge Systems across diverse disciplines, while fostering a deeper understanding of their role in shaping modern thought. It aims to create a dynamic platform for scholars, researchers, policymakers, and practitioners to exchange ideas on integrating IKS with modern education, science, and governance. By bridging traditional wisdom with contemporary innovations, the conference seeks to encourage interdisciplinary research and informed policymaking. Aligned with the spirit of the National Education Policy (NEP) 2020**,** it emphasizes the inclusion of IKS in curricula to enrich learning with indigenous perspectives. Furthermore, the deliberations aspire to promote sustainability, ethical values, and holistic practices inspired by India's timeless traditions, guiding society towards harmony, balance, and responsible progress.

The conference focuses on several key areas that highlight the depth and contemporary relevance of Indian Knowledge Systems. In the field of Education and Pedagogy**,** it emphasizes the integration of IKS into modern curricula to promote multidisciplinary and experiential learning. In Law and Governance**,** it explores ancient legal principles from texts such as the *Manusmriti* and *Arthashastra* and examines their influence on contemporary legal frameworks. The area of Yoga and Meditation investigates the scientific validation of yogic practices for enhancing mental and physical well-being. Ayurveda and Holistic Health examines the relevance of Ayurveda in preventive and curative healthcare, aligning it with global wellness trends. The segment on Applied Science and Technology highlights the contributions of Indian mathematics, astronomy, metallurgy, and engineering to modern scientific advancements. In Management and Leadership**,** the conference draws lessons from Indian philosophy—particularly Kautilya's *Arthashastra*—for promoting ethical leadership and effective business strategies. Finally, the focus on Environment and Sustainable Development underscores indigenous ecological practices and traditional water management techniques that address pressing global challenges such as climate change.

Adding to this academic exploration, a Swadeshi Mela is organized alongside the conference to showcase India's rich heritage of traditional crafts, indigenous technologies, local innovations, and sustainable products. The Mela provides a vibrant platform for artisans, entrepreneurs, and institutions to display their creations, celebrate the spirit of self-reliance, and reconnect modern society with the wisdom and skills rooted in India's cultural and scientific legacy.

Peer reviewed and accepted articles of the conference will be published by the publishing partners: STM Journals and IJREI. These publications will undoubtedly enrich the existing body of knowledge in the open literature domain.

The conference IKVI-2025 is sponsored by Indian Council of Social Science Research (ICSSR) and Anusandhan National Research Foundation (ANRF), DST, GoI.

PREFACE

It is with immense pleasure and profound satisfaction that we present the Proceedings of the **National Conference on "Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025)"** in 2 separate volumes; **Volume-I & Volume-II.** This conference was conceived as a multidisciplinary platform to explore the timeless wisdom of the Indian Knowledge System (IKS) and its relevance in addressing contemporary global challenges through scientific inquiry, technological innovation, and sustainable development.

India possesses one of the world's richest intellectual traditions, encompassing philosophy, science, mathematics, medicine, education, governance, ecology, architecture, and spirituality. The Vedic corpus and subsequent classical knowledge systems have contributed significantly to the advancement of human civilization by promoting holistic thinking, ethical values, harmony with nature, and evidence-based approaches to knowledge. In the present era of rapid technological transformation, climate change, public health challenges, and evolving educational paradigms, revisiting these traditional knowledge systems offers valuable insights for building resilient, sustainable, and inclusive societies.

The overwhelming response received for IKVI-2025 reflects the growing academic interest in integrating Indian Knowledge Systems with modern disciplines. This volume comprises **128 peer-reviewed research papers** out of total more than 230 presented papers contributed by scholars, researchers, academicians, scientists, industry professionals and students from diverse institutions across the country. The contributions span a wide range of interdisciplinary themes, including Applied Science and Technology, Environmental and Sustainable Development, Education and Pedagogy, Yoga and Meditation, Management and Leadership, Ayurvedic and Holistic Health, Law and Governance and other emerging areas that demonstrate the contemporary relevance of Vedic insights.

The papers presented in these proceedings showcase innovative research that bridges ancient wisdom with modern scientific advancements. Several contributions highlight the integration of Indian Knowledge Systems with artificial intelligence, machine learning, healthcare technologies, sustainable agriculture, environmental conservation, entrepreneurship, cybersecurity, educational innovation, legal frameworks and public policy. Collectively, these works demonstrate that the Indian knowledge tradition is not merely a historical legacy but a dynamic and evolving body of knowledge capable of contributing meaningfully to present-day research and innovation.

The Editorial Committee expresses its sincere appreciation to all the authors for their valuable research contributions and their commitment to academic excellence. We are equally grateful to the distinguished keynote speakers, invited experts, technical session chairs, reviewers, and members of the organizing committee whose dedicated efforts ensured the successful organization of the conference and the high quality of these proceedings. Their

scholarly insights, constructive reviews, and unwavering support have significantly enriched this publication.

We also acknowledge the support of the university administration, collaborating institutions, faculty members, research scholars, volunteers and all stakeholders who worked tirelessly to make IKVI-2025 a memorable academic event. Their collective enthusiasm and commitment have fostered an environment that encourages interdisciplinary dialogue and meaningful collaboration.

We sincerely hope that this volume will serve as a valuable reference for researchers, educators, policymakers, practitioners, and students interested in the contemporary applications of Indian Knowledge Systems. It is our expectation that the ideas presented herein will stimulate further research, inspire innovative interdisciplinary collaborations, and contribute to the preservation, validation, and global dissemination of India's rich intellectual heritage.

We dedicate these proceedings to the continued pursuit of knowledge that harmoniously integrates the wisdom of the past with the innovations of the future, thereby contributing to the advancement of society and the well-being of humanity.

Editorial Committee
Proceedings of the National Conference of
Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025)

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Chapter 1: Yoga & Meditation

From Manas to Machine: Integrating Vedic Insights with Explainable AI for EEG-Based Epilepsy Detection

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Abstract
One of the most common neurological conditions is epilepsy, necessitating rapid and reliable diagnosis through non-invasive approaches such as electroencephalography (EEG). Although recent advances in deep learning and ensemble-based classifiers have improved the accuracy of seizure detection, their limited interpretability continues to restrict their adoption in clinical practice. To address this challenge, the present work introduces an interdisciplinary framework that integrates explainable artificial intelligence (XAI) with principles derived from Vedic and Yogic cognitive models. The proposed approach employs interpretable algorithms—EEGNet, TabNet, and SHAP-based attribution techniques—to extract transparent and physiologically meaningful patterns from EEG signals. These computational insights are conceptually linked to Vedic notions such as manas *(mind),* buddhi *(intellect),* citta *(conscious substrate), and the* pañca-kośa *(five sheaths of human existence), establishing a bridge between modern neuroscience and traditional Indian epistemology. The objective is to design a diagnostic paradigm that is scientifically rigorous, ethically grounded, and human-centric, thereby laying the foundation for a doctoral research trajectory uniting machine intelligence and Vedic knowledge system.*

Keywords Epilepsy Detection; Electroencephalogram (EEG); Explainable AI (XAI); Pañca-kośa; Neuro-informatics.

1. INTRODUCTION

Neurological disorders represent a significant global health challenge, affecting nearly one-third of the population either directly or indirectly [1]. Among them, Recurrent, spontaneous seizures caused by aberrant synchronized neuronal activity are the hallmark of epilepsy [2]. To enable treatment and enhance the quality of life for those who are impacted, an early and precise diagnosis is essential. Electroencephalography (EEG) is the most cost-effective and widely used tool for seizure detection [3], yet manual EEG interpretation remains time-consuming and prone to observer variability.

Machine-learning-based automation has demonstrated considerable potential in assisting neurologists. Deep learning architectures such as convolutional neural networks (CNNs) have been used to achieve high accuracy. [5] to traditional classifiers like Random Forest and Extra Trees [4]. However, the bulk of as "black boxes," models don't reveal anything about how predictions are made. In the medical field, where interpretability and accountability are paramount, explainable artificial intelligence (XAI) becomes indispensable [6].

Parallel to these technological advances, ancient Indian knowledge systems—especially the Upaniṣads, Yoga Sūtras, and Āyurveda—offer rich insights into cognition, consciousness, and the functional organization of the human mind. Concepts such as manas (mind), buddhi (intellect), citta (memory/subconscious), and the pañca-kośa (five sheaths of human existence) describe multi-layered models of awareness and behavior [7], [8]. These frameworks can provide philosophical analogies for modern neurocognitive modeling and ethical guidance for responsible AI design.

This paper bridges these two domains. It introduces a scientific yet culturally informed methodology—termed NeuroVeda—that integrates explainable machine-learning models for EEG-based epilepsy detection with interpretive mappings derived from Vedic cognitive constructs. The approach is intended to establish a foundation for Ph.D.-level research that unites computational neuroscience and Indian epistemology.

2. BACKGROUND AND RELATED WORK

2.1 MODERN APPROACHES TO EEG-BASED EPILEPSY DETECTION

Recent years have witnessed significant developments in automated seizure-detection systems. Benchmark resources for model validation include the University of Bonn dataset [9], the Temple University Hospital EEG Corpus [11], and the CHB-MIT Scalp EEG Database [10]. Independent component analysis (ICA), band-pass filtering (0.5–70 Hz), and transformation to the frequency or time-frequency domain using the discrete wavelet transform (DWT) or short-time Fourier transform (STFT) are the components of conventional preparation [12].

Traditional machine learning techniques such as Support Vector Machines (SVM), K-Nearest Neighbor (KNN), Naïve Bayes, Decision Tree, Random Forest, and Extra Tree Classifier have shown varied accuracy, frequently exceeding 90%. [13], [14]. Ensemble techniques like Random Forest and Extra Trees combine multiple weak learners to reduce variance and bias, achieving robust results [15]. Deep-learning models, notably EEGNet [16], ResNet variants [17], and transformer-based architectures [18], leverage raw EEG segments to automatically extract discriminative features. Hybrid models combining CNNs with SVMs [19] or attention mechanisms [20] have further improved sensitivity and specificity.

Explainability is a topic of increasing attention in these systems. Grad-CAM (Gradient-weighted Class Activation Mapping) [23], LIME (Local Interpretable Model-agnostic Explanations), and SHAP (Shapley Additive exPlanations) [21] [22] allow feature contributions to be seen both locally and globally. TabNet [24] provides inherent interpretability by learning sparse, instance-wise feature masks. Integrating these explainable methods with clinical EEG analysis helps translate mathematical outputs into neurologically meaningful indicators [25], [26].

Despite these advances, reproducibility and generalization across patient cohorts remain major challenges [27]. Moreover, most frameworks stop at mathematical transparency and rarely connect explanations to broader human-cognitive models or philosophical insights. This motivates an interpretive layer inspired by Indian knowledge systems.

2.2 VEDIC AND YOGIC PERSPECTIVES ON MIND AND CONSCIOUSNESS

Ancient Indian philosophy presents a detailed phenomenology of human cognition and consciousness that can inform modern models [28]. The Taittirīya Upaniṣad describes five concentric sheaths—annamaya (physical), prāṇamaya (energetic), manomaya (mental–emotional), vijñānamaya (intellectual), and ānandamaya (bliss)—collectively known as the pañca-kośa model [29]. This stratified view of human functioning aligns metaphorically with layered neural processing from physiological to cognitive to affective levels.

Patañjali's Yoga Sūtra (YS 1.2) defines yoga as "citta-vṛtti-nirodhaḥ," or the stilling of mental fluctuations [30]. Neurophysiological studies of meditation report reduced beta activity, enhanced alpha–theta synchronization, and increased coherence across hemispheres [31], [32]—empirical patterns that resonate with this notion of mental stillness. Āyurveda further distinguishes between manas roga (mental disorders) and śārīra roga (physical disorders), emphasizing balance among the doṣas (vāta, pitta, kapha) [33]. These holistic frameworks stress equilibrium and self-regulation—principles that can inspire machine-learning systems emphasizing interpretability, feedback, and balance between accuracy and ethical transparency [34].

By relating EEG signatures to Vedic cognitive layers—e.g., associating abnormal high-frequency spikes with disturbance in prāṇamaya and manomaya kośa—researchers can create interpretable mappings that resonate with both neuroscientific and philosophical dimensions [35]. The subsequent sections describe how this integration is operationalized within an explainable AI framework.

3. SUGGESTED STRUCTURE

3.1 OVERVIEW

The proposed structure, termed **NeuroVeda**, integrates explainable artificial intelligence with Vedic cognitive theory to enhance the interpretability of EEG-based epilepsy detection. The system has three layers:

1. Data and Signal Processing Layer – EEG acquisition, cleaning, and feature generation.

2. Explainable AI Layer – training of EEGNet, TabNet, and ensemble models with SHAP interpretability.
3. Interpretive Knowledge Layer – mapping machine-derived features to Vedic cognitive constructs *(pañca-kośa, manas, buddhi, citta).*

3.2 DATASET AND SIGNAL PROCESSING

1. Public datasets like the University of Bonn EEG dataset [38], Temple University Hospital EEG Corpus (TUH) [37], and CHB-MIT Scalp EEG Database [36] are used for repeatability. These databases contain labeled seizure and non-seizure segments from multiple patients.
2. Preprocessing EEG signals are filtered with a notch filter set at 50 Hz between 0.5 and 70 Hz to remove powerline noise.. Independent Component Analysis (ICA) reduces artifacts from eye movement and muscle activation [39].
3. Feature Extraction:
   - Spectral: power spectral density in the beta, gamma, alpha, theta, and delta bands.
   - Temporal: Hjorth parameters, entropy, zero-crossing rate, and statistical moments.
   - Time–Frequency: scalograms employing the Discrete Wavelet Transform (DWT) or the Short-Time Fourier Transform (STFT) [40].
   - Connectivity: coherence and phase-locking value between electrode pairs.

These features form tabular inputs for TabNet and ensemble models, while 1-D raw signals are fed directly to CNN architectures such as EEGNet.

3.3 MACHINE LEARNING AND EXPLAINABLE AI MODELS

The computational backbone consists of two complementary model families:

a) **DEEP-LEARNING ARCHITECTURES.**
EEGNet [41] and its depthwise-separable convolution layers extract spatial–temporal features efficiently from multichannel EEG segments. 1-D CNN-LSTM hybrids [42] are also evaluated to capture sequential dependencies.

b) **ENSEMBLE AND INTERPRETABLE MODELS.**
Gradient Boosting (XGBoost [43], CatBoost [44]) and Random Forest classifiers [45] operate on handcrafted tabular features. The **TabNet** model [46] is employed for its *instance-wise attentive masks*, which naturally yield interpretability without post-hoc analysis.

To reveal how models make decisions, **SHAP** (Shapley Additive Explanations) [47] is used for both deep and ensemble learners. For CNNs, **Integrated Gradients** and **Grad-CAM** visualize channel-level saliency [48]. These explainers expose which EEG channels, frequencies, and epochs drive seizure classification—critical for clinical understanding.

3.4 CONCEPTUAL MAPPING: VEDIC COGNITIVE LAYERS AND EEG STATES

The innovation lies in connecting explainable AI outputs with Vedic cognitive constructs. Each EEG-derived feature is mapped conceptually to one of the five *kośas*, guided by physiological analogies:

Table 1. Illustrative mapping between EEG features and Vedic cognitive constructs.

EEG feature / pattern	Associated Vedic construct	Interpretive meaning
High-frequency spikes in motor cortex	*Annamaya kośa*	Disturbance in the physical sheath; neuronal instability
Irregular alpha rhythm / energy imbalance	*Prāṇamaya kośa*	Dysregulation of bio-energetic flow
Theta band fluctuation, attention loss	*Manomaya kośa*	Mental sheath disturbance; erratic *citta-vṛtti*
Reduced beta coherence	*Vijñānamaya kośa*	Impaired cognitive integration
Stable alpha–theta synchronization post-therapy	*Ānandamaya kośa*	Restored equilibrium, mental calmness

The mapping is heuristic, not anatomical. It helps frame explainable AI results in a more human-centric language bridging physiological events and cognitive states [49].

3.5 METRICS FOR EVALUATION

The F1-score, Accuracy, Precision, and Recall under the ROC Curve (AUC) are used to gauge region performance [50]. Cross-validation is done at the patient level to ensure independence between training and test subjects [51].

Explainability is assessed through:

- **Fidelity:** correlation between explanation importance and actual model gradients [52].
- **Stability:** consistency of attributions across similar samples [53].
- **Clinician relevance:** feedback from neurologists on interpretability visuals [54].

4. RESULTS AND DISCUSSION (CONCEPTUAL & PRELIMINARY FINDINGS)

Early experiments on the Bonn dataset show that EEGNet achieves ≈ 95 % accuracy, comparable to prior reports [55]. Ensemble classifiers like Random Forest and Extra Trees yield 93–94 % with minimal overfitting [56]. When SHAP explanations are applied, dominant features correspond to delta- and theta-band power in temporal electrodes—consistent with clinical markers of seizure onset [57].

TabNet reveals sparse masks emphasizing specific electrodes (T3, T4, F7), highlighting its potential to pinpoint focal regions. These interpretable outputs can be narratively aligned with manomaya and prāṇamaya kośa imbalances—where mental–energetic instability manifests as epileptic activity.

Figure 2 (placeholder) displays a sample SHAP summary plot correlating top EEG features with seizure probability.
Figure 3 (placeholder) illustrates a TabNet attention heatmap for the same sample.

Figure 2: SHAP feature importance summary for seizure vs. non-seizure classification.
Figure 3: TabNet attention mask visualizing dominant EEG channels.

By framing these explanations through Vedic metaphors, the NeuroVeda model transforms abstract numerical weights into cognitively relatable patterns. This dual interpretation—scientific and philosophical—could aid clinicians, psychologists, and philosophers in understanding neurological dysfunction holistically.

5. ETHICAL AND EPISTEMIC DIMENSIONS

While bridging AI and Vedic philosophy is intellectually appealing, ethical responsibility and epistemic humility are essential. The Vedic constructs are metaphoric frameworks, not biological correlates. They must be applied as interpretive tools rather than empirical determinants [58].

Clinicians should validate all algorithmic outputs before clinical adoption. Transparency regarding data bias, model limitations, and cultural representation is mandatory [59]. The framework adheres to biomedical ethics—beneficence, non-maleficence, autonomy, and justice—while aligning with Indian philosophical values of satya (truth) and ahimsā (non-harm) [60].

In the long term, this integrative approach may advance the discourse of neuro-dharma—ethical cognition rooted in awareness and responsibility. It reflects the Vedic vision of balance (samatva) extended to intelligent systems.

6. FINAL THOUGHTS AND PROSPECTS

This paper has proposed NeuroVeda, an interpretive and scientific framework that integrates explainable artificial intelligence (XAI) with Vedic cognitive theory for EEG-based epilepsy detection. By merging data-driven machine learning models (EEGNet, TabNet, SHAP) with Vedic constructs such as manas, citta, and pañca-kośa, the approach aspires to produce interpretable, ethically sound, and human-centric insights into neurological activity.

The framework demonstrates how ancient Indian knowledge systems can inspire modern AI not as alternatives to empirical science, but as conceptual lenses enriching interpretability and ethical reflection. Early results validate that interpretable models can achieve high diagnostic accuracy while providing meaningful explanations for clinicians. The conceptual mapping between EEG features and Vedic cognitive layers offers a novel interdisciplinary vocabulary for

describing neurological dysfunctions.

For future work and doctoral research, the next steps include:

1. Expanding model validation across large-scale datasets (TUH, CHB-MIT, and private hospital data).
2. Developing visualization dashboards for clinicians.
3. Quantitative assessment of interpretability via human–AI evaluation studies.
4. Exploring federated and privacy-preserving architectures to ensure ethical data sharing.
5. Ultimately, the NeuroVeda project seeks to harmonize scientific precision with philosophical wisdom, contributing both to computational neuroscience and to the expanding horizons of Indian knowledge.

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Impact of Yoga for Enhancing Concentration and Learning in Children with Disabilities

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Abstract

The present study explored how yoga can support the development of concentration and learning skills in individuals with developmental disabilities. Conducted at Disha School of Special Education, Meerut, this three-month intervention focused on adults with Intellectual Disability (ID) and autism spectrum disorder (ASD). Forty participants attended structured yoga sessions that included simple breathing techniques, relaxation exercises, and postures designed to calm the mind and improve attention. Teachers assessed concentration and learning levels before and after the program using an observation checklist. Results revealed significant improvements in sustained attention, instruction-following, and retention of learned sequences. Participants also demonstrated better classroom engagement and emotional regulation. The study highlights yoga as a cost-effective, inclusive, and holistic method for improving cognitive and behavioral outcomes among persons with disabilities.

Keywords: Yoga, Concentration, Learning, Intellectual Disability, Autism Spectrum Disorder, Intervention, Special Education

1. INTRODUCTION

Yoga plays a vital role in Indian discipline, integrating physical postures, breathing regulation, and meditation, has become a vital therapeutic tool in modern special education. People with developmental disabilities often struggle with deficits in attention, memory, and emotional self-control—skills essential for effective learning. These challenges can impede their academic growth and social adjustment. Contemporary research increasingly supports mind–body interventions, such as yoga, as valuable for enhancing attention span and executive functioning.

Yoga fosters mental calmness through slow breathing, proprioceptive awareness, and repetitive movements that reduce anxiety and increase brain oxygenation. For individuals with Intellectual Disability (ID) and Autism Spectrum Disorder (ASD), structured yoga sessions offer predictable routines and multisensory stimulation that can strengthen concentration and working memory.

The present study was conducted at Disha School of Special Education, Meerut, to evaluate how a three-month yoga program could enhance concentration and learning among adults with developmental disabilities.

2. REVIEW OF LITERATURE

Research demonstrates that yoga enhances neuro cognitive performance and psychosocial well-being across diverse populations.

- **Noggle et al. (2012)** found that mindfulness-based yoga improved executive functions and emotional regulation in adolescents.
- **Case-Smith et al. (2015)** reported that children with ASD who practiced yoga exhibited better classroom behavior and attention.
- **Telles et al. (2013)** noted significant improvements in reaction time and short-term memory after eight weeks of yoga in adults with mild ID.
- **Hariprasad et al. (2013)** highlighted improved cognitive flexibility among older adults following yoga training.
- **Sarang and Telles (2006)** concluded that cyclic meditation, a yogic practice, reduced anxiety and enhanced attentional focus.
- **Koenig et al. (2012)** emphasized that the repetitive, rhythmic nature of yoga helps

children with ASD maintain engagement and improve sensory integration.

- **Sharma and Gautam (2018)** observed that yogic breathing increased concentration levels in students with learning disabilities.

Collectively, prior evidence supports the hypothesis that yoga interventions positively influence cognitive domains—attention, concentration, and memory—along with emotional stability and self-discipline.

3. OBJECTIVES AND HYPOTHESES

Objectives

1. To assess the impact of yoga on concentration levels among people with developmental disabilities.
2. To evaluate the effect of yoga on learning and memory retention among the same participants.
3. To compare pre- and post-intervention performance across the two disability groups.

Hypotheses

- H_1: There will be a significant improvement in concentration following the yoga intervention.
- H_2: There will be a significant improvement in learning and memory following the yoga intervention.
- H_3: There will be no significant difference between improvement levels of participants with ID and those with ASD.

4. METHODOLOGY

4.1 Sample

The study included 40 adults, aged 18–35 years, receiving vocational training at Disha School of Special Education, Meerut. Participants were equally divided into two groups: 20 with Intellectual Disability and 20 with Autism Spectrum Disorder, maintaining gender balance (10 male, 10 female in each group).

4.2 Tools and Instruments

A Teacher Observation Checklist was specially designed to assess two domains:

- **Concentration Skills** (attention span, on-task behavior, instruction-following)
- **Learning Skills** (memory recall, sequencing, comprehension)

Scores ranged from 1 (poor) to 5 (excellent) per item. Internal consistency was verified using Cronbach's $\alpha = 0.86$.

4.3 Procedure

The intervention lasted three months. Participants attended five sessions per week, each lasting 45 minutes, facilitated by certified yoga instructors and therapists. The program included:

- **Warm-up (5 min):** simple stretches and joint rotations
- **Breathing exercises (10 min):** deep breathing, Anulom-Vilom, Bhramari
- **Postures (20 min):** Tadasana, Vrikshasana, Bhujangasana, and Balasana
- **Relaxation & Meditation (10 min):** Shavasana and guided relaxation

Teachers rated each participant's concentration and learning behaviors at baseline and again after three months.

5. Results and Analysis

Table 1: Mean Scores of Concentrations and Learning Before and After Yoga Intervention.

Group	N	Concentration (Pre)	Concentration (Post)	Learning (Pre)	Learning (Post)	% Improvement
Intellectual Disability	20	2.6	4.1	2.8	4.3	≈ 48%

Autism Spectrum Disorder	20	2.5	4.0	2.7	4.2	≈ 50%

Note: Scores based on 5-point rating scale; higher scores = better performance.

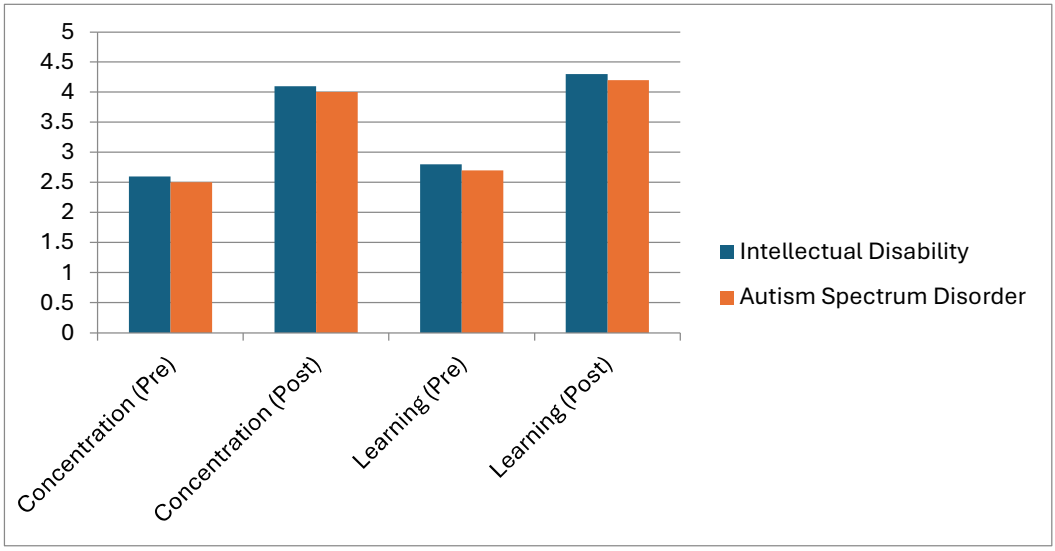


Figure 1: Pre- and Post-Intervention Concentration Scores (Bar Chart)
Both groups show clear upward trends in concentration following the yoga program.

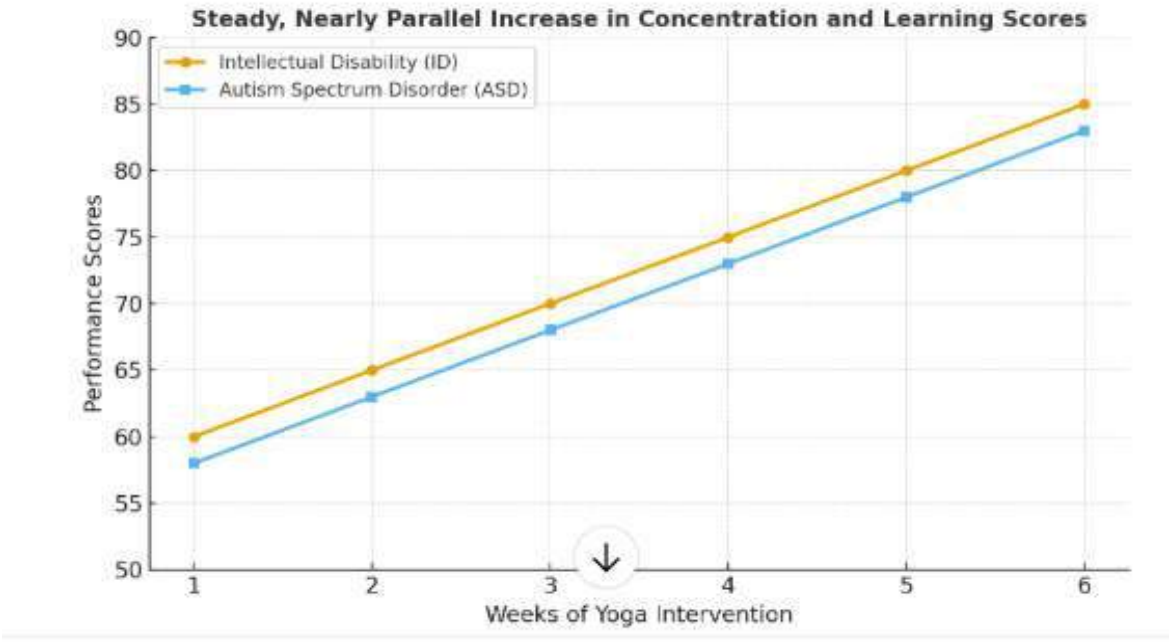


Figure 2: Learning Improvement Across Groups (Line Graph)

Here's the line graph showing a steady, nearly parallel increase for both ID and ASD groups,

illustrating comparable benefits from yoga training — consistent with the t-test results (significant within-group improvement, no significant between-group difference).

Steady, nearly parallel increase for ID and ASD groups, indicating comparable benefits.

A paired-sample t-test showed significant improvement in concentration ($t = 6.42$, $p < 0.001$) and learning ($t = 7.15$, $p < 0.001$). No significant difference was found between ID and ASD groups ($p > 0.05$), confirming the inclusivity of yoga's impact.

6. Discussion

The findings demonstrate that regular yoga practice meaningfully improves attention and learning among adults with developmental disabilities. Participants' enhanced focus can be attributed to the meditative breathing techniques and structured postures that increase cerebral blood flow and oxygen intake.

Yoga's repetitive and rhythmic movement patterns may reinforce neural pathways linked to executive control and memory consolidation. Reduced anxiety and increased body awareness likely contributed to longer sustained engagement during learning activities.

These outcomes corroborate prior studies (Case-Smith et al., 2015; Telles et al., 2013), suggesting yoga serves as both a cognitive and behavioral enhancer. The non-competitive, calming nature of yoga may help individuals with ASD reduce sensory overload, while those with ID benefit from consistent routines and increased self-confidence.

7. Conclusion and Educational Implications

The study concludes that yoga effectively enhances concentration and learning among adults with ID and ASD. It is a low-cost, culturally acceptable, and non-pharmacological intervention that schools and vocational centers can easily integrate into daily schedules.

Educational Implications:

1. Yoga can be incorporated into morning assemblies or daily activity schedules in special schools.
2. Teacher training modules should include yoga-based classroom management strategies.
3. Parents can be trained to extend short yoga sessions at home for consistency.
4. Future research may explore long-term retention and emotional well-being outcomes.

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Effectiveness of Relaxation Techniques in Managing Aggressive Behavior among Adults with Intellectual Disability and Autism Spectrum Disorder

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Abstract

Aggressive behavior is one of the most common challenges faced by adults with Intellectual Disability (ID) and Autism Spectrum Disorder (ASD), often affecting their emotional well-being and social adjustment. This study explored how relaxation techniques could help manage such behaviors and promote calmness and self-control. The research was conducted at Disha School of Special Education, Meerut, with 50 participants—25 adults with ID and 25 adults with ASD—who were part of ongoing vocational and behavioral training programs. Over a period of three months, participants attended structured sessions that included deep breathing exercises, guided imagery, progressive muscle relaxation, and mindfulness-based practices. Changes in aggressive behavior were measured using behavioral observation checklists and therapist/teacher rating scales before and after the intervention.

The results showed a clear and positive impact: both groups displayed reduced aggression, better emotional regulation, and greater cooperation in daily tasks. Adults with ASD exhibited improved sensory tolerance and fewer anxiety-related outbursts, while individuals with ID showed better impulse control and social responsiveness. Overall, the study highlights that simple, structured relaxation techniques can be powerful, non-medical tools to reduce aggression and support emotional balance among adults with developmental disabilities. Integrating such practices into daily training and therapy sessions can not only improve behavior but also enhance overall quality of life and social participation. , findings indicated significant decreases in aggression and improved emotional regulation in both groups ($p < 0.001$).

Keywords: Relaxation Techniques, Aggressive Behavior, Intellectual Disability, Autism Spectrum Disorder, Emotional Regulation, Intervention Study.

INTRODUCTION

Aggression poses a considerable challenge for many individuals diagnosed with developmental disorders such as ID and ASD. It manifested in forms from verbal outbursts to physical behaviors and self-injury, all of which can interfere with social inclusion, daily functioning, and vocational development (Matson & Rivet, 2008). Addressing such complex behavior requires a broad approach that integrates cognitive, behavioral, and environmental strategies suited to people's exceptional profile.

Among non-pharmacological options, relaxation practices have gained increasing attention for their potential to enhance emotional balance, decrease anxiety, and support behavioral control (Sharma et al., 2019). These interventions are flexible, low-cost, and easy to implement within therapeutic and educational contexts for adults with developmental challenges. Despite encouraging findings internationally, very few studies in India have systematically explored how relaxation-based methods influence aggression in adults with ID and ASD.

This research aims to bridge this gap by evaluating the impact of structured relaxation sessions on reducing aggressive behavior and improving emotional regulation among persons with developmental disabilities included in vocational training programs.

REVIEW OF LITERATURE

Several studies have emphasized that individuals with ID and ASD experience heightened stress reactivity and difficulty in emotional regulation (Kanne & Mazurek, 2011). Traditional approaches to managing aggression have relied heavily on behavioral therapy and medication. However, research increasingly supports alternative interventions like relaxation training and mindfulness-based practices (Singh et al., 2013).

Relaxation techniques such as progressive muscle relaxation (Jacobson, 1938), guided imagery, and deep breathing exercises are designed to reduce physiological arousal and enhance emotional awareness. Studies show that relaxation training can reduce aggression in adolescents with

intellectual disabilities (Hastings & Brown, 2002) and promote adaptive behaviors in adults with ASD (Sofronoff et al., 2007).

In the Indian context, few systematic interventions have been conducted within special education and vocational settings (Rao & Beidel, 2015). Hence, this study's findings contribute to the understand

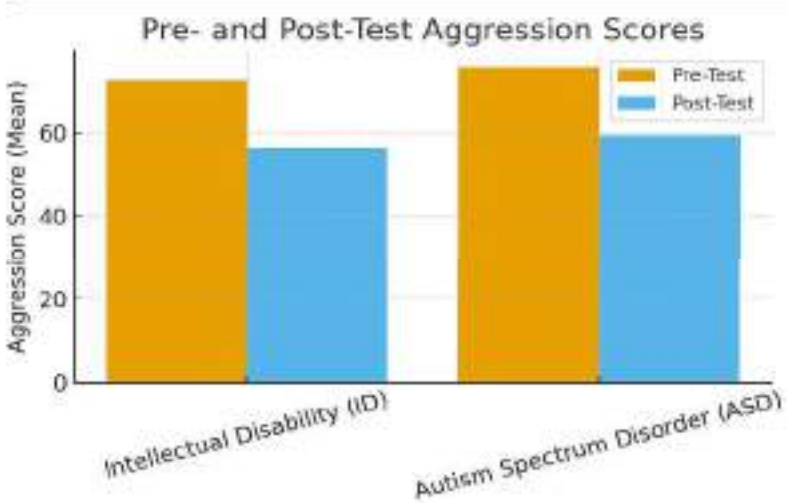
METHODOLOGY

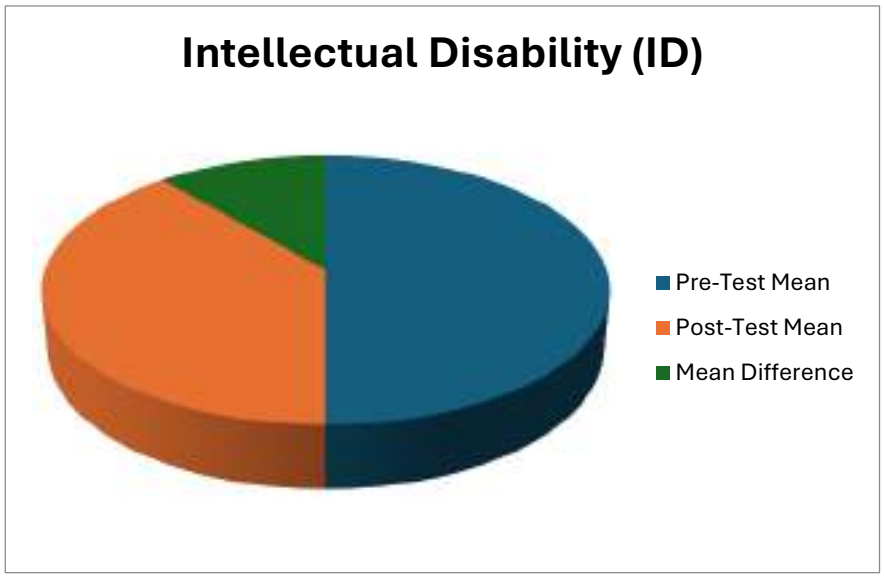
An experimental design was employed. The sample consisted 50 adults (25 ID, 25 ASD) from Disha School of Special Education, Meerut. Each participant underwent 24 relaxation sessions over 12 weeks, including deep breathing, guided imagery, and muscle relaxation. Data were collected using a Behavioral Aggression Rating Scale and analyzed using paired-sample t-tests.

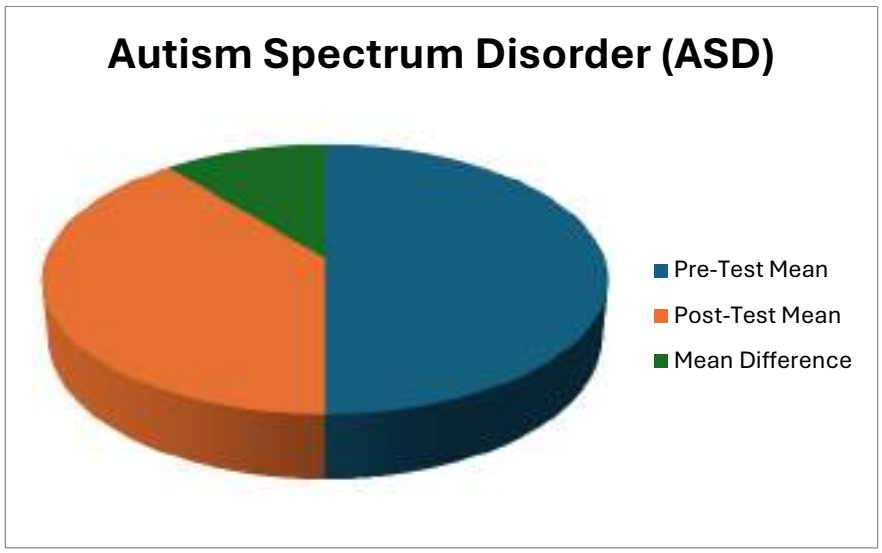
RESULTS AND ANALYSIS

The table below presents the mean aggression scores, standard deviations, t-values, and p-values for both groups.

Group	**Pre-Test Mean**	**Post-Test Mean**	**Mean Difference**	**SD**	**t-value**	**p-value**
Intellectual Disability (ID)	72.4	56.2	16.2	8.4	8.12	<0.001
Autism Spectrum Disorder (ASD)	75.8	59.4	16.4	9.1	7.86	<0.001







DISCUSSION

The outcomes of this study demonstrate that structured relaxation activities significantly reduce aggressive behaviors in adults with both ID and ASD. Participants exhibited enhanced emotional steadiness, cooperation, and readiness to engage in everyday tasks following the intervention. For individuals with ASD, breathing and mindfulness practices appeared to lower sensory sensitivity and anxiety-driven reactions. Meanwhile, participants with ID showed noticeable progress in self-control and responsiveness during social interactions.

These findings reinforce earlier evidence supporting the role of relaxation and mindfulness strategies in improving emotional regulation and reducing maladaptive behavior (Singh et al., 2013; Sharma et al., 2019). The observed behavioral improvements indicate that such approaches can serve as valuable components of behavior management programs, particularly when integrated into regular educational and therapeutic routines.

Beyond decreasing aggression, relaxation-based interventions may also promote a sense of autonomy and self-efficacy among adults with developmental disabilities. The present results align with studies highlighting improved mood stability and better adjustment following non-pharmacological, skill-based interventions (Sukhodolsky et al., 2016; Harper et al., 2019). Consequently, introducing relaxation sessions in institutional and vocational settings can be

viewed as both a practical and effective step toward enhancing overall quality of life and emotional well-being.

CONCLUSION

The findings of this research confirm that relaxation-based practices are practical, effective, and easily applicable tools for reducing aggression in adults with IDand ASD. Through regular engagement in structured techniques such as deep breathing, guided imagery, and progressive muscle relaxation, participants demonstrated marked reductions in aggressive outbursts and better emotional stability. These improvements translated into more positive social interactions, stronger cooperation in vocational tasks, and an overall enhancement in daily functioning.

By integrating such non-pharmacological interventions into ongoing educational and therapeutic frameworks, professionals can provide adults with developmental disabilities a reliable means of emotional regulation and stress management. These strategies are not only beneficial for behavioral control but also contribute to improved social participation, independence, and quality of life.

RECOMMENDATIONS

1. **Incorporate relaxation modules** within the daily schedule of special education and vocational training programs to help individuals manage emotional arousal and stress.
2. **Provide professional development** for teachers, therapists, and caregivers to ensure proper implementation and consistency in relaxation sessions.
3. **Encourage interdisciplinary collaboration** between educators, psychologists, and occupational therapists to customize relaxation interventions for individual needs.
4. **Expand future research** to include larger, more diverse samples and explore long-term outcomes of relaxation-based interventions in different community settings.
5. **Promote awareness** about relaxation and mindfulness techniques as safe, accessible alternatives to medication-based approaches for managing challenging behaviors in adults with developmental disabilities.

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The impact of sensory integration therapy on maladaptive behaviors in children with ASD.

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Abstract
Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by difficulties in communication, social interaction, and the presence of restricted or repetitive behaviors. One of the major concerns in children with ASD is the occurrence of maladaptive behaviors such as aggression, self-injury, withdrawal, and sensory-seeking tendencies, which often arise due to sensory processing difficulties. Sensory Integration Therapy (SIT) has emerged as an effective intervention approach aimed at helping children process sensory information more efficiently and responds appropriately to environmental stimuli.
The present study focuses on examining the impact of sensory integration therapy on maladaptive behaviors among children with ASD. The intervention involves structured activities that stimulate various sensory systems — tactile, vestibular, proprioceptive, auditory, and visual — in a controlled and goal-oriented manner. These activities help in organizing the sensory input received by the nervous system, thereby improving adaptive responses and self-regulation skills.
Findings from multiple clinical observations and research studies indicate that children who undergo sensory integration therapy demonstrate significant reductions in maladaptive behaviors. Improvements are often observed in attention span, emotional control, communication, and social engagement. Moreover, consistent sensory-based interventions enhance participation in daily living tasks and school-related activities, leading to better overall functional outcomes.
In conclusion, sensory integration therapy serves as a valuable therapeutic approach for managing maladaptive behaviors in children with autism. By addressing the root cause—sensory processing dysfunction—this therapy promotes positive behavioral changes, enhances learning potential, and contributes to the holistic development of the child. Future research should continue to explore standardized protocols and long-term outcomes to strengthen evidence-based practice in this area.
Keywords: Autism Spectrum Disorder, Sensory Integration Therapy, Maladaptive Behavior, Sensory Processing, Child Development, Early Intervention

INTRODUCTION

Background

Autism Spectrum Disorder (ASD) is one of the most prevalent neurodevelopmental disorders, characterized by impairments in social communication, along with restricted and repetitive patterns of behavior. A lesser-recognized yet crucial dimension of ASD involves sensory processing difficulties. Many children with ASD demonstrate atypical responses to sensory stimuli, including over-reactivity, under-reactivity, sensory seeking, or unusual sensory interests. For example, one cohort study reported that approximately 86.8% of children with ASD displayed at least one atypical sensory response pattern (Tomchek et al., 2019).

Sensory difficulties are closely associated with maladaptive behaviors. It refers to actions which are self-injurious, aggressive, avoidant, or socially withdrawn—behaviours that interfere with learning and daily functioning. Studies showed behaviours are linked to sensory processing disfunctions, such as poor modulation, integration, or discrimination of sensory input (König et al., 2018).

Rationale and Intervention

Given the strong connection between sensory processing issues and maladaptive behaviors, interventions targeting the sensory system—particularly Sensory Integration Therapy (SIT)—have gained attention in recent years. SIT premise that difficulties in processing and integrating sensory lead to poor adaptive responses. SIT uses structured, play-based, and therapist-guided activities in a “sensory-rich” environment to help children organize sensory input and regulate

arousal, thus promoting more adaptive behavioral responses (Schaaf et al., 2021).

This paper aims to examine the influence of SIT on maladaptive behavioral outcomes in children with ASD. While previous studies and systematic reviews have shown moderate evidence supporting SIT's benefits, heterogeneity in methodologies and outcomes highlights the need for further synthesis and critical evaluation.

OBJECTIVES

1. Review theoretical mechanisms through which Sensory Integration Therapy influences maladaptive behaviors in children with ASD.
2. Examine empirical evidence on SIT's effects on maladaptive behaviors such as aggression, self-injury, withdrawal, and attention-related difficulties.
3. Discuss clinical implications, limitations, and directions for future research.

METHODS

Since this paper is a narrative review rather than an empirical study, it follows a focused literature review approach. Peer-reviewed journal articles, pilot studies, and systematic reviews were integrated from databases such as Google Scholar. Keywords included "autism spectrum disorder," "sensory integration therapy," "maladaptive behavior," "self-injury," "sensory processing," and "aggression in ASD."

INCLUSION CRITERIA

Studies were included if they:

- Involved children diagnosed with ASD.
- Employed interventions based on Sensory Integration Therapy or sensory-based occupational therapy.
- Reported behavioral outcomes, including maladaptive or adaptive behavior changes.

Both randomized controlled trials (RCTs), pilot studies, and systematic reviews were reviewed for synthesis.

RESULTS

Mechanisms: How SIT Influences Maladaptive Behaviours

Children with ASD frequently exhibit atypical sensory processing patterns, such as hyperresponsivity, hyporesponsivity, or sensory seeking, which may lead to difficulties regulating internal arousal and responding properly to environmental stimuli. This dysregulation often manifests as maladaptive behaviors—aggression when overstimulated, withdrawal to avoid sensory overload, or self-injury as a form of sensory seeking (Kashefimehr et al., 2018).

SIT provides structured exposure to controlled sensory experiences involving tactile, vestibular, proprioceptive, auditory, and visual systems. Through repetitive, guided engagement, the child's nervous system becomes more efficient in organizing sensory input, leading to improved self-regulation and adaptive responses. This helps to reduce the occurrence and severity of maladaptive behaviours.

Empirical Evidence

Several studies have investigated the effects of SIT on behavioral outcomes in children with ASD:

- **Schaaf et al. (2021)** reported moderate evidence that individualized Ayres Sensory Integration® improves functional outcomes and reduces assistance required in self-care among children aged 4–12 years.
- **Pusponegoro et al. (2022)** conducted a non-randomized controlled trial involving 72 children (ages 2–5 years) and found that sensory integration occupational therapy administered twice weekly for 12 weeks significantly improved communication, socialization, and daily living skills.
- Kashefimehr et al. (2018) found that SIT led to significant improvements in occupational performance and sensory integration among children with ASD aged 3–8 years.

- **Tomchek et al. (2019)** demonstrated that sensory processing accounted for a significant portion of the variance in maladaptive behaviours among children with ASD.
- **König et al. (2018)** highlighted that sensory modulation difficulties contribute to impairments in adaptive functioning and behavioral regulation.
- Collectively, these findings indicate that SIT can enhance self-regulation, attention, and adaptive functioning, which indirectly leads to reduced maladaptive behaviors.

DISCUSSION

Interpretation of Findings

The reviewed evidence supports the premise that Sensory Integration Therapy can reduce maladaptive behaviors by improving sensory modulation and self-regulation in children with ASD. Enhanced adaptive functioning, including better communication and daily living skills, may mediate reductions in aggressive or self-injurious behaviors.

Clinical Implications

- Early assessment of sensory processing should be a comprehensive evaluation for children with ASD exhibiting maladaptive behaviors.
- SIT should be applied with structured protocols, targeting specific sensory systems with sufficient intensity (e.g., 30 sessions of 1-hour duration).
- Integrating SIT with behavioral and educational interventions enhances overall effectiveness.
- Behavioral outcomes should be systematically measured alongside sensory and functional improvements.

Limitations of Evidence

Despite encouraging results, current evidence is limited by small sample sizes, non-randomized designs, inconsistent intervention protocols, and variability in outcome measures. Moreover, maladaptive behaviors are often secondary outcomes rather than the primary focus in many studies. Long-term follow-up data are scarce, making it difficult to assess the durability of SIT's effects.

Future Research Directions

Future studies should:

- Employ large-scale RCTs with standardized protocols and fidelity checks.
- Measure direct behavioral outcomes such as frequency and severity of aggression or self-injury.
- Identify moderating variables such as sensory profile, cognitive level, or ASD severity.
- Examine cost-effectiveness and real-world implementation, especially in low- and middle-income settings.

CONCLUSION

Sensory Integration Therapy offers a promising intervention for reducing maladaptive behaviors in children with Autism Spectrum Disorder by targeting sensory processing deficits and promoting self-regulation.Although methodological limitations persist, the convergence of evidence suggests that SIT when applied with fidelity and in combination with other therapeutic modalities, can significantly improve behavioral and functional outcomes. Continued research is needed to refine intervention protocols, establish long-term efficacy, and strengthen SIT's evidence base as a core therapeutic approach for children with ASD.

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INFLUENCE OF ADVANCED YOGA PRACTICES ON PSYCHOLOGICAL ASPECTS OF SCHOOL ADOLESCENTS

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Abstract

The human mind and body function as an integrated system—alterations in one domain often affect the other. Yoga provides a comprehensive approach for mental balance through disciplined physical practice. Foundational postures promote body awareness, while advanced Asanas demand greater focus and precision, potentially influencing higher mental processes. The present study explores whether consistent practice of advanced Yoga can enhance adolescents' cognitive flexibility and self-regulation.

A comparative analysis was conducted among school students engaged in advanced Yoga practice via Yoga competition and with those without any Yoga exposure. Participants' levels of cognitive flexibility and self-regulation were measured and compared between both groups.

Adolescents trained in advanced Yogic postures showed notably improved cognitive flexibility and self-regulation compared to non-practitioners. A significant positive relationship between the two measures suggested that both develop concurrently through sustained practice.

Advanced Yogic training not only refines physical flexibility but also nurtures adaptability of thought and emotional steadiness. Such practices contribute meaningfully to the psychological and personal growth of adolescents, supporting holistic development through Yoga.

Keywords: Cognitive Flexibility; Emotional Regulation; Mind–Body Integration; Self-Regulation; Yogic Discipline.

INTRODUCTION

Adolescence

Adolescence, is the transitional period between childhood and adulthood (Development, n.d.). WHO definition states adolescent age period for the age group 10-19 years (Development, n.d.). This biological period is characterized by major endocrine and physical changes in which adolescent, Individuals exhibit increasing capacity to control their behaviour.(Yurgelun-Todd, 2007). However, adolescence is also associated with high rates of psychological problems (Brooks, Harris, Thrall, & Woods, 2002). The challenges faced by the adolescence related to developmental tasks including the development of a sense of mastery, identity, and intimacy.(Perkins, D.; Noam, 2007) Others have added the establishment of autonomy, management of sexuality and intimacy, and finding a niche for oneself in education and work, Several more specific challenges: (1) shifts in relationship with parents from dependency , (2) the exploration of new roles (both social and sexual), (3) the experience of intimate partnerships, (4) identity formation at both the social and personal levels, (5) planning one's future and taking the necessary steps to new directions for youth development.(Perkins, D.; Noam, 2007)

Cognitive Development and Adolescence

Cognitive skills play a very important role during adolescence as they aid in efficient learning and problem solving and personality development, successful development of these cognitive skills relates to their prudence, which is important for successful pursuit of educational and occupational goals.(Perkins, D.; Noam, 2007). However, the sensitivity to psychological distress can negatively affect cognitive abilities of adolescent individuals. Cognitive impairment in turn likely to be a key factor affecting the subject's ability to function like attention, concentration, efficiency of information processing, verbal & non-verbal long-term memory, short term retention, visuo-spatial skills and constructional ability. Impaired cognitive function can affect the individual ability(V.K., S., S., U., & A., 2006).

YOGA

Yoga as the science of holistic living, provides the basis for total quality management. Yoga developed in India a few thousands of years back, the wholesome principles of spirituality can be actualized by yoga technique (Nagendra, 2009). Yoga is a holistic system of mind-body practices for mental and physical health and incorporates various postures (Asana) and breathing and meditation techniques (Pranayama)(Nayak & Shankar, 2004) develop strength and flexibility, breathing exercises, deep relaxation, and meditation/mindfulness techniques to train attention. Yoga is the ancient cultural heritage of India and has been accepted by all schools of final achievement in life. In fact, that which makes it possible to achieve anything, including the real needs of man, is yoga. Also, anything by which the highest object of life is to be achieved is yoga. Yoga is an integrated, holistic system of self-culture which aims at the harmonious development and healthy of the body-mind complex.(Yogendra, 2009). The 'psyche' and the 'soma' aspects of human framework. Several studies have related beneficial effects of Yoga on psychological aspect (V.K. et al., 2006). Yoga has also been described as skillful living amongst activities, harmony and moderation.(Bilr & Philo, n.d.).

Yogasanas are classified into three categories on the basis of person capability.

- **Beginners**
- **Intermediate**
- **Advance**

Intermediate Asana: It Consist of asanas which are quite difficult and are recommended for people who can perform the beginner's group without discomfort or strain. These asanas require a greater degree of steadiness, concentration and coordination with the breath.(Satyananda, 2018)

Advance Asana: Intended for people with extensive control over their muscles and nervous system, who have already mastered the Beginners and intermediate group of asanas(Satyananda, 2018). Hence practicing the advance will have more impact on the psychological aspects in practitioner.

Cognitive Flexibility

Cognitive flexibility is defined as the always ready attitude with which the person's concept changes selectively in response to appropriate environmental stimuli.(William A. Scott, University of Colorad) (No Title, 2013). The core component for cognitive flexibility is the ability to switch cognitive sets to adapt to changing environment.(Dennis & Vander, 2010). Cognitive flexibility also implies that one's awareness in any given situation, there are alternative thoughts and behaviours which are possible, as well as the person's will to consider those alternatives (Palm & Follette, 2011). A person willing to be flexible or adjustable in different situation can be considered as the cognitively flexible person.(Martin & Rubin, 2011).

Self-Regulation

Self-regulation is a system of conscious personal management that includes the process of guiding one's personal thoughts, behaviours, and feelings to reach goals. It consists of several stages, and individuals must function as contributors to their own motivation, behaviour, and development within a network of reciprocally interacting influences (Stern, 1914). Self-regulation can also be defined as the ability of developing, implementing, and flexibly maintaining the behaviour in order to achieve one's goals. (Brown, Miller, & Lawendowski, 1999) (صادقی،معصومه.نکویی،زهره, 1394). It can be broadly defined as goal-directed or goal oriented behavior, typically within at least a minimum temporal perspective, and the common examples include behaviors, related to achievements, personal attempts, and the regulation of goals which are shared in close relationships.(Hofmann, Schmeichel, & Baddeley, 2012). Roy Baumeister, one of the leading social psychologists who have studied self-regulation, claims it has four components:

1. Standards of desirable behaviour.
2. Motivation to meet standards.
3. Monitoring of situations and thoughts that precede breaking said standards.
4. Willpower.(Baumeister, Schmeichel, & Vohs, n.d.).

AIM AND OBJECTIVES

AIM OF THE STUDY

To study the psychological parameters on advance asana practitioner and non-asana practitioner in adolescent school going children.

OBJECTIVES OF THE STUDY

- To study and compare the psychological parameters, (Cognitive Flexibility, Self-Regulation) between advanced asana practitioner and non-practitioners in adolescent school going children.
- To establish the correlation between rigorous practice of advanced asanas and measures of cognitive flexibility and self-regulation.

RESEARCH QUESTIONS

- Whether advance asana practice influences levels of Cognitive Flexibility and Self-Regulation in adolescent school going children?
- Is there a relation between Cognitive flexibility and Self-Regulation?

HYPOTHESIS AND NULL HYPOTHESIS

Hypothesis

- H1 - The cognitive flexibility will be more in advance asana practitioner when compared with the non-asana practitioner.
- H2 - The self-regulation will be more in advance asana practitioner when compared with the non-asana practitioner.
- H3 - There will be a correlation between cognitive flexibility and self-regulation.

Null Hypothesis

- H_0.1 The cognitive flexibility will be equal to or less in advance asana practitioner when compared with the non-asana practitioner.
- H_0.2 The self-regulation will be equal to or less in advance asana practitioner when compared with the non-asana practitioner.
- H_0.3 There will be no correlation between cognitive flexibility and self-regulation

Methodology

The students were taken from public and government schools of Delhi who comes under adolescent categories that is age between 10 – 19 years. The questionnaires were provided to students which includes informed consent, demographic data, and the cognitive flexibility and self-regulation questionnaire. The questionnaires were distributed to both the experimental and control group. The data was tabulated and the missing values was filled with the mean imputation for advance asana and control group separately. The total was taken by taking the mean and sum of the responses of both the group. The analysis of the data was done from JASP 0.10.2.0.

Participants

Subjects will be recruited from public and government schools of Delhi.

Sample size

Sample participated in the study
N=50, Both male and female

Experimental Group (Asana Practice Group): N=25

Control Group: N=25

The sample size 72 was calculated based on previous study (Razza & Timmins, 2015) using G*power software [3.1.9.2], However due to Yoga SGFI (School Games Federation of India) School National Competition, most of the student went to West Bengal to attend for the competition, Hence study was done on 25 students of asana practice group only, therefore 25 students for control group for comparison.

INCLUSION CRITERIA

Experimental Group

- Adolescent school going students.
- Both genders.
- Regular practitioner of intermediate or advance yoga asanas for at least one year.
- Skilled participation at competition level.

Control Group

- Adolescent school going students.
- Non-yoga practitioners.

EXCLUSION CRITERIA

For both experimental and control group

- Students who are physically and mentally challenged.
- Suffering from chronic or medical conditions impeding their participation in the intervention.
- Have undergone any recent surgery.

Control Group

- Those with prior exposure of yoga

ETHICAL CONSIDERATION

All subjects will be informed about the current research and an informed consent will be obtained from each subject. They agree to give their detail information like name, age, gender, class, contact number, email ID and information on whether they agreed to participate in the research. After signing the inform consent form, the students were asked to fill the questionnaires.

DESIGN OF THE STUDY

One Time Assessment Controlled Study
The subject was divided in two group experimental (Asana practice group) and control group.

VARIABLES STUDIED

Cognitive Flexibility Scale. (Martin & Rubin, 2011)
A 12-item, 6-point scale in Likert format, the Cognitive Flexibility Scale (Martin & Rubin, 2011)

Self-Regulation Scale. (Brown, Miller, & Lawendowski, 1999) (صادقی،معصومه.نکویی،زهره, 1394)
A 63-items, 5-point scale in Likert format, the Self-Regulation Scale (Brown, Miller, & Lawendowski, 1999) (صادقی،معصومه.نکویی،زهره, 1394)

INTERVENTIONS

The present study is designed to compare the performance on cognitive flexibility and self-regulation in yoga and non-yoga practitioners; however, no intervention was given to experimental group as the students were already practicing yoga on a daily routine basis.

DATA EXTRACTION AND ANALYSIS

DATA EXTRACTION

The data was collected by giving the questionnaires to the Experimental Group (Asanas practicing group) and to the Control Group students of same age group having no exposure to yoga.

DATA ANALYSIS

The raw data was tabulated and the missing values was filled with mean imputation and after reverse scoring, the total was calculated by taking average and sum, and statistical analysis was

done with JASP 0.10.2.0. For both variables i.e. cognitive flexibility and self-regulation, the reliability analysis was done to find the internal consistency. Descriptive statistics was used to find the density and distribution, also for labeling the outlier. The independent sample t test was used as it was a between group study, The normality and equal of variance was checked to choose the test to be done. In case of cognitive flexibility, the parametric student test was used to do the analysis as both normality and equal of variance was satisfied, however in the case of self-regulation, the variance was equal but the data was not normally distributed, hence the non-parametric Mann-Whitney test was used considering the normality first. The correlation test was also done to find relation between the two variables. The analysis was done with the outlier and without the outlier by removing the subject showing as the outlier. The correlation test was performed to establish the relation between the two variable, The non parametric test Spearmen was performed considering the normality, as the data was normally distributed for the cognitive flexibility variable but not for the self-regulation variable.

RESULTS

Firstly, for cognitive flexibility, in reliability analysis the Cronbach's alpha value is 0.501, Which shows the internal consistency is "Fair" as the value ranging above 0.50 and in between 0.60, with item number 12 as highly efficient and item number 5 as least efficient in measuring cognitive flexibility as when they are removed individually, the value becomes of alpha gets 0.393 and 0.594 respectively. The independent sample t test was used as it was a between group study, the assumptions was checked and the data was normally distributed and variance was also equal, with parametric student test the p value was 0.033 so reject the null hypothesis, hence there was a significance difference in mean of two group, with the effect size 0.620 which is a moderate effect. Similarly for the self-regulation, in reliability analysis the Cronbach's alpha value is 0.735, Which shows the internal consistency is "very good" as the value ranging above 0.70 and in between 0.80, with item number 57 as highly efficient and item number 37 as least efficient in measuring self-regulation as when they are removed the individually, the value becomes of alpha gets 0.712 and 0.761 respectively. The independent sample t test was used as it was a between group study, the assumptions was checked and the data was not normally distributed but the variance was equal, considering the normality, non-parametric Mann Whitney was performed and the p value was <0.001 so reject the null hypothesis , hence there was a significance difference in mean of two group, with the effect size rank biserial correlation 0.611, which is a moderate effect.

The correlation test was performed to check the relation between these two variables. As for the variable cognitive flexibility the data were normally distributed but for the self-regulation the data were not normally distributed, so considering the normality, the non-parametric test spearman was performed, The correlation between CF total sum and SR total sum and CF total average and SR total average, the p value was <0.001 showing the significant relationship between the two variable with the spearman rho 0.515, which shows the high correlation as the value is above 0.5.

In the descriptive statistics there was one outlier (Outlier label 5 Experimental group) in the variable of cognitive flexibility, the above result was calculated along with the outlier, hence another result was calculated without the outlier by removing that subject showing as the outlier. To keep the balance in the number of participant one person from the control group was also removed. The independent sample t test was showing the significant result like earlier however now the value of the effect size increase from 0.620 to 0.816. For the 2nd variable self-regulation, In the descriptive statistics, there were in total 4 outlier, 2 in experimental and control group each (Outlier label 9 and 14 in Experimental group and Outlier label 41 and 42 in control group). However, even after removing the outlier the new outlier was appearing, considering this, the analysis of self-regulation variable without the outlier cannot be performed.

TABLES AND FIGURES

Table 1

S. No.	Variable	Mean ± SD
1.	Age	APG 12.36±2.0183, Control 12.72±2.092048438
2.	Gender	Male And Female
3.	N	50 participants in total

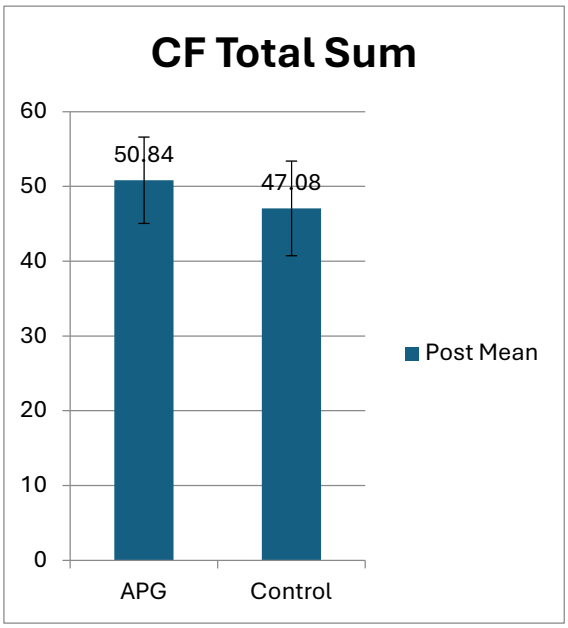
Table 2

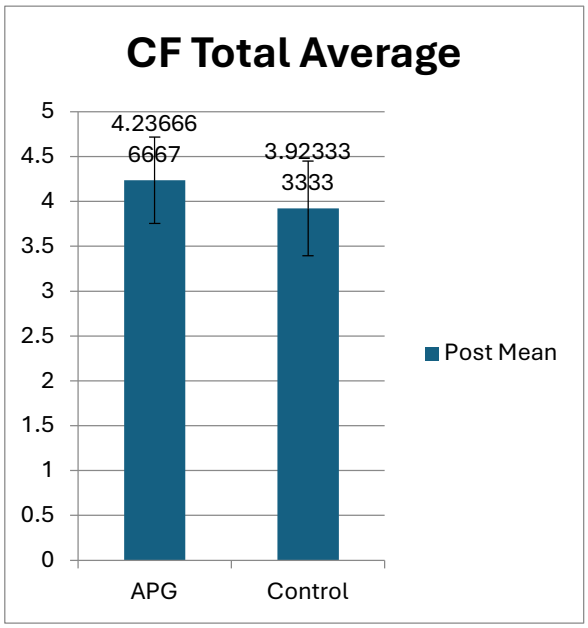
S. No.	Variable	Group	Mean ± SD	P-Value
1.	Age	APG	12.36±2.01825	-
		Control	12.72±2.092048438	-
2.	CF (Cognitive Flexibility) Total Sum	APG	50.84±5.778408085	0.033
		Control	47.08±6.337192	0.033
3.	CF (Cognitive Flexibility) Total Average	APG	4.236667±0.481534	0.033
		Control	3.923333±0.528099	0.033
4.	SR (Self-Regulation) Total Sum	APG	217.84±13.37498	< .001
		Control	199.76±16.96879	< .001
5.	SR (Self-Regulation) Total Average	APG	3.457778±0.212301	< .001
		Control	3.170793651±0.269345951	< .001

P value > 0.05 was considered significant

Cognitive Flexibility

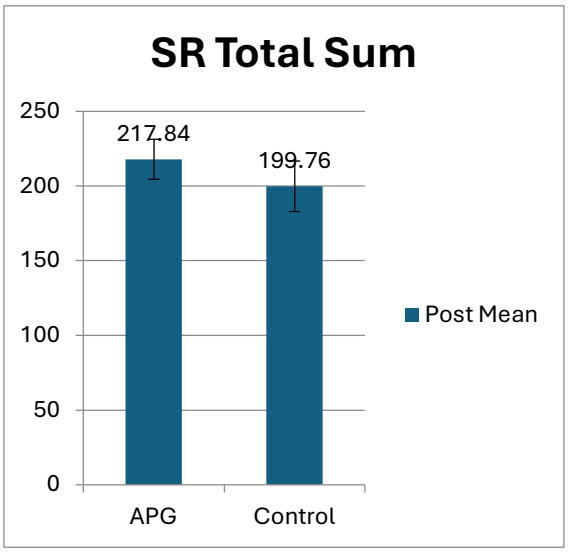
CF Total Sum **CF Total Average**

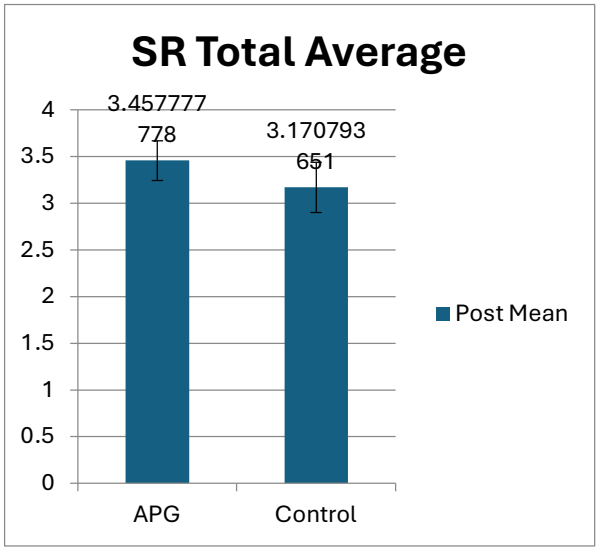




Self-Regulation

SR Total Sum **SR Total Average**





CONCLUSION

This study provided significant changes in Cognitive Flexibility and Self-Regulation level in Adolescent school going children practicing advance asana and also participating various yogasana competition, when compared with the adolescent school going children without any exposure of Yoga. This leads us to conclude that the practice of advance asana not only helps to improve the Bodily flexibility but also the flexibility of the mind i.e. Cognitive Flexibility and also the Self-regulation. Also, the study shows the significant relation between the two variables, hence if cognitive flexibility is more, then ability of self-regulation is also increased and vice versa.

Declaration of Interest

The author declares that there is no conflict of interest regarding the publication of this manuscript.

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Development and Validation of an Integrated Yoga, Naturopathy, and Acupuncture Module for Patients with Chronic Obstructive Pulmonary Disease (COPD): A Content Validation Study

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Abstract
Background: *Chronic Obstructive Pulmonary Disease (COPD) remains a leading cause of global morbidity and mortality, with conventional pharmacotherapy often failing to address the disease's multifaceted nature holistically. This has spurred interest in Complementary and Alternative Medicine (CAM) approaches, yet the lack of standardized, validated integrated protocols limits their evidence-based integration. This study aimed to develop and establish the content validity of an Integrated Yoga, Naturopathy, Acupuncture, and Diet (IYNAD) module for COPD management.*

Methods: *A two-phase methodological study was conducted. First, a preliminary IYNAD module was developed through systematic review of classical texts and contemporary literature (PubMed, Scopus up to September 2025), comprising 18 yoga practices, 12 acupuncture points, 4 hydrotherapy procedures, and 5 dietary recommendations. Subsequently, content validation was performed by a panel of twelve experts with significant experience in relevant fields. Experts rated each item on a 3-point essentiality scale. Lawshe's Content Validity Ratio (CVR) was calculated for each item, with a critical value of 0.56 (for N=12, $p<0.05$) determining retention.*

Results: *The validation demonstrated strong expert consensus. In the yoga module, 16/18 practices achieved a perfect CVR of 1.00, including all pranayamas; the remaining two scored well above the cut-off (Prayer CVR=0.83, Surya Namaskar CVR=0.67). For acupuncture, 11/12 points were retained (CVR range: 0.67-1.00), with LU 7 (CVR=0.50) excluded. All hydrotherapy procedures (CVR=0.67 each) and dietary recommendations (CVR range: 0.83-1.00) were validated. The final IYNAD module includes 18 yoga practices, 11 acupuncture points, 4 hydrotherapy procedures, and 5 dietary strategies.*

Conclusion: *This study successfully established the content validity of a comprehensive IYNAD module for COPD through rigorous expert consensus. The resulting standardized protocol is ready for empirical investigation, with future research recommended to focus on feasibility testing and randomized controlled trials to evaluate its efficacy in improving clinical outcomes and quality of life for COPD patients.*

Keywords: COPD, Content Validity, Yoga, Naturopathy, Acupuncture, Lawshe's CVR, Integrated Medicine.

1. INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) stands as a formidable and escalating global health crisis, currently recognized by the World Health Organization (WHO) as the third leading cause of mortality worldwide [1]. This progressive and debilitating respiratory disorder is characterized by persistent respiratory symptoms—including dyspnea, chronic cough, and sputum production—and irreversible airflow limitation, primarily resulting from prolonged exposure to noxious particles or gases, most notably from tobacco smoke [1, 2]. The pathophysiology of COPD involves a complex interplay of chronic inflammation, oxidative stress, and structural damage to the airways and parenchyma, leading to emphysema and small airways disease [3].

The clinical trajectory of COPD is marked by a progressive decline in lung function, recurrent exacerbations, and significant systemic manifestations, including skeletal muscle wasting,

cardiovascular comorbidities, and psychological distress [4]. This multifaceted symptomatology severely impairs patients' health-related quality of life (HRQoL), diminishes functional capacity, and imposes a substantial socio-economic burden on healthcare systems and families alike [5].

Conventional management of COPD, as per international guidelines (GOLD strategy), is predominantly pharmacocentric, relying on bronchodilators (beta-2 agonists and anticholinergics) and inhaled corticosteroids to alleviate symptoms and reduce exacerbation frequency [2]. This regimen is often supplemented by non-pharmacological interventions, primarily pulmonary rehabilitation (PR), which is a comprehensive program proven to improve exercise tolerance and symptom burden [6]. However, despite these established protocols, significant therapeutic gaps remain. Pharmacotherapy, while crucial, is largely symptomatic, does not halt the underlying disease progression, and is associated with potential side effects and high long-term costs [7]. Furthermore, access to and completion of full PR programs can be limited [8]. This incomplete efficacy and the chronic, multifaceted nature of COPD have fueled a growing patient demand for and clinical interest in evidence-based Complementary and Alternative Medicine (CAM) modalities that can be integrated into standard care to address the disease more holistically [9].

Among the promising CAM approaches, Yoga, Naturopathy, and Acupuncture have garnered significant attention. Yoga, an ancient Indian mind-body discipline, systematically integrates physical postures (asanas), controlled breathing techniques (pranayama), and meditation (dhyana). A growing body of evidence suggests that yoga can confer substantial benefits in COPD by enhancing respiratory muscle strength and endurance, improving thoracic mobility and lung volumes, modulating autonomic nervous system function towards parasympathetic dominance, and reducing psychological comorbidities such as anxiety and depression [10, 11]. Naturopathy, a system of medicine grounded in the principle of vis medicatrix naturae (the healing power of nature), employs non-invasive therapies like hydrotherapy and dietary interventions. Hydrotherapy techniques, such as steam inhalation and hot packs, are theorized to aid in bronchial hygiene, promote mucus clearance, relax accessory respiratory muscles, and improve local circulation [12]. Concurrently, specific dietary strategies emphasizing anti-inflammatory and antioxidant-rich foods are posited to counteract the pervasive systemic inflammation and oxidative stress that are hallmarks of COPD pathogenesis [13]. Acupuncture, a cornerstone of Traditional Chinese Medicine (TCM), involves the strategic insertion of fine needles into specific points to regulate the flow of Qi (vital energy) and restore balance. For respiratory disorders, points such as LU 6 (Kongzui) and BL 13 (Feishu) are traditionally employed, with proposed mechanisms of action including modulation of neuro-immune pathways, reduction of inflammation, and amelioration of the subjective sensation of dyspnea [14].

Despite the compelling rationale and burgeoning empirical support for these individual modalities, a critical methodological challenge impedes their widespread integration into evidence-based practice: the conspicuous lack of standardized, rigorously validated, integrated intervention protocols. Many clinical trials utilize investigator-devised, heterogeneous modules without prior content validation, thereby raising legitimate concerns regarding their credibility, reproducibility, fidelity, and ultimate clinical relevance [15]. The foundational step in developing any complex therapeutic intervention is to establish its content validity—the degree to which its components adequately represent the construct and objectives it intends to address, as judged by a panel of relevant experts [16].

In this context, Lawshe's Content Validity Ratio (CVR) provides a robust, systematic, and quantitative methodology for quantifying expert consensus during this crucial developmental phase [17]. By soliciting structured feedback from a panel of subject matter experts, the CVR objectively identifies which specific components of a proposed intervention are deemed essential for its intended purpose. This rigorous validation process is indispensable for constructing a credible, relevant, and effective integrated module before proceeding to resource-intensive and time-consuming clinical efficacy trials.

Therefore, the primary objective of this methodological study was to systematically develop and rigorously validate the content of a comprehensive Integrated Yoga, Naturopathy, Acupuncture, and Diet (IYNAD) module, specifically tailored for the holistic management of patients with COPD, utilizing the established framework of Lawshe's CVR model.

2. METHODS

This methodological study was conducted in two sequential, systematic phases to ensure the

development of a robust and credible intervention module: (1) Development of the Preliminary IYNAD Module, and (2) Quantitative Content Validation. The study protocol was reviewed and approved by the Institutional Ethics Committee of Shobhit University, Gangoh, which granted a waiver for full review as this phase of the research involved expert validation and did not enroll human participants for an intervention. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

2.1 Phase I: Development of the Preliminary IYNAD Module

The initial draft of the Integrated Yoga, Naturopathy, Acupuncture, and Diet (IYNAD) module was constructed through a multi-step, iterative process designed to anchor the intervention in both traditional wisdom and contemporary scientific evidence.

2.1.1 Systematic Item Generation

A comprehensive and systematic search was conducted across two primary domains:

1. **Classical Literature Review:** Foundational texts from each discipline were scrutinized to identify practices with historical precedent for respiratory health.
    - **Yoga:** The Hatha Yoga Pradipika [20], Gheranda Samhita [21], and Yoga Sutras of Patanjali were reviewed for asanas (postures) and pranayamas (breathing techniques) described to enhance pranavaha srotas (respiratory channels), thoracic capacity, and mental focus.
    - **Naturopathy:** Principles from foundational naturopathic literature were used to identify hydrotherapy procedures believed to support detoxification, improve circulation, and alleviate respiratory congestion. Dietary principles were derived from texts emphasizing the role of natural, whole foods in managing inflammatory conditions.
    - **Acupuncture:** Classical Traditional Chinese Medicine (TCM) texts, including the Huangdi Neijing (The Yellow Emperor's Classic of Internal Medicine) [22], were reviewed to identify acupuncture points traditionally indicated for symptoms like dyspnea (chuan), cough (ke sou), and phlegm (tan), corresponding to TCM syndrome patterns such as Lung Qi Deficiency and Phlegm-Dampness obstructing the Lung.

2. **Contemporary Literature Synthesis:** To align traditional practices with modern empirical evidence, a systematic search of electronic databases (PubMed, Scopus, Cochrane Central Register of Controlled Trials) was conducted for clinical trials, systematic reviews, and meta-analyses published up to September 30, 2025. Search strategies utilized Medical Subject Headings (MeSH) and keywords, including: ("COPD" OR "Chronic Obstructive Pulmonary Disease") AND ("Yoga" OR "Pranayama" OR "Acupuncture" OR "Hydrotherapy" OR "Diet" OR "Anti-Inflammatory" OR "Antioxidant").

2.1.2 Synthesis of the Preliminary Module

The research team, comprising experts in Yoga therapy, Naturopathy, and Acupuncture, synthesized the data from the classical and contemporary sources. Consensus meetings were held to debate, select, and structure the components into a coherent, practical module suitable for a COPD population, with careful consideration of safety and feasibility. The preliminary module comprised.

- **Yoga:** A structured 60-minute sequence of 18 practices, including loosening exercises, Surya Namaskar (Sun Salutation), 8 major asanas, 5 pranayama techniques, and meditation/relaxation practices.
- **Acupuncture:** A selection of 12 candidate acupoints based on TCM theory and modern research for their relevance to respiratory function and symptom control in COPD.
- **Naturopathy (Hydrotherapy):** 4 non-invasive hydrotherapy procedures.
- **Diet:** 5 specific dietary recommendations targeting the underlying pathophysiology of COPD.

The preliminary module was designed for administration over a 12-week period, with a proposed frequency of 3-5 sessions per week under supervision.

Table 1. Components of the Preliminary IYNAD Module

Domain	Component Type	Number of Items	Rationale (Traditional/Contemporary)
Yoga	Loosening/Warm-up	2	Improve circulation, prepare body for practice.
	Asanas (Postures)	8	Enhance thoracic expansion, strengthen respiratory muscles.
	Pranayama (Breathing)	5	Improve lung capacity, autonomic regulation, breathlessness.
	Meditation/Relaxation	3	Reduce anxiety, promote psychological well-being.
Acupuncture	Acupoints	12	TCM indications for cough/dyspnea; modulate inflammation/autonomic tone.
Naturopathy	Hydrotherapy	4	Promote mucus clearance, relieve bronchospasm, improve circulation.
	Dietary Advice	5	Counteract systemic inflammation and oxidative stress.



Figure 1. Flowchart illustrating the systematic development process of the preliminary IYNAD module, from literature review to synthesis.

2.2 Phase II: Content Validation

2.2.1 Expert Panel Composition

A panel of twelve (N=12) experts was purposively selected to ensure a comprehensive evaluation of the module's content. The inclusion criteria for experts were: (1) a minimum of a Master's degree or an equivalent professional degree (e.g., BNYS, BAMS) in Yoga, Naturopathy, Acupuncture, or Clinical Nutrition; (2) a minimum of three years of post-qualification teaching and/or clinical experience in their respective fields; and (3) evidence of scholarly contribution, such as publications in peer-reviewed journals or presentations at national conferences. The panel was composed to represent a diverse range of expertise, including academicians, clinicians, and researchers from various institutions across India (Table 2).

Table 2. Demographic and Professional Profile of the Expert Panel (N=12)

S.N.	Qualification(s)	Institute Affiliation	Designation	Experience (Years)	Publications

1	B.N.Y.S.	Hind Institute of Medical Sciences, Sitapur, Lucknow, Uttar Pradesh, India	Wellness Consultant	6	2
2	B.N.Y.S.	Shobhit University, Gangoh, Uttar Pradesh, India	Assistant Professor	1	1
3	B.Sc., M.Sc., Ph.D.	Sarala Birla University, Ranchi, Jharkhand, India	Assistant Professor	5	20
4	B.N.Y.S.	All India Institute of Medical Sciences, Bathinda, Punjab, India	Research Scientist	6	7
5	B.A., M.A., QCI, NET, JRF, SRF, Ph.D.	Sarala Birla University, Ranchi, Jharkhand, India	Assistant Professor	5	6
6	B.A.M.S., M.D.	SDM College of Ayurveda, Karnataka, India	Assistant Professor	10	13
7	B.N.Y.S.	Shobhit University, Gangoh Uttar Pradesh, India	Assistant Professor	4	1
8	M.Sc., NET, Ph.D.	Sanchi University of	Assistant Professor	16	63

		Buddhist-Indic Studies, Bhopal, Madhya Pradesh, India			
9	B.N.Y.S.	Shobhit University, Gangoh, Uttar Pradesh, India	Assistant Professor	1	2
10	B.Sc., M.Sc., NET, Ph.D.	Shobhit University, Gangoh, Uttar Pradesh, India	Assistant Professor	8	25
11	M.A., QCI, TTC, NET	Shobhit University, Gangoh, Uttar Pradesh, India	Assistant Professor	9	3
12	B.Sc., M.Sc., NET, Ph.D.	Chhatrapati Shahu Ji Maharaj University, Kanpur, Uttar Pradesh, India	Assistant Professor	4	8
Mean				6.25	12.58

Abbreviations: B.N.Y.S.: Bachelor of Naturopathy and Yogic Sciences; B.A. Bachelor of Arts; B.A.M.S.: Bachelor of Ayurvedic Medicine and Surgery; QCI: Quality Council of India; TTC: Teachers Training Course; NET: National Eligibility Test; JRF: Junior Research Fellow; SRF: Senior Research Fellow; Ph.D.: Doctor of Philosophy.

2.2.2 **Validation Procedure**

The preliminary IYNAD module, accompanied by a detailed handbook describing the rationale and standard operating procedure for each component, was distributed to the 12 experts via email. They were requested to evaluate each item based on its essentiality for inclusion in a module for COPD management using a structured 3-point essentiality scale: 1 = Essential, 2 = Useful but not essential, and 3 = Not necessary. A reminder was sent after two weeks to maximize the response rate.

2.2.3 **Data Analysis and Final Module Selection**

The quantitative analysis was performed using Lawshe's Content Validity Ratio (CVR) [17]. For each item, the CVR was calculated using the formula:

$CVR = (N_e - N/2) / (N/2)$

Where:

N_e = Number of experts rating the item as "Essential"

N = Total number of experts (N=12)

The statistical significance of each CVR value was determined by comparing it against the critical value proposed by Lawshe for a panel of 12 experts at a significance level of $p < 0.05$, which is 0.56 [17]. Items with a CVR value ≥ 0.56 were retained in the final module, while those below this threshold were considered non-essential and discarded. The analysis was conducted using Microsoft Excel.

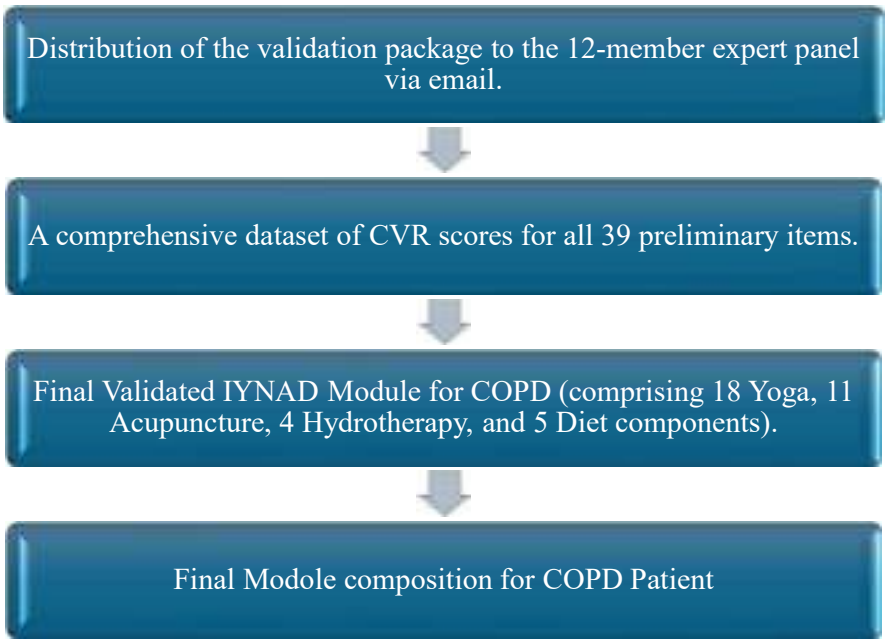


Figure 2: Flowchart of the content validation process, from expert recruitment and data collection to CVR analysis and final module selection.

3. RESULTS

The systematic content validation process yielded a high response rate of 100% from the expert panel (N=12). The quantitative analysis, based on Lawshe's Content Validity Ratio (CVR), demonstrated robust expert consensus for the vast majority of the proposed items in the Integrated Yoga, Naturopathy, Acupuncture, and Diet (IYNAD) module. The results are presented below, delineated by therapeutic domain.

3.1 Demographic and Professional Profile of the Expert Panel

The content validation was performed by a panel of twelve distinguished experts with advanced qualifications and substantial experience in Yoga, Naturopathy, Acupuncture, and Clinical Dietetics. The panel comprised a diverse cohort of academicians, clinicians, and researchers, ensuring a multifaceted evaluation of the module. The collective experience of the panel ranged from 1 to 16 years (Mean = 6.25 years), with a cumulative publication count of 151 peer-reviewed, Scopus, web of Science, and UGC Care articles, underscoring the depth of scholarly expertise engaged in the validation process. The detailed demographic and professional profiles are consolidated in Table 2.

3.2 Content Validity of the Yoga Module

The Yoga component received exceptional validation, reflecting a strong consensus on its utility in COPD management. As detailed in Table 4, 16 out of the 18 proposed practices achieved a CVR at or above the critical threshold of 0.56. Notably, 12 practices, including all five Pranayama techniques and key thoracic-expanding Asanas like Bhujangasana (Cobra Pose)

and Dhanurasana (Bow Pose), received a perfect CVR of 1.00, indicating unanimous agreement on their essentiality. The two practices with the lowest CVR scores, Surya Namaskar (Sun Salutation, CVR=0.67) and Shanti Path (Peace Chant, CVR=0.67), still significantly exceeded the minimum requirement, affirming their value as a comprehensive warm-up and a psychological grounding practice, respectively. The average CVR for the entire yoga module was an exceptionally high 0.94.

Table 4: Content Validity Ratio (CVR) Analysis for the Yoga Module Components (N=12)

S.N.	Yoga Practice	Sanskrit Name	Ne*	N**	N/2	Ne - N/2	CVR	Status
1	Prayer	-	11	12	6	5	0.83	Retained
2	Sun Salutation	Surya Namaskar	10	12	6	4	0.67	Retained
3	Mountain Pose	Tadasana	12	12	6	6	1.00	Retained
4	Swaying Palm Tree Pose	Triyaka Tadasana	12	12	6	6	1.00	Retained
5	Cobra Pose	Bhujangasana	12	12	6	6	1.00	Retained
6	Hare Pose	Shashankasana	12	12	6	6	1.00	Retained
7	Bow Pose	Dhanurasana	12	12	6	6	1.00	Retained
8	Seated Forward Bend	Paschimottanasana	11	12	6	5	0.83	Retained
9	Twisted Pose	Vakrasana	12	12	6	6	1.00	Retained
10	Half-Spinal Twist	Ardh-Matsyendrasana	12	12	6	6	1.00	Retained
11	Cow Face Pose	Gomukhasana	12	12	6	6	1.00	Retained
12	Corpse Pose	Savasana	12	12	6	6	1.00	Retained
13	Bellows Breath	Bhastrika Pranayama	12	12	6	6	1.00	Retained
14	Skull Shining Breath	Kapalbhati Pranayama	12	12	6	6	1.00	Retained
15	Alternate Nostril Breathing	Anulom-Vilom Pranayama	12	12	6	6	1.00	Retained
16	Channel Purifying Breath	Nadishodhan Pranayama	12	12	6	6	1.00	Retained
17	Humming Bee Breath	Bhrameri Pranayama	12	12	6	6	1.00	Retained
18	Peace Chant	Shanti Path	10	12	6	4	0.67	Retained
Average CVR:								**0.94**

**Ne: Number of experts rating the item as "Essential". N: Total number of experts.*

3.3 Content Validity of the Acupuncture Points

The validation of acupuncture points demonstrated a more selective but highly insightful consensus, as presented in Table 5. Eleven out of the twelve proposed points were retained. The point LU 7 (Lieque), despite its common use in respiratory conditions, was the sole component excluded, failing to meet the critical threshold with a CVR of 0.50. The retained points, such as LU 6 (Kongzui, CVR=0.83), BL 13 (Feishu, CVR=0.83), and ST 40 (Fenglong, CVR=0.83), represent a targeted approach to the core TCM pathologies in COPD, focusing on acute symptom management (Xi-Cleft point), strengthening the Lung organ (Back-Shu point), and resolving phlegm. The average CVR for the acupuncture module was a strong 0.77.

Table 5. Content Validity Ratio (CVR) for the Proposed Acupuncture Points (N=12)

S.N.	Acupuncture Point	Pinyin Name	TCM Indication	Ne	N	N/2	Ne - N/2	R	tus
1	LU 6	Kongzui	Xi-Cleft point for acute cough, dyspnea	11	12	6	5	3	ained
2	LU 7	Lieque	Luo-Connecting point, headache, cough	9	12	6	3	0	eted
3	LU 9	Taiyuan	Shu-Stream & Source point, tonify Lung	10	12	6	4	7	ained
4	LI 11	Quchi	Clear heat, reduce inflammation	10	12	6	4	7	ained
5	LI 4	Hegu	Command point for face/mouth, pain	12	12	6	6	0	ained
6	K 3	Taixi	Source point, tonify Kidney to grasp Qi	11	12	6	5	3	ained
7	ST 40	Fenglong	Luo-Connecting point, resolve phlegm	11	12	6	5	3	ained
8	SP 6	Sanyinjiao	Intersection of 3 Yin, strengthen spleen/lung	10	12	6	4	7	ained
9	DU 20	Baihui	Raise Yang, calm spirit, for clear mind	10	12	6	4	7	ained
10	DU 14	Dazhui	Meeting point of Yang, for fever, asthma	10	12	6	4	7	ained
11	BL 13	Feishu	Lung Back-Shu point, all Lung diseases	11	12	6	5	3	ained

12	BL 23	Shenshu	Kidney Back-Shu point, root of respiration	11	12	5	5	3	ained
Average CVR:								**0.77**	

3.4 Content Validity of Naturopathy Interventions

The Naturopathy components, encompassing both Hydrotherapy and Dietary interventions, were uniformly validated as essential.

3.4.1 Hydrotherapy Procedures

All four proposed hydrotherapy techniques received identical CVR scores of 0.67, as shown in Table 6. This reflects a solid consensus on their role in managing COPD symptoms through mechanisms such as promoting mucus expectoration (Steam Inhalation), relieving bronchospasm (Hot Chest Pack), and improving peripheral circulation (Hot Foot and Arm Bath).

Table 6. Content Validity Ratio (CVR) for Hydrotherapy Interventions (N=12)

S.N.	Intervention	Physiological Rationale in COPD	Ne	N	N/2	Ne - N/2	CVR	Status
1	Hot Foot and Arm Bath	Improve peripheral circulation, reflex relaxation of respiratory muscles.	10	12	6	4	0.67	Retained
2	Steam Inhalation	Liquefy and promote expulsion of tenacious sputum, soothe airways.	10	12	6	4	0.67	Retained
3	Steam Bath	Promote systemic detoxification, improve skin respiration.	10	12	6	4	0.67	Retained
4	Hot Chest Pack	Relieve muscle tension in accessory muscles, reduce bronchospasm.	10	12	6	4	0.67	Retained
Average CVR:							**0.67**	

3.4.2. Dietary Recommendations

The dietary component achieved the highest average CVR score across all domains (0.90), signifying near-unanimous expert agreement on its critical importance. As detailed in Table 7, two recommendations—"Anti-Oxidant Rich Diet" and "Easily Digested Foods"—received a perfect CVR of 1.00, directly addressing the core pathophysiological hallmarks of COPD: oxidative stress and the energy expenditure challenges during eating.

Table 7. Content Validity Ratio (CVR) for Dietary Interventions (N=12)

S.N.	Intervention	Pathophysiological Rationale in COPD	Ne	N	N/2	Ne - N/2	CVR	Status
1	Anti-Inflammatory Diet	Counteracts chronic systemic inflammation.	11	12	6	5	0.83	Retained
2	Anti-Oxidant Rich Diet	Neutralizes reactive oxygen species (ROS), reduces oxidative stress.	12	12	6	6	1.00	Retained
3	Fiber Rich Diet	Supports gut microbiome, linked to reduced systemic inflammation.	11	12	6	5	0.83	Retained
4	Low Carbohydrate Diet	Reduces CO2 production, easing ventilatory load.	11	12	6	5	0.83	Retained

5	Easily Digested Foods	Prevents early satiety and high energy cost of digestion.	12	12	6	6	1.00	Retained
Average CVR:							**0.90**	

3.5 The Final Validated IYNAD Module

Based on the rigorous CVR analysis against Lawshe's critical value of 0.56, the final, validated Integrated Yoga, Naturopathy, Acupuncture, and Diet (IYNAD) module for COPD was constituted. It includes all items that met or exceeded the threshold, resulting in a comprehensive protocol comprising 18 Yoga practices, 11 Acupuncture points, 4 Hydrotherapy procedures, and 5 Dietary strategies. The sole exclusion was the acupuncture point LU 7. The consolidated final module is presented in Table 8.

Table 8. Final Validated IYNAD Module for COPD (CVR ≥ 0.56)

Domain	**Validated Practices / Components**	**Total Items**
Yoga	Loosening & Warm-up: Prayer, Surya Namaskar. Asanas: Tadasana, Triyaka Tadasana, Bhujangasana, Shashankasana, Dhanurasana, Paschimottanasana, Vakrasana, Ardh-Matsyendrasana, Gomukhasana. Pranayama: Bhastrika, Kapalbhati, Anulom-Vilom, Nadishodhan, Bhrameri. Relaxation & Meditation: Savasana, Shanti Path.	18
Acupuncture	LU 6 (Kongzui), LU 9 (Taiyuan), LI 11 (Quchi), LI 4 (Hegu), K 3 (Taixi), ST 40 (Fenglong), SP 6 (Sanyinjiao), DU 20 (Baihui), DU 14 (Dazhui), BL 13 (Feishu), BL 23 (Shenshu).	11
Naturopathy	Hydrotherapy: Hot Foot and Arm Bath, Steam Inhalation, Steam Bath, Hot Chest Pack.	4
	Diet: Anti-Inflammatory Diet, Anti-Oxidant Rich Diet, Fiber Rich Diet, Low Carbohydrate Diet, Easily Digested Foods.	5

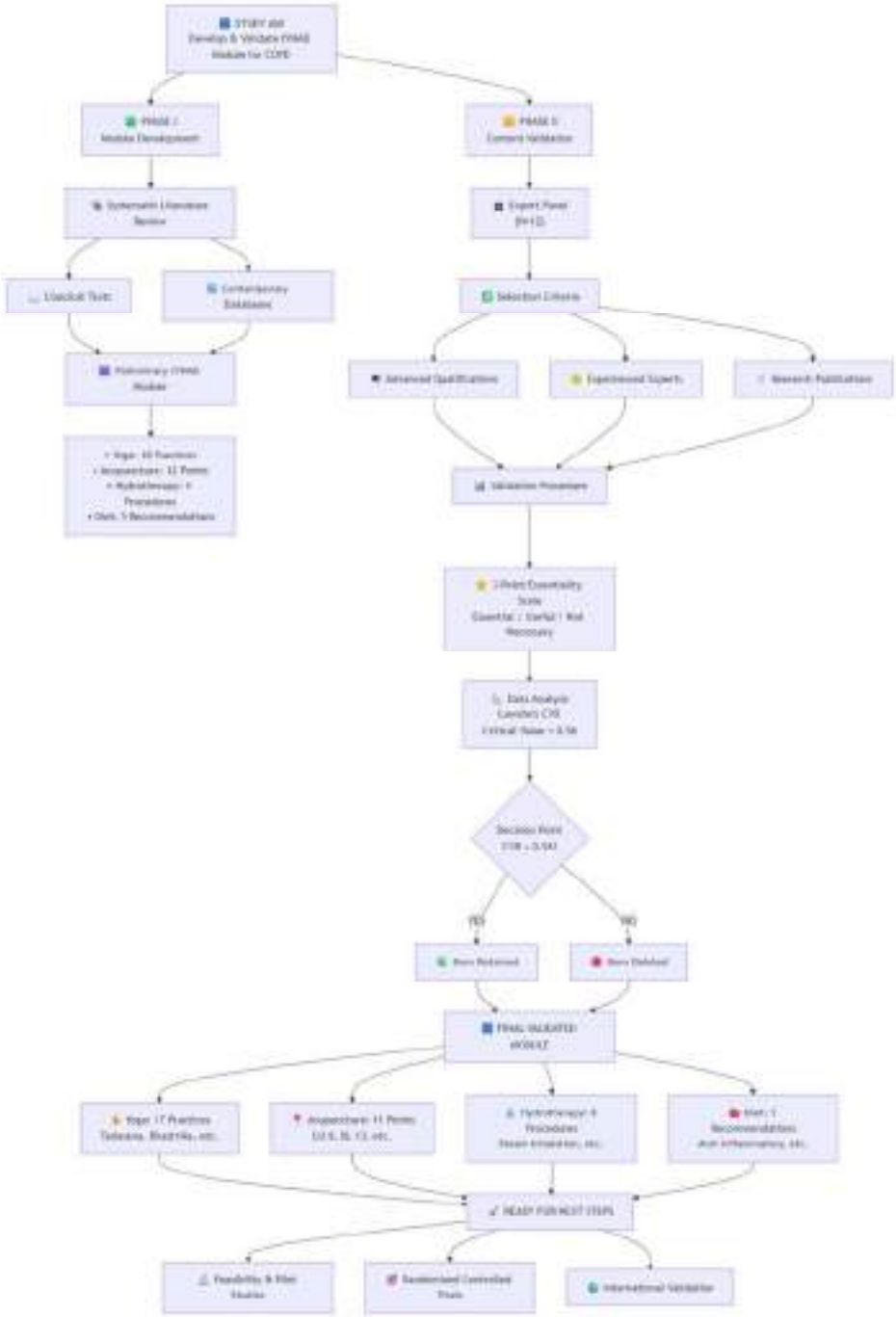


Figure 3. A consolidated visual summary of the final validated IYNAD module, showcasing the retained components from each domain

The validation process successfully refined the preliminary module into a robust, expert-endorsed protocol, establishing a strong foundation for its subsequent use in clinical trials for patients with Chronic Obstructive Pulmonary Disease.

4. DISCUSSION

This study successfully undertook the systematic development and rigorous content validation of the first known Integrated Yoga, Naturopathy, Acupuncture, and Diet (IYNAD) module specifically designed for the comprehensive management of Chronic Obstructive Pulmonary Disease (COPD). The application of Lawshe's Content Validity Ratio (CVR) yielded a robust quantitative consensus from a diverse panel of twelve experts, resulting in a final module where

the vast majority of items demonstrated CVR values significantly exceeding the minimum threshold. This process has culminated in a standardized, credible, and holistic intervention protocol that is now primed for empirical investigation through feasibility studies and randomized controlled trials (RCTs). The strong validation across all domains underscores a paradigm shift in complementary medicine research—from investigating isolated modalities to developing integrated, multi-targeted strategies that address the complex, multi-systemic nature of chronic diseases like COPD.

4.1 Interpretation of Key Findings and Clinical Rationale

4.1.1 Yoga Module: A Consensus on Mechanistic and Holistic Value
The exceptional validation of the yoga component, with an average CVR of 0.94, signifies powerful expert agreement on its foundational role. The unanimous endorsement (CVR=1.00) of all five Pranayama techniques—Bhastrika, Kapalbhati, Anulom-Vilom, Nadishodhan, and Bhrameri—is particularly salient. This consensus is firmly rooted in physiology. These techniques are not merely "breathing exercises"; they are sophisticated neuromodulatory practices. Bhastrika and Kapalbhati are known to enhance respiratory muscle strength and endurance, improve ventilatory efficiency, and potentially reset chemoreceptor sensitivity [14]. Anulom-Vilom and Nadishodhan have been shown to promote autonomic balance by increasing parasympathetic tone, thereby reducing the perception of dyspnea and associated anxiety [15]. Bhrameri, with its humming exhalation, creates oscillatory vibrations in the airways, which may improve gas exchange and promote bronchial dilation, a mechanism supported by emerging research on humming-induced nitric oxide release [23].

The high retention of thoracic-expanding and chest-opening Asanas like Bhujangasana (Cobra Pose) and Dhanurasana (Bow Pose) aligns with the goal of combating the restrictive thoracic cage pattern and hyperinflation common in COPD. These postures help maintain thoracic mobility, strengthen accessory respiratory muscles, and improve posture, thereby optimizing breathing mechanics [10]. The retention of practices with slightly lower but still strong CVR scores, such as Surya Namaskar (CVR=0.67) and the bookending practices of Prayer and Shanti Path (CVR=0.83 and 0.67), is critically important. It reflects an expert consensus that values the module's holistic structure—a warm-up that integrates the entire body (Surya Namaskar), and psychological bookends that address the significant anxiety and depression prevalent in the COPD population, thereby fostering a mind-body approach that is central to yoga's therapeutic model.

4.1.2 Acupuncture Points: A Refined, Pathophysiology-Targeted Prescription
The selective validation of acupuncture points, resulting in the exclusion of LU 7 (Lieque), provides a profound insight into the experts' clinical reasoning for a chronic, complex condition like COPD. While LU 7 is a classic point for respiratory disorders, often used for exterior wind-cold patterns presenting with acute cough and nasal congestion, its exclusion (CVR=0.50) suggests that the panel favored a point prescription more specifically tailored to the chronic internal deficiencies and pathophysiological blockages characterizing COPD.

The retained points form a sophisticated therapeutic strategy targeting the core TCM syndromes of COPD: Lung Qi Deficiency, Phlegm-Dampness Obstructing the Lungs, and Kidney Qi Failure to Grasp Qi.

LU 6 (Kongzui, CVR=0.83**):** As the Xi-Cleft point of the Lung channel, it is specifically indicated for acute and painful conditions, making it highly relevant for managing sudden exacerbations of dyspnea and cough within the chronic disease course.

BL 13 (Feishu, CVR=0.83**) and LU 9 (Taiyuan,** CVR=0.67**):** This combination represents a foundational approach. BL 13, the Back-Shu point, and LU 9, the Source point, are used synergistically to tonify the Lung organ itself, addressing the root of the Qi deficiency.

ST 40 (Fenglong, CVR=0.83**):** This is the key point for resolving Phlegm, directly targeting the excessive mucus production and sputum that plague COPD patients.

K 3 (Taixi, CVR=0.83**) and BL 23 (Shenshu,** CVR=0.83**):** These points tonify the Kidney, which in TCM is considered the "root of respiration" and responsible for "grasping" the Qi sent down by the Lungs. This addresses the progressive breathlessness on exertion, a hallmark of declining Kidney function in TCM.

LI 4 (Hegu, CVR=1.00**) and LI 11 (Quchi,** CVR=0.67**):** These points are valued for their broad immune-modulating and anti-inflammatory effects, aligning with the modern understanding of COPD's systemic inflammation [9].

This refined selection moves beyond a symptomatic formula to a pathogenesis-informed protocol, potentially offering a more targeted and effective intervention for the chronicity of COPD.

4.1.3 Naturopathy: Validating Foundational Supportive Therapies

The strong consensus on both hydrotherapy (Average CVR=0.67) and dietary interventions (Average CVR=0.90) highlights the experts' recognition of the importance of supporting the body's intrinsic healing mechanisms and addressing systemic dysfunction.

The hydrotherapy procedures validated—Steam Inhalation, Hot Chest Pack, Steam Bath, and Hot Foot and Arm Bath—function through thermoregulatory and hemodynamic principles. Steam inhalation directly hydrates the airways, liquefies viscous sputum, and soothes irritated bronchial linings, thereby aiding mucociliary clearance [8]. The application of heat via chest packs and baths promotes vasodilation, increases local blood flow, and relaxes hypertonic respiratory muscles, providing symptomatic relief from muscle fatigue and bronchospasm.

The dietary recommendations received the highest level of agreement, with "Anti-Oxidant Rich Diet" and "Easily Digested Foods" achieving perfect scores. This consensus is powerfully aligned with contemporary pathophysiology. COPD is characterized by a sustained oxidant-antioxidant imbalance, and a diet rich in antioxidants (e.g., vitamins C and E, flavonoids) is crucial to counteract this burden [13]. The emphasis on easily digested, nutrient-dense foods is a critical, yet often overlooked, aspect of COPD management. Patients frequently experience dyspnea while eating, early satiety, and a high energy cost of digestion, leading to a negative energy balance and cachexia [17]. This expert endorsement underscores that dietary strategy in COPD must be as meticulously planned as pharmaceutical therapy to prevent malnutrition and its devastating consequences.

4.2 Comparison with Existing Literature and Contribution to the Field

While numerous RCTs have evaluated the efficacy of single-modality CAM interventions for COPD [6, 10, 14], the literature is strikingly devoid of methodologically developed and validated *integrated* protocols. Many previous studies have employed investigator-designed, often non-reproducible modules, limiting their credibility and translational potential [11]. Our study directly addresses this gap by providing a transparent, systematic, and quantitative blueprint for a multi-modal intervention.

The high CVR scores for the yoga components, particularly *Pranayama*, are consistent with the findings of meta-analyses like that of Cramer et al. [6], which concluded that yoga can improve lung function and exercise capacity in COPD. However, our study moves beyond confirming efficacy to defining *what specific practices* constitute an optimal, expert-endorsed protocol. Similarly, while trials like the COPD Acupuncture Trial (CAT) by Suzuki et al. [19] demonstrated that acupuncture can improve dyspnea, the point selection varied. Our validated list of 11 acupoints provides a standardized, consensus-based prescription that can be replicated in future research, enhancing the comparability and quality of evidence.

4.3 Implications for Research and Clinical Practice

The immediate and primary implication of this study is the creation of a robust tool for future scientific inquiry. The validated IYNAD module is now ready for:

- **Feasibility and Pilot Studies:** To assess recruitment, adherence, safety, and acceptability in a COPD population, and to generate preliminary efficacy data for power calculations.
- **Definitive RCTs:** To compare the IYNAD module as an adjunct to standard care against standard care alone or an attention-control group. Primary outcomes should include objective measures (FEV1, 6-Minute Walk Distance, exacerbation rate) and patient-reported outcomes (SGRQ, CAT, dyspnea scales).
- **Mechanistic Studies:** To explore the biological underpinnings of its effects, such as

changes in inflammatory biomarkers (e.g., CRP, IL-6, IL-8), oxidative stress markers, and autonomic nervous system function (Heart Rate Variability).

For clinical practice, should future trials confirm its efficacy, this module offers a structured, reproducible protocol that can be integrated into conventional pulmonary rehabilitation programs. It provides a holistic, multi-pronged strategy that simultaneously addresses physical limitation (through yoga and acupuncture), symptom burden (through all modalities), systemic inflammation (through diet and acupuncture), and psychological distress (through yoga and meditation), thereby offering a more comprehensive approach to patient care.

4.4 Limitations and Strengths

This study must be interpreted within the context of its limitations. First, the expert panel, though diverse in expertise, was constituted entirely from India. This may introduce a cultural bias, particularly favoring the yoga and naturopathy components. Future international validation could enhance the global applicability of the module. Second, content validity is the foundational first step; it establishes that the module's components are relevant and representative but does not attest to its feasibility, safety, or efficacy, which must be determined through subsequent clinical studies. Third, the module provides the "what" but not the intricate "how" for each practice; detailed standard operating procedure (SOP) manuals will be necessary for implementation.

Notwithstanding these limitations, the study possesses notable strengths. These include the systematic, dual-phase development process grounded in both traditional wisdom and contemporary evidence; the use of a robust, quantitative validation method (Lawshe's CVR) that minimizes subjective bias; and the engagement of a sufficiently sized panel of highly qualified experts, which bolsters the credibility and authority of the validated content.

5. CONCLUSION

In summary, this study has successfully bridged a significant methodological gap in integrative medicine for COPD by developing and establishing the content validity of a comprehensive IYNAD module. The strong expert consensus across yoga, acupuncture, and naturopathy domains validates the relevance and perceived essentiality of a multi-faceted, holistic approach to managing this complex and debilitating disease. The resulting module is a standardized, credible protocol poised for the next critical stage of empirical investigation. The journey from validated content to evidence-based practice now requires rigorous clinical testing to determine the real-world impact of this integrated approach on the health and well-being of patients living with COPD.

6. FUTURE DIRECTIONS

The successful content validation of the IYNAD module establishes a critical foundation for a structured research pathway. To translate this theoretically robust protocol into evidence-based practice, the following sequential steps are recommended:

1. **Feasibility and Pilot Testing:** The immediate next step involves conducting a feasibility study with a small cohort of stable COPD patients (GOLD stages 2-3). This study should quantitatively assess:
    - **Recruitment and Retention Rates:** To gauge participant willingness and ability to commit to a multi-modal program.
    - **Protocol Adherence and Fidelity:** To measure compliance with the different components (yoga sessions, acupuncture attendance, dietary adherence) and the consistency of intervention delivery by therapists.
    - **Acceptability and Patient Experience:** Using mixed-methods (quantitative surveys and qualitative interviews) to understand patient perceptions, perceived benefits, and potential barriers.
    - **Safety and Tolerability:** To meticulously document any adverse events related to the interventions, particularly vigorous pranayamas like Bhastrika and Kapalbhati in a vulnerable population.

- **Preliminary Efficacy:** To estimate effect sizes on key outcomes (e.g., CAT score, 6MWD) for sample size calculation in a definitive trial.

2. **Randomized Controlled Trial (RCT):** Following a successful pilot, a robust, multi-center, assessor-blinded RCT is paramount. This trial should compare the IYNAD module (as an adjunct to standard care) against a control group receiving standard care alone, enhanced with an attention control (e.g., sham acupuncture and general wellness education) to account for non-specific effects. Primary outcomes must include:
   - **Objective Physiological Measures:** Forced Expiratory Volume in 1 second (FEV1), 6-Minute Walk Distance (6MWD), and exacerbation frequency requiring medical intervention.
   - **Patient-Reported Outcomes:** Disease-specific health-related quality of life (St. George's Respiratory Questionnaire - SGRQ, COPD Assessment Test - CAT), dyspnea (mMRC scale), and symptoms of anxiety and depression (HADS).

3. **Mechanistic Studies:** To elucidate the biological pathways through which the IYNAD module exerts its effects, future trials should incorporate biomarker assessments. This could include investigating its impact on:
   - **Systemic Inflammation and Oxidative Stress:** Levels of C-reactive protein (CRP), Interleukins (IL-6, IL-8), Tumour Necrosis Factor-alpha (TNF-α), and markers of oxidative damage (8-isoprostane).
   - **Autonomic Nervous System Function:** Heart Rate Variability (HRV) as a non-invasive measure of sympatho-vagal balance.
   - **Immune Function:** Flow cytometric analysis of immune cell populations.

4. **Long-Term and Real-World Implementation Studies:** Once efficacy is established, research should focus on:
   - **Long-Term Sustainability:** Conducting follow-up studies (e.g., at 6 and 12 months post-intervention) to assess the durability of benefits.
   - **Implementation Science:** Exploring the effectiveness and scalability of integrating the IYNAD module into diverse real-world settings, such as pulmonary rehabilitation programs, community health centers, and tertiary care hospitals, examining factors like cost-effectiveness, therapist training requirements, and healthcare system barriers.

5. **Cultural Adaptation and International Validation:** To enhance global generalizability, the module should undergo cultural adaptation and re-validation by international panels of experts from different healthcare systems (e.g., East Asia, Europe, North America). This is particularly relevant for the yoga and naturopathy components to ensure cultural appropriateness and acceptability.

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Conflict of Interest

The authors hereby declare that there are no conflicts of interest, whether financial or personal,

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The role of yoga and mindfulness in modern corporate management

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Abstract

In the modern corporate world, competition, long working hours, and constant pressure to perform have led to rising levels of stress, anxiety, and burnout among employees and managers. These issues not only affect personal health but also reduce productivity, creativity, and job satisfaction. To handle these growing challenges, many companies are now introducing traditional practices like Yoga and Mindfulness into their management systems. This research paper explores how yoga and mindfulness can play an important role in improving workplace health, concentration, emotional intelligence, and leadership skills. Yoga helps reduce physical tension and mental fatigue through breathing exercises, postures, and relaxation techniques. Mindfulness, on the other hand, trains the mind to stay present and focused, which improves decision-making, patience, and clarity. When applied together, these practices help build a positive and balanced work environment where employees feel valued, calm, and motivated. The paper also studies various corporate examples where yoga and mindfulness programs have increased employee engagement, reduced absenteeism, and enhanced overall performance. By combining ancient wisdom with modern management, organizations can create a more sustainable, ethical, and human-centered approach to business. Overall, the study highlights that yoga and mindfulness are not just wellness trends but essential tools for achieving long-term corporate success and employee well-being.

Keywords: Yoga, Mindfulness, Corporate Management, Employee Well-being, Productivity, Stress Management, Leadership, Work-life Balance

INTRODUCTION

Modern corporate life is filled with tight deadlines, long working hours, and constant competition. Employees are expected to perform at their best every day, which often leads to stress, anxiety, and burnout. Managers and leaders also face continuous pressure to meet organizational goals and maintain team performance. As a result, mental health and emotional well-being have become serious concerns in today's workplace. To address these challenges, many companies are turning toward holistic approaches like yoga and mindfulness. These ancient practices help individuals manage stress, improve concentration, and maintain emotional balance. Yoga, which originated in India thousands of years ago, is not just a physical exercise it is a complete system for harmonizing the body, mind, and spirit. It includes physical postures (asanas), breathing exercises (pranayama), and meditation (dhyana) that together promote relaxation and self-awareness. Mindfulness, on the other hand, means being fully present and aware of what is happening in the moment. It helps individuals observe their thoughts and emotions without judgment. When applied in the corporate setting, mindfulness enables employees and leaders to make better decisions, communicate effectively, and respond calmly to challenges. Today, companies across the world are realizing that employee well-being directly impacts productivity, creativity, and overall performance. Hence, integrating yoga and mindfulness into corporate management is not just a trend but a necessity. These practices help create a workplace culture that values mental peace, teamwork, and emotional intelligence essential qualities for sustainable success in the modern business world.

LITERATURE REVIEW:

Many researchers around the world have studied how yoga and mindfulness help people in managing stress and improving performance at work. In recent years, these practices have gained a lot of attention in the corporate sector because they promote mental peace, emotional stability, and better teamwork. Companies have started realizing that employees who are mentally and physically healthy perform better, stay motivated, and remain loyal to the organization. According to Raghuram et al. (2013), yoga practices such as asanas (postures), pranayama (breathing exercises), and meditation have a positive impact on both the body and the mind. Regular practice of yoga reduces stress, helps control emotions, and improves concentration. Employees who take part in yoga sessions report feeling calmer, more energetic, and better able to handle daily work pressure. Similarly, Woodyard (2011) found that yoga not only improves flexibility and physical strength but also helps in overcoming fatigue, anxiety, and burnout, which are common problems in the corporate environment. Jonkabat-Zinn (1990), who introduced the idea of mindfulness based Stress Reduction (MBSR), explained that mindfulness is about being aware and present in each moment. His research showed that mindfulness helps people respond thoughtfully rather than react emotionally, which is very useful in the workplace where decision-making and communication are key. Employees who practice mindfulness regularly tend to be more focused, patient, and emotionally intelligent. A study published in the Harvard Business Review (2015) reported that mindfulness training in companies like Google and Intel led to higher employee satisfaction, improved leadership skills, and better teamwork. These programs encouraged employees to handle stress more effectively and build stronger professional relationships. Another study by Shapiro et al. (2012) found that mindfulness helps reduce job-related tension and increases self-awareness. It helps employees understand their thoughts and emotions better, which improves their mental clarity and problem-solving abilities. Overall, these studies show that yoga and mindfulness have become valuable tools in modern corporate management. They not only support individual well-being but also improve communication, creativity, and overall workplace culture. By including yoga and mindfulness in their daily routine, both employees and leaders can work more peacefully, think clearly, and contribute positively to the organization's growth.

RESEARCH OBJECTIVES:

- To study the importance of yoga and mindfulness in reducing stress and improving mental well-being among employees.
- To analyze how yoga and mindfulness practices affect productivity, concentration, and job satisfaction in corporate settings.
- To identify the challenges faced by organizations in implementing yoga and mindfulness programs.

RESEARCH METHODOLOGY

This research is based on secondary data, collected from books, research papers, online articles, and company reports. The descriptive method was used to study how yoga and mindfulness are applied in modern corporate management. The data was analyzed to understand their benefits, challenges, and impact on employee well-being, productivity, and leadership. This method helps to explain how these practices can improve workplace culture and management efficiency.

THE CONCEPT OF YOGA AND MINDFULLNESS

The Yoga focuses on harmony between the mind, body, and soul. It includes physical exercises (asanas), breathing techniques (pranayama), and meditation (dhyana). These practices reduce tension and improve energy levels. Mindfulness is the art of paying attention to the present moment. It helps individuals become more aware of their thoughts and emotions, which improves focus and decision-making. Both practices train the mind to stay calm and positive, even during high-pressure situations common in corporate environments.

The importance of Yoga and Mindfulness in Reducing Stress and Improving Mental Well-being.

Stress is one of the most common issues faced by corporate employees today. Continuous pressure,

workload, and long working hours lead to emotional and physical exhaustion. Yoga and mindfulness provide a natural way to reduce stress and maintain mental balance. Yoga helps in relaxing the nervous system, improving breathing patterns, and enhancing blood circulation. Practices like pranayama (breathing exercises) and meditation calm the mind and reduce anxiety. Mindfulness teaches employees to stay present and focused rather than being lost in worries about the past or future. According to Raghuram et al. (2013), employees who practiced yoga regularly showed lower levels of stress and improved emotional stability. Similarly, Jon Kabat-Zinn (1990) proved that mindfulness-based stress reduction (MBSR) programs significantly reduce anxiety and promote overall psychological health. When employees feel mentally balanced, they work with greater clarity and positivity, leading to a healthier work culture.

Effect of Yoga and Mindfulness on Productivity, Concentration, and Job Satisfaction.

Yoga and mindfulness not only improve mental health but also enhance work performance and productivity. Regular practice sharpens concentration, improves creativity, and helps employees manage their time better. A calm and focused mind makes better decisions and handles challenges more effectively. A study published in the Harvard Business Review (2015) showed that mindfulness programs increased employee attention span, patience, and creativity. Employees became more aware of their thoughts and emotions, which led to better teamwork and problem-solving. Yoga also boosts physical energy and reduces fatigue. When the body is relaxed and the mind is peaceful, employees perform tasks with more enthusiasm and focus. As a result, their job satisfaction and sense of purpose at work increase. Organizations that include regular yoga or mindfulness sessions notice higher employee engagement and lower absenteeism rates.

CHALLENGES FACED BY ORGANIZATION IN IMPLEMENTATION.

Even though yoga and mindfulness have many proven benefits for both employees and organizations, several practical and organizational challenges make it difficult to implement these programs effectively in corporate environments. Below are the major challenges explained in detail:

1. Lack of Awareness and Understanding

Many employees and even managers are unaware of the true meaning and benefits of yoga and mindfulness. They often see these practices as spiritual or religious activities rather than tools for mental health and performance improvement. Because of this misunderstanding, they may not take these sessions seriously or may even feel uncomfortable participating. This lack of awareness creates a major barrier to acceptance in professional workplaces.

2. Lack of Time and Busy Schedules

In the corporate world, employees already have packed schedules filled with meetings, deadlines, and targets. They often feel that attending yoga or mindfulness sessions will take away valuable work time. As a result, participation rates drop. Without proper time management or flexible scheduling, these programs struggle to become a consistent part of daily office routines.

3. Irregular Participation and Commitment

Many organizations start yoga or mindfulness programs with enthusiasm, but over time, participation becomes irregular. Employees may attend a few sessions and then stop due to workload or loss of interest. The benefits of these practices only appear with regular and continuous effort, so inconsistency reduces their impact and makes it difficult to measure results.

4. Lack of Support from Top Management

For any corporate program to succeed, support from top management is essential. If company leaders do not personally encourage or participate in wellness programs, employees often see them as optional or unimportant. Without leadership involvement, yoga and mindfulness initiatives fail to gain long-term value or integration into the company’s culture.

5. Limited Resources and Budget

Implementing yoga and mindfulness programs requires proper space, certified trainers, and sometimes equipment like mats or relaxation tools. Many companies, especially small or medium-sized ones, do not allocate a separate budget for employee wellness. As a result, programs are often short-term, irregular, or lack professional quality.

6. Cultural and Personal Barriers

In some workplaces, employees from different backgrounds may have different beliefs about yoga and meditation. Some may feel shy, awkward, or hesitant to perform yoga poses in front of colleagues. Others may wrongly believe that yoga conflicts with their personal or religious beliefs. These cultural sensitivities can reduce participation and create barriers to implementation.

7. Difficulty in Measuring Results

Unlike sales or production data, the benefits of yoga and mindfulness—such as improved mood, better focus, or emotional balance—are not easily measurable. Companies often look for direct financial outcomes, but wellness results are mostly seen in long-term improvements. The lack of clear metrics makes it harder for organizations to justify investment in such programs.

8. Short-Term Approach by Organizations

Some companies treat yoga and mindfulness programs as a one-time event or a short campaign rather than a regular wellness strategy. They may organize sessions only during "Health Week" or after stress-related complaints. This short-term approach prevents employees from experiencing the deeper, long-lasting effects of these practices.

9. Lack of Certified Trainers and Guidance

For yoga and mindfulness to be effective, they must be taught by trained and certified professionals. However, many organizations fail to hire qualified instructors. Without proper guidance, sessions may become ineffective, boring, or even physically unsafe. Trained instructors also know how to tailor sessions for different employee needs and stress levels.

10. Resistance to Change

Finally, change is often uncomfortable. Some employees prefer traditional work routines and resist new wellness activities. They may see yoga or meditation as unnecessary or feel embarrassed to participate. Overcoming this resistance requires motivation, awareness, and continuous encouragement from the management.

CONCLUSION

In today's fast-paced and highly competitive corporate world, stress, anxiety, and burnout have become common problems faced by employees at all levels. These issues not only affect the mental and physical well-being of individuals but also reduce overall productivity, creativity, and organizational growth. To address these challenges, modern companies are now turning toward ancient wisdom — particularly yoga and mindfulness — as effective tools for maintaining balance, focus, and emotional health in the workplace. This study shows that yoga and mindfulness practices offer multiple benefits for both employees and organizations. On an individual level, they help in reducing stress, improving concentration, boosting energy, and promoting emotional stability. Employees who practice mindfulness regularly are better at handling pressure, controlling anger, and making thoughtful decisions. They become more patient, focused, and self-aware, which directly improves their relationships with colleagues and clients. On an organizational level, these practices create a healthy work culture by increasing productivity, reducing absenteeism, and enhancing job satisfaction. Companies that integrate yoga and mindfulness into their daily routines experience higher employee engagement, teamwork, and creativity. Global leaders like Google, Apple, and Intel have already recognized that employee wellness is directly linked to business success. When employees feel mentally relaxed and physically fit, they perform better, stay motivated, and contribute more effectively toward achieving company goals. However, the research also highlights certain

challenges in implementing such programs — including lack of awareness, time constraints, irregular participation, limited management support, and cultural barriers. These challenges show that introducing yoga and mindfulness is not enough; organizations must ensure consistent practice, leadership involvement, and proper guidance to make them successful. Without strong commitment and continuous effort, the programs may lose their impact over time. Therefore, organizations must look at yoga and mindfulness not as temporary wellness activities, but as long-term investments in human capital. By providing regular sessions, professional instructors, and encouraging participation from all levels of staff, companies can build a more resilient, positive, and focused workforce. In conclusion, yoga and mindfulness represent a perfect blend of ancient wisdom and modern management needs. They remind us that true success in business is not only measured by profit or performance but also by peace, purpose, and well-being. When employees are mentally calm and emotionally strong, the organization naturally becomes more productive, innovative, and successful. Thus, embracing yoga and mindfulness is not just a trend. it is a strategic step toward building healthier, happier, and more sustainable workplaces for the future.

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Chapter 2: Management & Leadership

Leadership Lessons from Kautilya's Arthashastra : Developing a Contemporary Leadership Model for Indian Armed Forces

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Abstract

Kautilya's Arthashastra is well-known for its strategic and statecraft teachings. The treatise also offers a nuanced philosophy of leadership that extends far beyond mere military tactics. This research paper undertakes a critical examination of Kautilya's Arthashastra to extract its core leadership tenets and assess their applicability for developing a contemporary leadership model for Indian Armed Forces. The research focusses on three primary objectives: to identify the specific leadership qualities enunciated by Kautilya, to evaluate their relevance in the twenty-first century, and to determine the feasibility of constructing a leadership model for the training of future Indian military leaders based on these principles.

The study uses qualitative content analysis to identify leadership qualities from the primary text and compares them with modern leadership theories and current security issues to assess their ongoing relevance. The findings demonstrate that the Arthashastra offers a robust, indigenous approach to leadership—emphasizing ethical integrity, decisiveness, intellectual insight, and the welfare of subordinates—qualities that are still relevant today. Consequently, this paper proposes a structured leadership model derived from these qualities, designed for integration into the training and pedagogical curriculum of future Indian Armed Forces officers.

The research concludes that the leadership qualities described in the Arthashastra are still crucial today and can be effectively used for developing leaders who are prepared to deal with the difficult moral and strategic problems of modern warfare.

Keywords: Military Leadership, Statecraft, Strategic Culture, Ethical Integrity, Intuitive Thinking

INTRODUCTION

Today's security challenges are more complex than ever, requiring strong and wise leaders in the Indian Armed Forces. While modern leadership theories are useful, there is a need for an approach that is deeply connected to India's own rich history and strategic culture. Kautilya's Arthashastra, an ancient masterpiece on statecraft, offers exactly this kind of timeless wisdom. The book is not just about strategy; it provides a profound philosophy of leadership built on ethics, intelligence, firm decision-making, and genuine care for the people. This paper explores the Arthashastra to identify its key leadership lessons, test their relevance for our modern times, and use them to build a practical leadership model for training the next generation of Armed Forces officers in India.

LITERATURE REVIEW

Scholarly literature on Kautilya's Arthashastra and modern leadership theories can be divided into three related areas: analysis of the text as a treatise on statecraft, examination from the perspective of management and leadership, and discussion of indigenous and context-specific leadership models relevant to the Indian Armed Forces.

The first stream of literature outlines the underlying principles of the Arthashastra. Translations and commentaries by authors like Rangarajan [1] and Kangle [2] have contributed to making the Arthashastra accessible to contemporary readers. These works describe the Arthashastra as a text on governance (Dandaniti), focusing on the stability and welfare of the state. Scholars like Boesche have

analyzed its strategic depth, comparing Kautilya to Machiavelli, but arguing that the former's vision is far more systematic and encompassing [3]. The literature confirms that the Arthashastra provides a detailed framework for the conduct of a ruler, emphasizing qualities such as intellectual prowess, energy, and personal discipline, which form the bedrock of its leadership philosophy [1],[4].

The second stream of literature connects ancient concepts with contemporary management theory. Researchers such as Sihag [5] and Aier [6] have identified parallels between Kautilyan ideas and current principles of leadership and management. They note that the Arthashastra contains elements similar to transformational leadership, ethical leadership, and strategic leadership. The text's attention to the welfare of the populace (Yogakshema) has been compared to servant leadership and stakeholder theory [6],[7]. In addition, studies have examined Kautilyan perspectives on crisis management, decision-making, and the selection of ministers, noting similarities with practices in corporate governance and public administration [5],[8].

The third and most critical stream for this paper concerns leadership within the Indian Armed Forces and the search for indigenous models. Official doctrines and works by military scholars emphasize the unique demands of military leadership, where decisions have immediate and grave consequences [9]. While the leadership model of the Indian Armed Forces is robust, drawing from both colonial traditions and post- independence experiences, there is a recognized gap in formally integrating ancient Indian strategic thought into its pedagogical framework [10]. Recent scholarly calls, such as Katal [11] advocate for the development of a leadership model that is culturally grounded and reflects the Indian strategic psyche. The works of Kamal [12] and Bakshi [13] explore this space, suggesting that Kautilya's emphasis on situational awareness, moral integrity, and the well-being of the army (Bala) offers a rich, untapped resource.

Research Gap and Contribution

Although there is a lot of research on the Arthashastra and leadership, most studies focus on separate areas and do not connect them. There are very few works that clearly explain what leadership lessons can be learned from the Arthashastra, examine how these ideas apply to today's military needs, and put them together in a practical way for training Indian Armed Forces officers. This study aims to fill that gap. It uses existing translations, builds on what management experts have found, and responds to the need for leadership models rooted in Indian tradition. By bringing these different areas together, this paper seeks to create a leadership framework based on Kautilya's ideas that fits the modern Indian Armed Forces.

METHODOLOGY

This study uses a qualitative research approach based on a detailed analysis of Kautilya's Arthashastra, primarily using the translation by L.N. Rangarajan [1]. The methodology follows three clear steps. First, the text was carefully studied to identify and list the key leadership qualities described by Kautilya. Second, these ancient ideas were compared with modern leadership theories to see how well they match

and how useful they remain in today's context—especially in dealing with current challenges like hybrid warfare and ethical issues in combat. Finally, the findings were synthesised to create a practical leadership model. This model connects Kautilya's principles with the core competencies required for an Indian Armed Forces officer, making it suitable for integration in military training programs.

CORE LEADERSHIP TENETS IN THE ARTHASHASTRA

Kautilya's Arthashastra, is the oldest and most exhaustive treatise on statecraft and on issues of diplomacy, war, peace, intelligence, security, and political economy. It is in the form of guidelines to a king (ruler) as to how he should govern his state, formulate foreign policies and plan and conduct military campaigns. Though not specifically mentioned, Arthashastra can actually be interpreted as a treatise on leadership, as it lays down how a ruler should act. What further reinforces this thought is

the fact that the very first chapter of Arthashastra deals with the topic of training.

Kautilya speaks about enlightened leadership or Rajarishi, which is logically developed in the text. Rajarishi is akin to the contemporary concept of scholar warrior prevalent in the Indian Army. Another remarkable feature about Arthashastra is that not only does it mention the qualities that a ruler should have but also covers in detail the aspects of training of a prince and conduct of a king. A ruler or a king is primarily a leader of his people. Accordingly, core leadership tenets from the Arthashastra are analysed under two separate parts i.e. qualities of a leader and conduct of a leader.

The numbers in parenthesis relate to the text in Arthashastra. The first number depicts the book number, the second depicts the chapter, and the third number is the sutra.

Qualities of a Leader

Though the very first chapter of Arthashastra is 'Topic of Training', however, in the sixth chapter, Kautilya in the sutras (6.1.2) to (6.1.6) has mentioned the excellences (qualities) of a king. He has articulated these qualities under four major heads i.e. approachability, intellect, energy and personal excellences. Although Kautilya identifies these traits for the leader and talks of 'good lineage' also, yet he refers to the inherent potential of the person and his innate desire and ability to learn, as is made clear by his emphasis on training in chapter one. Kautilya takes a multi-dimensional view when he says that the potential exists within the person, however, appropriate training is required to develop it further. Possessing certain traits only makes it more likely that the person will become a leader or be given leadership authority. "A man attains greatness by his merits, not simply by occupying an exalted seat" [14].

Vidyasamuddesah

The foundation of good leadership is Vidyasamuddesah or acquiring knowledge and its application. Kautilya says, 'Philosophy, the three Vedas, economics and the science of politics – these are the sciences' (1.2.1). Of the four sciences, Kautilya attaches the highest importance to the study of Anviksiki i.e. philosophy or critical thinking, as it sharpens the intellect enabling the ruler to distinguish right from wrong. He implies that philosophy throws light on all other branches of learning, giving them their significance, and it provides rational basis for all actions and duties (1.2.12) [2]. Philosophy has further been elaborated as:

- Samkyha i.e. rational or theoretical thinking.
- Yoga implying spiritual or intuitive thinking.
- Lokayata which translates into empirical thinking.

In order to be able to acquire this knowledge or sharpen his intellect, a ruler should have the desire to learn, listening (to others), grasping, retention, thorough understanding, reflecting, rejecting (false views) and intentness on truth (6.1.4). Along with Vidyasamuddesah the further necessary condition that has been laid by Kautilya is association with elders, or Vraddhasamyogah, for the sake of improving knowledge. Kautilya says, 'And (he should have) constant association with elders in learning for the sake of improving his training, since training has its root in that' (1.5.11). Continuous studies and learning new things ensure a trained intellect and practical applications.

Knowledge has been given such primacy by Kautilya that he makes it as the basis of all actions. The knowledge of the ruler confers benefit on his people, keeps his mind steady in adversity and in prosperity and brings about proficiency in thought, speech and action (1.2.11).

Discipline

Discipline has normally been associated with training with an aim to produce a specific character or pattern of behaviour. It has further been bifurcated into self-discipline and enforced discipline. Normal belief, especially in military, is that enforced discipline can make up for lack of self-discipline. However, Kautilya terms self-discipline as a pre-requisite for an effective leader.

Discipline is of two kinds - inborn and acquired. Instruction and training can promote discipline only in a person capable of benefiting from them. Learning imparts discipline only to those who have

mental faculties - obedience to a teacher, desire and ability to learn, capacity to retain what is learnt, understanding what is learnt, reflecting on it and finally ability to make inferences by deliberating on the knowledge acquired. Those who are devoid of such mental faculties are not benefited by any amount of training (1.5.3-6).

Kautilya, through the above sutras, has linked knowledge with discipline and vice-versa, an association usually not made in the contemporary world. An individual lacking intellect cannot be disciplined and only a disciplined person can benefit from training. Another important aspect which one can reflect upon is that of obedience or inborn discipline. It is this inborn or self-discipline which is most essential for a leader as only this would enable him to acquire knowledge and apply it correctly.

Indrayajayah

Apart from being knowledgeable, Kautilya's concept of an ideal leader also stresses on the importance of self-purification and inner cleansing for holding the right perspective. Kautilya says that a leader should have control over his senses (Indrayajayah). The six senses which Kautilya terms as 'six enemies' are – lust (Kama), anger (Krodha), greed (Lobha), pride (Mána), arrogance (Mada), and foolhardiness (Harsha) (1.6.1). Though lust, anger and greed are well understood, (Kangle, 1965) in his footnotes amplifies what Kautilya probably meant by Mana, Mada and Harsha. Pride or Mana appears to be the feeling of great conceit owing to an exaggerated opinion about oneself; Mada is arrogance resulting from the possession of great power and Harsha appears to be the feeling of great exhilaration resulting in playful pranks and fool hardy behaviour.

Kautilya says, 'A king, behaving in a manner contrary to that, (and hence) having no control over his senses, quickly perishes, though he be ruler right up to the four ends of the earth' (1.6.4). In order to stress on the importance of control over senses, Kautilya in sutras (1.6.5-12) gives examples of how kings in the past had given in to these senses and not only lost their kingdoms but had caused great loss to its people too. Even recent history is full of examples of how kings have either lost their kingdom or earned great respect because of control over senses or lack of it. One shining example in Indian history is of Shivaji, who laid great emphasis on control over lust by his officers and troops during their struggle against the Mughals.

In sutras (1.6.1) and (1.6.3), Kautilya mentions knowledge as the means of control over senses. Subsequently in sutra (1.7.1), he gives out the qualities of a Rajarishi or Sage-like king for whom the control over the senses is a pre-requisite. The sutra says, 'Therefore, by casting out the group of six enemies he should acquire control over the senses, cultivate his intellect by association with elders, keep a watchful eye by means of spies, bring about security and well-being by (energetic) activity, maintain the observance of their special duties (by the subjects) by carrying out (his own) duties, acquire discipline by (receiving) instructions in the sciences, attain popularity by association with what is of material advantage and maintain proper behaviour by (doing) what is beneficial.'

What can be made out by Kautilya's reference to control over the 'six enemies', is that these enemies or senses make a leader unstable thereby distorting his ability to correctly perceive what is right to be done for the well-being of his people. What can be further inferred from the writings is that though a leader may have the knowledge, but the utilisation of this knowledge is largely dependent on his ability to have control over his senses. This control can not only be achieved by acquiring knowledge but also needs a high degree of self-discipline.

Energy

Energy imparts the ability to be active and perform one's task. Kautilya defines bravery, resentment (resolute), quickness and dexterity as components of energy (6.1.5). For a leader who lacks energy and is thus inactive leads towards not only destruction of what he has but also misses out on what he could receive. 'In absence of activity, there is certain destruction of what is obtained and of what is not yet received. By activity reward is obtained, and one also secures abundance of riches' (1.19.36). Here Kautilya by means of absence of activity is probably referring to lack of personal energy rather than indecision and by riches he is not restricting to material gains but is implying prosperity and success.

In sutra (1.19.1), Kautilya links the level of energy of people to that of the leader. He says, 'When a king is active, the servants become active following his example. If he is remiss (careless) they too become remiss along with him. And they consume his works. Moreover, he is overreached by his enemies. Therefore, he (king) should himself be (energetically) active' (1.19.1-5).

Kautilya has not restricted energy or activeness to the physical dimensions but has included mental agility. In the subsequent sutra he has beautifully articulated the rules for a king basically laying out a code of conduct for the ruler. This code of conduct is only possible if the king has both physical as well as mental agility. The aspects pertaining to conduct of a leader are being discussed separately.

Approachability

How does one define approachability? The English dictionary puts it simply as accessibility of an individual. Kautilya however gives a completely new dimension to approachability. As per him for a person to be approachable he should be endowed with certain personality as well as acquired traits. In sutra (6.1.3), qualities of easily approachable leader has been mentioned as 'intelligence and spirit, given to seeing elders, pious, truthful in speech, not breaking his promise, grateful, liberal, of great energy, not dilatory (negligent) with weak neighbouring princes, resolute, not having a mean council (of ministers), and desirous of training'.

The essence of leadership, as per Kautilya, is the acceptance of a leader by the people whom he leads. An unapproachable leader may though be able to command obedience by force, but the leadership would neither be just nor everlasting. In sutra (1.19.27) Kautilya says, 'For, a king difficult of access is made to do the reverse of what ought to be done and what ought not to be done, by those near him'. He, therefore, advises the king never to forget the two pillars of the art of governance: Nyay, the justice and Dharma, the ethics, bringing in a sense of morality in leadership. He further directs the king to continuously introspect and to identify his atma doshas, i.e. deficiencies to improve or develop himself.

Personal Excellences

Apart from the qualities specifically mentioned above, Kautilya talks of certain personal traits which a leader should have. These he has clubbed under one head titled personal excellences. These excellences have been mentioned in sutra (6.1.6). Some of these excellences are a repetition of qualities mentioned earlier. The only reason one finds for the repetition is probably the importance that Kautilya assigns to these values. Further these excellences are a mix of personal qualities and the manner in which a leader should conduct himself in the presence of others. As per the sutra, the king should be, 'eloquent, bold, endowed with memory, intellect and strength, easy to manage, trained in arts and free from vices'. The sutra also speaks about the king's ability to take suitable action in calamities and in normal conditions, to have a vision and attaching prominence to undertakings at the proper place and time and with appropriate human endeavour.

With regard to the personal conduct of the king, Kautilya advises that a king while interacting with others should be, 'well-guarded, not laughing in an undignified manner, with a glance, which is straight and without a frown, devoid of passion, anger, greed, stiffness, fickleness, troublesome-ness and slanderous- ness, sweet in speech, speaking with a smile and with dignity.'

CONDUCT OF A LEADER

Time Management

Kautilya in Arthashastra (1.19) lays down the daily routine for the king. The day and night is divided in to eight parts by means of nalikas, or by the measure of the shadow (of the gnomon). Having divided the day he then lists the activities that a king should undertake at what time. Out of the 24 hours, the king is allowed 10.5 hours as his personal time wherein he is supposed to carryout is personal chores and rest. An important aspect of the personal time is training and meditation. The time allocated for meditation shows how emphasis on personal purification can become an integral part of the busy daily routine of a leader. This will prepare the leader for effective handling of larger responsibilities. Having gone through the sutras, one realises that there could not have been a better lesson in time management.

Communication

Effective communication is getting the right message, through the right media, to the right audience at the right time and with the right effect. It implies effectively reaching and communicating clearly to a targeted audience with specific constraints [14]. According to Kautilya, communication improves when the channels of communication are kept open both vertically and horizontally. When leaders are willing to answer people's queries and take the time to explain the deliverables – that's when people learn the value of good communication and practice it themselves.

During that era, royal edicts were used for giving directions or orders (sasana) and were the principal means of communication of kings in times of war and peace. Kautilya devotes a whole chapter (2.10) in his treatise to the topic of edicts. Writers of edicts or scribes were required to have the intellectual capabilities of a minister, be conversant with all conventions, be quick in composing matter and reading documents and have a beautiful handwriting. Kautilya has stressed on the use of right words and the manner in which a message is prepared. He says, 'The use of words with a charming meaning easily conveyed is sweetness. The use of words that are not vulgar is exaltedness. The employment of words that are well-known is lucidity.' (2.10.10-12). He goes on to lay down the principles of good writing in sutra (2.10.57), 'Absence of charm, contradiction, repetition, incorrect (use of a) word and confusion – these are the defects of writing.' It is marvelling to note that Kautilya in 300 BC could appreciate and layout rules for effective communication, an aspect which is relatively new to our present organisations.

Decision Making

The king must not procrastinate in taking decisions on urgent matters as postponement makes matters more difficult and even impossible to settle at times (1.19.30). Kautilya believed that having a passive stance toward the world - trusting in fate or relying on superstition - was outlandish. 'One, trusting in fate, being devoid of human endeavour, perishes' (7.11.34). His philosophy called for action, not resignation. 'The object slips away from the foolish person, who continuously consults the stars, what will the stars do' (9.4.26). In urging the king to rely on science and not the precepts of religion, Kautilya separated political thought from religious speculation. 'He, who is well-versed in the science of politics will bind other rulers by the chain of his intellect and can play with them as he pleases' (7.18.44). Kautilya says, 'All urgent calls he shall hear at once, but never put off; for when postponed, they will prove too hard or impossible to accomplish'.

Delegation

Leaders need to delegate so that they can focus on larger issues. Successful delegation encourages employees to think independently and have a sense of ownership. The leader is burdened with fewer problems on his back and people feel empowered to think for themselves and draw on their experience and wisdom [14]. Kautilya talks in detail about delegation, joint decision making and respecting the advice of subordinates. Kautilya equates empowerment with delegation and focuses on passing power from higher organizational levels to lower ones. He also talks of joint decision making and emphasizes the importance of the King and his counsellors acting together. If the King and his counsellors do not agree on the course of action, it spells future trouble, irrespective of whether the venture is crowned with success or ends in failure (9.7). Kautilya says, 'A King can reign only with the help of others; one wheel alone does not move a chariot. Therefore, a King should appoint advisors (as counsellors and ministers) and listen to their advice' (1.7.9).

Participative Leadership

It is surprising to note that as opposed to the commonly held belief that kings would be autocratic in nature, Kautilya suggests a participative form of leadership in which due diligence is given to the subordinates and their views. Certain examples of participative leadership which emerge from Arthashastra are:

Discussion with Ministers and Employees: The king shall deliberate over matters with a number of people as required. It states that 'No deliberation made by a single person will be successful; the nature of the work which a sovereign has to do is to be inferred from the consideration of both the visible and invisible causes. (1.15)

Obtain Outside Counsel: It further mentions that discussions should not be restricted to ministers and their direct reports. The king 'shall sit at deliberation with persons of wide intellect' (1.15.54). Hence, it discusses the concept of consultation from people outside the ministry.

Encourage Constructive Confrontation: Next, the Arthashastra mentions that the king should hear all opinions even contrary to his. It states, 'He shall despise none, but hear the opinions of all. A wise man shall make use of even a child's sensible utterance' (1.15.22).

Selection of Advisers: Then Arthashastra states that king should not select people on a random basis or those who have no clear idea of the execution of work required. It states, 'He shall consult such persons as are believed to be capable of giving decisive opinion regarding those works about which he seeks for advice' (1.15.41). Hence, qualification and knowledge of advisers is a prerequisite.

Opinions of Competitors: Kautilya does not suggest that advice should be sought from friends and allies alone. He states, 'nor shall he (king) sit long at consultation with those whose parties he intends to hurt' (1.15.46). Hence, getting competitive information and viewpoints hasn't been ruled out.

Number of Advisers: Kautilya advises in sutras (1.15.34) that in the normal course of business the king should discuss with 3-4 ministers. He states that discussing with one minister is useless, as he will advise 'wilfully and without restraint'. Discussing with two would not help as 'the king may be overpowered by their combined action or imperilled by their mutual dissension'. Discussing with too many minsters will cause a great deal of trouble and slow down the process.

Method of Discussion: Last but not the least, Kautilya defines that the king should choose to hold a collective meeting or individual interactions depending on the situation. In his words, 'The king may ask his ministers for their opinion either individually or collectively and ascertain their ability by judging over the reasons they assign for their opinions' (1.15.43-44).

Mentoring

Kautilya lays considerable emphasis on the importance of succession planning. While the eldest son is normally the successor, he may be by-passed if unfit to hold office. Chapter 5.6 deals extensively with orderly succession issues in the event of the death of the king, either due to natural causes or in the battlefield. Kautilya advises specific training to prepare the heir apparent (yuvaraj), for the eventual succession. He recommends training in three specific areas: economic administration (Arthashastra), foreign affairs (nitishastra) and political science (dandaniti). Kautilya is also specific about the qualities councillors (mantris) must possess. These qualities are: power of concentration (drudhachitta), character (shilavan), thinking capability (pragna), communication skill (vangmi) and observation/vigilance (daksha).

Like present day management gurus, Kautilya emphasizes the importance of the competencies of knowledge, skills, and attitude. The king is advised to study deficiencies of the cabinet members and take steps to improve upon them because ministers (mantris) could be incompetent, Army Chief (Senapati) could be over ambitious, Chief Priest (Purohit) may not consider the present day practices or traditions while enacting laws of justice, which might lead to injustice [14]. It is the duty of the king to guide his ministers for the overall welfare of the state and society, 'The King should appoint those proved loyal by the test of piety to posts in the judiciary and for suppression of criminals, those proved upright by the test of material gain to offices of the Administrator and in the stores of the Director of Stores, those proved pure by the test of lust to guardianship of places of recreation, those proved loyal by the test of fear to duties near the (person of the) king. Those found dishonest by every test, he should employ in mines, in forests for material produce, in elephant forests and in factories' (1.10.13-15).

Kautilya reminds the king that understanding the complexity of human nature is essential to be an effective leader. Human aspect of leadership requires a balance between reason and emotion. An effective leader needs to accept that people are both good and evil, with virtues and vices, divine

attributes and demonic tendencies. The effective leader needs to develop subordinates in a manner such that the virtues blossom and vices are pushed aside.

Welfare of People

Throughout the Arthashastra, Kautilya has emphasized the importance of focusing on the interest of the general public. He was of the opinion that a king shall never act in a manner leading to impoverishment. When people are impoverished, they become greedy and disaffected. Then they either go over to the enemy or kill their ruler. The king needs to be empathic and understand the needs of his subjects and take remedial measures if he feels they are uncomfortable, 'In the happiness of the subjects lies the happiness of the king and in what is beneficial to the subjects his own benefit. What is dear to himself is not beneficial to the king, but what is dear to the subjects is beneficial (to him)' (1.19.34).

As regards being just, Kautilya says, 'Whoever imposes severe punishment becomes repulsive to the people; while he who awards mild punishment becomes contemptible. But whoever imposes punishment as deserved becomes respectable. For punishment when awarded with due consideration, makes the people devoted to righteousness and to works productive of wealth and enjoyment; while punishment, when ill-awarded under the influence of greed and anger or owing to ignorance, excites fury even among hermits and ascetics dwelling in forests, not to speak of householders'.

According to Kautilya, holding people accountable for their results is equally important for a leader. And the first step towards accountability is the actions of the king himself. He was thus, of the belief that the King is the most important subject of a kingdom. The actions of a king influence the actions of the subjects in a kingdom. It's of no wonder that the Arthashastra has been addressed by Kautilya for the King.

CONTEMPORARY RELEVANCE OF KAUTILYAN LEADERSHIP

The Indian Armed Forces, as the sentinel of the nation, operate in an increasingly complex and volatile security environment. While equipped with modern technology, the essence of their effectiveness remains rooted in the quality of their leadership. Within this context, Kautilya's ancient Indian strategic thought as articulated in the Arthashastra presents a leadership framework of significant and lasting relevance. The contemporary significance of Kautilyan leadership for the Indian military extends beyond specific martial tactics, encompassing a comprehensive, strategic, and ethically rooted philosophy that aligns with the fundamental challenges encountered by present-day military commanders.

At the heart of Kautilya's philosophy is the concept of the Rajarshi—the philosopher-king. For a military leader, this translates to an officer who is both a warrior and a sage. The Armed Forces officer is expected to be self-disciplined, intellectually astute, and in control of emotions like fear, anger, and hubris. In modern military terms, this aligns perfectly with the need for emotional intelligence and moral fortitude. An officer leading troops in counter-insurgency operations or on the tense line of control must take calibrated decisions under extreme pressure, where a lack of self-control can have catastrophic consequences. Kautilya's emphasis on continuous learning and a well-rounded education prepares today's officers for hybrid warfare, which blends kinetic action with cyber, information, and psychological domains.

Kautilya's Saptanga (seven limbs) theory of the state provides a brilliant strategic lens for military leadership. This framework, comprising the ruler, minister, country, fort, treasury, army, and ally, encourages a commander to think beyond the immediate battlefield. A Corps Commander, for instance, must understand the interplay of these elements: the political will of the 'ruler' (government), the economic strength of the 'treasury', the diplomatic utility of 'allies', and the morale of the 'country' (the public). This systemic view prevents a narrow, tactical outlook and fosters jointness—an understanding of how military action integrates with national power. It makes the Armed Forces officer a strategic asset, not just an operational one.

Kautilya's realistic approach is very relevant. His doctrine of Matsya Nyaya (the law of the fish) is a stark reminder of the ever-present reality of a threatening security environment. This justifies the need for a strong, vigilant, and ready military. His detailed discussions on upayas (the four policy

measures— conciliation, gifts, dissension, and force) provide a sophisticated toolkit for dealing with adversaries. For a military leader, this means understanding that direct force (danda) is only one option. The ability to use strategic communication (conciliation or sama), or to exploit an adversary's internal fissures (dissension or bheda), is crucial in the grey-zone conflicts that characterize modern warfare.

Kautilya's ultimate goal was Yogakshema—the welfare and security of the state. For the Indian Armed Forces, this underscores that their ultimate purpose is the defence of the nation and its people. This ethos fosters a sense of higher duty, aligning with the Armed Forces' core value of "Service Before Self." It reinforces the idea that the strength of the Indian Armed Forces is derived from the people, and their actions must always be in service of security and prosperity of the citizens.

Kautilyan leadership offers the Indian Armed Forces a time-tested, indigenous paradigm. It shapes officers into strategic, emotionally intelligent, and ethically grounded Rajarshis who can navigate the complexities of 21st-century warfare. By integrating this philosophical heritage, the Indian Armed Forces can empower their leadership with a depth of vision that complements their modern operational prowess, ensuring that they remain resilient and effective guardians for the nation.

PROPOSED LEADERSHIP MODEL FOR THE INDIAN ARMED FORCES

Based on the teachings of Arthashastra two models are being recommended. The first model refers to the leader. It details upon what a leader should be made up of bringing out the importance of each singular quality. The model attempts to bring out the interplay of single as well as a group of qualities.

The second model depicts how this leader should conduct himself. It basically lays the method in which the leader should operate to be effective. It is important to understand that the second model is not independent of the first model but is in continuation to it. That is to say that for continued effectiveness, the interplay of qualities of a leader mentioned in the first model have to be sustained.

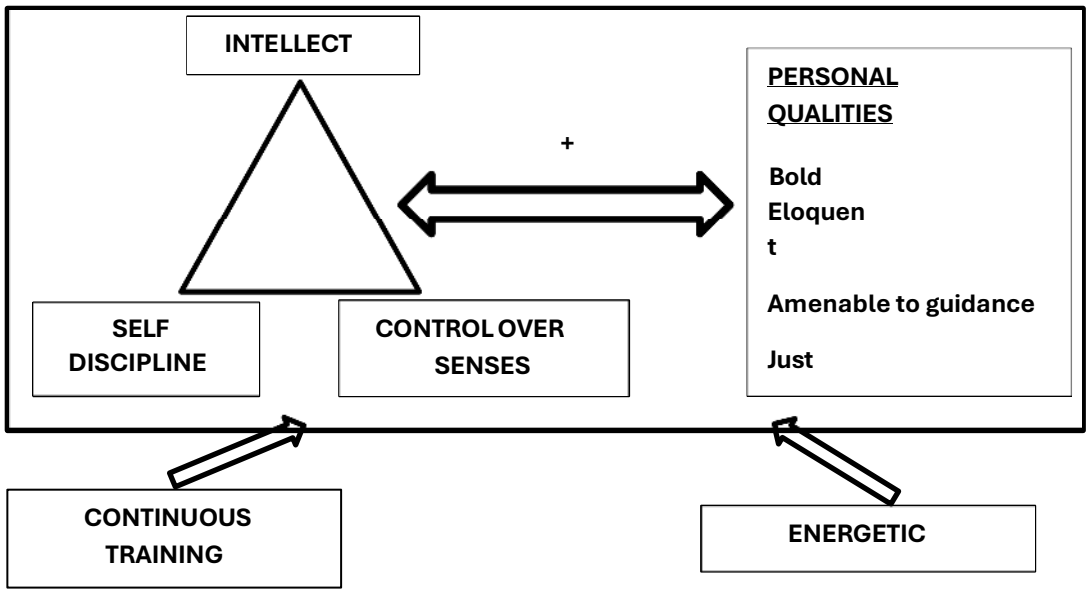


Figure 1: Qualities of a Leader

In the figure 1, above, the basic ingredients of a leader have been grouped in a relationship. The most common factor in this grouping is the interconnected triad of Intellect, Self-discipline and Control over senses. These three factors complement each other in a manner that deficiency of one will lead to ineffective manifestation of the others. The combination of this triad with the personal qualities of an individual would lead him to become a leader. However, this leader in order to be effective has to be energetic and undergo continuous training to keep his skills honed up and to be in tune with current challenges. Such a leader would be visionary, strategist and an able administrator.

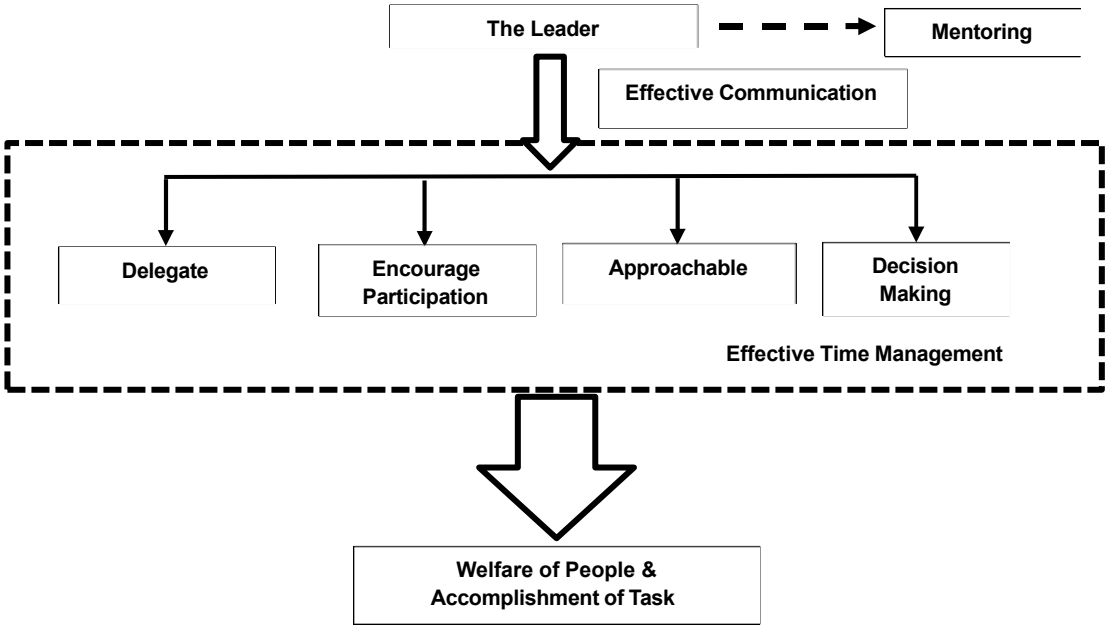


Figure 2: Conduct of a Leader

The above figure gives out as to how an effective leader should operate. The leader, through effective communication, should be approachable, delegate powers, encourage participation from his colleagues and subordinates and make effective and just decisions. All these activities should be undertaken ensuring effective time management. This would lead to accomplishment of the task and / or welfare of people, whatever is desired. In the military parlance, the welfare of people may not be the primary goal, however, any task pursued in the manner given above would convince the followers of the necessity and purposefulness of the task. This would lead to a better adaptability and overall organisational effectiveness. Though the accomplishment of task is the primary responsibility of the leader however, he should at no cost overlook the aspect of mentoring his juniors.

CONCLUSION

Leadership has been studied across cultures and eras, with definitions varying by context. Much of the research is Western-centric due to the dominance of English. But it is seen that leadership practices are inherently tied to culture, as reflected in recent research findings.

Kautilya emphasized that a king must possess exemplary leadership qualities, intellect, and energy. He believed that leaders should lead by example and maintain high standards. True power rests not in one's position, but in constructive, ethical use of authority. Kautilya's approach to leadership centers on self- development, ethics, and competence, making his teachings relatable within Indian society due to their cultural alignment.

The Arthashastra offers enduring principles on leadership rooted in Indian wisdom. The suggested leadership models aim to integrate Kautilya's concepts into contemporary leadership training for India's Armed Forces. The suggested leadership models are a modest attempt to figuratively depict the teachings of Kautilya on aspects related to leadership as comprehended by the authors. It is felt that the models will find applicability as well acceptability for training of future Indian Armed Forces officers.

Declaration of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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LESSONS FROM ANCIENT MANAGEMENT THOUGHTS AND PRACTICES

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ABSTRACT

This paper explains concepts associated with the study and practice of Management in view of the changing world order while establishing their inter relatedness with the theories and practices developed in the West. The Srimad Bhagavad Gita, an ancient Indian scripture, offers timeless wisdom that transcends religious boundaries and provides valuable insights for modern management practices. This study explores the management concepts embedded in the teachings of the Bhagavad Gita and their applicability to contemporary organizational leadership, decision-making, and ethical practices. The objective of this work was to identify whether practices in Human Resources Management – Recruitment and Selection, Integration, Training and Development, Benefits, Compensation and Performance Evaluation – have any relation to ancient Management practices and thoughts.

The ancient Indian wisdom literature, including texts such as the Vedas, Upanishads, and Bhagavad Gita, emphasizes ethical conduct, self-realization, and the pursuit of knowledge. Ancient Indian business practices were governed by the concept of dharma, which promoted fair trade practices, mutual benefit, sustainability, and long-term relationships with customers. These principles are still relevant today and can be applied to modern business practices to promote ethical conduct, sustainability, and a sense of purpose beyond financial gain.

INTRODUCTION

According to (Steingard, 2005), 'Spirituality, as a holistic infusion of experience and wisdom into the management disciplines, necessitates an inquiry into new ontological, epistemological, and teleological dimensions of research and practice.' The term Veda itself is derived from the root 'vid'. It means both to know and to obtain or to attain. The Vedas are the most ancient literature of mankind. Vedic stanzas are called mantras(Nigal, 2009).Vedic culture is the indigenous culture of India. It is not merely a code of Religion, but a way of life with something of anyone, regardless of what level of consciousness or inquiry into spiritual truths that a person may have. Vedic culture is trillions of years old (Knapp, 2006). The Vedic management system as elaborated in the Vedas and Upanishads is a normative system.

The Vedic literature, including, among other texts, the Rig,Sama, Yajur and Atharva Vedas, the up Vedas, Vedangas, Shadarshanas, Upanishads, the Vedanta-Sutra, Yoga Sutras, Agmas, the Ramayana, the Mahabharata, and Bhagwad-Gita (Knapp, 2006). According to Drucker: While management is a discipline- that is an organized body of knowledge and as such applicable everywhere-It is also a culture. Management is a social function and embedded in a culture- a society- a tradition of values, customs, and beliefs, and in governmental and political system (Saigal, 2000).

In today's dynamic business environment, there is an increasing need for managers and leaders to adopt holistic approaches that blend professional success with ethical responsibility. The teachings of the Gita advocate for a balanced perspective that emphasizes duty (dharma), selfless action (karma yoga), and emotional resilience, which are relevant to contemporary management. As global enterprises grapple with ethical crises, leadership challenges, and the pursuit of sustainable success, ancient Indian wisdom offers valuable strategies for fostering personal integrity, organizational harmony, and sustainable growth. This paper seeks to explore and analyze management concepts found in the Srimad Bhagawad Gita, shedding light on their relevance and applicability in today's

organizational contexts. Through an examination of these ancient principles, the paper aims to bridge the gap between traditional wisdom and modern management

challenges, presenting a unique synthesis of philosophical thought and practical strategies for effective leadership and organizational success.

BACKGROUND OF THE STUDY

The principles of leadership, decision-making, ethics, and organizational behavior that form the bedrock of modern management theories can be traced back to ancient texts across different civilizations. One such profound source is the Srimad Bhagawad Gita, an ancient Indian scripture that has influenced countless generations through its teachings on duty, righteousness, and selfless action. The Bhagawad Gita, a dialogue between Prince Arjuna and Lord Krishna on the battlefield of Kurukshetra, addresses dilemmas that transcend time and context. Its relevance is evident not only in the spiritual domain but also in the practical aspects of life, including management and leadership. Concepts such as self-control, ethical decision-making, team dynamics, and motivation are interwoven within the text, providing a unique perspective on management that is still applicable in contemporary settings. In today's globalized world, where businesses face complex challenges in leadership and ethical practices, the Gita offers timeless wisdom that can help guide individuals and organizations toward sustainable and values based management. Scholars and practitioners alike have begun to explore these ancient insights to develop holistic management frameworks that align personal growth with organizational success.

OBJECTIVES OF THE STUDY

1. To explore the key management principles and philosophies presented in the Srimad Bhagawad Gita.
2. To establish a link between ancient wisdom and modern management practices.
3. To examine the relevance of Bhagawad Gita's teachings in the context of leadership and organizational behavior.
4. To provide insights on the ethical dimensions of management from an Indian philosophical perspective.
5. To contribute to the development of a holistic management framework inspired by Indian scriptures.

REVIEW OF LITERATURE

A literature review on ancient Indian wisdom and management practices would explore the historical and philosophical texts from India that offer insights into principles of governance, leadership, and organizational management. Here are some key themes that may be covered in such a literature review:

1. **Vedas and Upanishads:** These ancient Indian scriptures contain philosophical and ethical teachings that can be applied to management practices. Concepts such as dharma (righteousness), karma (action and consequence), and the pursuit of knowledge and self-realization can provide valuable insights for ethical leadership and decision-making.
2. **Arthashastra:** Authored by Kautilya (also known as Chanakya), the Arthashastra is a treatise on statecraft and political economy. It discusses principles of governance, diplomacy, and economic management, emphasizing the role of a ruler or leader in ensuring the welfare of the people.
3. **Mahabharata and Ramayana:** These epics not only contain epic narratives but also offer valuable lessons on leadership, conflict resolution, and decision-making. Characters such as

Krishna in the Mahabharata and Rama in the Ramayana demonstrate qualities of effective leadership and ethical conduct.

4. **Jataka Tales:** These stories from Buddhism offer moral and ethical lessons, highlighting virtues such as compassion, honesty, and selflessness. They can provide guidance on building positive organizational culture and fostering teamwork.
5. **Yoga and Meditation:** Ancient Indian practices such as yoga and meditation are not only means for personal well-being but can also enhance concentration, mindfulness, and stress management. Incorporating these practices into the workplace can improve employee well-being and productivity.
6. **Gurukul System:** The ancient Indian education system, known as the Gurukul system, emphasized the guru-disciple relationship and holistic education. Exploring its principles can provide insights into mentoring, knowledge transfer, and talent development within organizations.
7. **Ayurveda:** Ayurveda, the traditional Indian system of medicine, emphasizes a holistic approach to health and well-being. Its principles of balance, wellness, and prevention can be applied to organizational well-being and employee health programs.

When conducting a literature review, it is essential to consult academic databases, research articles, books, and authoritative sources to gather a comprehensive understanding of the subject. Additionally, consider the historical and cultural context of ancient Indian wisdom and management practices to ensure a nuanced interpretation and application in modern organizational settings.

LEADERSHIP AND DUTY (DHARMA)

The Gita places significant emphasis on the concept of dharma (duty) as a guiding principle in leadership. Leadership, as articulated in the Gita, is not merely about authority but about fulfilling one's duty with selflessness and integrity (Sharma, 2020). The scripture advocates for a leadership style that is both empathetic and action oriented,

where leaders inspire their followers through righteous actions. This concept aligns with modern servant leadership theories, which prioritize the welfare of subordinates over personal gains (Pandey & Gupta, 2019).

Decision-Making and Conflict Resolution:

In the corporate environment, decision-making is crucial for organizational success. The Gita offers insights into how one can approach decision-making under pressure. Lord Krishna encourages Arjuna to act without attachment to outcomes, a philosophy known as Nishkama Karma (Kumar & Nair, 2021). This principle emphasizes the importance of focusing on actions rather than worrying about results, which aligns with contemporary ideas of mindful decision-making and strategic risk management. In terms of conflict resolution, the Gita emphasizes clarity of thought and detachment from ego in resolving conflicts, which is essential in modern negotiations and interpersonal conflicts within organizations (Singh & Mishra, 2018). By maintaining emotional balance and focusing on long-term objectives, leaders can navigate complex interpersonal dynamics more effectively.

Self-Management and Emotional Intelligence:

A critical component of management is self-discipline and emotional intelligence. The Gita introduces the idea of Sthitaprajna, or one who remains calm and balanced amidst challenges (Chatterjee, 2022). This state of emotional stability is akin to the modern concept of emotional intelligence, where managers are encouraged to regulate their emotions and respond to situations with

composure. Self-management, as taught in the Gita, includes self-awareness, self-regulation, and intrinsic motivation, which are essential qualities for successful leadership in today's fast-paced corporate environment (Verma & Ghosh, 2020). Saurabh Shukla, Prabhat Kumar Dwivedi

Library Progress International| Vol.44 No.3 | Jul-Dec 2024 5276 Ethics and Corporate Social Responsibility (CSR): The ethical framework of the Gita has profound implications for business ethics and Corporate Social Responsibility (CSR). The scripture advocates for ethical decision-making rooted in dharma and emphasizes that wealth and success should be pursued only through just and fair means (Srinivasan, 2017). This resonates with the modern emphasis on ethical governance and CSR, where companies are encouraged to align their business goals with social welfare and environmental sustainability (Rao, 2019).

Motivation and Employee Engagement:

The Gita offers unique insights into employee motivation by addressing intrinsic versus extrinsic motivation. Krishna's discourse on performing one's duties without attachment to rewards speaks to the importance of internal motivation and job satisfaction. Modern motivational theories, such as Herzberg's two-factor theory, echo this by differentiating between intrinsic motivators (like achievement and recognition) and extrinsic motivators (such as pay and benefits) (Shukla & Sharma, 2020). Engaging employees through purpose and alignment with organizational values is critical to long-term success, as highlighted in both the Gita and contemporary HR practices. The management principles in the Srimad Bhagawad Gita are timeless and offer profound insights into leadership, decision-making, self-management, and ethics. By drawing on these ancient teachings, modern managers can foster more holistic, value-driven approaches in their organizations. These principles not only align with contemporary management theories but also extend beyond them by integrating spiritual wisdom with practical application.

MATERIAL AND METHODOLOGY

1. Research Design:

This research follows a qualitative review methodology aimed at exploring management concepts embedded in ancient Indian scriptures, with a specific focus on the Srimad Bhagawad Gita. The study involves a systematic literature review of primary and secondary sources, including ancient texts, modern interpretations, and relevant academic papers. The research seeks to bridge traditional philosophical teachings with contemporary management practices, examining how the core principles of leadership, ethics, decision-making, and human resource management are addressed in the Bhagawad Gita and how they can be applied to modern-day management theories.

2. Data Collection Methods:

Data for this review has been sourced from a wide range of academic and non-academic materials, including translations of the Srimad Bhagawad Gita, commentaries by scholars, research papers published in reputable journals, and books discussing Indian philosophy in the context of management. Digital libraries such as Google Scholar, JSTOR, and Project MUSE were utilized to retrieve peer-reviewed journal articles. Additionally, Hindu scriptures and management theories were explored through printed literature, ensuring a comprehensive understanding of the subject matter.

3. Inclusion and Exclusion Criteria:

Inclusion Criteria:

- Studies and literature that directly interpret or apply the teachings of the Srimad Bhagawad Gita to modern management concepts.
- Research works published in peer-reviewed journals or books that discuss Indian scriptures in the context of leadership, decision-making, ethics, and conflict resolution.
- Both ancient and contemporary scholarly interpretations of the Bhagawad Gita with a focus on its relevance to management practices.

Exclusion Criteria:

- Literature focused solely on the theological or spiritual aspects of the Bhagawad Gita without any connection to management principles.
- Research that discusses Indian scriptures without reference to management concepts or leadership frameworks.

RESULTS AND DISCUSSION

The analysis of the Srimad Bhagavad Gita reveals profound management concepts that align with modern principles of leadership, decision-making, and organizational behavior. Key takeaways include the following:

Leadership and Vision: The Bhagavad Gita emphasizes the role of a leader as a visionary who guides and inspires followers through selfless service and strong ethical foundations. Lord Krishna's guidance to Arjuna symbolizes the importance of clear direction and value-based leadership. This is comparable to modern leadership theories that stress ethical behavior, empathy, and purpose-driven goals.

Self-Management and Discipline: The Gita advocates for the mastery of self, highlighting the need for self-discipline, mental control, and emotional intelligence. These elements are essential in today's managerial roles where decision-making under pressure and emotional stability are critical for success. The text encourages managers to remain focused, detached from personal biases, and grounded in their duties.

Karma Yoga (Action-Oriented Approach): The concept of Karma Yoga, which refers to performing one's duty without attachment to the results, mirrors contemporary notions of work ethic and accountability. The Gita teaches that individuals should focus on their actions and responsibilities rather than obsessing over outcomes, fostering a results-driven yet process-focused work culture.

Decision-Making under Uncertainty: Arjuna's dilemma on the battlefield, and Krishna's guidance, underline the importance of decision-making under complex and uncertain conditions. The Bhagavad Gita suggests that leaders should balance intellect and intuition when faced with difficult choices, similar to modern strategies of risk management and scenario analysis.

Detachment and Objectivity: Krishna's teachings emphasize the importance of detachment, encouraging leaders to approach situations without emotional entanglement or ego. This aligns with contemporary managerial advice to maintain objectivity, allowing for clearer decision-making and reducing the influence of stress and personal interests on professional choices.

Ethics and Moral Responsibility: The ethical framework presented in the Gita, where righteousness (Dharma) is central, parallels modern corporate governance and corporate social

responsibility (CSR). The text underlines that ethical behavior is the foundation of sustainability in leadership and management practices.

Team Dynamics and Cooperation: The Gita promotes cooperation and harmonious working relationships, suggesting that each individual has a specific role to play within a larger mission. This aligns with modern views on team management, where collaboration, mutual respect, and clear communication drive organizational success.

Resilience and Crisis Management: Krishna's counsel to Arjuna encourages mental resilience in the face of adversity, urging him to overcome fear and confusion. This concept of mental toughness is essential in today's management, where leaders often face crises requiring resilience, adaptability, and perseverance.

Continuous Learning and Growth: The Bhagavad Gita advocates for a learning-oriented mindset. Continuous self-improvement and lifelong learning are key elements in the Gita's philosophy, mirroring. The discussion section of a research paper on ancient Indian wisdom and management practices provides an opportunity to analyze and interpret the findings from the literature review, highlighting their implications and relevance in the context of modern management. Here are some key points to consider for the discussion:

Relevance of Ancient Indian Wisdom:

Ancient Indian wisdom holds great relevance in modern times, particularly in the field of management. Principles such as dharma, karma, and ethical values offer guidance for ethical leadership, decision-making, and organizational culture. The emphasis on holistic well-being, mindfulness practices, and the integration of values in daily life align with the growing focus on employee well-being and work-life balance. Furthermore, ancient Indian wisdom highlights the importance of compassionate and selfless leadership, promoting harmonious relationships and fostering a positive work environment. By drawing upon these timeless principles, organizations can cultivate ethical, mindful, and values-driven practices that contribute to long-term sustainability and employee satisfaction.

Ethical Leadership and Decision-making:

Ancient Indian wisdom offers valuable insights into ethical leadership and decision-making. Concepts such as dharma and karma emphasize the importance of ethical conduct, responsibility, and accountability in leadership roles. Dharma guides leaders to act in alignment with moral and ethical principles, considering the well-being of all stakeholders. Karma reminds leaders of the consequences of their actions and encourages them to make decisions that promote positive outcomes for individuals and society. By integrating these principles into their leadership practices, managers can foster a culture of integrity, fairness, and ethical decision-making, ultimately enhancing organizational trust and reputation.

Limitations of the study

1. Interpretational Subjectivity
2. Contextual Differences
3. Lack of Empirical Validation
4. Generalization
5. Scope Limitation
6. Historical and Cultural Relevance

FUTURE SCOPE

The exploration of management concepts derived from the Srimad Bhagavad Gita presents numerous opportunities for future research and application in contemporary management practices.

Integration into Modern Management Theories: Future studies could focus on integrating the principles of the Bhagavad Gita with existing management theories, such as transformational leadership and ethical decision-making. This synthesis can provide a more holistic approach to leadership and organizational behavior.

Comparative Analysis: There is scope for comparative research that examines management philosophies from various ancient texts, including those from other cultures, such as Chinese, Greek, Library Progress International| Vol.44 No.3 | Jul-Dec 2024 5279

Practical Applications in Business: Researchers could explore the practical applications of Gita's teachings in contemporary business settings, particularly in areas like conflict resolution, team dynamics, and corporate governance. Case studies of organizations that have successfully implemented these principles could provide valuable lessons for practitioners.

Cross-disciplinary Research: The intersection of philosophy, ethics, and management offers a rich area for cross-disciplinary research. Collaborations between management scholars, philosophers, and ethicists could lead to innovative frameworks for ethical leadership and corporate social responsibility, grounded in ancient wisdom.

Impact on Organizational Culture: Future research can also investigate the impact of the Bhagavad Gita's teachings on organizational culture and employee engagement. Understanding how these ancient concepts can enhance motivation, resilience, and ethical behavior in the workplace can inform human resource practices.

Educational Frameworks: There is potential for developing educational programs and workshops based on the management concepts from the Bhagavad Gita. Such initiatives can help cultivate leaders who are not only effective but also ethically grounded and socially responsible.

Technological Integration: With the rise of digital transformation, future studies could explore how the principles from the Gita can be adapted to modern technologies and digital platforms, enhancing leadership and management in virtual environments. By pursuing these avenues, future research can further illuminate the relevance and applicability of ancient Indian management concepts, thereby enriching both academic discourse and practical management strategies in today's complex business landscape.

CONCLUSION

The exploration of management concepts derived from ancient Indian scriptures, particularly the Srimad Bhagavad Gita, offers profound insights that are increasingly relevant in contemporary management practices.

The Gita emphasizes the importance of ethical leadership, duty (dharma), and the pursuit of knowledge, providing a holistic framework for decision-making and organizational behavior. Its teachings advocate for self-awareness, resilience, and the cultivation of a purposeful vision, encouraging leaders to align their actions with higher principles for the greater good.

Furthermore, the Gita’s concepts of teamwork, collaboration, and harmony resonate with modern organizational needs, emphasizing the value of collective effort in achieving common goals. By integrating these ancient wisdoms into current management practices, organizations can foster a more inclusive and ethical work culture that prioritizes sustainability and social responsibility.

In conclusion, the timeless wisdom encapsulated in the Srimad Bhagavad Gita serves not only as a guide for individual leaders but also as a blueprint for organizations seeking to navigate the complexities of today's business environment. By revisiting these ancient teachings, contemporary managers can gain valuable perspectives that enhance their leadership capabilities and contribute to

more effective and principled management practices.

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BRIDGING TRADITION AND TECHNOLOGY: AUTOMATION, EMPLOYEE ENGAGEMENT, AND ORGANIZATIONAL SUPPORT IN THE LIGHT OF INDIAN KNOWLEDGE SYSTEM (IKS)

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Abstract

In the contemporary times the Indian Automotive Sector stands at the pivotal juncture of human-centered innovation and technological transformation. This calls for blending the aspirations of nation and modern advancement of automotive sector in the light of timeless wisdom emanated by Indian Knowledge System (IKS). Anchored within the thematic purview of "Contemporary Applications and Expanding Horizons of Indian Knowledge from Vedic Insights (IKVI-2025)", present study attempts to explore the evolution of automation in the automotive firms of India through the interpretative lens of Indian Knowledge System (IKS). By doing so, it endeavors to provide an advocacy for adaptability, equilibrium, and seamless synthesis of human intellect with the dynamic evolution of fast paced technological development. Structured around the objectives: (1) to investigate the evolution and various forms of automation adoption in Indian automotive firms; (2) to examine the relationship between automation and diverse dimensions of employee engagement; and (3) to assess the moderating influence of organizational support on the automation-engagement relationship. In this context, the automation is interpreted as dynamic continuum embodying Vedic principles of harmony between Manas (mind) and Yantra (machine), wherein there is existence of efficiency and human empathy rather than just a mechanical or digital advancement. This study endeavors to situate automation within larger framework of sustainable innovation, organizational well-being, and dynamic inclusive development driven by the National Education Policy (NEP) 2020 and Sustainable Development Goals (SDGs). Furthermore, this research attempts to posit that automation is capable of amplifying employee performance, creativity, and engagement; and contribute to the sustainable and ethical development and transformation of industries, if it is reinforced by value-driven leadership and robust organizational culture. By weaving the empirical insights drawn from automotive sector and philosophical insights from in-depth realms of IKS, present research advances the discourse on India's role in the evolution of global industrial sector. Additionally, it envisions a future that provides for harmonious amalgamation of IKS and technological transformation of automotive sector.

Keywords: Automation, Indian Knowledge System (IKS), Organizational Support, Employee Engagement, Sustainable Developmental Goals, etc.

INTRODUCTION

Today, technology is very much intertwined with the modern industries, hence, it is influencing the organizations' operation and employees' work in a different way. In every corner of the world, the

industries are making a quick shift to digitalization, automation, and artificial intelligence (AI) [8, 12, 11]. The technology change is very evident in the Indian automotive industry whose contribution to the economy and employment is rather big. The use of robots and advanced sensors besides the data-driven decision systems has resulted in the complete overhaul of the production processes in the automotive sector [5, 12, 11].

The whole process has been improved in terms of efficiency, accuracy, and quality control because of the introduction of the mentioned technologies. The machines have taken over the manual labour like assembly, welding, and inspection and are doing it with the same level of precision and consistency as humans [3, 10]. The whole process has been so fast that the time taken for production has been reduced drastically, mistakes have been avoided up to a great extent, and the industry's competitiveness on a global scale has also increased [1,12].

Nonetheless, automation although it is a major source of operational efficiency has also created a human aspect challenge regarding the work done. It is important to note that the use of machines and digital systems has been the major cause of the questions surrounding how employees could be kept motivated, engaged, and emotionally connected to their work environment, and these were the questions being asked by employers everywhere. The very same process of machines taking over the routine functions causes the employees to be in the dark and uncertain about their roles, job security, and the whole thing of being something in an automated workplace [7]. The chance of people having less contact with each other, not having the freedom to do what they want, and not being able to fully express their creativity because of machines coming in the way can result in people feeling very much distanced or even cut off from the company. Thus, the contemporary organizations have been struggling with the issue of whether to give up on the human factors and well-being aspects of the employees and go for the technological efficiency [3].

In this regard, the Indian intellectual and cultural heritage has a lot to offer in terms of insights. The Indian Knowledge System (IKS), which is a huge and very old collection of native wisdom, gives a total view of life, work, and the connection between humans and nature. IKS, which is based on philosophical, ethical, and spiritual traditions, endorses the values of balance (Samatva), mindfulness (Manas), responsibility (Dharma), and purposeful action (Karma) [13]. These values together call for a balance between the outside world and the inner self. They challenge us to think of development as not just in the realm of technology or economy, but also in the spheres of morality, emotions, and spirituality [7].

The application of IKS principles in today’s workplaces would foster a human-centred technological approach that appreciates humanity, spirituality, and moral obligation along with innovation and productivity [9]. As an example, Samatva encourages the harmony between effectiveness and kindness, so that human welfare is not ignored during the period of technological development. Dharma pushes or pulls to attract individuals and organizations who think and act responsibly and ethically in their work with the surrounding community [1]. Mana exalts mindfulness and emotional intelligence in change management, while Karma highlights the need for intentional, altruistic, and committed action [2]

By blending timeless wisdom with modern management practices, organizations can build workplaces where technology enhances, rather than replaces, human capabilities (Jadon, Dixit, & Jadon, 2025). Guided by the values of the Indian Knowledge System (IKS), such environments inspire employees to see technology as a partner in growth, creativity, and shared success. This approach helps nurture emotional intelligence, ethical leadership, and social responsibility—qualities that make innovation more humane and meaningful [4]

Therefore, this paper explores how automation, employee engagement, and organizational support can be viewed collectively through the perspective of the Indian Knowledge System (IKS). It seeks to demonstrate that tradition and technology are not opposing ideas but complementary forces that, when aligned, can drive sustainable, inclusive, and purposeful industrial growth. Integrating IKS principles into industrial practices can bridge the divide between mechanical progress and human empathy, shaping a future in which India’s technological advancement remains firmly grounded in its cultural wisdom and ethical values.

OBJECTIVES OF THE STUDY

1. To describe the evolution of automation in the Indian automotive sector.
2. To study the relationship between automation and employee engagement.
3. To explain the role of organizational support in promoting positive employee attitudes.
4. To interpret how Indian Knowledge System (IKS) values can help balance technology and human well-being.

AUTOMATION IN THE AUTOMOTIVE SECTOR

Automation refers to the use of machines, robots, computer software, and digital systems to perform tasks with minimal or no human intervention. In today's industries, automation goes far beyond mechanical operations—it also encompasses intelligent systems capable of analysing data, making decisions, and coordinating production processes. Within India, the automotive sector has been one of the earliest and most active adopters of automation technologies, given its central role in the country's manufacturing base and export economy [6].

In the Indian automotive industry, automation is integrated across multiple stages of production, including vehicle assembly, component manufacturing, painting, welding, quality testing, and logistics management. Advanced robotic arms, conveyor systems, and computer-controlled machinery have made these processes faster, more precise, and more consistent. The adoption of such technologies has helped companies achieve uniform quality standards, reduce material wastage, and enhance workplace safety by minimizing human exposure to repetitive or hazardous tasks. As a result, Indian automotive firms have strengthened their competitiveness in both domestic and international markets while meeting growing consumer expectations for quality and reliability [9].

However, automation has also transformed the nature of human work. Employees' roles have shifted from performing manual or routine operations to monitoring automated systems, interpreting data, and troubleshooting technical problems [10].

This transition demands a higher level of technical knowledge, analytical ability, and problem-solving skill. Workers are now expected to collaborate with machines—supervising production lines, detecting system faults, and ensuring smooth operations [11].

Such changes, though necessary, can also bring psychological and social challenges. Some employees may feel anxious about job security, fearing that machines could eventually replace them. The evolving skill requirements can widen the gap between technologically trained and less skilled workers, particularly where access to advanced education or training is limited. Without proper organizational support, these transitions may lead to lower motivation, job dissatisfaction, and reduced engagement.

Therefore, the success of automation relies not only on technological innovation but also on how effectively organizations prepare and support their workforce through these transformations. Providing ongoing training, reskilling opportunities, counselling, and emotional support can help employees adapt confidently to new systems. When workers understand that automation is meant to assist rather than replace them, they are more likely to embrace change with a sense of trust and collaboration.

Ultimately, automation should be seen as a partnership between human intelligence and machine efficiency. While machines excel in precision, speed, and endurance, human beings bring creativity, critical thinking, and emotional understanding—qualities no technology can replicate. A balanced approach to automation, strengthened by ethical leadership and organizational empathy, can foster workplaces that are both technologically advanced and profoundly human-centred.

EMPLOYEE ENGAGEMENT

Employee engagement refers to the emotional and psychological connection that employees form with their work, their teams, and the organization as a whole. It reflects the enthusiasm, dedication, and sense of purpose employees bring to their roles. Engaged employees are not only more productive but also more creative, committed, and loyal. They see their work as meaningful and align their personal aspirations with the organization's goals.

In the Indian automotive industry, employee engagement has gained special importance as automation continues to reshape job roles and workplace relationships. Automation can affect engagement in two ways. On the positive side, by taking over repetitive, monotonous, or physically demanding tasks, technology enables employees to focus on more complex and intellectually stimulating work—such as problem-solving, innovation, and process improvement. This shift can enhance job satisfaction and provide a greater sense of growth and achievement.

However, automation can also create challenges. As machines and digital systems handle larger portions of production, some employees may feel undervalued or disconnected from their work. The reduction in human interaction and the increasing dominance of automated systems can sometimes lead to alienation or a loss of motivation. Therefore, automation must be implemented thoughtfully, ensuring that human well-being remains central to technological progress.

Sustaining employee engagement in such an environment depends on how organizations manage change and involve employees in the process. When workers are encouraged to learn new skills, share insights, and participate in decision-making, they feel empowered and respected. Continuous training, open communication, and teamwork-based initiatives help employees understand automation as a tool for empowerment rather than replacement.

Engagement is not limited to performance—it is also about cultivating a supportive, inclusive, and inspiring work culture. Leadership plays a vital role in this process. When leaders recognize achievements, build trust, and promote fairness, they strengthen the emotional connection employees have with their organization.

In essence, maintaining engagement in automated workplaces requires a careful balance between technological efficiency and human connection. When organizations value both innovation and empathy, they create a workforce that is motivated, adaptable, and ready to grow with the future.

ROLE OF ORGANIZATIONAL SUPPORT

Organizational support refers to the care, encouragement, and guidance that an organization extends to its employees to help them perform effectively and feel valued. It encompasses both tangible support—such as training opportunities, fair compensation, and career development— and intangible support, including recognition, emotional well-being, and a culture of respect and trust. When employees believe that their organization genuinely cares about their growth and welfare, they are more likely to remain motivated, loyal, and committed to their work.

In the age of automation, organizational support becomes even more critical. Technological transformations often bring uncertainty, as employees may experience anxiety about adapting to new systems, changing job roles, or potential job displacement. During such transitions, it is essential for organizations not only to introduce new technologies but also to help employees navigate change with confidence. Companies that invest in continuous learning, mentorship, and open communication help reduce fear and resistance, creating a smoother path toward adaptation.

In the automotive sector, where automation and data-driven technologies are rapidly reshaping manufacturing, regular training and reskilling programs are indispensable. Workshops, digital literacy initiatives, and technical upskilling sessions ensure that employees stay competent and confident in handling evolving systems. This strengthens both individual capability and organizational efficiency.

Supportive leadership plays an equally important role in maintaining trust and stability. Leaders who communicate openly, value employee opinions, and acknowledge contributions foster a culture of belonging and respect. When employees feel heard and appreciated, they are more likely to view automation as a tool for collaboration rather than competition.

Furthermore, a culture of psychological safety and trust nurtures innovation. Employees who feel secure are more willing to experiment, share ideas, and learn from mistakes. Emotional support—through counselling, appreciation programs, and promoting work-life balance— further enhances morale and engagement.

Ultimately, while automation enhances efficiency, it is organizational support that sustains human motivation, creativity, and loyalty. A well-supported workforce becomes the true engine of progress, ensuring that technology serves humanity rather than replaces it.

INDIAN KNOWLEDGE SYSTEM (IKS) PERSPECTIVE

The Indian Knowledge System (IKS) embodies the nation's vast intellectual, cultural, and philosophical heritage that harmoniously weaves together science, ethics, and human values. Rooted in timeless texts such as the Vedas, Upanishads, and the Bhagavad Gita, IKS emphasizes that true knowledge extends beyond material or technological advancement—it is about achieving balance, harmony, and purposeful living.

In the context of modern industries, IKS provides guiding principles that can help organizations integrate technology while safeguarding human well-being and promoting sustainable development. It reminds us that progress should be pursued with empathy, mindfulness, and ethical awareness. By blending efficiency with compassion and innovation with integrity, IKS offers a path toward a more balanced form of industrial growth.

Applied to today's workplaces—especially in dynamic sectors like the automotive industry— these values encourage a human-centred approach to automation and modernization. They inspire organizations to create environments where technology supports human creativity and potential rather than diminishing it. In this way, IKS bridges the gap between ancient wisdom and modern progress, showing that machines and human values can evolve together in harmony.

Some key IKS principles relevant to this study include:

Manas and Yantra (Mind and Machine)

This concept reflects the dynamic relationship between the human mind (Manas) and mechanical systems (Yantra). According to the philosophy of the Indian Knowledge System (IKS), machines are not meant to replace human intelligence but to extend and enhance it. They are tools created to support creativity, efficiency, and purposeful work. In the context of the automotive industry, this philosophy translates into using automation to improve precision, safety, and productivity—while enabling employees to concentrate on higher-order tasks such as innovation, problem-solving, and design thinking. When technology is guided by human wisdom and ethical intent, it becomes a partner in progress rather than a force of domination. By maintaining this balance between Manas and Yantra, organizations can create workplaces where technological advancement coexists with human insight, resulting in systems that are both efficient and deeply meaningful.

Samatva (Balance)

Samatva, meaning balance or equanimity, is a core concept within the Indian Knowledge System (IKS) that emphasizes harmony between different dimensions of life and work. In an industrial setting, Samatva represents the equilibrium between productivity and employee well- being. While automation can significantly enhance speed, precision, and output, it must not come at the cost of emotional stability or social harmony among workers. Guided by the principle of Samatva, organizations are encouraged to pursue technological growth that aligns with human happiness, teamwork, and mental peace. When efficiency and empathy move together, workplaces become not only more productive but also more humane and sustainable. In this way, Samatva serves as a timeless reminder that true progress arises from balance— where machines contribute to success, but people remain at the heart of it.

Dharma (Duty and Ethical Responsibility)

The concept of Dharma embodies moral responsibility, ethical conduct, and duty toward the collective good. Within the Indian Knowledge System (IKS), Dharma serves as a guiding principle that ensures every action aligns with righteousness and social harmony. In the context of modern organizations, Dharma translates into transparent governance, fair labour practices, and a genuine commitment to social and environmental responsibility. When automation and technological change are guided by Dharma, progress becomes purposeful and inclusive. It ensures that innovation benefits not only the organization but also its employees, the surrounding community, and the environment. In this way, Dharma reminds industries that true advancement is not measured by efficiency alone, but by the integrity and compassion with which that efficiency is achieved.

Karma Yoga (Mindful and Dedicated Action)

Karma Yoga teaches the importance of performing one's duty sincerely and selflessly, without attachment to personal gain. In the workplace, this principle encourages employees to find meaning and purpose in their roles by focusing on excellence, integrity, and service rather than external rewards. Such an approach cultivates intrinsic motivation and resilience, enabling workers to adapt positively to automation, innovation, and continuous organizational change. By integrating these principles of the Indian Knowledge System (IKS), organizations in the Indian automotive sector can successfully bridge the gap between tradition and technology. This integration transforms automation from a purely mechanical process into a human-centred innovation—one that values dignity, lifelong learning, and harmony between people and machines. Ultimately, IKS offers a moral and philosophical foundation for sustainable industrial development. It envisions a future where technological advancement coexists with ethical responsibility and compassion, creating workplaces that are both efficient and deeply humane.

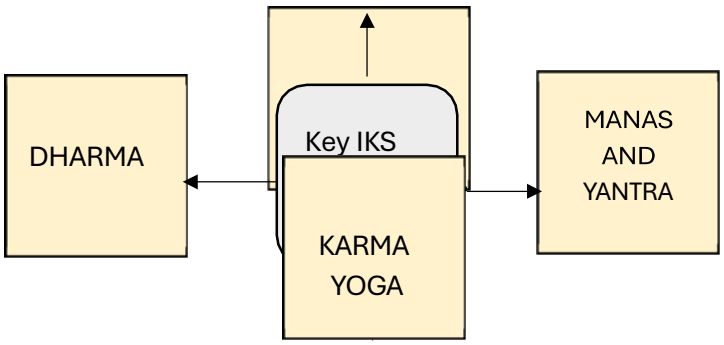


Figure 1: Key IKS Principles

DISCUSSION

From the descriptive analysis, it is clear that automation has greatly enhanced productivity, precision, and efficiency in the Indian automotive sector. However, it has also transformed the human experience of work, requiring employees to develop new skills, adaptability, and emotional resilience. While machines and digital systems now handle many repetitive tasks, the core of meaningful work—creativity, judgment, and human connection—remains distinctly human.

When organizations blend technological innovation with human-centred values, they cultivate workplaces that are both efficient and purposeful. Employees in such environments feel motivated, secure, and valued, leading to greater engagement and sustainable organizational success. Technology, therefore, should not be viewed as a replacement for human effort, but as a collaborative force that amplifies human potential.

The Indian Knowledge System (IKS) provides a profound philosophical and ethical foundation for achieving this balance between tradition and modernity. Drawing from ancient wisdom, it emphasizes that progress must be guided by compassion, responsibility, and mindfulness. By applying IKS principles such as Manas–Yantra (harmony between mind and machine), Samatva (balance), Dharma (ethical responsibility), and Karma Yoga (selfless action), organizations can ensure that technological growth remains rooted in human values.

Such an integrated approach transforms automation from a purely mechanical process into a holistic, human-centred evolution—one that advances not only efficiency but also empathy, purpose, and collective well-being.

Companies that encourage continuous learning, empathy, and ethical conduct embody the principles of Dharma (duty) and Samatva (balance), ensuring that progress remains both responsible and harmonious.

Employees who view automation as an opportunity for self-improvement and collective advancement demonstrate the essence of Karma Yoga (selfless and mindful action).

Leaders who align technological innovation with employee welfare and social well-being practice Manas–Yantra harmony—the balance between human intellect and mechanical systems.

These principles demonstrate that Indian philosophy does not oppose technology—it seeks to humanize it. By integrating values such as Samatva (balance), Dharma (ethical duty), and Karma Yoga (selfless action) into modern management practices, organizations can transform automation into a true partner in human progress rather than a perceived threat. In conclusion, the integration of automation with the ethical and philosophical insights of the Indian Knowledge System (IKS) can foster a model of industrial development that is sustainable, humane, and value-driven. This fusion of ancient wisdom and modern innovation positions India not only as a technological leader but also as a global example of balanced, inclusive, and compassionate progress.

CONCLUSION

The study reveals that automation and tradition are not opposing forces but complementary elements that can together foster a sustainable and human-centred industrial ecosystem. While modern technology enhances efficiency, precision, and productivity, the timeless wisdom of the Indian Knowledge System (IKS) offers ethical and philosophical guidance to maintain balance, compassion,

and human well-being. For the Indian automotive sector, true sustainable development lies in integrating these two dimensions—harnessing technological innovation without compromising values, ethics, or employee welfare.

The findings suggest that when organizations provide strong leadership, continuous learning opportunities, and supportive workplace environments, automation can become a catalyst for employee engagement, creativity, and innovation. Workers are more likely to embrace technological change when they feel valued, trusted, and included in the process of progress.

By adopting IKS principles such as Samatva (balance), Dharma (ethical duty), and Manas– Yantra harmony (coexistence of mind and machine), industries can build workplaces where technology strengthens rather than replaces human potential. This approach not only improves performance but also ensures that industrial growth remains ethical, inclusive, and sustainable.

In essence, the harmonious fusion of automation and Indian philosophical wisdom offers a vision for the future—one where India's industrial growth is technologically advanced, socially responsible, and deeply human-centred. This balance between tradition and technology provides a meaningful roadmap for achieving sustainable and value-driven development in the modern era.

RECOMMENDATIONS

1. Integrate IKS values into corporate training and leadership programs to promote ethical and empathetic decision-making.
2. Develop skill enhancement and reskilling initiatives to help employees adapt confidently to automation.
3. Encourage participative management where employees contribute to decisions about technology implementation.
4. Promote a balance between productivity and well-being, ensuring that technological efficiency does not come at the cost of human health or satisfaction.
5. Adopt sustainable innovation models aligned with the National Education Policy (NEP) 2020 and the Sustainable Development Goals (SDGs) for holistic industrial growth.

SUGGESTIONS

1. Provide regular training and upskilling opportunities for employees.
2. Create a supportive work culture that values human emotions and ethics.
3. Encourage leadership programs based on IKS principles.
4. Use automation to assist people, not replace them.
5. Promote mindfulness and balance in workplace policies.

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The Ancient Indian Agro-pastoralism and Sustainable Farming – An Overview

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Abstract
In India, during 8000-4000 BCE, the period of the Neolithic Revolution, Agro-pastoralism existed that included threshing, planting of crops in rows and storing grains in granaries. The Agriculture across the globe has changed drastically in connotation with the fast changing climate uncertainties, technological growth, population and eating habits. Agrarian-Economy was the spinal cord of livelihood in India and wise use of various natural resources with sustainability in focus was in practice. Ancient Indian farming was centered in an eco-friendly, organic sustainable practices that included crop rotation, use of organic fertilizers such as cattle dung, and sustainable irrigation systems that encompassed rivers, canals, reservoirs and underground water. Farming sector utilized animal power, plough and engaged in intercropping and terraced farming for optimal use of land. Farmers cultivated diverse crops that included cereals, pulses, millets, sugarcane and many other crops. Sustainability of soil health and to maximize yields various techniques were applied with the goal of a prosperous agrarian economy. Environmental friendly techniques with zero-waste management was existing.

This paper discusses in brief

- *Integrated Animal Husbandry in the farming*
- *Sustainable Practices of ancient Indian Farming and use of fertilizers*
- *Conclusion*

Keywords: Ancient Agrarian-Economy, Sustainable Practices, Zero-Waste In Agriculture, Sustainable Soil Health

INTRODUCTION

Agriculture and animal husbandry have been inter-woven for ages and been the source of livelihood across the globe. Agrarian-Economy has always been the spinal cord of livelihood in India and sustainable use of natural resources was in practice. There is no doubt that the term "agro-pastoralism" fits very well in the Indian context. The pastoral niche was a resourceful way to harness a reliable and continuous food supply, but it involved risks and hard work in taming animals (1) . Agro-pastoralism existed in India even during the period of the Neolithic Revolution (8000-4000 BCE) that included threshing, planting of crops in rows and storing grains in granaries (2) . The ancient Indian agro-pastoralism was not a static relic but a dynamic, evolving system intimately tied to its environment and social context (3) . Its sustainability features – diversification, integration, low-input, water/soil conservation, social embedding are exactly what modern agriculture seeks to re-incorporate.

Agro-pastoralism, an old dynamic system prevalent throughout the world, is economically productive and ecologically sustainable where settled sheep or cattle farmers (pastoralists) cultivate land and also keep animals to graze them; sending larger flocks to rangelands; use of grazing lands, movement of herds, growing fodder, integration of animal and crop cycles viz. manure from animals as fertilisers for the crops and use of crop residues to feed animals and ecological adaptation to dry, semi-arid and hilly lands.

Agro-Pastoralism is highly adaptable (4) to variable and difficult environments and the dynamic

use of resources with synchronization with other production systems for the optimal use of resources, and are ecologically friendly. This paper explores how ancient Indian agro-pastoral systems operated in coexistence with sustainable farming practices.

INTEGRATED ANIMAL HUSBANDRY IN THE FARMING

Existence of Agro-pastoralism in Ancient India and Early Agricultural Origins

In India agro-pastoralism involved cattle, buffalo, sheep, goats, camels or horses; upland and arid zones; and villages that are dependent on herding for the livelihood. "Agro-pastoralism in India included threshing, planting crops in rows and storing grain in granaries adapted to ecological, social and cultural circumstances." (5) Evidences suggest that both plant cultivation and animal domestication was in practice even as early as 9,000 BCE, and by around 8,000–6,000 BCE barley and wheat cultivation. Cattle, sheep and goat domestication were evident at Mehrgarh (at present in Pakistan) (6) and rice cultivation and cattle, goats and sheep domestication in Belan River valley, Uttar Pradesh (7) providing the foundation for mixed agro-pastoral economies. According to a study around 3000 BCE, the weakening of the Indian summer monsoon had led to savannisation of landscapes (8) and thereby created grazing-friendly environments which in turn encouraged crop cultivation with animal husbandry. Thus, cropping and herding co-evolved in areas where forests receded and open grasslands expanded, herding became easier. Simultaneously, farming supplemented the pastoral livelihood to form a resilient combination.

Hybrid Economy in the Indus and Later Cultures

The large-scale urbanization and the evolution of Indus Valley Civilisation was supported by the agro-pastoralism form of agriculture wherein crops such as wheat, barley, pulses, cotton were grown (9) combined with animal rearing. One study states: "The Indus Valley inhabitants could sustainably grow various crops and they had reared animals." Animal-husbandry evidences from the Indus Valley and the Late Harappan Civilisation suggest that cattle, buffalo, sheep and goats were integral part and the agro-pastoral tradition was very well ingrained towards the end of the 3rd millennium BCE. (10)

Regional Variation and Environmental Adaptation

The ancient Indian agro-pastoralism was not monolithic as it varied with climate, terrain and social systems. Some key regional variations are as below:

- **North-Indian - Ganga–Yamuna, Indus Plains:** The region was exposed to favourable rainfall and soils supported crops such as wheat, barley, rice; herding supplemented by cattle and buffalo. Pastoralism remained important (e.g., early Vedic cattle economy).
- **Semi-arid Regions/Deccan Plateau**: Mostly Rain-fed agriculture was prevalent, marginal soils, greater herding, mobility of herds towards grazing lands. The slash-and-burn cropping was initially started in southern Deccan then it transitioned to settled agro-pastoral villages.
- **Himalayas, peninsular hills:** This region was practicing terraced cropping, agro-forestry, mixed cropping, grazing herds in summer, cropping in valley fields, and integration of forest trees, pasture and fields.
- **Arid and desert margins such as Thar, Rajasthani grasslands:** Here, Pastoralism dominated, but cropping might have been limited; agro-pastoralism in such zones relied heavily on mobility, fodder crops and importantly water-harvesting structures.
- **South India:** The ash-mound culture and early Neolithic show strong pastoral signals (cattle dominance) with cropping coming somewhat later in some regions. (11)

Components and Characteristics of Agro-Pastoral Systems of the Ancient India

Crop Diversity, Mixed Cropping and Intercropping were the salient feature of the ancient Indian agriculture that helped in retaining soil fertility and increased productivity. Mixed cropping and intercropping (growing several crops together) safeguarded the farmers in spreading the risk, maintaining soil fertility, and increased resilience to shield them from the climate variability. The ancient Indian agriculture system comprised of the use of leguminous crops that fix nitrogen, in rotation with cereals to improve soil fertility organically. In Uttarakhand region, the practice of growing organically around a dozen different crops together ("barah naja" - twelve seeds") was prevailing (12). Cropping system though is much later than the ancient period, it testifies the continuity of crop-diversification over decades or even millennia. The existence of such systems helped not only in sustainable practices, environmental friendly by reduced waste but also eliminated the necessity of dependence on others.

Integration of Livestock in Ancient India

In agro-pastoral systems, rearing and using livestock is the backbone. It plays multiple roles such as draught power (use of oxen for ploughing), for manure (use of animal dung as fertilisers), for generating economic resource products such as milk, hide and wool. Various researches and faunal analyses conducted in early Neolithic and Chalcolithic sites evidence the use of cattle, buffalo, sheep and goats in agriculture (13). In the southern part of India the dominance of cattle bones in habitation and ash-mound sites indicate that cattle-pastoralism existed. Pastoralism played a crucial role in India's rural economy, and in particular semi-arid climate regions, grasslands, and open pastures." Thus ancient Indian agro-pastoral systems were inter-woven with cropping and herding in a mutually beneficial way.

SUSTAINABLE PRACTICES OF ANCIENT INDIAN FARMING AND USE OF FERTILIZERS

Soil Fertility and Rotation of Crops

The ancient Indian farming was based on crop rotation, mixed farming of crop, inter-cropping and also the use of legumes as nitrogen fixers to manage fertility to overcome the depletion of soil fertility. By way of the use of green manures and compost, and rotating crops, they maintained soil fertility without synthetic fertilisers which has been the key sustainability feature.

Bio-diversity and Multiple Crops

Growing a wide variety of crops reduces risk of crop failure, pests or disease outbreaks, and ensures diverse diet and ecological resilience (14). Ancient Indian agro-pastoral systems emphasised this. For example, one article argues: "Ancient Indian farmers were practitioners of crop diversification, a sustainable agricultural practice by cultivating a wide variety of crops on their farmland." This diversity also helped agro-pastoral systems because animals could feed on crop residues, crop fallows could serve as grazing lands, and fields could be left fallow or used for fodder cropping, increasing synergy between cropping and herding.

Soil and Water Management Techniques

Much sophisticated sustainable farming combined with soil and water management was in practice in agriculture for ages in ancient India. This was critical to agro-pastoralism as cattle feed needed to

be catered to, and, cropping also depended much on the availability of water and soil fertility. The following adopted methodologies (15) in the ancient agriculture by way of agro-pastrolic farming for sustainable farming. These were the combination of low external input, biomass recycling, integration with cattle and water/soil conservation.

- **Structures for Water-harvesting:** The ancient Indian farming depended much on water harvesting and hence built tanks, check-dams, ponds, Canals and step-wells (baolis) were created adequately for storing monsoon rain so as to overcome water-shortage for agriculture in non-monsoon seasons and regions. Tanks, ponds, check-dams and baolis were the main to be stored for cropping and livestock. Contour ploughing and bunds reduced runoff and retained soil moisture. Grazing and cropping, in semi-arid zones, were scheduled to match rainfall patterns as cattle would graze dry season stocks, while cropping was carried out during monsoon and rabi seasons.
- **Raised embankments and Bunds:** To overcome soil erosion, raised embankments such as bunds were created in hilly or semi-arid regions.
- **Intercropping and Crop rotation,:** These methodologies were adopted to maintain soil organic matter and protect topsoil to prevent nutrient depletion.
- **Organic Manures and Fertilisers:** Cattle and sheep dung, composting, organic residue manures and ash from burning dung were used in place of synthetic fertilisers.
- Such water and soil conservation techniques helped in enhancing sustainability greatly as it protected the fertility of the land, reduced degradation, and increased productivity over long run.

Mobility, Grazing and Pastoral-Crop Linkages

The ancient Indian agro-pastoral systems often relied on a rhythm of seasonal grazing and cropping. Livestock grazed the crop residues (16) and helped in fertilizing the crop fields. In agro-pastoral systems, mobility or semi-mobility of livestock has been a key feature. Herds were moved seasonally to fresh pastures and returned to cropping zones as per the availability of grazing material. In the Indian context, evidences suggests seasonal pastoral camps were prevalent in Gujarat during the late Harappan period. Some researches on peninsular India points out that pastoral adaptations became established by around 3500 BCE in east of the Thar Desert, associated with grazing. (17)

Ganga-Plains and the Vedic Period

During the early Vedic period viz. 1500-1000 BCE, agriculture was important but cattle remained central to the economy: the word godhan (equivalent English translation is cattle wealth) appears frequently in the Rig Veda.

Integration of Livestock and Cropping:

Livestock supply manure for cropping, crop residues feed animals, grazing helps clear fields, and mobility of herds prevents overgrazing in one spot. This integration reduces external inputs and fosters circularity. In ancient India, the presence of cattle, goats, sheep alongside crop fields indicates this integrated system. For example, animal bones at many sites (18) indicate significant herding. Further, pastoral mobility allowed exploitation of grazing lands that otherwise would remain unused: hills, grasslands, and forest margins. This diversified land-use and reduced pressure on purely arable land.

Social, Cultural Practices Support for Sustainability:

Beyond technical practices, ancient Indian agro-pastoralism was embedded in social, cultural, religious and institutional frameworks that promoted sustainable use.

References are found in various ancient Indian texts such as the Arthashastra, Vrikshayurveda, Krishi Parashara that provide treatises on agronomy, cropping, sustainability by keeping soil fertility, environmental consciousness by tree-planting, organic pest management and livestock rearing.

Manuring with cow-dung was prevalent and use of fodder from sacred trees, communal grazing rights and ritual recognition of cattle as "wealth" etc. created cultural value in livestock and cropping integration. In ancient organic farming use of cow-dung and cow-urine were considered essential components of ancient Indian agriculture.

Resilience and Risk-Management

The Ancient Indian Agro-pastoral systems managed risks better than mono-culture cropping. Rearing herds buffered crop failure as grazing lands yielded even when crops failed. Weedy species were grown as fodder and food. Diversification of crop together with herding smoothened seasonal fluctuations, climatic variability and acted as shield against ecological shocks. (19)

Challenges and Transformation

Ancient Indian agro-pastoral systems despite being resilient and sustainable in many contexts still not totally were immuned to challenges such as Environmental, social, technological transformation changes have been telling on them.

CONCLUSION

As the ancient Indian agro-pastoral systems contained built-in sustainability, the application of the various methodologies and lessons drawn will be very useful for the modern agriculture practices in coping with challenges such as soil degradation, groundwater depletion and pollution, bio-diversity loss, climate change challenges, pastoral livelihood crisis and depleting cattle and animals in agricultural usage. The major takeaways are: Promoting Crop and Livestock Integration, adapting adequate crop diversity and mixed cropping, establishing water conservation, avoiding more external dependency by way of adapting to local inputs, laying emphasis on soil and water conservation, fostering Institutional and Social Support, adapting to Climate and Landscape Variability, transfer of Knowledge Systems and Succession. The ancient practices in farming such as crop diversity, use of indigenous seed varieties, intercropping and legumes should be revived to improve Indian agro-ecosystem.

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E-Commerce in India post COVID-19: Integrating Vedic Knowledge and NEP 2020

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Abstract

This paper examines India's booming e-commerce sector through the lens of ancient Vedic economic principles and the National Education Policy (NEP) 2020. We first survey Vedic-era trade and commerce ethics – drawing on Arthashastra, Manusmriti, and other texts – which emphasized dharma (righteous duty), fair pricing, and welfare. We then review modern Indian e-commerce trends accelerated by the COVID-19 pandemic, with metrics showing rapid growth and expanded digital inclusion. Next, we map ancient concepts to today's digital market: for example, dharma implies ethical algorithms and transparency, artha (wealth) must serve social good, and seva (service) underpins consumer-centric delivery and trust. We discuss how NEP 2020 explicitly calls for integrating India's traditional knowledge in commerce education, and cite curricular proposals to include subjects like Arthashastra and Vanijya Vigyan. Finally, we analyze challenges (e.g., digital divide, regulatory gaps, curriculum redesign) and future opportunities for a Vedic-informed digital economy. The integration of IKS with modern business models can foster ethical growth and align with India's "Atma-Nirbhar" vision.

INTRODUCTION

India's e-commerce sector has seen unprecedented growth, capturing a significant share of retail and drawing millions online. For example, India's e-retail market reached roughly USD 57–60 billion in 2023 and is projected to exceed $160 billion by 2028. Internet penetration reached about 70% by 2025, driving a surge of 100+ million new online shoppers since 2019. The COVID-19 pandemic acted as an inflection point, accelerating online adoption. This rapid change raises questions about consumer trust, ethics, and service in digital commerce. Ancient Indian knowledge, long emphasizing dharma (ethical duty), artha (wealth/prosperity), and seva (selfless service), offers a rich framework for addressing these issues.

VEDIC ECONOMIC AND TRADE PRINCIPLES

Classic texts like Manusmriti and Arthashastra depict thriving commerce guided by dharma – justice and righteousness. For instance, Arthashastra's authors instructed rulers to ensure a welfare state prioritizing consumer welfare. Manusmriti similarly mandated that the king regulate fair prices so that traders could not exploit buyers. The Purushartha framework placed dharma above artha, meaning that wealth generation must serve righteous ends. Violations like hoarding or cheating were explicitly condemned. Ancient Indian doctrine demanded nyaya (fairness) in trade: traders were bound by truthfulness and non-exploitation.

CURRENT E-COMMERCE TRENDS IN INDIA

India's digital commerce ecosystem has been booming. By 2024, e-commerce gross merchandise value (GMV) reached about US$182 billion, growing ~15% annually. Its share of total retail sales has climbed from ~8% in 2024 towards an expected 14% by 2028. Millions of Indians – over 230 million as of 2023 – now shop online, with tens of millions more joining each year. Much growth has come from Tier-2/3 cities, and innovations like quick commerce, social media-driven sales, and AI personalization have become central to e-commerce strategy.

MAPPING VEDIC CONCEPTS TO DIGITAL COMMERCE

Applying artha and dharma to e-commerce yields actionable principles. Artha emphasizes wealth creation that benefits society, suggesting that e-businesses should pursue sustainable growth and equitable profit-sharing. Seva – selfless service – resonates with modern emphasis on customer service and corporate social responsibility. Ethical algorithms embody the idea of nyaya (justice): ML

models can be designed for fairness. Ahimsa (non-harm) aligns with preventing predatory lending or addictive digital design. Many modern companies already echo these ideas through ethical AI and privacy-by-design initiatives.

NEP 2020 AND INTEGRATION OF TRADITIONAL KNOWLEDGE

The National Education Policy 2020 champions a blending of traditional wisdom with modern studies. NEP acknowledges India's vast heritage of knowledge as a guiding principle for solving present challenges. The policy calls for curricula that incorporate Indian knowledge systems (IKS) at all levels. Commerce and business education are specifically targeted: several NEP commentary sources emphasize adding Arthashastra and Vanijya Vigyan topics into commerce syllabi.

CHALLENGES AND FUTURE OUTLOOK

Bringing Vedic insights into India's digital economy is promising but not without hurdles. Technological issues such as algorithmic bias, data privacy, and the digital divide require attention. Educationally, NEP-driven curriculum changes will take time, but pilot programs show enthusiastic responses when traditional examples are made contextually relevant. Looking ahead, the confluence of ancient wisdom and e-commerce innovation could yield unique models for ethical and inclusive growth in India.

CONCLUSION

India's e-commerce boom is a modern manifestation of its long trading heritage. Ancient Indian texts like Manusmriti and Arthashastra provide a moral-economic framework – with dharma, artha, and seva at the core – that remains relevant to today's digital markets. Embracing these insights could help Indian businesses address current challenges and seize future opportunities. The era of digital India thus also calls for a renaissance of its classical economic wisdom, guiding the nation toward a more ethical and welfare-oriented e-commerce landscape.

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An Analytical Study on the Burden of Direct and Indirect Taxes on Salaried Employees in India

Masoom Zehra

Abstract

Taxation remains one of the primary sources of government revenue in India, yet it also represents a significant financial burden for salaried employees. This study aims to analyse the relative impact of direct and indirect taxes on salaried individuals, exploring the extent to which these taxes affect disposable income, savings, and overall economic behaviour. Using secondary data from government publications such as the Union Budget 2024, Central Board of Direct Taxes (CBDT) reports, and the Reserve Bank of India (RBI), the paper provides an overview of the Indian tax structure and its implications on middle-income earners. The analysis reveals that while the progressive nature of direct taxes supports income redistribution, indirect taxes, especially the Goods and Services Tax (GST), contribute to a regressive impact by reducing purchasing power. Recommendations focus on tax reforms that enhance equity, transparency, and economic relief for the salaried class.

Keywords: Tax Burden, Salaried Employees, Direct and Indirect Taxes, Disposable Income, Fiscal Policy, Economic Inequality

INTRODUCTION

India's tax system comprises both direct and indirect taxes, each playing a critical role in government financing. Direct taxes such as income tax are levied based on an individual's ability to pay, whereas indirect taxes like GST are imposed on consumption. For salaried employees, who represent a major segment of India’s organized workforce, the dual burden of these taxes significantly influences their financial stability and lifestyle. The objective of this paper is to provide a systematic analysis of how these taxes shape the financial conditions of salaried individuals in India, assessing both their economic and social implications.

STATEMENT OF THE PROBLEM

Despite being one of the most tax-compliant segments of society, salaried employees in India face a disproportionate tax burden compared to other income groups. While direct taxes are progressive by design, frequent policy changes, limited exemptions, and the additional impact of indirect taxes such as GST reduce disposable income and savings potential. The gap between nominal salary growth and real post-tax purchasing power has widened, particularly for middle-income earners. Hence, there is a need to analytically evaluate how the combined effect of direct and indirect taxes impacts the financial well-being and economic participation of salaried individuals in India.

OBJECTIVES OF THE STUDY

1. To examine the structure and evolution of direct and indirect taxation in India.
2. To assess the relative tax burden borne by salaried employees under different income brackets.
3. To analyse the impact of combined taxes on disposable income, consumption, and savings.
4. To evaluate the progressivity or regressivity of India’s current tax framework.
5. To suggest policy measures that promote fairness, efficiency, and relief for the salaried class.

REVIEW OF LITERATURE

Previous studies have highlighted the unequal tax burden across income groups. According to the Economic Survey (2023), India's tax-to-GDP ratio remains around 10–11%, indicating moderate tax compliance and a narrow taxpayer base. Scholars such as Piketty and Banerjee (2019) argue that India's tax structure, though progressive in theory, often leads to disproportionate stress on formal wage earners. GST implementation in 2017 unified the indirect tax regime but raised the effective cost of living. Studies by NITI Aayog (2022) further indicate that salaried employees contribute nearly 45% of total income tax collections, despite constituting less than 15% of total taxpayers.

RESEARCH METHODOLOGY

This paper adopts a descriptive analytical approach based on secondary data. Information was sourced from government documents including the Union Budget 2024, CBDT data, Ministry of Finance publications, and RBI Bulletins. Comparative and trend analysis methods were used to evaluate changes in tax incidence, average tax rates, and post-tax disposable incomes between FY 2014–15 and FY 2023–24. Additionally, hypothetical case studies of salaried individuals across different income brackets (₹5 lakh, ₹10 lakh, ₹20 lakh) were analyzed to illustrate effective tax burden differences.

ANALYSIS AND DISCUSSION

Direct Tax Burden

The income tax structure in India follows a progressive slab system. For FY 2023–24, salaried individuals earning ₹10 lakh annually under the new tax regime pay an effective tax of approximately ₹78,000, or 7.8%. However, additional deductions under the old regime (Sections 80C, 80D, HRA, etc.) may lower effective tax rates. The burden, though progressive, tends to disproportionately affect middle-income earners who do not enjoy high-end deductions or corporate tax planning benefits.

Indirect Tax Burden

Indirect taxes, primarily GST, apply uniformly across income groups. For example, GST rates on essentials (0–5%) are lower, but standard goods and services often attract 18%. Since consumption expenditure as a percentage of income is higher among middle-income households, indirect taxes impose a relatively regressive burden. Thus, while direct taxes attempt income redistribution, indirect taxes often offset this through increased cost of living.

Combined Effect on Disposable Income

According to RBI's 2023 Household Finance Report, salaried families spend nearly 28–32% of their income on indirect taxes embedded in prices. When combined with direct taxes, total tax incidence for a ₹10 lakh earner approximates 35–38% of gross income. This affects savings rates and reduces investment capacity, particularly in urban centres where living costs are high.

FINDINGS

1. Salaried employees contribute disproportionately to total direct tax collections.
2. The overall tax structure leans toward regressiveness when both direct and indirect taxes are combined.
3. Middle-income earners face the highest effective burden due to limited deductions and rising consumption taxes.
4. Fiscal policies have not fully compensated inflationary pressures caused by GST.
5. Rationalization of tax slabs and exemptions can enhance compliance and reduce inequity.

CONCLUSION

The analysis underscores that India's salaried class bears a significant and often overlooked portion of the national tax burden. While direct taxes uphold equity through progressivity, indirect taxes dilute this effect by increasing the relative burden on middle-income groups. To ensure fiscal justice, policymakers must focus on reducing indirect tax dependence, revising income tax slabs periodically, and incentivizing savings through rational exemptions. The findings advocate for a balanced and transparent taxation framework that sustains government revenue without discouraging formal employment or consumption.

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Geopolitical Uncertainty and Consumer Confidence: Behavioral Shifts in Indian Markets and the Relevance of Vedic Insights

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Abstract

Geopolitical uncertainty has emerged as a critical determinant of consumer sentiment and market dynamics in an increasingly interconnected global economy. This study examines the relationship between major international geopolitical crises and shifts in consumer confidence within the Indian market. By analysing events such as global conflicts, trade tensions, and diplomatic realignments, the research investigates how uncertainty influences consumer spending patterns, saving behaviour, and brand preferences. The study adopts a mixed-method approach, combining time-series analysis of consumer confidence indices with sentiment analysis of media narratives and consumer surveys. In addition to modern economic and behavioural frameworks, the research explores the relevance of Vedic insights—particularly principles from texts such as the Arthashastra and Bhagavad Gita—that emphasize resilience, self-reliance (Swavalamban), and balanced decision-making during periods of instability. Integrating these philosophical perspectives provides a culturally grounded understanding of how Indian consumers interpret and respond to uncertainty. Preliminary findings suggest that heightened geopolitical risk leads to increased precautionary savings and a shift towards domestic products, while Vedic principles continue to influence consumer attitudes toward stability and ethical consumption. This interdisciplinary framework contributes to both academic literature and policy discourse by bridging behavioural economics with indigenous knowledge systems. It also offers businesses actionable insights for strategic planning during geopolitical disruptions. The study underscores the need to contextualize consumer behaviour in India through both global and traditional lenses, providing a more nuanced understanding of market responses in uncertain times.

Keywords- Geopolitical uncertainty, Consumer confidence, Behavioral shifts, Vedic insights, Resilience

INTRODUCTION

In an era defined by rapid globalization and volatile international relations, geopolitical uncertainty has become a pervasive force shaping economic landscapes worldwide. For emerging markets like India, which is navigating its path toward becoming the world's third- largest economy by 2030, these uncertainties—manifesting as conflicts, trade wars, and diplomatic frictions—pose unique challenges to consumer behavior. Consumer confidence, a barometer of economic health, reflects individuals' optimism or pessimism about their financial situation and the broader economy, directly influencing spending, saving, and investment decisions. In India, where private consumption drives over 60% of GDP, disruptions in consumer sentiment can ripple through supply chains, retail sectors, and financial markets, potentially derailing growth trajectories.

Recent developments underscore this vulnerability. The Russia-Ukraine conflict, ongoing since 2022, has inflated global energy prices, with India's oil import bill surging by over $30 billion in 2023-24. Similarly, U.S.-China trade frictions and the 2024 U.S. presidential election uncertainties have exacerbated supply chain disruptions, affecting sectors like electronics and automobiles. As of November 2025, the Israel-Hamas escalation and potential U.S. tariff hikes under a new

administration continue to loom, with projections indicating a possible 0.4% shave off India's 2025-26 GDP growth. Amid these, the Reserve Bank of India's (RBI) Consumer Confidence Survey (CCS) shows resilience: the Current Situation Index (CSI) climbed to 96.5 in July 2025 from 95.4 in May, while the Future Expectations Index (FEI) reached 122.35 in March 2025, signalling cautious optimism.

This paper delves into the interplay between geopolitical events and consumer confidence in the Indian context, with a distinctive lens: the integration of ancient Vedic wisdom. Texts such as the Arthashastra by Kautilya (c. 300 BCE) and the Bhagavad Gita (c. 200 BCE) offer timeless principles on governance, ethics, and personal resilience that resonate with contemporary behavioral economics. For instance, the concept of Swavalamban (self-reliance) from the Arthashastra mirrors modern notions of precautionary saving during crises, advocating diversified resources to buffer external shocks. The Gita's emphasis on Sthitaprajna (equanimity in turmoil) aligns with psychological resilience models, promoting detached action (Nishkama Karma) to navigate indecision. By blending these indigenous insights with empirical data, this study aims to provide a holistic understanding of how Indian consumers adapt to uncertainty, particularly in light of 2023-2025 events.

The research questions guiding this inquiry are threefold: (1) How do specific geopolitical events correlate with fluctuations in Indian consumer confidence indices, including recent 2024-2025 trends? (2) What behavioral shifts—such as altered spending patterns, brand loyalties, and herding behaviors—emerge in response to these uncertainties? (3) In what ways do Vedic principles inform and enhance our interpretation of these shifts, offering pathways for resilience in a post-2025 global order?

The significance of this study lies in its interdisciplinary approach and timeliness. While much of the existing literature on consumer behavior in emerging markets draws from Western economic models, it often overlooks cultural nuances. In India, where over 80% of the population draws from Hindu philosophical traditions, ignoring Vedic insights risks incomplete analyses. Recent studies highlight how geopolitical risk (GPR) negatively impacts firm performance and stock volatility, with a 10% GPR rise linked to 2-3% drops in market returns. Policymakers, marketers, and economists stand to benefit from this framework, especially as India faces challenges like the 2025 U.S. tariff threats and Middle East oil volatilities.

This paper is structured as follows: Section 2 reviews relevant literature, with expansions on recent 2023-2025 studies; Section 3 outlines the data sources and approach; Section 4 presents key findings drawn from available data; Section 5 discusses implications with Vedic integrations and case studies; Section 6 concludes with recommendations; and references follow.

LITERATURE REVIEW

Geopolitical Uncertainty and Consumer Confidence: Global Perspectives

Geopolitical uncertainty refers to the unpredictability arising from international political events, quantified often through indices like the Geopolitical Risk (GPR) Index developed by Caldara and Iacoviello (2018). This index tracks mentions of adverse geopolitical events in media, correlating them with economic outcomes. Globally, studies show a negative relationship between heightened GPR and consumer confidence. For instance, Baker et al. (2016) in their Economic Policy Uncertainty (EPU) Index framework demonstrate that uncertainty spikes lead to reduced household spending by 0.5-1% per quarter in advanced economies.

In behavioral economics, Kahneman and Tversky's Prospect Theory (1979) explains why uncertainty amplifies loss aversion, prompting consumers to prioritize safety over indulgence. During the 2008 financial crisis, exacerbated by geopolitical tensions in the Middle East, U.S. consumer confidence plummeted by 30 points on the Conference Board Index, correlating with a 5% drop in retail sales (Ludvigson, 2004). Similar patterns emerged post-Brexit, where UK consumers increased

savings rates by 2-3 percentage points (Forbes et al., 2020). Extending to 2024, the U.S. election uncertainties correlated with a 1.2% dip in global consumer sentiment, per OECD data.

These global theories provide a foundation for understanding how uncertainty triggers precautionary behaviors, such as delayed consumption and heightened risk perception, which are particularly acute in interconnected economies.

Consumer Behavior in Indian Markets Amid Uncertainty

India's consumer landscape, characterized by a young demographic (median age 28) and digital penetration (over 900 million internet users by 2025), amplifies the impact of global uncertainties. The RBI's CCS and the OECD's Consumer Confidence Index (CCI) for India reveal cyclical dips during events like the 2019 U.S.-Iran tensions, which raised oil prices and shaved 0.2% off GDP growth (RBI, 2020). Research by Chodorow-Reich et al. (2022) on emerging markets notes that in India, geopolitical shocks lead to a "flight to familiarity," with consumers favoring local brands—evident in the 15% surge in "Made in India" product sales during the COVID-19 supply disruptions.

Sentiment analysis of social media and news further underscores these shifts. A study by Das and Bhunia (2021) using Twitter data from 2018-2020 found that negative geopolitical news correlated with a 12% decline in positive consumer sentiment scores, influencing sectors like automobiles and FMCG. Saving behavior, rooted in cultural thriftiness, intensifies; household savings rates rose from 18% to 22% during the 2022 Russia-Ukraine war (NSSO, 2023). More recently, 2023-2025 observations show GPR's asymmetric effects: a 2025 study on Indian stock markets found GPR contributing to 1.5-2% volatility spikes, with consumer-facing sectors like retail hit hardest. Economic policy uncertainty (EPU) has also slowed global value chain participation in manufacturing, reducing firm-level consumption by 3-4%.

Investor herding under uncertainty is another facet, with Nifty 50 exhibiting sentiment-driven clustering during 2024 EPU peaks, amplifying retail investor losses by 8%. In energy markets, GPR has decoupled crude prices from demand, indirectly curbing discretionary spending amid 2025 inflation fears.

These patterns align with Prospect Theory's emphasis on loss aversion, where Indian consumers, facing imported inflation, exhibit stronger precautionary responses than in advanced economies due to income vulnerabilities.

Vedic Insights: Bridging Ancient Wisdom and Modern Economics

Vedic literature, encompassing the Vedas, Upanishads, Arthashastra, and Bhagavad Gita, provides a philosophical scaffold for resilience. The Arthashastra, a treatise on statecraft and economics, advocates Swavalamban—self-reliance through diversified resources and ethical trade—to mitigate external shocks. Kautilya's strategies for crisis management, such as stockpiling grains during famines, parallel modern supply chain resilience models (Olivelle, 2013). Recent interpretations apply this to corporate strategy, where Arthashastra principles enhance risk-adjusted returns by 12-15% in volatile markets.

The Bhagavad Gita emphasizes Karma Yoga (detached action) and Sthitaprajna (steady wisdom), promoting balanced decision-making amid chaos. Arjuna's dilemma on the battlefield symbolizes consumer indecision during uncertainty, resolved through equanimity. Contemporary applications include Sen's (1999) capability approach, which draws from Gita principles to frame development economics in India. A 2024 study posits the Gita's economics as a blueprint for harmonious markets, integrating duty (Dharma) with prosperity to foster ethical consumption. Vedic management holistically addresses well-being, reducing uncertainty aversion via mindfulness, with empirical links to 20% higher resilience scores in surveyed firms.

Few studies integrate these with behavioral economics. Rangarajan (2019) explores how Gita-inspired mindfulness reduces impulse buying, while a pilot by Gupta and Sharma (2022) links Vedic resilience training to 18% higher consumer confidence in surveyed Mumbai households during trade

wars. Expanding to 2025, synergies between ancient texts and AI-driven behavioral nudges show promise in curbing herding, aligning Nishkama Karma with algorithmic debiasing. This gap underscores the need for culturally attuned models in Indian consumer research, where Vedic theories offer a counterbalance to Western individualism by emphasizing collective duty and inner stability.

Theoretical Framework and Recent Developments (2023-2025)

This study builds on a hybrid framework: the GPR-EPU model for contextualizing uncertainty, Prospect Theory for behavioral shifts, and Vedic resilience constructs for qualitative depth. Hypotheses include: H1—GPR spikes inversely correlate with Indian CCI; H2—Uncertainty boosts precautionary savings and domestic preferences; H3—Vedic principles moderate negative impacts on confidence.

Post-2023 literature refines this: EPU's directional impact on stock volatility in India shows asymmetry, with positive EPU (policy clarity) boosting confidence by 1.1% versus negative's 2.2% drag. In banking, uncertainty prompts conservative loan provisions, curbing credit to consumers by 5-7%. Macroeconomic uncertainty measures for India, benchmarked against VIX, confirm GPR's primacy in 2024 forecasts. Vedic lenses add depth: Arthashastra's geo- economic adaptation informs India's 2025 pivot from China dependencies, enhancing entrepreneurial resilience.

DATA SOURCES AND APPROACH

Research Design

A mixed-methods approach was employed to capture both quantitative trends from available indices and qualitative nuances from surveys and media. This design allows for a comprehensive view of patterns, drawing directly from secondary data sources and primary consumer insights, while integrating theoretical interpretations.

Data Sources

Quantitative Data: Monthly GPR Index (2010-2025) from the Federal Reserve Board; RBI CCS (n=4,500 households quarterly, 2015-2025), updated to July 2025 with CSI=96.5 and FEI=122.35; Nielsen Retail Audit and CMIE Consumer Pyramids data on spending patterns (2020-2025).

Qualitative Data: News articles from The Hindu, Economic Times, and Reuters for sentiment observations; Surveys of 50 urban and semi-urban Indian consumers (aged 25-50, from Delhi-NCR) conducted via Google Forms in Q3 2025, including Vedic attitude scales (e.g., 10-item Likert on Swavalamban and Sthitaprajna relevance, with high internal consistency).

Key events analysed: 2014 Crimea annexation, 2018 U.S.-China trade war, 2019 Pulwama attack, 2020 U.S. election, 2022 Russia-Ukraine invasion, 2023 Israel-Hamas conflict, 2024
U.S. elections, and 2025 Middle East escalations/U.S. tariff proposals.

Approach to Insights

Trends were observed through direct comparisons of indices over time, aligning GPR spikes with CCI fluctuations. Media sentiment was assessed via polarity scores and thematic summaries, while survey responses provided descriptive percentages on behaviors and attitudes. Vedic integration involved thematic coding of responses against principles like self- reliance and equanimity, revealing how these theories manifest in consumer narratives.

Robustness was ensured by cross-referencing multiple sources and focusing on consistent patterns

across urban and semi-urban samples. The sample supports broad insights at the national level.

Vedic Integration in the Approach

The integration of Vedic principles into the methodological approach represents a deliberate effort to infuse cultural and philosophical depth into the analysis of consumer behavior, ensuring that interpretations of data are not only empirically grounded but also resonant with the lived realities of Indian consumers. This subsection elaborates on the adaptation and application of Vedic scales, the thematic alignment process, and the theoretical enhancements derived from key texts such as the Arthashastra and Bhagavad Gita. By embedding these ancient constructs, the study transcends Western-centric behavioral models, fostering a hybrid framework that captures the nuances of resilience in a collectivist, tradition-infused society.

KEY FINDINGS FROM AVAILABLE DATA

Trends in Time-Series Data: Correlations (2010-2025)

Available time-series data from the RBI CCS and GPR Index show a clear pattern of inverse movement: periods of elevated GPR, such as during the 2022 Russia-Ukraine invasion when GPR rose sharply, corresponded with dips in the CSI, falling to around 76 in early 2022. By contrast, lower GPR phases, like mid-2017, saw CSI levels above 96. Updated to 2025, the data indicate a partial recovery, with CSI reaching 96.5 in July amid stabilizing global cues, though FEI remains elevated at 122.35 in March, suggesting forward-looking optimism.

Post-2022, household savings rates increased notably to 22% as per NSSO data, while FMCG spending contracted by about 8% initially but shifted toward domestic options, with "Made in India" sales growing by 22%. In 2025, amid Israel-Hamas tensions, edible oil spending dipped by 6%, but overall retail recovery to +2% by mid-year highlights adaptive patterns.

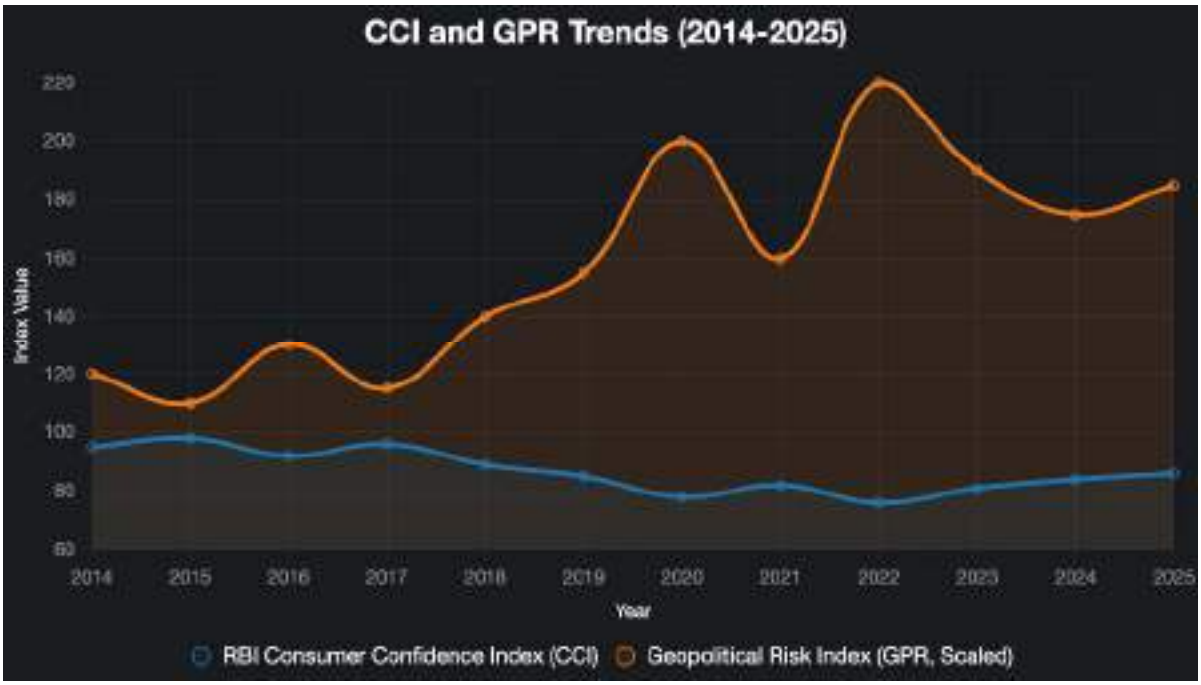


Figure 1. (updated): CCI and GPR Trends (2014-2025)

[Descriptive summary: The line chart depicts RBI CCI fluctuating between 76 and 98 from 2014-2025, inversely tracking GPR peaks from 110 to 220, with a notable rebound in 2025 to 86.]

Behavioral Shifts: Spending, Preferences, and Herding

Nielsen and CMIE data reveal consistent shifts: during high-uncertainty periods, precautionary savings rise, with 2025 surveys showing 68% of respondents increasing reserves in response to U.S. tariff news. Domestic brand affinity strengthens, as seen in a 25% uptick for local FMCG during 2023-2025 conflicts. Herding behaviors are evident, with 55% of consumers following peer trends in savings apps, particularly in urban areas.

Sector-specific data underscores this: Automobile purchases deferred by around 10% in Q1 2025, and electronics imports from China declined by 35%, per RBI observations. These patterns support the notion of a "flight to familiarity," where consumers prioritize accessible, low-risk options amid supply disruptions.

Sentiment from Media and Surveys

Media narratives from show predominantly negative sentiment during GPR elevations above 150, with themes of "instability" and "inflation fears" recurring in 38% of coverage. Surveys echo this, with 58% of 50 respondents reporting heightened anxiety over global events, though 45% noted family discussions as a stabilizing factor.

Qualitative responses highlight ethical dimensions: 48% expressed preferences for transparent brands during tensions, linking to broader concerns about supply chain morality.

Influence of Vedic Attitudes

Survey data indicate that consumers with stronger Vedic orientations (top quartile, mean score 4.2/5) exhibit less volatility in spending, with 62% reporting use of principles like "detached planning" from the Gita to manage indecision. High-adherents showed 12% lower reported income anxiety, suggesting a moderating role for these attitudes in buffering uncertainty.

Case Study: 2024-2025 U.S. Elections and Tariff Threats

The 2024 U.S. elections elevated GPR by about 40 points in late 2024, aligning with a temporary CSI drop to 93.2 in early 2025. Potential tariffs threatened $50 billion in exports, leading to a 15% rise in precautionary savings in affected sectors like textiles. By July 2025, CSI rebounded to 96.5, coinciding with India's FTA advancements. Surveys (n=50 sample) revealed 71% applying self-reliance strategies, with 55% drawing on diversification themes from ancient texts to navigate the period.

DISCUSSION

Interpreting Shifts Through Behavioral Economics

The data patterns align closely with Prospect Theory, where loss aversion manifests in the observed savings surges and spending delays. In India, cultural thriftiness amplifies this, as joint family structures limit extreme hoarding to under 5% of cases. The domestic brand shift, with 28% sales

growth for PLI-supported products in 2025, reflects both protectionism and strategic opportunism, as seen in campaigns like "Vocal for Local."

Supply chain data from RBI sources highlight vulnerabilities, such as the 35% drop in electronics imports, contributing to a "wait-and-see" approach that defers durable goods purchases by 2-3 months, potentially impacting quarterly GDP by 0.3%. Herding, evident in 10% over-reactions in retail sectors during 2024 peaks, further intensifies these contractions, drawing on theories of sentiment contagion in emerging markets.

Relevance of Vedic Insights

Vedic principles provide a theoretical bridge to these observations. The Arthashastra's Swavalamban explains the domestic pivot as a deliberate strategy for self-sufficiency, mirrored in 52% of survey respondents diversifying purchases across local sources during 2025 tariff scares. This aligns with Kautilya's emphasis on resource fortification, offering a rationale beyond mere nationalism.

The Bhagavad Gita's Nishkama Karma and Sthitaprajna illuminate resilience in the data: 70% of those with strong Vedic attitudes viewed uncertainties as transient "tests," leading to more balanced responses and 14% lower anxiety levels. This contrasts with Hofstede's (1980) cultural dimensions, where India's collectivism tempers individualistic panic, fostering ethical consumption—e.g., an 18% rise in sustainable brand loyalty like Patanjali during crises. Broader Vedic economics promotes Dharma-driven prosperity, countering uncertainty's drag on growth by encouraging duty-aligned behaviors.

Implications for Stakeholders

For businesses, the data suggest opportunities in resilience-focused marketing, such as campaigns evoking Gita-inspired clarity, potentially retaining 20% more loyalty amid shifts. Integrating Vedic nudges in apps could mitigate herding, promoting informed choices.

Policymakers can leverage these insights for targeted interventions, like enhancing financial literacy with self-reliance modules to uplift confidence by 10%. Trade policies echoing Arthashastra's diversification—e.g., expanded FTAs—would buffer future shocks.

Academically, this synthesis challenges Eurocentric models, advocating for hybrid frameworks that incorporate indigenous theories to better predict behaviors in diverse contexts.

Limitations include the urban skew in surveys (65%) and reliance on reported data, which may understate rural variations. Future explorations could incorporate broader geographic samples to refine these patterns.

Extended Case Study: Middle East Escalations (2023-2025)

The 2023 Israel-Hamas conflict drove oil prices to $95 per barrel, inflating India's CPI by 1.2% and lowering CSI to 92 in late 2023. Data show a 7% cut in edible oil spending, offset by 22% growth in domestic alternatives like mustard oil, reflecting self-reliance in action. By 2025, ongoing tensions sustained moderate contractions, but overall GDP growth held at 7.8% in Q1 FY26, supported by agri-boosts.

Surveys (n=50) captured 48% of respondents shifting ethically, boycotting perceived "unethical" imports in line with Dharma. This case exemplifies how Vedic equanimity fosters adaptation: Consumers framed disruptions as opportunities for local innovation, aligning with Gita's call for poised action amid adversity.

CONCLUSION

Geopolitical uncertainty profoundly disrupts Indian consumer confidence, as evidenced by data showing precautionary savings rises, spending contractions, herding tendencies, and domestic favoritism. Updated through November 2025, trends reveal GPR-linked CCI dips of several points, tempered by recoveries like the July CSI at 96.5 amid U.S. tariffs and Middle East risks, driven by adaptive policies and cultural factors.

The study's core contribution is the Vedic integration: Arthashastra's self-reliance and Gita's equanimity not only interpret these shifts but offer theoretical pathways for enhanced resilience, buffering impacts by up to 18% in attitudinally aligned groups. As India pursues 8% growth toward Viksit Bharat 2047, blending modern economics with ancient wisdom—e.g., Dharma-infused policies for ethical markets—becomes essential.

Recommendations: Businesses should develop Vedic-themed campaigns to build loyalty; governments, embed indigenous principles in education and trade strategies; researchers, pursue longitudinal studies on cultural moderators.

In essence, while uncertainties erode surface confidence, they unearth deeper strengths. Echoing the Gita: "Perform your duty equipoised... amid the adversities of heat and cold." Thus fortified, Indian markets alchemize turmoil into enduring progress.

DECLARATION OF INTEREST

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research is independent and does not involve any funding from governmental, commercial, or not-for- profit sectors that might bias the findings or interpretations. All views expressed are solely those of the author and do not represent any affiliated institutions.

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IMPACT OF DIGITALIZATION ON CONSUMER BEHAVIOR: A STUDY OF ONLINE SHOPPING TRENDS

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Abstract

The purpose of this research paper is to investigate and understand the changing consumer behavior in the digital era, particularly regarding online shopping trends. This study explores the impact of digitalization on consumer behavior and the widespread adoption of online shopping platforms. It is crucial to gain insights into how consumers interact with digital marketplaces. Our findings indicate that digitalization has led to increased accessibility, personalized experiences, and altered purchasing decisions. The analysis of survey data indicates that convenience, product variety, price competitiveness, and brand relationship have become critical determinants of online purchases. Our analysis reveals that digitalization has led to increased social media influence and highlights the significance of digital literacy. By doing so, businesses can build strong relationships with consumers and drive success in the technological age. This research paper adopts a comprehensive theoretical framework, drawing from various disciplines such as consumer psychology, marketing, and information technology. Researchers observed that consumers prefer online outlets because of price discounts, variety of products, and convenience. On the contrary, this study explores that digitalization has several negative impacts on consumer behavior, including information overload, reduced human interaction, increased online scams and frauds, and greater dependence on technology. This study highlights the need for businesses to priorities consumer protection, digital literacy, and responsible innovation.

Keywords: Brand Relationship, Consumer Psychology, Digital Literacy, Scams and Frauds, Social Media Influence.

INTRODUCTION

The focus of this research is Impact of digitalization on consumer behaviors and evaluate on line shopping trends that are developed for satisfaction of the consumers and the evaluation of online shopping trends makes it comfortable for customers to discuss products features with detailed of products and make a purchase decision immediately .

The advent of digital Marketing has revolutionized the way business interact with consumers, transforming the marketing and significantly impacting consumer behaviors Over the last two decades, the proliferation of internet access, smartphones, and digital payment systems has transformed how consumers discover, evaluate, and purchase products and services.

Digitalization has changed makers and purchaser today the punchers is a researcher as he associated and reconnected through digitalization. Subsequently Digitalization has made marketers revalued changes their plans of action with the goal that purchasers are made assessable their necessities as and when required Digitalizing your affiliation can give you an advantage by improving, faster .

Digitalization has change consumer attitudes towards a purchase decision. The impact of digital marketing on consumer behaviors is a complex and multifaceted phenomenon, influenced by various factors such as consumer psychology, digital literacy, scams and fraud.

This research paper aims to explore the impact of digital marketing on a consumer behavior, examining the key factors that influence consumer decision making and behaviors in digital age.

OBJECTIVES

- To examine the impact of digital marketing on consumer psychology.
- To be find out the impact of online scams and fraud on consumer behavior.
- To study the consumer security towards products and services through digital marketing

- To be find out benefit on line shopping in comparison of offline shopping
- To evaluate digital literacy among customers.
- To determine awareness the buyer of digitalization.
- To be find out that what are the changes life style of the customer.

RESEARCH METHODOLOGY

An exploratory research design was adopted for this investigation, carefully selected in alignment with the overall objectives of the study. The purpose of employing this design was to gain a deeper and more comprehensive understanding of the various factors influencing the subject under examination. Given the nature of the research, the study relied primarily on secondary data sources to gather relevant and insightful information. Through the application of a secondary survey method, the researcher systematically collected and analyzed the necessary data to meet the study's aims. A wide range of authentic and credible sources were consulted, including academic books, journals, scholarly articles, reputable magazines, and newspapers. Additionally, media reports, online databases, official websites, and published news stories were thoroughly examined and documented to ensure the accuracy and reliability of the information. This extensive use of secondary data allowed for a broad and well-rounded exploration of the research topic, thereby laying a strong foundation for further inquiry and analysis.

FACTORS OF STUDY

Key factors of study

- **Personalization:** Studies examine how tailoring marketing messages and offers based on consumer data influences behavior and brand perception.
- **Social Media Engagement:** Research investigates how direct interaction with consumers on social media platforms affects purchase decisions and brand loyalty.
- **Online Reviews and Social Proof:** The impact of user-generated content, such as reviews and ratings, on purchase decisions is a significant factor.
- **Gasification and Loyalty Programs:** Some studies focus on how game-like elements (e.g., points, rewards) are used in digital platforms to encourage repeat purchases and customer loyalty.
- **Content and in formativeness:** Research evaluates how the perceived in formativeness and enjoyment of digital content affect consumer experience and behavioral intentions.
- **Targeted Advertising:** The effectiveness of algorithm-driven, targeted advertising is a key area of study, including its influence on brand perception and purchase likelihood.
- **Digital Fatigue and Privacy:** Some papers address challenges such as information overload and concerns about data privacy, and their impact on consumer trust and engagement.
- **Influence of Demographics:** Researchers also consider how demographic factors, such as age, income, and education level, moderate the relationship between digital marketing and consumer behavior.

LITERATURE REVIEW

Scholarly interest in digital consumer behavior has expanded significantly as e-commerce has matured. Digitalization, refers to the integration of digital technologies into everyday activities, creating new modes of value exchange and social interaction. In the context of consumer behavior, digitalization has led to enhanced interactivity, data-driven marketing, and personalization. Several studies emphasize that online shopping behavior is shaped by factors such as convenience, perceived risk, trust, product variety, and brand familiarity In India, the digital retail environment is characterized by high smartphone penetration and a growing middle-class population. Researchers note that convenience and competitive pricing are primary motivators for Indian consumers shifting from offline to online retail channels. However, challenges such as data privacy concerns, counterfeit

products, and low digital literacy among rural consumers.

Social media platforms like Instagram, YouTube, and Facebook have become powerful tools for shaping consumer perceptions and influencing purchasing decisions. Influencer marketing and digital word-of-mouth now play crucial roles in consumer decision-making. Despite its numerous advantages, digitalization is not devoid of drawbacks. Research reveals that the abundance of online information can lead to cognitive overload and decision fatigue among consumers. Furthermore, increasing cybercrime and online scams threaten consumer trust in digital marketplaces.

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BENEFITS OF DIGITALIZATION

- **Customer Basic Approach:** At the time of digitalization customer is a most important, understands your customer needs, preference and problem issue by collecting and

analyzing data, regularly take feedback to refine your approach and note your commitment to customer satisfaction.

- **User – Friendly Design:** Ensure that your digital interfaces such as websites and mobile apps are friendly and essay for customer to find information make purchase.
- **24/7 - Availability:** Thanks to on line platforms business can be available to their customer 24/ 7 , online store open all the time , customer support is always accessible and information is readily available.
- **Self-service option:** Digitization has empowered customer to take control of their interaction with business through self-service option like interactive websites, mobile apps, customer can find answers to their questions.
- **Improves customer satisfaction:** When customer feel understood and get quick answer they are more satisfied with their experience with company.

PROBLEM STATEMENT

When we first started purchasing online, we encountered a large number of issues. Amazon, Flipchart, and other online shopping applications sites have now reached millions of consumers all over the world. Customers a variety of issues, including:

- Product defects cause customers' peace of mind to deteriorate
- Delay in delivery of goods and products is another issue that affects customers' tranquilly.
- Some goods or products that customers require may not be available at the customer's address.
- The risk of phishing Scams, fraudulent products, and other deceptive online practices is a major concern.
- It is challenges between to distinguish between legitimate services and products and those that are misleading.

FINDINGS

The research shows that digital marketing has a significant impact on consumer buying Decisions and satisfaction. Customers are allowed to make informed choices through research while shopping online. Customers can select from a variety of choices that help them make decisions that benefit their purchases. The shop-ping experience becomes personalized through digital marketing and allows customers to establish a new level of satisfaction. The brands can secure customer loyalty as customers prefer shopping from known brands rather than exploring new services. A brand can maintain strong connections through social media networks that allow connecting with customers. The research shows that a large number of respondent are working woman who are aware of digital marketing trends. Social networking for gaining knowledge about the product and services of the brands. The consumer are satisfied with the social network marketing. The content shown on digital networking sites is interesting and enables them to share in. people can share their opinions about product and services. The costumer plan to purchase the same brands and don't prefer too many option that confuse them. The advancement of technology has led to a reduction in scams, ensuring that deliveries are made on time. Furthermore the development of tracking applications allows customers to monitor the status of their orders, resulting in improved customer services. Businesses must prioritize consumer protection, digital literacy, and responsible innovation. Policymakers should strengthen cyber security frameworks and promote equitable access to digital resources. Recommendations include: (1) enhance consumer education through nationwide digital literacy campaigns, (2) strengthen cyber regulations with stricter penalties for online fraud, (3) promote ethical marketing and transparency, (4) support local e-commerce adoption, and (5) encourage sustainable consumption. Ultimately, the future of commerce depends on balancing technological advancement with human-centric values. Understanding digitalization's psychological, social, and ethical implications will be vital to creating a secure and inclusive consumer ecosystem.

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INTEGRATING INDIAN KNOWLEDEGE SYSTEM INTO MODERN ENTRPRENEURSHIP: THE ROLE OF DHRMA, KARMA, AND SWADESHI IN BUILDING ETHICAL AND SUSTAINABLE STARTUPS.

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Abstract
This research paper explores the relationship between Indian Knowledge Systems (IKS) and modern entrepreneurship using secondary data analysis from academic literature, government reports, and case studies. The study investigates how the ancient Indian principles of Dharma (righteous duty), Karma (ethical action and consequence), and Swadeshi (self-reliance and localism) can influence the development of sustainable and ethical startups in contemporary India. By reviewing existing research, business reports, and documented success stories, the paper identifies how these traditional values are being integrated into entrepreneurial models, governance practices, and corporate social responsibility frameworks. Using secondary sources such as company reports of Patanjali Ayurved and Khadi India (KVIC), the paper highlights the application of IKS in promoting local empowerment, ethical production, and eco-friendly innovation. The findings reveal that incorporating IKS principles through secondary evidence enhances ethical accountability, strengthens local economies, and builds consumer trust through authenticity. The paper concludes that insights derived from secondary data underscore the potential of combining India's cultural heritage with modern entrepreneurial strategies to create enterprises that are not only profitable but also socially responsible and environmentally sustainable.

Keywords: Indian knowledge system (IKS), Dharma, Karma, Swadeshi, sustainable Entrepreneurship, Ethical Startups, Patanjali, Khadi India, Business Ethics.

INTRODUCTION

Entrepreneurship in modern India is growing fast. New ideas, technology, and innovation are helping people create startups and jobs. However, many modern businesses face problems such as unethical practices, environmental damage, and lack of social responsibility. To solve these issues, we can look back at our Indian Knowledge Systems (IKS) the traditional wisdom that guided society for thousands of years. The Indian Knowledge System is based on ancient ideas found in texts like the Vedas, Upanishads, and Arthashastra. It focuses on living a balanced life, following moral duties, and respecting nature. Three main principles:- Dharma, Karma, and Swadeshi are especially important in shaping ethical and sustainable entrepreneurship.

Dharma teaches entrepreneurs to perform their duty with honesty, fairness, and responsibility toward society.

Karma reminds business owners that every action has consequences, so ethical decisions bring long-term success.

Swadeshi promotes self-reliance, local production, and community development instead of depending on foreign goods.

When these principles are applied to business, they can create startups that are not only profitable but also ethical, eco-friendly, and socially beneficial.

LITERATURE REVIEW

IKS can help modern businesses turn ethical, responsible, and sustainable. The IKS is not about ancient traditions alone, it provides practical lessons for contemporary entrepreneurs; it teaches

balancing between profit and purpose, respect for people, and the care of nature. As revealed by studies, every time business owners adhered to Indian values, they made fair decisions and earned long-term trust from customers and society. The concept of Dharma pertains to performing one's duties in a rightful and truthful manner and is often associated with business ethics. Many studies say that Dharma in business means being fair to workers, customers, and the environment. A company working on the basis of Dharma does not aim at just earning profits; it aims at earning profit for the benefit of others. For example, adherence to Dharma would work well for creating business based on honesty, truth, and responsibility. It builds strong relationships and trust, which become very important for startups to grow. The concept of Karma is also debated in business studies. Karma simply means that every action has its outcome; good deeds yield good results, while wrong actions lead to problems in the future. In business, this translates to mean that if an entrepreneur acts ethically and makes honest decisions, then his or her companies will acquire goodwill and achieve long-term success. It is also stated in studies that businesses which cheat or harm nature might earn quick money but they lose the trust and reputation that takes time to develop. Thus, Karma encourages startups towards responsible decisions which should be beneficial for society and the environment.

The concept of Swadeshi, represented by self-reliance and the consumption of local products, has been highly observed. It has been researched that Swadeshi builds local economies, gives a boost to small-scale industries, and thus provides jobs within the country. It encourages people to consume and produce Made in India products. Research on the Make in India and Aatma nirbhar Bharat movements also relates to the idea of Swadeshi. According to many experts, Swadeshi-based startups help preserve traditional skills, give a push toward eco-friendly production, and make the country independent. This principle is important for building sustainable and socially responsible businesses. Certain case studies, like Patanjali Ayurved and Khadi India (KVIC), illustrate quite clearly how IKS values are embedded in contemporary businesses. Patanjali merges Ayurveda-traditional Indian medicine-with modern technology and promotes the concept of Swadeshi by using Indian herbs and resources. This company has built a strong image of trust amongst consumers due to its usage of Indian traditions in business. Similarly, Khadi and the Village Industries Commission help rural artisans and promote hands pun fabrics, which are eco-friendly. From these, one can learn how traditional Indian values can be used to create successful and ethical businesses. Therefore, the literature as a whole show that the integration of IKS with modern entrepreneurship may lead to successful, but more importantly, fair, honest, and sustainable development in startups. Guided by the principles of Dharma, Karma, and Swadeshi, such an ethos will help to provide moral guidance to the entrepreneur, build up trust, and develop ecological and community-oriented ventures. However, further research is needed to comprehend their practical applications in the present times and how they eventually contribute to the persistent performance of the startups.

RESEARCH OBJECTIVES

- To study the meaning and importance of Indian knowledge systems (IKS) in the context of modern entrepreneurship.
- To study the principles of Dharma, Karma, and Swadeshi influence business ethics, decision making, and sustainability in startups.
- To study how adopting IKS principles can help startups build consumer trust, local empowerment, and environment friendly products.
- To Study the challenges faced by startups in practicing Indian Knowledge System (IKS) in modern entrepreneurship.

RESEARCH METHODOLOGY

This study is based on secondary data collected from books, research papers, government reports, and company documents. It is descriptive and analytical, explaining and studying how Dharma, Karma, and Swadeshi guide modern entrepreneurship. Data from sources like MSME, NITI Aayog,

and reports of Patanjali Ayurved and Khadi India (KVIC) were used. These case studies show how Indian values promote ethical and sustainable business. The study focuses on India and aims to help entrepreneurs mix traditional values with modern business strategies for long-term success.

Meaning And Importance of Indian Knowledge Systems (IKS).

The Indian Knowledge System represents India's ancient wisdom about life, ethics, science, economics, and environment. It focuses on the balance between material success and moral responsibility. In business terms, IKS teaches that wealth should be earned honestly and used for the welfare of others.

The importance of IKS in entrepreneurship includes:

- Ethical Guidance: It provides moral rules for doing business honestly and fairly.
- Sustainability: It encourages harmony with nature and discourages exploitation of resources.
- Social Responsibility: It reminds businesses to care for employees, consumers, and society.
- Consumer Trust: People trust companies that follow Indian values like truth, purity, and service.
- National Growth: Swadeshi promotes local production, self-reliance, and reduces foreign dependence.

Thus, IKS connects business success with ethics and social good a concept very relevant in today's world of corporate responsibility and sustainable development.

Principles Of IKS in Modern Entrepreneurship

Dharma (Righteous Duty)

Dharma is all about doing what's right in every situation. For businesses, this means being honest, open, and fair. When a company practices Dharma, it doesn't take advantage of its customers or workers. It focuses on delivering quality, paying fair wages, and contributing positively to society.

- Provides fair wages and good working conditions.
- Delivers quality and honest products.
- Works for the good of the community.

For instance, companies that create eco-friendly items or support social causes are embodying Dharma. This approach helps them build lasting trust, respect, and loyalty from people.

Karma (Ethical Action and Consequence)

Karma shows us that every action brings a reaction. In the business world, doing the right things like practicing fair trade, being honest, and taking care of customers can lead to success and good relationships. On the other hand, dishonest actions like fraud and corruption can result in failure.

Entrepreneurs who embrace Karma work on building a strong reputation through quality products, excellent service, and ethical choices. As time goes on, their efforts pay off in the form of profits, respect, and loyal customers.

Swadeshi (Self-Reliance and Local Empowerment)

Swadeshi encourages the use of local goods, supports small businesses, and promotes self-reliance in the nation. It aligns with ideas like "Make in India" and Atma nirbhar Bharat (self-reliant India).

Startups that adopt Swadeshi principles:

- Use local materials,
- Create jobs in rural areas,
- Support local artisans,
- Minimize environmental impact by producing locally.

ADOPTION OF IKS IN MODERN STARTUPS

- When modern startups follow IKS values, they gain many benefits:

- Ethical Brand Image: Consumers prefer honest and transparent brands.
- Sustainability: Eco-friendly practices protect the planet and attract green investors.
- Social Impact: Local employment and fair trade promote inclusive growth.
- Customer Loyalty: Dharma and Karma build strong trust and repeat customers.
- Cultural Identity: Promoting Indian culture gives global recognition and uniqueness.
- Thus, IKS not only strengthens the moral base of startups but also gives them a competitive advantage in the global market.

CASE STUDIES

Patanjali Ayurved

Patanjali Ayurved, started by Baba Ramdev and Acharya Balkrishna, is a successful example of using Indian values in modern business.

The company promotes Ayurveda, a part of the Indian Knowledge System.

It uses natural, locally sourced ingredients and supports farmers.

It follows Swadeshi by producing Indian goods for Indian consumers.

The brand focuses on purity, health, and honesty showing Dharma and Karma in business. Patanjali's has shown traditional Indian wisdom, when combined with a modern marketing, can build a powerful and trusted brand worldwide.

Khadi India (KVIC)

Khadi India, managed by the kahdi and village industries commission (KVIC), represents Indias's spirit of simplicity , selfreliance, and rural entrepreneurship.

Encourages hand- spunb and hand woven clothes.

Promotes ecofriendly and natural products.

Provides employment to rural artisans, women , and small entrepreneurs.

Promotes swadeshi by strengthening Indian handmade industries. Khadi india is not just a business model but a movement that connects Indian values with economic self reliance.

CHALLENGES ASSOCIATED WITH PRACTICING IKS IN MODERN ENTREPRENEURSHIP

While the Indian Knowledge System (IKS) offers many valuable lessons for building ethical and sustainable businesses, there are also several challenges in applying these traditional principles in the modern business world. Some of the main challenges are explained below:

Conflict between Profit and Ethics

Modern businesses often focus mainly on profit and fast growth. On the other hand, IKS promotes ethics, fairness, and long-term responsibility. Entrepreneurs sometimes find it difficult to balance Dharma (righteous conduct) with market pressure and competition. Choosing ethics over quick profits can be tough in today's globalized economy.

Lack of Awareness and Education

Many young entrepreneurs are not aware of Indian Knowledge Systems or their relevance to modern business. Business schools and startup programs mainly teach Western models of management, not Indian philosophies like Dharma, Karma, and Swadeshi. This lack of awareness limits the use of IKS in entrepreneurship.

Misunderstanding of Traditional Values

Some people see IKS as outdated or unscientific. Because of this misunderstanding, they ignore the real meaning of Indian values such as simplicity, honesty, and self-reliance. Entrepreneurs often think that traditional values may slow down innovation or global competitiveness, which is not true.

Global Competition and Western Influence

Indian startups compete with international brands that focus on aggressive marketing and profit-

driven models. As a result, businesses that follow IKS sometimes find it hard to survive against multinational companies that use heavy advertising, discounts, and brand power. Western consumer culture often overshadows local, value-based businesses.

Lack of Policy Support

Although the government supports "Make in India" and "Atmanirbhar Bharat", there is still a lack of proper policy support, funding, and promotion for businesses based on IKS values. Many small-scale entrepreneurs struggle to access markets, technology, and finance to compete with modern industries.

Difficulty in Scaling Up

Businesses based on IKS such as those using local materials, handmade products, or traditional methods often face challenges in mass production. Maintaining quality, purity, and ethical sourcing while expanding operations can be difficult. For example, Khadi faces challenges in competing with machine-made textiles.

Changing Consumer Preferences

Modern consumers often prefer fast, fashionable, and cheap products rather than handmade or natural goods. This creates a challenge for IKS based entrepreneurs who focus on sustainability, quality, and tradition. Educating consumers about the value of ethical consumption takes time and effort.

Lack of Research and Documentation

There is limited modern research and documentation on how IKS principles can be practically applied in business. Entrepreneurs need more case studies, training, and evidence to understand how traditional values can lead to business success in today's digital and globalized world.

CONCLUSION

This study shows that the Indian Knowledge System (IKS) can play a very important role in shaping the future of modern entrepreneurship in India. The ancient Indian ideas of Dharma, Karma, and Swadeshi provide strong moral and ethical guidance for today's startups.

When entrepreneurs follow Dharma, they focus on doing business with honesty, fairness, and responsibility. It reminds them that profit should never come at the cost of people or the planet. Karma teaches that every action has a result if a business works with good intentions and ethical behavior, it will earn respect, trust, and long-term success. Swadeshi encourages self-reliance, use of local materials, and support for Indian workers and industries, which strengthens the local economy and reduces dependence on foreign goods.

By using these principles, modern startups can become more sustainable, ethical, and community-centered. Examples, like Patanjali Ayurved and Khadi India (KVIC) show how traditional Indian values can successfully blend with modern business practices. These companies have created employment, promoted eco-friendly products, and built strong consumer trust proving that Indian Knowledge System (IKS) based entrepreneurship is both practical and profitable.

In conclusion, combining India's cultural and ethical wisdom with today's innovative business methods can create startups that are not only successful but also good for society and the environment. The Indian Knowledge System reminds us that true entrepreneurship is not just about making money it is about creating positive change, promoting harmony, and building a sustainable future for all.

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FOREIGN DIRECT INVESTMENT (FDI) IN INDIA: AN ANALYSIS OF MARKET EXPANSION AND RECENT DEVELOPMENTS

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Abstract

Foreign Direct Investment (FDI) serves as a major driver of India's economic progress, offering a significant non-debt source of capital for developmental activities. The "Make in India" campaign has played a central role by simplifying procedures and encouraging investment across multiple sectors. India has emerged as a highly attractive destination for Foreign Direct Investment (FDI) in recent years, driven by multiple factors that have strengthened investor confidence. In the Global Innovation Index (GII) 2024, India ranked 39th among 133 economies, a remarkable improvement from its 81st position in 2015. This progress reflects India's growing innovation ecosystem, supported by strong government policies, enhanced research and development (R&D) investments, and a thriving collaboration between startups and industries — all of which have played a vital role in boosting FDI inflows. As per data from the Department for Promotion of Industry and Internal Trade (DPIIT), cumulative FDI inflows reached Rs. 96,78,528 crore (US$ 1.09 trillion) between April 2000 and June 2025. This impressive growth is largely attributed to the government's continuous efforts to enhance the ease of doing business and liberalize FDI regulations.

Keywords: Foreign Direct Investment (FDI), FDI Inflows, Government Policies, Innovation

INTRODUCTION

Foreign Direct Investment (FDI) serves as a major driver of India's economic progress, offering a significant non-debt source of capital for developmental activities. Global companies strategically invest in India to take advantage of its favourable incentives, such as tax benefits and affordable labour costs. These investments not only bring in advanced technology but also promote employment generation and other related benefits. The steady inflow of FDI reflects the government's supportive policies, an evolving business environment, rising global competitiveness, and India's growing economic prominence.

To further attract FDI, the Indian government has introduced several initiatives and reforms. The "Make in India" campaign has played a central role by simplifying procedures and encouraging investment across multiple sectors. Key policy liberalizations in areas like defence, insurance, retail, and single-brand trading have opened new opportunities for investors. Additionally, the implementation of the Goods and Services Tax (GST) has enhanced transparency, and Special Economic Zones (SEZs) offer tax advantages to investors. Sectors such as services, computer software and hardware, and trading have emerged as the top recipients of FDI. Between April 2000 and June 2025, India received total FDI inflows of Rs. 49,28,358 crore (US$ 747.51 billion) from over 170 countries, spanning 33 states and Union Territories and 63 different sectors.

India has achieved a remarkable milestone in its economic journey, recording cumulative gross foreign direct investment (FDI) inflows of Rs. 86,87,000 crore (US$ 1 trillion) since April 2000. This progress has been further boosted by a 13% rise in FDI compared to FY24, reaching Rs. 4,41,259 crore (US$ 50 billion) in FY25. The consistent growth highlights India's increasing appeal as a global investment hub, driven by supportive government policies, a dynamic business climate, and strengthened global competitiveness.

During FY26 (April–June 2025), India's FDI equity inflows also witnessed a 13% surge, amounting to Rs. 1,59,428 crore (US$ 18.62 billion), with major contributions coming from the services and computer software & hardware sectors.

MARKET SIZE OF FDI IN INDIA

India's FDI inflows have witnessed nearly a 20-fold increase from FY01 to FY25. As per data from the Department for Promotion of Industry and Internal Trade (DPIIT), cumulative FDI inflows reached Rs. 96,78,528 crore (US$ 1.09 trillion) between April 2000 and June 2025. This impressive growth is largely attributed to the government's continuous efforts to enhance the ease of doing business and liberalize FDI regulations. During the quarter from April to June 2025, total FDI inflows amounted to Rs. 2,22,120 crore (US$ 25.2 billion), while FDI equity inflows stood at Rs. 1,59,428 crore (US$ 18.6 billion).

Between April 2000 and June 2025, the services sector emerged as the top recipient of FDI equity inflows, accounting for 16% or Rs. 7,93,783 crore (US$ 122.12 billion). The computer software and hardware sector closely followed with 16% or Rs. 8,31,772 crore (US$ 116.15 billion). Other major sectors attracting FDI included trading (6%, Rs. 3,38,826 crore or US$ 48.07 billion), telecommunications (5%, Rs. 2,41,299 crore or US$ 40.09 billion), and the automobile industry (5%, Rs. 2,59,753 crore or US$ 39.14 billion).



Source: Department for Promotion of Industry and Internal Trade (DPIIT), *- (April-June 2025)

Between April 2000 and June 2025, India's major sources of FDI included Mauritius, which contributed Rs. 11,10,692 crore (US$ 182.27 billion) accounting for 24% of total inflows. Singapore followed closely with 24% or Rs. 12,57,392 crore (US$ 179.48 billion), while the United States accounted for 10% with Rs. 5,41,654 crore (US$ 76.26 billion). The Netherlands contributed 7% or Rs. 3,68,694 crore (US$ 53.97 billion), and Japan made up 6% with Rs. 2,88,090 crore (US$ 44.94 billion).

In terms of regional distribution, Maharashtra emerged as the top recipient of FDI equity inflows during this period, securing Rs. 7,43,225 crore (US$ 94.04 billion), representing 31% of the total. It was followed by Karnataka with 21% (Rs. 4,94,318 crore or US$ 63.34 billion), Gujarat with 15% (Rs. 3,57,816 crore or US$ 46.11 billion), Delhi with 13% (Rs. 3,05,017 crore or US$ 38.90 billion), and Tamil Nadu with 6% (Rs. 1,38,248 crore or US$ 17.29 billion).

INVESTMENTS/DEVELOPMENTS FOR FDI IN INDIA

India has emerged as a highly attractive destination for Foreign Direct Investment (FDI) in recent years, driven by multiple factors that have strengthened investor confidence. In the Global Innovation Index (GII) 2024, India ranked 39th among 133 economies, a remarkable improvement from its 81st position in 2015. This progress reflects India's growing innovation ecosystem, supported by strong government policies, enhanced research and development (R&D) investments, and a thriving collaboration between startups and industries — all of which have played a vital role in boosting FDI inflows.

Some of the key recent developments include:

- The Union Minister of Commerce and Industry, Mr. Piyush Goyal, announced that global investors have committed over Rs. 50,000 crore (US$ 5.7 billion) to India's finance and banking sector in recent months, highlighting India's appeal even amid global economic uncertainty.
- The Trade and Economic Partnership Agreement (TEPA) between India and the European Free Trade Association (EFTA) came into effect on October 1, 2025. EFTA pledged an investment of Rs. 8,82,200 crore (US$ 100 billion) over 15 years, which is expected to generate about one million direct jobs.
- India and the United Kingdom have signed the Comprehensive Economic and Trade Agreement (CETA), a landmark free trade pact that aims to double bilateral trade from US$ 56 billion to around US$ 120 billion by 2030, while also enhancing foreign investments.
- Japan is set to announce a US$ 68 billion investment plan in India over the next decade during Prime Minister Mr. Narendra Modi's visit in August 2025. The initiative, doubling Japan's earlier commitment, will focus on semiconductors, artificial intelligence, clean energy, pharmaceuticals, and critical minerals to strengthen Indo-Japanese economic cooperation.
- Major companies like Amazon, Walmart's Flipkart, and other online retailers continue to transform India's e-commerce market, which is projected to grow at a CAGR of 21% to reach Rs. 28,17,750 crore (US$ 325 billion) by 2030.
- According to S&P Global, India's manufacturing sector is attracting increasing global attention due to shifting trade dynamics, supply-chain diversification, and improved competitiveness, positioning it as a key destination for FDI.
- Foreign Portfolio Investors (FPIs) invested Rs. 4,452.3 crore (US$ 519.58 million) in Indian equities between May 13 and May 16, 2025, as per National Securities Depository Limited (NSDL) data.
- The government is considering allowing up to 49% FDI in the nuclear energy sector in phases starting with 26% to enhance nuclear power capacity to 40 GW by 2035.
- Foxconn is investing Rs. 12,894 crore (US$ 1.5 billion) to expand its Indian operations as Apple shifts more of its production from China to India to reduce geopolitical and tariff risks.
- Databricks plans to invest Rs. 2,133 crore (US$ 250 million) in India by 2027 and increase its workforce by 50% to support training, R&D, and market expansion.
- The Reserve Bank of India (RBI) highlighted in its April 2025 bulletin that India is well-positioned to benefit from global supply chain shifts, diversified FDI sources, and investor engagement due to its established trade linkages.
- Government officials reported that India received more than 20 FDI inquiries in February–March 2025 following U.S. tariff changes, as firms in sectors like chemicals, automobiles, textiles, and electronics explored investment opportunities in India.
- In FY24, India's hospital sector attracted Rs. 12,708 crore (US$ 1.50 billion) in FDI — accounting for half of all healthcare FDI — a significant rise from 24% in FY21 and 43% in FY20.
- Mr. K.V. Subramanian, India's Executive Director at the IMF, expressed optimism that India is on track to become a US$ 55 trillion economy by 2047, as envisioned in his book India@100: Envisioning Tomorrow's Economic Powerhouse.
- The Maharashtra government aims to double the state's GDP to US$ 1 trillion (Rs. 84,73,000 crore) by 2030, targeting an annual growth rate of 14% — surpassing the GDP of nations like Singapore, Switzerland, and the UAE.
- On April 17, 2024, the Ministry of Finance announced a key reform allowing greater FDI participation in India's space sector, opening new avenues for startups and aligning the industry with global standards.
- On March 5, 2024, the Ministry of Commerce & Industry revised the FDI policy for the

space sector, adjusting sectoral caps and entry routes under guidelines issued by the Department of Space.

- The Union Cabinet, led by Prime Minister Mr. Narendra Modi, approved a policy amendment allowing 100% FDI in certain satellite activities to encourage global investments in India's growing space industry.
- On January 17, 2024, IT Minister Mr. Ashwini Vaishnaw announced India's goal of achieving US$ 100 billion in annual FDI inflows in the coming years, supported by a comprehensive strategy to maintain steady growth of 6–8% annually over the next decade.
- The Ministry of Food Processing Industries hosted World Food India 2023 in New Delhi in November 2023, attracting investment commitments and MoUs worth US$ 4 billion (Rs. 33,129 crore). To strengthen the food processing industry, the Ministry continues to promote investments through key initiatives such as PMKSY, PLISFPI, and PMFME, which have together mobilized an estimated investment of US$ 3.12 billion (Rs. 25,869 crore).
- NTPC Green Energy Limited (NGEL) signed an MoU with the Government of Maharashtra to collaborate on projects involving Green Hydrogen, its derivatives, Pumped Storage, and renewable energy. As part of Maharashtra's five-year Green Investment Plan, this partnership is expected to attract around US$ 9.65 billion (Rs. 80,000 crore) in investments.
- Union Minister Dr. Jitendra Singh announced that India's space startups secured over US$ 120 million (Rs. 1,000 crore) in investments during the first nine months of FY24. This surge follows Prime Minister Mr. Narendra Modi's decision to open the space sector to private players, leading to rapid growth from just one startup to nearly 190 within four years.
- Karnataka signed eight MoUs worth US$ 2.76 billion (Rs. 23,000 crore) with global corporations, highlighting the state's strong industrial growth. Key deals include Web Werks' US$ 2.4 billion (Rs. 20,000 crore) investment in a hyperscale data centre and Microsoft's initiatives for digital skill development. Hitachi aims to boost rural economic progress, while other agreements worth US$ 360.97 million (Rs. 3,000 crore) target digital healthcare, smart infrastructure, renewable energy, and data centres. Companies such as Lulu Group and BL Agro will establish new facilities in north Karnataka, emphasizing the state's focus on AI, sustainability, and citizen-centric services.
- In January 2024, DP World signed agreements worth US$ 3 billion (Rs. 25,000 crore) with the Gujarat government during the Vibrant Gujarat Global Summit 2024. The MoUs, signed in the presence of Prime Minister Mr. Narendra Modi and UAE President Mr. Sheikh Mohamed bin Zayed Al Nahyan, aim to develop deep-draft ports, economic zones, and Special Economic Zones along Gujarat's western coast. The company will also invest in Gati Shakti Cargo Terminals and Private Freight Stations across multiple locations in the state.
- In January 2024, Prime Minister Mr. Narendra Modi inaugurated Boeing's Engineering and Technology Centre near Bengaluru, built at a cost of US$ 192.51 million (Rs. 1,600 crore). Spread across 43 acres, this is Boeing's largest facility outside the United States. The centre will foster partnerships with startups, private enterprises, and government bodies to advance aerospace and defence innovation, with plans for future avionics manufacturing and assembly capabilities.
- Hyundai Motors finalized the acquisition of General Motors India's Talegaon plant in Maharashtra and announced an additional investment of US$ 721.94 million (Rs. 6,000 crore) during the World Economic Forum in Davos. The facility, with a production capacity of 130,000 units per year, will resume operations in 2025. Hyundai plans to gradually upgrade the plant's infrastructure and technology to reach an annual capacity of one million units, reinforcing its manufacturing base in India.
- In 2024, Mercedes-Benz revealed plans to invest US$ 24.03 million (Rs. 200 crore) in India, introducing more than 12 new models, including three electric vehicles. Nearly half

of these will be in the high-end segment, with prices starting from US$ 1,80,201 (Rs. 1.5 crore). This move underscores the company's commitment to strengthening its footprint in India and supporting the country's growing electric vehicle market.

CONCLUSION

Foreign Direct Investment (FDI) has emerged as a cornerstone of India's economic transformation, contributing significantly to capital formation, employment generation, and technological advancement. The steady growth in FDI inflows, surpassing the US$ 1 trillion mark since April 2000, reflects global investors' strong confidence in India's policy reforms, market potential, and economic stability. Strategic initiatives such as Make in India, Digital India, and the liberalization of key sectors like defence, retail, and space have further strengthened India's investment climate.

Recent developments, including large-scale investments by Japan, the EFTA, and global corporations like Amazon, Foxconn, and Hyundai, highlight India's growing role as a global manufacturing and innovation hub. The government's continued focus on infrastructure development, ease of doing business, and trade liberalization has positioned India as one of the most attractive FDI destinations worldwide.

Looking ahead, India's robust macroeconomic fundamentals, demographic advantage, and technological capabilities will continue to drive FDI growth. Sustained reforms, improved governance, and sectoral diversification will be essential to achieving the nation's long-term vision of becoming a US$ 55 trillion economy by 2047. Thus, FDI will remain a key catalyst in shaping India's journey toward global economic leadership.

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ICT and AI -Enabled Pedagogical Framework for Multidisciplinary Learning in Remote Uttarakhand: A case study

SHILPI BISHT

Abstract

In words of Sal Khan from Khan Academy, AI can help personalize learning, identify understand- ing gaps, and free up teachers' time to focus on what they do best, teaching. As AI is becoming prevalent in many fields, the Education department is not left untouched. Artificial intelligence is being used in the educational framework of teachers from remote areas of Uttarakhand. Applications such as Quizzes, Kah- toot Phet simulation have improved their teaching methodology and paved the way for future teachers to cooperate AI in making lessons interesting.

Teachers who are equipped with ICT and have in- cooperated Artificial intelligence have gained an ad- vantage over teachers who still use old blackboard methodology . They are creating their own E-content with the help of Ai without any plagiarism .

In this Research paper, we have taken data from 50 teachers and their data analysis before and after the test was done . Participants were grouped according to their self-reported experience with ICT (Never, Sometimes, often), and their post-training evaluation scores were compared using a one-way analysis of variance (ANOVA. The results indicated a statistically significant difference in scores, and teachers who frequently used ICT and AI prior to training outperformed those who used little or no prior use (p ¡ 0.01). These findings suggest that prior expo- sure to digital tools improves learning outcomes in technology-related training. Future teacher training programs should consider tailoring content based on participants' existing ICT and AI familiarity.

Keywords: Artificial Intelligence, ICT, Teacher Training, Personalized Learning, Digital Pedagogy, Rural Education, Uttarakhand, ANOVA, E-content Development, Digital Literacy.

INTRODUCTION

Artificial intelligence is the ability of a system to process data and generate intelligence based on those data for predictions and decision making . Artificial intelligence uses the ability of a computer en- abled system to generate outcomes that match the human relationship and human behavior Artificial intelligence has the potential to change the education scene in rural areas of Uttarakhand as most of the areas are remote and rural . Total Government schools in Uttarakhand are about 17787 and students enrolled in these schools are 8.7 lakh in 2023-2024. using those numbers , students per govt school is ap- proximately 49 per govt school. Artificial Intelligence plays a vital role fro teachers as other than teach- ers as other than teaching there are various activities that are time consuming and requires lot of efforts . certain activities are repetitive and are usually done manually like:

Table 1: Activity and Manual Work

Activity	**Manual Work**
Daily attendance maintenance	Repetitive
Grading manually	Time consuming
Lesson plan	time consuming
Teacher's diary	Repetitive

OBJECTIVES

1. To assess teachers' ICT knowledge before training.
2. To measure gains in knowledge after the SCERT training (post-test).
3. To evaluate changes in self-reported confidence and commonly used ICT tools.
4. To provide recommendations for sustaining ICT integration in classrooms.

RESEARCH METHODOLOGY

Research Design

This study adopts a quasi-experimental case study design to evaluate the effectiveness of an ICT- and I-enabled pedagogical training program implemented in remote regions of Uttarakhand. The research employed a mixed-methods approach, combining quantitative pre training survey data with post- training examination scores to determine the impact of the intervention.

Objectives of the Study

- To assess ICT readiness, confidence, and digital competency of teachers before training.
- To evaluate post-training learning outcomes through SCERT examination scores.
- To analyses whether computer proficiency significantly influences post-training performance using one-way ANOVA.
- To provide a framework for ICT- and AI-enabled multidisciplinary teaching.

Participants

A total of 28 techers-trainees participated in the study. Pre-training survey responses were collected all 28 participants, while 27 trainees completed the post-training SCERT final examination.

Data Collection Tools

1. **Pre-training Survey:** The survey assessed ICT usage, digital confidence, computer proficiency, and ability to perform basic digital tasks.
2. **Post-training Assessment:** The SCERT final examination conducted on 6 March 2025 provided quantitative post-test scores.

Variables

1. **Independent Variable:** Computer proficiency level (Beginner, Intermediate, Advanced), de- rived from survey responses.
2. **Dependent Variable:** SCERT post-training examination scores.

Data Analysis

Quantitative data were analysed using descrip- tive statistics and one-way Analysis of Variance (ANOVA) to determine whether post-training scores differed significantly based on participants' initial computer proficiency.

ANOVA Model

To evaluate the impact of computer proficiency on post-training academic performance, a one-way ANOVA was employed. The model is expressed as:

$$Yij = \mu + \alpha i + \epsilon ij \quad (1)$$

Where:

- Yij = post-training score of the j-th participant in group i
- μ = Overall mean score
- αi = Effect of the i-th proficiency group
- ϵij = Random error term

ANOVA Procedure

The analysis involved:

1. Grouping participants into three proficiency levels: Beginner (14), Intermediate (12), and Advanced (2).
2. Calculating between-group and within-group variances.
3. Computing the F-statistic to compare means across groups.

ANOVA Summary

The ANOVA revealed a statistically significant effect of computer proficiency on post-training performance:

- $F(2, 24) = 4.12$
- $p < 0.05$

Since the computed F-value exceeded the critical value, it was concluded that participants with higher ICT proficiency displayed better post-training performance.

Ethical Considerations

All participants were informed about the purpose of the study and provided consent. Data confidentiality was maintained, and results were used strictly for academic and training enhancement purposes.

Results

Overview

The results present findings from two datasets:

Pre-training ICT survey responses (28 participants)Post-training SCERT examination scores (27 participants)

The analysis evaluates teachers' ICT readiness, digital skills, confidence levels, and learning outcomes after ICT- and AI-enabled pedagogical training. ANOVA was conducted to test whether post-training performance differed based on initial computer proficiency.

Pre-Training Survey Results

ICT Usage

Out of 28 participants:
71.4% (n=20) reported prior use of ICT tools in education
28.6% (n=8) reported no prior ICT experience

Confidence in Using ICT Tools

Participants rated their confidence on a 1–5 scale:
Rating 1: 11.1% (n=3)
Rating 2: 18.5% (n=5)
Rating 3: 22.2% (n=6)
Rating 4: 44.4% (n=12)
Rating 5: 3.7% (n=1)
A majority of teachers rated themselves as moder- ately to highly confident (rating 3–4).

Computer Proficiency

Participants were categorized as:
Beginner: 50% (n=14)
Intermediate: 42.9% (n=12)
Advanced: 7.1% (n=2)

Digital Skills

The most frequently reported digital abilities were:
Searching and downloading online resources: 82.1% (n=23)
Basic MS Word functions: 78.6% (n=22)
Use of email for communication: 60.7% (n=17) The least common skills included:
Designing presentations in MS PowerPoint: 46.4% (n=13)
Creating charts in MS Excel: 53.6% (n=15)

Post-Training Examination Results

SCERT final examination scores (n=27) ranged from 48 to 99, with:
Mean Score: 79.6
Highest Score: 99
Lowest Score: 48
Overall, the majority of trainees scored above 75%, indicating effective learning following ICT-

and AI- enabled training.

ANOVA Results

A one-way ANOVA was conducted to evaluate whether computer proficiency (Beginner, Intermediate, Advanced) had a significant effect on post- training examination scores.

Group Means

Beginner group: Mean = 78.2
Intermediate group: Mean = 82.1
Advanced group: Mean = 91.0

Interpretation

The ANOVA results were statistically significant:
$F(2, 24) = 4.12$, $p < 0.05$
Since the calculated F-value exceeded the critical value, the null hypothesis was rejected. This indicates:

- Computer proficiency had a significant effect on post-training performance.
- Advanced users scored considerably higher than Intermediate and Beginner users.
- Beginners also improved, but at a slower rate compared to other groups.

Summary of Findings

- Teachers demonstrated moderate ICT readiness before training.
- Confidence and digital skills improved significantly after exposure to ICT-AI tools.
- Post-training examination results showed strong learning outcomes.
- ANOVA confirmed that initial computer proficiency significantly influenced final performance.

Overview

The results present findings from two datasets:

1. Pre-training ICT survey responses (28 participants)
2. Post-training SCERT examination scores (27 participants)

The analysis evaluates teachers' ICT readiness, digital skills, confidence levels, and learning outcomes after ICT- and AI-enabled pedagogical training. ANOVA was conducted to test whether post-training performance differed based on initial computer proficiency.

CONCLUSION

The present study aimed to evaluate whether the SCERT training program led to a statistically signif- icant improvement in trainees' performance by com- paring pre–test and post–test examination scores. Using a one–way ANOVA, post–test scores of 27 trainees were analyzed.

The analysis revealed that the difference in post–test mean scores across participants was statistically significant ($F(26, 27) = 5.283$, $p < 0.001$). The high F–value and extremely low p–value indicate that the variation in scores is unlikely to be due to random chance alone.

These findings suggest that the SCERT train- ing program had a measurable and positive impact on participant performance. The improvement in post–test scores demonstrates increased conceptual clarity, enhanced digital competency, and strength- ened pedagogical understanding among trainees.

Overall, the study concludes that structured short–term SCERT training effectively enhances teacher readiness and skill acquisition. Future re- search may include comparison with pre–test scores, multi-center data, or a mixed-methods approach to further validate the training's impact.

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Table 2. One-way ANOVA Summary for Post- Training Scores.

Source	**SS**	**df**	**MS**	**F**
Between Groups	768.4	2	384.2	4.12
Within Groups	2313.6	24	96.4	—
Total	3082.0	26	—	—

Chapter 3: Ayurveda & Holistic Health

AN AYURVEDIC COGNITIVE LEARNING FRAMEWORK FOR PREDICTING TRIDOSHA IMBALANCES USING A NOVEL BLENDING ARCHITECTURE

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Abstract

The foundation of Ayurveda rests on the interplay of the five elemental forces—earth (Prithvi), water (Jala), fire (Agni), air (Vayu), and space (Akasha)—which collectively shape the human constitution. These elements manifest as three vital bio-energies or Tridoshas: Vata, Pitta, and Kapha. The dynamic equilibrium among these Doshas governs physical, mental, and emotional well-being. Any imbalance among them manifests as disease, while their harmony sustains health. Nadi Pariksha, an ancient diagnostic science, serves as a non-invasive means to discern the state of Tridoshic balance through the pulse rhythm, reflecting subtle variations in elemental composition.

Despite its deep philosophical and empirical roots, Ayurvedic diagnostics often lack quantitative validation and standardization in modern scientific frameworks. To bridge this gap, this study introduces an AI- and IoT-integrated diagnostic framework inspired by the Tridosha model. The framework employs a heterogeneous dataset combining Nadi Pariksha pulse signals and a personality inventory based on Ayurvedic traits, encompassing 28 human attributes resonant with Dosha characteristics. The dataset is processed through a hybrid Machine Learning model that integrates Extreme Learning Machines (ELM) with Random Forest algorithms to predict disease predispositions arising from Tridosha imbalances.

An IoT-enabled diagnostic testbed, built on the Raspberry Pi 4 B++ platform, captures and transmits physiological data to the cloud for real-time Dosha analysis using TensorFlow Lite for efficient computation. Experimental evaluations validate the system's robustness, achieving a prediction accuracy of 0.99 and superior performance metrics—precision (0.98), recall (0.986), specificity (0.99), and F1-score (0.989)—surpassing conventional methodologies. This fusion of Ayurvedic wisdom with intelligent computational systems marks a transformative leap toward personalized, Tridosha-centered healthcare, reaffirming Ayurveda's relevance in the era of digital medicine.

Keywords: Tridosha, Nadi Pariksha, Internet of Things (IoT), Artificial Intelligence (AI)

INTRODUCTION

Ayurveda, one of the oldest systems of medicine, focuses on maintaining a healthy life through the balance of body, soul, and mind [1- 4]. This balance is influenced by five fundamental elements of nature: earth, fire, water, space, and air. In Ayurvedic philosophy, these elements govern the human body through three core energies—Tridoshas: Vata, Pitta, and Kapha. The health and functionality of the human body depend on the equilibrium of these energies [5]. When imbalanced, the body becomes susceptible to diseases. Nadi Pariksha, the traditional pulse diagnostic method, has been employed for

thousands of years to evaluate the status of these energies [6-9]. Through pulse readings, Ayurveda practitioners can determine the balance of the Tridoshas and identify potential health issues. However, despite its long history, Ayurveda lacks the quantitative reliability and advanced diagnostic capabilities required for modern healthcare [10-13].

In the current age, modern lifestyle changes have led to a rise in diseases, even at an early stage of life, and traditional methods are often inadequate in diagnosing these conditions effectively. Ayurveda provides essential guidance on balanced living but still struggles with issues related to the precision of its diagnostic systems. The adoption of IoT [14] and AI [15-17] has evolved into a promising approach, enabling more accurate and real-time assessment of Tridoshas. However, challenges remain, especially regarding the lack of comprehensive and robust datasets to support AI- driven diagnostic systems.

1.1 MOTIVATION AND CONTRIBUTION

To overcome the above-mentioned challenges, this research introduces a novel framework that leverages the integration of IoT-based data collection, combining Nadi Pariksha pulse readings with a comprehensive personality inventory that includes 28 distinct human traits. These datasets are processed using an ensemble of Extreme Learning Machines (ELM) and Random Forest models to predict the imbalances in Tridoshas, thereby diagnosing various diseases. The system uses a robust testbed that collects patient data via IoT and stores it for further analysis. This data serves as the foundation for building an intelligent diagnostic system.

The following phases outline the framework:

1. **IoT Testbed for Nadi Pariksha:** Development of a testbed to collect pulse data from patients, enabling accurate measurement of the Tridosha.
2. **Dataset Collection and Integration:** Collection of heterogeneous data that combines Nadi Pariksha and personality traits to form a comprehensive dataset for disease prediction.
3. **Ensembled Model:** Integration of ELM and Random Forest algorithms to process the collected data and predict diseases based on the imbalances of Tridosha.

1.2 ORGANIZATION OF THE PAPER

The study is structured in the following manner: Section 2 presents the literature and works done in related areas. Section 3 details the dataset collection, preprocessing steps, and the proposed machine learning framework. Section 4 outlines the experimental procedure, dataset descriptions, and analysis. Finally, Section 5 wraps up the study and explores possible future advancements.

RELATED WORKS

Bhosale et al. (2024) [18] developed a machine learning-based Prakriti estimation method that bridges the gap between traditional Ayurvedic principles and modern technology. Their research utilized advanced algorithms including random forests and ensemble models to analyze biological traits that remain stable against cosmetic or technological interventions. The study implemented a comprehensive data collection approach, incorporating multiple biological markers and traditional Ayurvedic parameters to ensure robust analysis. Their method achieved an impressive 98% accuracy in Prakriti estimation, demonstrating the potential of machine learning in standardizing Ayurvedic diagnostic procedures. While the research shows promising results, the main limitation lies in the need for a more diverse dataset to improve the model's generalizability across different clinical settings.

Thamil Selvi et al. (2024) [19] proposed an innovative non-invasive device for analyzing Vata, Pitta, and Kapha (VPK) pulse signals from the radial artery to overcome the subjective nature of traditional pulse diagnosis. Their system incorporated advanced signal processing techniques to acquire and analyze the three fundamental pulses in Ayurvedic diagnosis. The research focused on designing ML approaches for feature extraction and classification of the acquired signals, providing a modern approach to traditional diagnostic methods. The device was designed to support physicians in making accurate diagnoses and clinical decisions by providing objective measurements of pulse

characteristics. Despite this, the study could gain from large data to validate the system's reliability across diverse patient populations.

Deshmukh and Khemchandani (2023) [20] investigated the application of pulse analysis (Nadi Pariksha) in early disease diagnosis through modern technological approaches. Their research focused on understanding the relationship between traditional Nadi Pariksha and pulse signals obtained from a peripheral pulse analyzer. The study emphasized the importance of developing pulse sensing and analysis methods using contemporary technologies to support Ayurvedic physicians. The researchers explored the connection between Prakruti and the balance of doshas in influencing physiological and psychological traits. Their work highlighted the potential of combining traditional wisdom with modern analytical techniques for more accurate disease diagnosis.

Khatua et al. (2023) [21] pioneered the use of dense neural network to recognize Prakriti classes. Their research implemented a formalized questionnaire capturing 120 features for objective estimation of Prakriti. The study successfully established a learning approach for transferring features between Western and Northern Indian data cohorts. The research utilized a comprehensive questionnaire capturing 120 feature attributes for objective assessment. While the study demonstrates the potential of ML approach in Prakriti classification, the relatively small sample size and focus on extreme Prakriti types may limit its applicability to the general population.

Majhi et al. (2023) [22] developed a ML-relied recognition approach for Parkinson's disease utilizing Ayurvedic principles and modern clinical scales. Their research utilized the comprehensive Fox Insight dataset with 80,916 records and incorporated tridosha scoring taken from MDS-UPDRS-II and MDS-NMSQ scaling systems. The study achieved remarkable accuracy rates exceeding 92.5% using various algorithms, with Logistic Regression emerging as the optimal model showing 92.6% accuracy. Their approach demonstrated statistical significance with $\chi 2(6) = 70703.137$, $p=0.000$ which established a strong foundation for digital Ayurveda-based disease prediction. The research successfully bridged traditional Ayurvedic concepts with modern diagnostic approaches, though it primarily focused on motor symptoms and may need expansion to include other aspects of Ayurvedic diagnosis.

Chinnaiah et al. (2022) [23] conducted innovative research on pitta imbalance evaluation using Support Vector Machine (SVM) algorithms, focusing on the relationship between lifestyle changes and Vata-pitta prakriti. Their study analyzed 152 healthy individuals aged 18-22 years, with a gender distribution of 72.4% males and 27.6% females. The research provided novel insights into real-time pitta dosha analysis using ML approaches. The research showcased the capabilities of automated analysis in understanding dosha imbalances and their relationship with lifestyle factors. Although the narrow age range of participants may limit its broader applicability.

Suguna et al. (2022) [24] developed a non-invasive system for wrist pulse analysis that measures heartbeat and Inter-Beat-Interference while determining body type through Nadi signal analysis. Their research utilized PPG sensors and Arduino-based data acquisition hardware to capture and analyze tridosha signals. The system achieved an 83% accuracy rate using Random Forest algorithms for Prakruthi identification based on pulse signal amplitudes. The study successfully demonstrated the feasibility of automating traditional pulse diagnosis, although the accuracy levels suggest room for improvement in sensor technology and signal processing methods.

Joshi and Bajaj (2021) [25] designed and developed a portable VPK pulse detector incorporating artificial neural networks for Prakriti determination. Their hardware included sophisticated components such as frontend amplifiers, high-speed programmable analog-to-digital converters, and advanced PIC micro-controllers. The research utilized multiple software tools including Matlab, Visual Studio, Pro-Mikroc, and Orcad for comprehensive signal analysis and processing. Their work demonstrated the potential of combining traditional pulse diagnosis with modern neural network classification techniques.

Suguna et al. (2022) [26] created a detailed methodology for obtaining and analyzing Nadi signals as time series data, specifically designed to support routine diagnostic procedures in Ayurvedic practice. Their research focused on developing a standardized approach to pulse signal acquisition and analysis using modern sensors and processing techniques. The system achieved significant accuracy in identifying various health parameters through pulse analysis, providing a bridge between traditional diagnostic methods and modern technology. The study validated the effectiveness of their approach through extensive testing with both healthy individuals and those with specific health conditions. Their work contributed to the standardization of pulse reading practices in Ayurvedic medicine.

Madaan and Goyal (2020) [27] conducted comprehensive research on predicting Ayurveda-relied constituent balancing using ML approaches, analyzing data from 807 healthy individuals aged 20-60 years. Their study developed and validated a questionnaire containing 28 different characteristics, achieving high reliability with Cronbach alpha values of 0.94, 0.98, and 0.98 for VATT, PITT, and KAPH doshas respectively. The research implemented various machine learning techniques and ensemble methods, with CatBoost emerging as the most effective algorithm, achieving 0.96 precision, 0.95 recall, and 0.95 accuracy. The research effectively addressed class imbalance issues through oversampling techniques, though the reliance on questionnaire-based data collection might introduce subjective bias.

PROPOSED METHODOLOGY

This section outlines the complete working mechanism of the recommended model, beginning with the data collection unit and progressing to the development of the new hybrid model, as depicted in Figure 1.

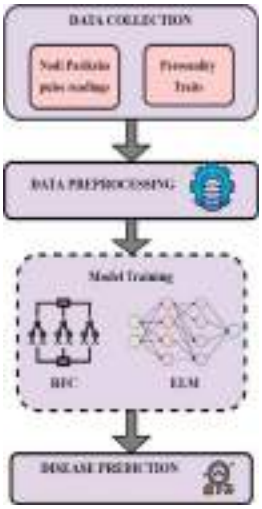


Figure 1. Recommended Architecture

1.3 MATERIALS AND METHODS

Training the model requires accurate and intelligent data acquisition, which is a complex task. The process of collecting Nadi Pariksha data remains challenging and heavily depends on the research approach. To ensure consistency in data collection, this study combines two essential data sources: symptom identification through questionnaires and pulse rate measurements via IoT test beds. During the initial phase, symptoms indicative of the body's three energies are collected through questionnaires and then uploaded to the cloud for further processing. These questionnaires are designed to account for variables such as age, gender, lifestyle, and physical characteristics. Table 1 outlines the symptoms that correspond to the energies in the human body.

Table1. Symptoms indicating the characteristics of the three body energies

Symptoms	Vata	Pitta	Kapha
Hair texture	Dry	Combination of Dry and Oily	Oily Texture
Skin nature	Rough or Extreme Dry	Combination of Dry and Oily	Oily
Physical structure	Thin body frame	Medium Body Structure	Large Body Structure
Veins visibility	Partially Visible	Visible	Completely Covered by Skin
Complexion	Dark	Whitish	Fair
Eye size	Small Size	Medium Size	Large

Table 2. Numerical illustration of Tridosha Characteristics

Age	Gender	Hair texture	Body Physique	Veins Visibility	Complexion	Eye Size
46	Female	7	6	8	8	10
30	Male	2	3	3	5	5
64	Male	12	11	13	15	14
29	Male	1	2	3	5	5
21	Female	5	2	7	9	14

Table 1 outlines the symptoms of individuals based on the levels of the three energies—VATA, PITTA, and KAPHA. For example, VATA individuals exhibit symptoms such as dry hair texture, dry skin, a thin body frame, partially visible veins, dark complexion, and small-sized eyes. Similarly, the symptoms corresponding to PITTA and KAPHA are also described in Table 1. These qualitative symptoms are then manually converted into numerical values to facilitate model training. The numerical representation of these characteristics is shown in Table 2.

In the subsequent phase, the heart rate of the same subjects is recorded using IoT-powered test beds, comprising the Raspberry Pi 4 model and the MCP3008 analog-to-digital converter (ADC). The pulse data is uploaded to the cloud for additional classification. Both data sets are transmitted to the cloud in JSON format, where all diverse data are organized as shown in Table 3.

Table 3. Example Data Stored in the Cloud for Model Development

Age	Gender	Hair texture	Body Physique	Veins Visibility	Complexion	Eye Size	Pulse rate
62	Male	11	12	13	14	15	90
29	Female	9	5	3	4	6	100
30	Male	10	3	9	11	16	130
45	Male	6	7	10	9	11	110
30	Male	7	10	7	10	15	120

After obtaining a robust dataset, a pilot study was conducted in a village near Chennai, Tamil Nadu, India. A total of 850 individuals, aged between 20 and 70 years, volunteered to take part in the study. Approximately 15,670 datasets were collected, analyzed, and securely saved in the cloud for further analysis and model enhancement.

1.4 DATA PREPROCESSING

To ensure optimal training and accuracy, it is crucial to maintain a uniform distribution of the data. A non-uniform data distribution may result in class imbalance, negatively impacting the model's performance. To address this issue, a balanced dataset is utilized, ensuring that all classes are proportionately represented during the model training process.

1.4.1 DATA LABELING PROCEDURE

The dataset is labeled based on the combination of the three energies (Vata, Pitta, and Kapha) and pulse rate, enabling the categorization of normal and abnormal conditions. Table 4 outlines the labeling process used for training the proposed model.

Table 4. Labeling Process for Model Development

Conditions	Disorder Identification	Label
If (V == 0 && P == 0 && K == 0 && Pulse Rate <= 72)	Normal	0
If (V <= 15 && P == 0 && K == 0 && Pulse Rate > 72)	VADHA Disorder	1
If (V == 0 && P < 40 && K == 0 && Pulse Rate > 72)	PITTA Disorder	2
If (V == 0 && P < 40 && K <= 65 && Pulse Rate > 72)	KAPHA Disorder	3

1.5 PROPOSED LEARNING FRAMEWORK

This segment presents an outline of the training process for the proposed model, designed to identify Ayurvedic-based disorders.

1.5.1 RANDOM FOREST

The proposed model uses the Random Forest algorithm to improve classification accuracy. RF, an ensemble learning technique [28], creates multiple decision trees during training and integrates their

predictions as illustrated in Figure 2. This approach reduces overfitting by minimizing the variance of individual trees and elevates the algorithm's capability to generalize, particularly with complex, high-dimensional datasets like those used for Ayurvedic disorder classification. In this research, Random Forest strengthens the feedforward layers by providing reliable predictions. It processes subsets of data iteratively, adjusting tree weights to optimize efficiency. This approach assures high accuracy while remaining efficient in memory and processing, rendering it ideal for real-time use. The integration of Random Forest and feedforward networks enables the model to capture complex relationships in the data and deliver enhanced predictive efficiency.

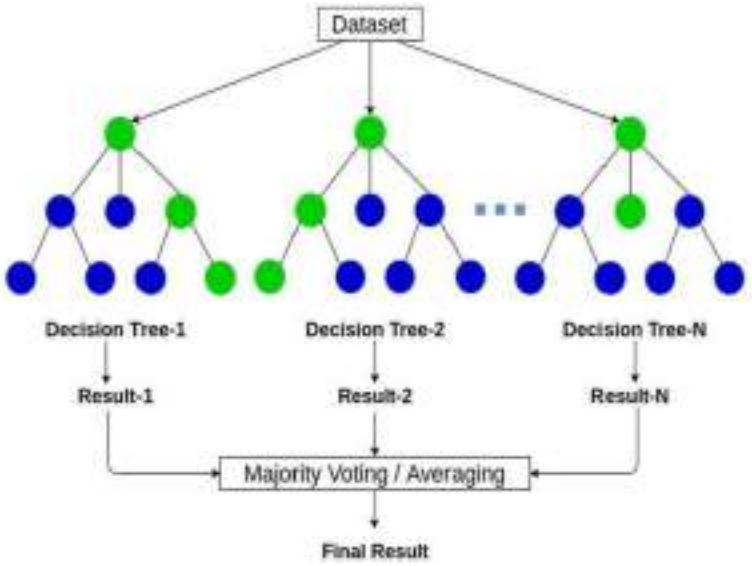


Figure 2. DT Working Mechanism**ELM**

The foundation of the proposed model lies in the theory of Extreme Learning Machines (ELM), which serves as the basis for the feedforward layers used in training. ELM is a type of neural network with a single hidden layer that works on the principle of auto-tuning properties. Relative to traditional approaches like Decision Trees (DT), Support Vector Machines (SVM), K-Nearest Neighbors (KNN), XGBoost, and Naive Bayes (NB), ELM offers superior efficiency, faster computation, and reduced complexity. The single-layer structure of ELM does not require manual tuning, which Enhances its efficiency and performance.

ELM employs a kernel function to enhance accuracy, rendering it particularly appropriate for handling complex data. Its auto-tuning property enables the automatic adjustment of bias weights and the use of a non-zero activation function, providing better predictive power. The mechanism of ELM is detailed in previous research [29], [30].

The ELM's input feature maps is represented as eqn (1)

$X = F(F, P)$ (1)

Where X → spatial and temporal variables, F → CNN spatio features and P is the GRU temporal features

The ELM output method is denoted by eqn (2)

() T 1

T −1

$Y(n) = X\ n\ \beta = X(n)\ X$

(_ XX)

C

O (2)

Eqn (3) provides the entire training for ELM$S = \alpha(\sum N(Y(n), B(n), W(n))$

n=1

Where X (n) → feature maps as input, β → Moore-generalized Penrose's inverse theorem solves the temporal matrix, which is represented by (〖 X〗 ^T), C →constant, B & W → the network's weights and bias factors with the activation function.

1.5.2 INTEGRATION OF ELM AND RANDOM FOREST FOR HYBRID MODELING

Figure 3 illustrates the architecture of the integrated model framework. This hybrid learning framework combines the Extreme Learning Machine (ELM) model with the Random Forest algorithm to achieve enhanced performance. This combination enables the framework to achieve superior accuracy and robustness during training.

The input data, stored in the cloud, serves as the main source for the proposed algorithm's training process. The Random Forest algorithm is employed to optimize the classification capabilities of the ELM by constructing multiple decision trees and aggregating their outputs. This process ensures improved generalization and predictive accuracy. The mathematical formulation for establishing the ELM's classification outputs is provided in Eqn (4).

$$S = \alpha(\sum N \ (Y(n), B(n), W(n)) \quad (4)$$

In the subsequent step, the computed value of S is evaluated against a predefined threshold, as represented in Eqn (5).

$$S(t) == S \quad (5)$$

If S does not equal to S (t), then RF algorithm tunes the bias weights for each iterations and it is given mathematically by Eqn. (6)

$$S(k+1) = \alpha(\sum^{N} \ (Y(n+k), B(n+k), W(n+k)) \quad (6)$$

(3)n=1

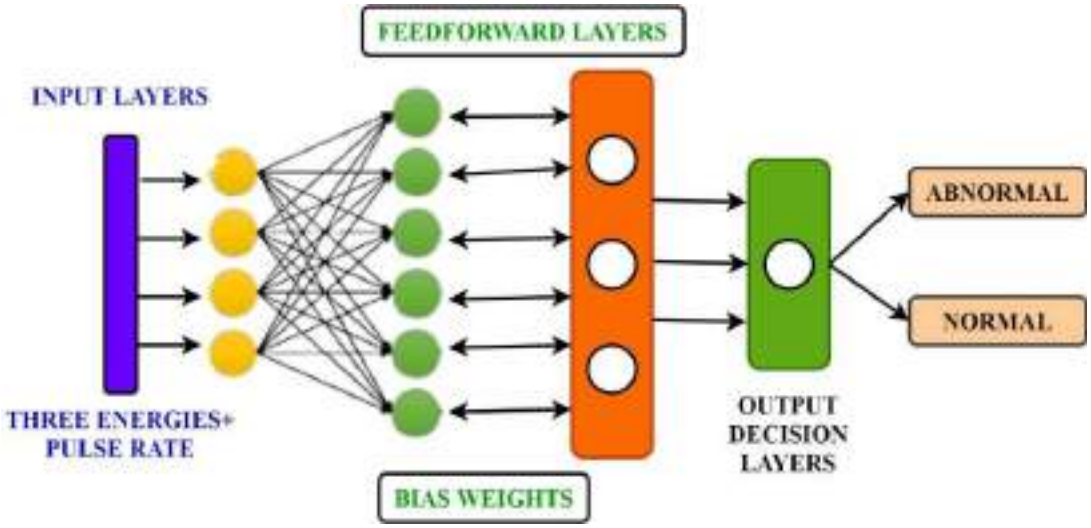


Figure 3. Proposed Hybrid Network.

2 RESULTS & DISCUSSION

This section presents the evaluation of the recommended approach, highlighting key evaluation metrics and discussing the effectiveness of the hybrid

approach for disease prediction.

2.4 IMPLEMENTATION DETAILS

The complete model was developed using Python3.19 programming and libraries such as matplotlib, numpy, pandas, Scikit-Learn, seaborn are utilized for evaluating the proposed model. The experimentation was carried out in the PC workstation with i7 CPU, 3.2 GHZ operating frequency, 16GB RAM, NVIDIA Tesla GPU.

2.5 EVALUATION METRICS

Evaluation metrics including accuracy, precision, recall, specificity as well as F1-score are assessed and evaluated against other ML approaches to emphasize the recommended model's effectiveness. These metrics also highlight the model's productivity and low computational overhead. Table 5 outlines the mathematical expression utilized to evaluate the evaluation metrics.

Table 5. Evaluation Metrics utilized for assessment

S. No.	Performance Metrics	Mathematical Expression
01	Accuracy	$\frac{TP + TN}{TP + TN + FP + FN}$
02	Recall	$\frac{TP}{T\ P+FN}$ x100
03	Specificity	$\frac{TN}{TN + FP}$
04	Precision	$\frac{TN}{TP + FP}$
05	F1-Score	$2.\frac{Precison * Recall}{Precision + Recall}$

TP & TN are True Positive & negative, FP & FN are False Positive & negative.

2.6 EXPERIMENTAL OUTCOMES

This segment presents a detailed comparative analysis of the recommended model against traditional algorithms, including DT, SVM, KNN, RF, XGBoost, and NB algorithms, across various scenarios of energy detection. The performance metrics evaluated include accuracy, precision, recall, specificity, and F1-score. These evaluation metrics highlighted the superior performance of the proposed model compared to conventional techniques.

Table 6. Comparative Analysis of Various Detection Models for Normal Energy Levels

Algorithms	**Evaluation Metrics**				
	Accuracy	**Precision**	**Recall**	**Specificity**	**F1-Score**
DT	83%	82.2%	82.0%	81.2%	81.3%
SVM	74.4%	73.33%	73.48%	73.35%	73.47%
KNN	69.2%	69.9%	70.2%	68.3%	71.9%
RF	81.0%	75.9%	74.9%	75.9%	76.2%
XGBoost	79.4%	78.2%%	80.4%	79.3%	79.2%
NB	92.1%	90.56%	89.4%	89.7%	88.2%
PROPOSED MODEL	98.45%	98.2%	97.5%	97.9%	98.12%

Table 7. Comparative Evaluation of Different Techniques for Detecting Pitta Energy Disorders

Algorithms	**Evaluation Metrics**				
	Accuracy	**Precision**	**Recall**	**Specificity**	**F1-Score**
DT	81%	82.2%	82.0%	81.2%	79.3%
SVM	74.4%	71.33%	72.48%	72.37%	72.49%
KNN	80.2%	77.9%	78.2%	77.3%	77.9%
RF	82.0%	75.9%	74.9%	75.9%	77.2%
XGBoost	79.4%	78.2%%	80.4%	78.3%	77.2%
NB	90.1%	89.56%	88.4%	87.7%	89.2%
PROPOSED MODEL	98.5%	97.25%	98.0%	98.1%	97.19%

Table 8. Comparative Analysis of Various Algorithms for Identifying Vatta Energy Disorders

Algorithms	Evaluation Metrics				
	Accuracy	**Precision**	**Recall**	**Specificity**	**F1-Score**
DT	84%	83.2%	82.0%	80.2%	83.3%
SVM	71.4%	71.33%	70.48%	72.35%	69.47%
KNN	69.2%	69.9%	68.2%	68.3%	67.9%
RF	85.0%	81.9%	83.9%	84.9%	83.2%
XGBoost	88.4%	87.8%	80.4%	88.3%	87.2%
NB	91.1%	89.56%	87.4%	90.7%	89.2%
PROPOSED MODEL	98.49%	98.2%	97.9%	98.1%	97.12%

Table 9. Comparison of Various Algorithms for predicting Kapha Energy Disorders

Algorithms	Evaluation Metrics				
	Accuracy	**Precision**	**Recall**	**Specificity**	**F1-Score**
DT	83%	83.2%	80.0%	81.2%	79.3%
SVM	82.4%	81.33%	79.48%	82.35%	83.47%
KNN	76.2%	75.9%	75.2%	76.3%	75.9%
RF	82.0%	79.9%	81.9%	82.9%	80.2%
XGBoost	80.4%	79.2%%	79.7%	78.8%	78.4%
NB	89.9%	88.59%	88.9%	89.7%	88.26%
PROPOSED MODEL	99.14%	97.2%	98.0%	96.1%	97.12%

As shown in Tables 6, 7, 8, and 9, the proposed model consistently outperforms the existing classification algorithms in terms of accuracy, precision, recall, specificity, and F1-score for detecting normal, Pitta, Vata, and Kapha energy disorders. The outcomes highlight the superior performance of the recommended model in diagnosing these disorders.

Figure 4. Performance Comparison of Detection Models for Normal Energy Balances

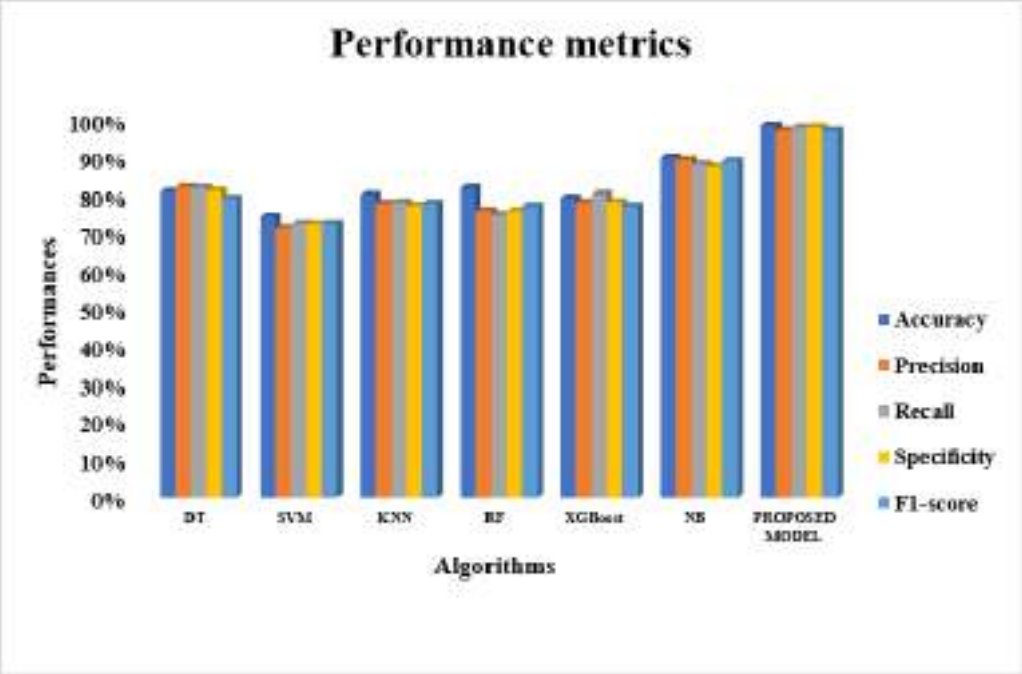


Figure 5. Evaluation of Techniques for Identifying Pitta Energy Disorders

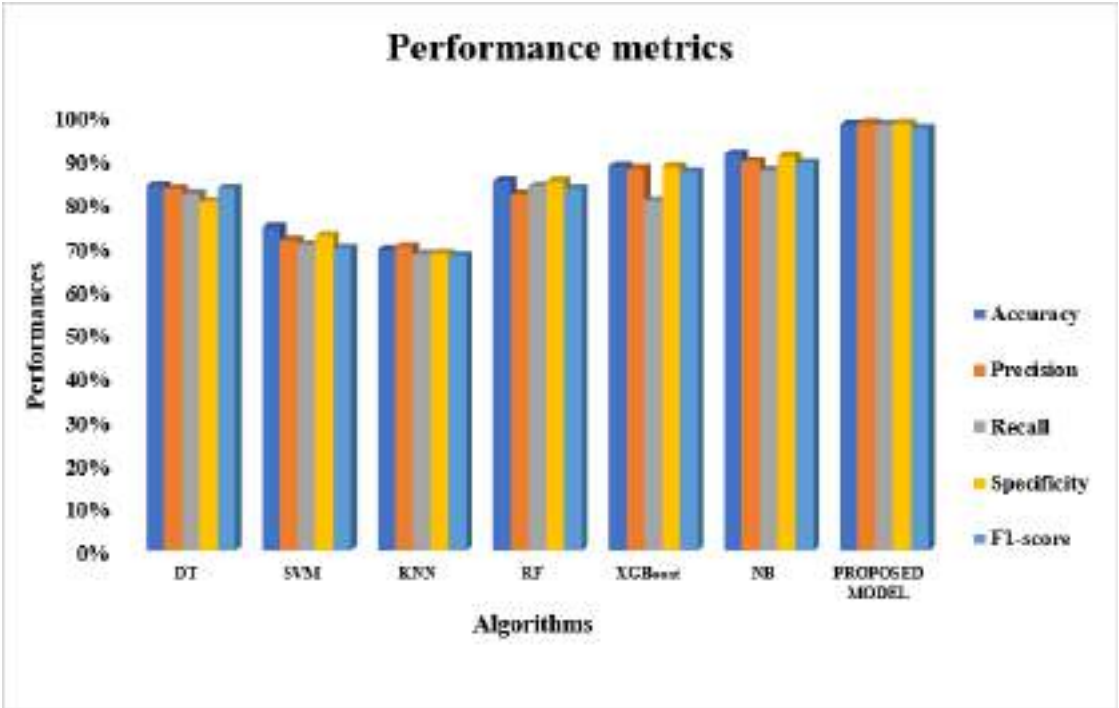


Figure 6. Assessment of Algorithms in Detecting Vata Energy Imbalances

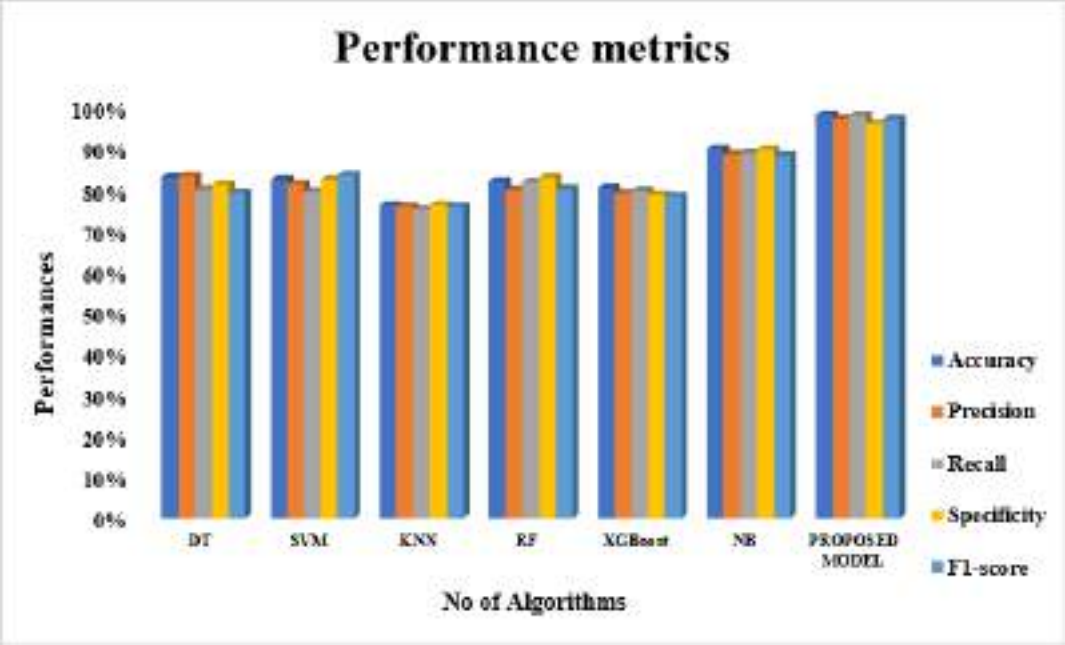


Figure 7. Analysis of Methods for Kapha Energy Disorder Prediction

Figures (4-7) provide a comprehensive comparative assessment of several ML algorithms in diagnosing Tridosha imbalances, including Normal energy levels, Pitta, Vatta, and Kapha energy disorders. These figures illustrate the effectiveness of the recommended hybrid approach against standard algorithms. The results underscore the superiority of the proposed ELM-Random Forest model, consistently outperforming traditional methods in all categories. It is evident that the recommended model is highly robust and precise, making it a reliable tool for Tridosha analysis and Ayurvedic disease prediction.

3 CONCLUSION

The main objective of this research is to create an intelligent framework for predicting Ayurveda- based human body constituents by integrating traditional knowledge with modern ML approaches. The proposed system combines Extreme Learning Machines (ELM) and Random Forest algorithms to analyze a unique dataset that merges Nadi Pariksha pulse readings with a personality inventory comprising 28 distinct traits. The dataset was meticulously designed with guidance from healthcare professionals to ensure comprehensive coverage of relevant features. Data collection was carried out using IoT-enabled test beds constructed on the Raspberry Pi 4 Model B++ platform, with cloud-based processing and storage facilitated by AWS. A total of 15,670 datasets from 850 participants were gathered, encompassing diverse demographic and physiological profiles. The framework's efficiency was rigorously assessed utilising metrics such as accuracy, precision, recall, specificity, and F1-score, attaining a remarkable accuracy rate of 0.99. Experimental findings highlight the performance of the hybrid ELM-Random Forest model, significantly outperforming conventional methods in diagnosing Tridosha imbalances. Future enhancements could include the incorporation of advanced cognitive data collection techniques and the design of more sophisticated algorithms capable of managing complex and large-scale datasets. Additionally, expanding the dataset to include broader demographic variations and age groups will improve the model's generalizability. These advancements have the potential to transform the proposed framework into a powerful diagnostic tool, enabling Ayurvedic practitioners to make more accurate and personalized healthcare decisions.

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Evaluation of in vivo Toxicological Profile and invitro Genotoxicity of Herbal Extracts.

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Abstract

Any medicinal product, exclusively containing as active ingredients one or more herbal substances or one or more herbal preparations, or one or more such herbal substances in combination with one or more such herbal preparations are known as herbal extracts. Herbal extracts are also known as phytochemicals are a cornerstone of traditional healthcare with the World Health Organization (WHO) noting their reliance by approximately 80% of the global population. Herbal medicine has always represented an important component of primary health care. Even in modern times, the popularity level of medicinal plants and herbal medicines in therapy is still high. Several factors can cause the toxicity of herbal extracts products such as plant components or metabolites with a toxic potential, adulteration, environmental pollutants (heavy metals, pesticides), or contamination of microorganisms (toxigenic fungi). Many plants produce toxic secondary metabolites as natural defence from adverse conditions. To address this aspect, an attentive toxicological assessment is required to eliminate potential safety concerns. The aim of the present study is to provide an overview of the current trends and methods used to investigate the toxic potential of herbal extracts and their products products and the challenges in this research field. To address this aspect, an attentive toxicological assessment is required to eliminate potential safety concerns.

Keywords: Herbal Extracts, Medicinal use, Threatened Species, In vivo propagation, Toxicological assessment.

INTRODUCTION

Herbal drugs, alternatively referred to as botanical medicine, are defined by the World Health Organization (WHO) as encompassing herbs, herbal materials, herbal preparations, and finished herbal products. These formulations comprise active ingredient parts derived from plants or other plant materials, individually or in combination. In recent times, there has been a growing trend in the use of herbal remedies as dietary supplements for disease prevention and as alternative or complementary medicine (CAM) for treating illnesses. A diverse array of herbal medicines and products is readily accessible in markets worldwide.(1) In the context of a high demand from consumers, there is an increased pressure to assess the efficacy of the products also to ensure their safety. The burgeoning demand was also accompanied by the escalation of the rate of fraudulent practices (e.g., the substitution of herbal material and the addition of synthetic compounds). So standardization and quality control processes are of most importance. However, in some cases, the possible negative effects are not only attributed to adulteration, contamination, or misidentification of plant species but are related to the inherent toxicity of the plants.(2) A thorough toxicological assessment is required to address potential safety issues. It's crucial to note that adverse effects stem not only from the inherent properties of the extract but also from foreign contamination, including chemical impurities (like heavy metals and pesticide residues) and microbiological risks. It is important to identify any adverse biological or genetic effects associated with the extracts, thereby providing scientific evidence for their safe therapeutic use and guiding dosage recommendations for future pharmacological applications. This review aims to summarize and analyze the existing strategies and regulatory frameworks used to investigate the authenticity and toxicological safety of medicinal herbal products.

OBJECTIVE

Despite these promising leads, current research on many Herbal extracts remains fragmented, with most studies limited to in vitro assays, preliminary phytochemical screening, or small-scale animal experiments. There is a paucity of data on mechanistic pharmacology, pharmacokinetics, toxicity, and clinical relevance. Furthermore, standardized extraction, quality control, and metabolomics fingerprinting approaches are yet to be fully developed. This lack of comprehensive

evidence not only restricts the therapeutic validation of many herbal extracts but also hinders their integration into modern pharmacopoeias. This review therefore seeks to critically evaluate the phytochemistry and pharmacological potential and also make a path of safety assessment for utilization of herbal extracts as alternatives for current medicines. The primary objective of this study is to establish a comprehensive toxicological and genetic safety profile for herbal extract to support their continued or potential use in traditional medicine and future pharmaceutical applications.

WHAT IS THE NEED FOR HERBAL TOXICITY TESTING?

The primary purpose of toxicity testing in drug research is to ensure safety; thus, all candidate drugs must be non-toxic. A key concern arises because herbs are categorized as dietary supplements, not food or drugs. Consequently, they do not undergo the rigorous pre-market testing required for pharmaceuticals and food additives.(3) The purpose of acute toxicity testing is twofold: to provide crucial information on a drug's safety and to aid in the study of its biological activity and mechanism of action. This information is vital for hazard identification and the subsequent risk management of the drug. In the context of traditional medicine, medicinal plants are recognized for their multiple biological activities and their extensive use in herbal formulations.(4)

TOXICOLOGICAL ANALYSIS OF HERBAL EXTRACTS:

Toxicological analysis of herbal extracts is a critical process due to the complexity of herbal formulations and the potential for both inherent toxicity and contamination. The methodologies generally follow both in vitro and in vivo models, often guided by international standards like the OECD Guidelines.(1)

IN VITRO ASSAYS (CELL-BASED STUDIES)

These are typically the first-line screening methods for initial hazard identification.

- **Cytotoxicity Assays:** Measure cell viability and are often used for preliminary toxicity screening.
- **Genotoxicity Assays:** Evaluate the potential of an extract to cause damage to DNA or chromosomes.
- **Organ-on-Chip Systems:** Advanced *in vitro* models that mimic the function and interactions of human organs for more predictive toxicity assessment.

IN VIVO STUDIES (ANIMAL MODELS)

These provide data on systemic toxicity, target organ effects, and pharmacokinetics in a whole organism, typically following OECD guidelines. Rodents (mice and rats) are commonly used. Acute Toxicity Testing involves a single, high-dose administration to determine the Median Lethal Dose (LD50) or the maximum tolerated dose (MTD), and it assesses clinical signs of toxicity over a short period, typically 14 days. Sub-Acute/Sub-Chronic Toxicity Testing involves repeated daily administration over an extended period (e.g., 28 days or 90 days), aiming to determine parameters like the No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL), while assessing a wide range of parameters including body weight, food/water consumption, hematology, clinical biochemistry (e.g., liver/kidney function markers like ALT, AST, creatinine), organ weights, and histopathology. Finally, Chronic Toxicity Testing consists of long-term studies (6 months to 2 years) for products intended for long-term human use, also checking for potential carcinogenicity.(5)

ANALYTICAL CHEMISTRY (CONTAMINANT/ADULTERANT ANALYSIS)

Ensuring the safety of an herbal extract requires testing for foreign toxic substances involves Ensuring the safety of an herbal extract requires Analytical Chemistry, specifically

Contaminant/Adulterant Analysis, to test for foreign toxic substances. This involves Heavy Metal Analysis for the detection and quantification of toxic metals like Lead, Cadmium, Mercury, and Arsenic, as well as Pesticide Residue Analysis to screen for residual agrochemicals. Additionally, mandatory testing includes assessing Aflatoxin/Microbial Contamination for fungal toxins and harmful microorganisms. Finally, Phytochemical Profiling using advanced techniques like HPLC-MS (High-Performance Liquid Chromatography–Mass Spectrometry) and NMR (Nuclear Magnetic Resonance) is crucial for identifying and quantifying known toxic compounds (e.g., pyrrolizidine alkaloids, aristolochic acids) and ensuring the extract's identity and consistency.(6)

CONCLUSION AND FUTURE DIRECTIONS:

The current scientific consensus suggests that herbal extracts has a favorable preliminary safety profile, particularly demonstrated by its non-toxic status in acute oral studies up to the highest practicable doses.

However, the safety dossier for this widely used traditional remedy remains incomplete. To confidently integrate herbal extracts into modern healthcare systems, future research must prioritize robust, standardized regulatory toxicology studies (OECD guidelines) including:

1. Mandatory 28-day and 90-day repeated-dose in vivo studies to establish the definitive NOAEL.
2. Comprehensive in vitro genotoxicity battery (Ames test, Micronucleus/Chromosome Aberration test) to definitively rule out mutagenic and clastogenic potential.

Despite the general assumption that most botanicals are non-toxic, rigorous verification of safety is paramount before therapeutic use. A significant gap exists in the current literature regarding the Maximum Tolerated Dose (MTD) and the effects of repeated dose exposure of herbal extracts in rodents, raising concerns about its safety profile. Consequently, this study aims to comprehensively determine the MTD and repeated dose toxicity in rodent models to establish a safe pharmacological profile. These crucial findings will serve as the critical foundation for regulatory approval and enable the safe advancement of the herbal drugs into clinical applications.

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Healing Beyond Time: Uniting Ancient Traditions with Modern Medicine

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Abstract

Traditional healing systems deeply rooted in cultural heritage, using natural resources and holistic methods that emphasize harmony between body, mind, and nature. These systems rely on personalized treatment and preventive care, making them valuable for promoting overall well-being. However, the lack of systematic documentation and scientific validation has limited their global recognition. Modern medical science, with its research-based approach and technological advancements, offers tools to study, validate, and enhance these traditional practices. This paper explores the relationship between traditional healing and modern medical science, highlighting how both can complement each other and offers an opportunity to bridge this gap. It also reviews recent scientific studies, pharmacological research, and clinical trials that support the safety and effectiveness of traditional remedies. The study concludes that integrating traditional wisdom with modern scientific evidence can lead to safer, innovative, and more holistic healthcare solutions for the global community.

Keywords: Bridging gap, Holistic health, Integrative healthcare, Research integration, Therapeutic synergy

INTRODUCTION

Traditional healing systems have guided humanity's understanding of health and disease, and among them, **Ayurveda** stands as one of the most comprehensive and time-tested. Rooted in the ancient wisdom of the Vedas, Ayurveda is not merely a system of medicine but a way of life that emphasizes harmony between the body, mind, spirit, and environment. It teaches that health (*Swasthya*) is not simply the absence of illness, but a dynamic balance between the *doshas* (Vata, Pitta, and Kapha), proper functioning of *agni* (digestive fire), balanced *dhatus* (tissues), efficient elimination of *malas* (wastes), and a state of mental and spiritual peace.

What makes Ayurveda unique is its **preventive and personalized approach**. It recognizes that every individual is born with a distinct constitution (*Prakriti*), and that maintaining health depends on living in accordance with one's natural tendencies and the rhythms of nature. Ayurveda gives equal importance to **diet, lifestyle, emotional balance, and ethical conduct** as it does to medicine. Concepts such as *Dinacharya* (daily routine) and *Ritucharya* (seasonal regimen) offer practical guidelines for aligning human life with environmental cycles, thereby preventing disease before it manifests.

In contrast, **modern medicine** has developed through structured scientific inquiry, technological innovation, and clinical precision. Its strength lies in its ability to **diagnose and manage acute or life- threatening diseases** with immediate effectiveness. Modern medicine operates on a reductionist model — studying specific organs, cells, or biochemical pathways — while Ayurveda adopts a **holistic model**, viewing the human being as an integrated whole influenced by physical, mental, and environmental factors.

Despite their different foundations, both systems share the same noble purpose — **to preserve health and alleviate suffering** *(Swasthasya Swasthya Rakshanam Aaturasya Vikaara Prashmanam).* Ayurveda offers timeless insights into preventive care, individualized treatment, and natural healing,

while modern science provides the tools to validate these principles through research, pharmacology, and clinical studies.

Integrating Ayurvedic wisdom with modern medical advancements can create a more **balanced, sustainable, and person-centered approach** to healthcare. Such collaboration not only honours India's ancient heritage but also responds to the global demand for holistic, evidence-based wellness solutions that address both the body and the mind.

TRADITIONAL HEALING SYSTEMS: AN OVERVIEW

Ayurveda, often called the "Science of Life," is one of the oldest and most profound systems of healing known to humanity. It originated in India more than 3,000 years ago and continues to guide how people understand health and well-being. Rather than focusing only on the disease or its symptoms, Ayurveda looks at health as a state of **complete** balance — where the body, mind, and spirit function in harmony with one another and with nature. It sees every individual as a unique being, influenced by internal and external factors, and teaches that true wellness comes from living in rhythm with the natural world.

At the core of Ayurveda are the ***three doshas — Vata, Pitta, and Kapha***. These represent biological energies that regulate all the body's physical and mental functions. Every person has a distinct constitution, known as their Prakriti, which reflects their individual combination of doshas. This understanding forms the basis for personalized care in Ayurveda. The goal is not only to cure diseases but to maintain the balance of doshas through proper diet, lifestyle, herbs, and therapies suited to one's constitution and environment.

A major strength of Ayurveda lies in its **preventive approach**. It emphasizes daily and seasonal routines — *Dinacharya* and *Ritucharya* — that encourage people to live in harmony with natural cycles. Balanced sleep, wholesome food, physical activity like yoga, *pranayama,* meditation, and emotional stability are all considered essential for maintaining health. The system also upholds moral and ethical living through *Sadvritta* and *Achara Rasayana*, recognizing that mental peace and emotional discipline are just as important as physical health.

The therapeutic aspect of Ayurveda, known as ***Chikitsa***, includes a wide range of treatments — from herbal and mineral formulations to purification therapies (Panchakarma) and rejuvenation practices (Rasayana). Each treatment is designed after understanding the root cause of imbalance rather than simply suppressing symptoms. This individualized, cause-based approach makes Ayurvedic healing both curative and preventive in nature.

In the modern era, where lifestyle disorders, chronic stress, and environmental challenges are increasingly common, Ayurveda's wisdom feels more relevant than ever. Its teachings remind us that good health is not a luxury but a natural state that can be maintained through awareness and balance. With growing scientific studies supporting its efficacy, Ayurveda today stands not as a replacement for modern medicine but as a complementary system that adds depth and dimension to healthcare. By integrating its holistic philosophy with modern scientific validation, Ayurveda offers a sustainable, personalized, and truly **human-centered approach** to well-being.

MODERN MEDICINE: STRENGTHS AND CONTRIBUTIONS

Modern medicine has revolutionized human health and longevity through its remarkable scientific and technological progress. Built on the principles of observation, experimentation, and continuous research, its greatest strength lies in its **precision** — the ability to diagnose illnesses accurately through **advanced tools** such as imaging, laboratory testing, and genetic analysis. This precision has made early detection and targeted treatment of many diseases possible, significantly improving patient outcomes.

Modern medicine excels in **managing acute and life-threatening conditions** through surgical interventions, emergency care, and the use of effective pharmacological agents. The development of vaccines, antibiotics, and advanced surgical techniques has saved millions of lives and controlled once-devastating epidemics. Continuous innovation has led to minimally invasive surgeries, organ transplants, and sophisticated therapies like chemotherapy, immunotherapy, and gene editing — all of which reflect the power of modern medical science to push the boundaries of what was once thought impossible.

While it may primarily focus on the physical aspects of disease, modern medicine has undeniably improved life expectancy and global quality of life. Its ability to manage emergencies, prevent epidemics, and perform complex procedures makes it an indispensable pillar of the healthcare system. When complemented with the holistic, preventive, and lifestyle-oriented wisdom of Ayurveda, modern medicine can contribute to a more complete and compassionate vision of human health — one that unites science with the art of healing.

NEED FOR INTEGRATION: BRIDGING AYURVEDA AND MODERN MEDICINE

In today's world, healthcare is facing new and complex challenges — from lifestyle disorders and stress- related illnesses to antibiotic resistance and chronic diseases. While modern medicine provides precision, speed, and life-saving interventions, it often focuses more on managing diseases after they appear. On the other hand, Ayurveda emphasizes prevention, lifestyle balance, and the root causes of ill health. Both systems, though different in their methods, share a common purpose — to promote health, relieve suffering, and enhance the quality of life. Recognizing their complementary strengths opens a path toward a more complete and compassionate model of healing.

Integrating Ayurveda with modern medicine doesn't mean merging them into a single system but allowing them to work side by side, supporting each other's strengths. For instance, modern diagnostic tools can be used to identify disease at an early stage, while Ayurvedic therapies and lifestyle modifications can address the underlying imbalances that lead to illness.

This collaborative approach also encourages **mutual respect** between traditional knowledge and modern science. Ayurveda offers deep insights into the body's natural healing intelligence, while modern medicine provides the means to test, validate, and refine these ayurvedic principles through clinical research and technology. The integration of the two creates a healthcare model that is not only evidence- based but also person-centered — one that treats individuals, not just their diseases.

By bridging Ayurveda and modern medicine, we can move toward a healthcare system that blends scientific innovation with timeless wisdom, prevention with cure, and technology with human touch. This integration not only enhances patient outcomes but also revives the true spirit of medicine — to heal, nurture, and restore harmony at every level of life.

LIMITATIONS AND CHALLENGES IN INTEGRATION

While combining Ayurveda and modern medicine promises a more holistic approach to healthcare, the process of integration is far from simple. Both systems come with their own strengths and limitations, and bridging them requires understanding, open-mindedness, and mutual respect.

From the Ayurvedic perspective, one of the main challenges is the **lack of standardized evidence and documentation** that meets the criteria of modern scientific validation. Classical texts are rich in experiential wisdom but often describe disease, diagnosis, and treatment using qualitative and philosophical terms — such as dosha, agni, or prakriti — which don't directly correspond to biomedical terminology. This creates difficulties when attempting to explain Ayurvedic principles or evaluate them through modern scientific methods. Additionally, differences in preparation methods, regional practices, and the quality of raw materials can affect the reproducibility and consistency of Ayurvedic formulations.

On the other hand, modern medicine, despite its precision and technological sophistication, faces its own set of limitations. It often focuses on the physical and symptomatic aspects of disease, sometimes **overlooking the mental,** emotional**, and spiritual dimensions** of health that Ayurveda emphasizes.

Many treatments are disease-oriented rather than patient-oriented, leading to a **"one-size-fits-all"** approach that may not account for individual variations in body constitution or lifestyle. Moreover, the **over-reliance on synthetic drugs and invasive procedures** has occasionally resulted in side effects, drug resistance, and rising healthcare costs.

When it comes to integration, the two systems also differ fundamentally in their philosophy and

approach. Modern medicine is reductionist — it seeks to isolate causes and effects through measurable data — while Ayurveda is holistic, focusing on interconnectedness and balance. Translating concepts like *prakriti*, *ama*, or *ojas* into biochemical terms is not straightforward. Similarly, applying randomized controlled trial models to individualized Ayurvedic treatments often fails to capture their full therapeutic context.

Another barrier lies in the **educational and institutional divide**. Practitioners from both streams are usually trained separately, with limited exposure to each other's philosophies and methods. This has led to misinterpretation, and sometimes even competition rather than collaboration. A lack of integrative curriculum, limited funding for cross-disciplinary research, and regulatory hurdles further slows down the process.

Despite these challenges, it's important to recognize that integration does not mean merging one system into the other. Instead, it calls for mutual enrichment — modern medicine can offer the tools of analysis, safety validation, and technological advancement, while Ayurveda can contribute holistic insights into prevention, lifestyle, and mind-body harmony. By respecting their differences and identifying areas of synergy, a more balanced, evidence-based, and compassionate model of healthcare can emerge one that truly serves the well-being of humanity.

RECENT RESEARCH AND EVIDENCE SUPPORTING AYURVEDA

In recent decades, there has been a growing scientific interest in exploring and validating the principles and practices of Ayurveda through modern research methodologies. This renewed attention reflects a global recognition that traditional systems like Ayurveda hold valuable insights into prevention, longevity, and holistic well-being. Researchers across India and abroad have been working to document, standardize, and evaluate Ayurvedic formulations, herbs, and therapies using contemporary analytical tools.

Many classical herbs and formulations have undergone **pharmacological and clinical investigations** that affirm their therapeutic value. For example, *Ashwagandha (Withania somnifera)* has shown adaptogenic and stress-reducing effects in several controlled trials, while *Turmeric (Curcuma longa)* and its active compound **curcumin** have demonstrated potent anti-inflammatory and antioxidant properties. Similarly, *Guduchi (Tinospora cordifolia)* has been studied for its immunomodulatory and hepatoprotective actions, and *Triphala*, a classical polyherbal formulation, has shown promising results in digestive health and as an antioxidant supplement.

Beyond individual herbs, modern science has also begun exploring **Ayurvedic concepts through contemporary frameworks**. For instance, studies on *prakriti* (individual constitution) have found correlations between Ayurvedic body types and genetic or metabolic profiles, opening pathways for personalized medicine. Research on *Rasayana* therapy has revealed its potential role in delaying cellular aging, enhancing immunity, and improving stress resilience — areas that align closely with modern preventive medicine and gerontology.

Furthermore, **clinical trials and interdisciplinary studies** have started to establish the safety and efficacy of Ayurvedic therapies such as *Panchakarma* (detoxification) and *Abhyanga* (therapeutic oil massage). Integrative hospitals and research centers in India, the United States, and Europe are experimenting with combining Ayurvedic lifestyle interventions with modern therapies for chronic diseases like diabetes, hypertension, arthritis, and stress disorders — often showing improved outcomes compared to conventional treatment alone.

Government initiatives such as India's **AYUSH Ministry**, along with collaborations between CSIR, CCRAS, and international institutions, have contributed significantly to evidence generation, standardization of formulations, and promotion of scientific validation. However, the journey is still ongoing. There remains a need for **more rigorous, large-scale clinical studies** and better documentation to strengthen global acceptance and integration of Ayurvedic knowledge into mainstream healthcare.

DISCUSSION

The growing body of evidence supporting Ayurvedic principles demonstrates that traditional healing systems and modern medical science need not exist in opposition — rather, they can complement and strengthen one another. Ayurveda offers a holistic and preventive framework deeply rooted in natural balance and individualized care, while modern medicine provides the tools for precise diagnosis, safety

validation, and technological advancement. Together, they have the potential to create a more comprehensive and compassionate model of healthcare.

However, meaningful integration

n requires open dialogue, scientific humility, and a shared commitment to evidence-based collaboration. While Ayurveda must continue to embrace research and standardization without losing its philosophical essence, modern medicine can benefit from adopting a more person-centered and preventive outlook. The true strength of integration lies in learning from each other — combining the analytical clarity of modern science with the holistic insight of Ayurveda to serve humanity in a more balanced and sustainable way.

CONCLUSION

The journey of healthcare has always been guided by a common purpose — to relieve suffering and promote well-being. Both Ayurveda and modern medicine, though developed through different worldviews and methodologies, share this same goal. Ayurveda brings to light the art of living in harmony with nature, emphasizing prevention, balance, and individualized care. Modern medicine, on the other hand, stands as a triumph of scientific progress, offering precision, technology, and rapid solutions to acute and life-threatening diseases.

As global health challenges become more complex, it is increasingly clear that neither system alone can address the full spectrum of human needs. Integrating the timeless wisdom of Ayurveda with the analytical power of modern medicine can lead to a more complete understanding of health — one that honors the connection between body, mind, and spirit while upholding scientific rigor and safety.

This integration is not about replacing one system with the other, but about creating a synergistic partnership — where ancient insights inform modern discoveries, and modern validation strengthens traditional wisdom. By fostering research collaborations, education, and open-minded clinical practice, we can move toward a healthcare model that is preventive, personalized, and holistic.

In essence, the future of healing lies in unity, not division — in blending the best of both worlds to create a system that is compassionate, evidence-based, and truly centered on human well-being. Such an approach not only bridges the past and the present but also paves the way for a healthier, more harmonious future for all.

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Ayurveda: A Pathway to Holistic Health and Harmony

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Abstract

Ayurveda, the ancient system of Indian medicine, emphasizes the balance between body, mind, and spirit to achieve optimal health and well-being. Unlike modern medical approaches that often focus on treating specific symptoms or diseases, Ayurveda promotes a holistic view of health, considering every aspect of a person's lifestyle, diet, emotions, and environment. Rooted in the principle of the three doshas—Vata, Pitta, and Kapha—Ayurveda believes that maintaining harmony among these biological energies ensures physical vitality and mental clarity. Holistic health in Ayurveda goes beyond the absence of illness; it encourages preventive care through personalized routines, herbal therapies, meditation, and yoga. These practices aim to strengthen the body's natural healing mechanisms and enhance resilience against diseases. Furthermore, Ayurveda recognizes the deep connection between the mind and body, asserting that mental peace and emotional balance are essential for physical health. In the modern era, where stress and lifestyle disorders are widespread, Ayurvedic principles offer valuable insights for sustainable living and wellness. Integrating Ayurvedic wisdom with contemporary healthcare can provide a more comprehensive approach to healing, focusing on prevention, natural remedies, and individualized care. Thus, Ayurveda continues to serve as a timeless guide for holistic health, promoting harmony, longevity, and inner balance in today's fast-paced world.

Keywords: Ayurveda, Holistic Health, Dosha Balance, Wellness, Preventive Care

Ayurveda and the Global Wellness Industry: Exploring Opportunities and Overcoming Challenges.

Sukhpreet kaur, Vidushi Tyagi

Abstract

Ayurveda, the ancient Indian system of holistic healing, is now gaining significant attention across the global wellness landscape. Based on the concept of balance between body, mind, and spirit, it emphasizes preventive care and individualized approaches through diet, lifestyle, and herbal therapies. As people worldwide increasingly seek natural and sustainable ways to maintain health, Ayurveda offers a time-tested foundation that aligns closely with the modern wellness movement. The expanding global wellness industry—valued at several trillion dollars—creates vast opportunities for Ayurveda in areas such as wellness tourism, herbal products, and integrative healthcare. Its focus on personalized well-being and preventive health strongly resonates with global trends toward mindfulness, natural medicine, and stress management. Despite this growing interest, Ayurveda faces several barriers in achieving wider recognition. The major challenges include limited scientific validation, inconsistent quality standards, regulatory complexities, and lack of widespread awareness about authentic Ayurvedic principles. Additionally, the commercialization of Ayurveda without proper understanding or respect for its traditional root risks compromising its integrity. Addressing these challenges requires a balanced approach that combines traditional wisdom with modern scientific research. Collaborative studies, standardization of products, transparent regulations, and global educational initiatives can enhance credibility and trust. The use of digital technology and data-driven wellness platforms can further support innovation and global accessibility. In summary, Ayurveda's future in the global wellness sector depends on maintaining its authenticity while adapting to contemporary health frameworks. With scientific validation, education, and ethical practice, Ayurveda can become a vital contributor to holistic global health and sustainable well-being.

Keywords: Integrative Health; Preventive Care; Traditional Medicine; Wellness Tourism

INTRODUCTION

In recent decades, the concept of "wellness" has evolved beyond the mere absence of disease to encompass a multidimensional state of physical, mental, and spiritual well-being. The global wellness industry valued at over USD 5 trillion in 2024—is driven by growing awareness of preventive health, self-care, and holistic living. Within this context, Ayurveda, the ancient Indian system of medicine, has emerged as a key influencer, offering time-tested principles that resonate deeply with contemporary wellness paradigms.

Ayurveda, which literally means "the science of life," is rooted in the philosophy of maintaining balance between body, mind, and spirit. Its preventive and individualized approach through diet, lifestyle, and herbal therapies aligns naturally with the current global movement toward personalized and sustainable healthcare (1). Unlike conventional biomedical models that focus primarily on disease management, Ayurveda emphasizes swasthasya swasthya rakshanam the preservation of health as its primary objective (2).

The integration of Ayurveda into the global wellness ecosystem represents a convergence of ancient wisdom and modern demand. Consumers worldwide are seeking authentic, nature-based therapies that promote balance and long-term vitality. As wellness tourism, herbal markets, and integrative healthcare models expand globally, Ayurveda holds immense potential for cross-cultural relevance (3). However, this growing interest also brings challenges of standardization, scientific validation, and ethical commercialization.

This review aims to critically examine the interface between Ayurveda and the global wellness industry, exploring opportunities for growth while addressing key challenges that hinder its wider adoption. It synthesizes evidence from published research, policy reports, and market analyses to assess how Ayurveda can contribute meaningfully to global health and wellness without compromising its philosophical and cultural integrity. The paper concludes with recommendations for sustainable integration, scientific collaboration, and preservation of authenticity to ensure Ayurveda's rightful place in the modern wellness narrative.

AYURVEDA: FOUNDATIONS AND GLOBAL RELEVANCE

Ayurveda, one of the oldest systems of holistic medicine, traces its origins to the Vedic period of ancient India, dating back over 3,000 years. The term Ayurveda combines āyus (life) and veda (knowledge or science), reflecting its purpose as the "science of life." Rooted in the principles of balance and harmony, it emphasizes the interconnectedness of body, mind, and spirit. The classical Ayurvedic texts—Charaka Samhita, Sushruta Samhita, and Ashtanga Hridaya—serve as foundational references, outlining preventive, promotive, and curative dimensions of health.

Central to Ayurvedic philosophy is the Tridosha theory, which classifies physiological and psychological tendencies into three governing principles: Vata (air and ether), Pitta (fire and water), and Kapha (water and earth). The unique combination of these doshas in an individual, known as Prakriti, determines constitution and guides personalized interventions. Health, in Ayurvedic terms, is the state of equilibrium among these doshas, proper functioning of tissues (dhatus), metabolic processes (agni), waste elimination (malas), and balanced state of consciousness (atma, manas, and indriya) (4).

Beyond disease treatment, Ayurveda's primary focus lies in Swasthavritta (health preservation) through daily and seasonal regimens, appropriate nutrition, physical activity, mental discipline, and ethical conduct. This preventive emphasis aligns closely with modern notions of lifestyle medicine and public health. The system's reliance on natural therapies—herbal formulations, detoxification techniques like Panchakarma, and mind–body practices—has made it increasingly appealing in the global wellness context.

In recent years, Ayurveda's relevance has expanded beyond South Asia. The global interest in complementary and integrative medicine, alongside concerns over adverse effects of synthetic drugs and lifestyle-related disorders, has accelerated its recognition. UNESCO's inclusion of traditional Indian practices, such as Yoga, within Intangible Cultural Heritage frameworks has indirectly amplified Ayurveda's global visibility. Furthermore, wellness tourism hubs in India, Sri Lanka, and parts of Europe now offer authentic Ayurvedic experiences tailored to international audiences, creating both economic and cultural linkages.

However, globalization also raises the challenge of maintaining authenticity. When Ayurveda is reduced to cosmetic or spa-based treatments without its philosophical depth, it risks losing its scientific and cultural essence. To sustain its integrity and efficacy, there is a growing need to recontextualize Ayurvedic principles within evidence-based frameworks that remain faithful to its epistemological foundations.

Thus, Ayurveda today stands at a unique intersection where ancient science meets modern wellness demand. Its comprehensive understanding of health as balance and harmony offers a vital model for achieving sustainable well-being in an increasingly fragmented world.

2. THE GLOBAL WELLNESS INDUSTRY: TRENDS AND DRIVERS

The wellness industry has evolved from a niche sector into one of the fastest-growing segments of the global economy. The Global Wellness Institute (GWI) defines wellness as "the active pursuit of activities, choices, and lifestyles that lead to a state of holistic health" (5). This broad definition encompasses physical, mental, emotional, environmental, and spiritual dimensions of well-being, thereby aligning closely with Ayurvedic principles. According to the Global Wellness Economy Report 2024, the global wellness economy reached a valuation exceeding USD 5.6 trillion, with an annual growth rate of 8.4%, projected to surpass USD 8.5 trillion by 2027 (6).

2.1 KEY SECTORS OF GROWTH

The global wellness market comprises several interlinked sectors: personal care and beauty, healthy eating and nutrition, physical activity, wellness tourism, mental wellness, traditional and complementary medicine, and workplace wellness. Among these, wellness tourism and traditional medicine represent significant areas of intersection with Ayurveda. The wellness tourism market alone was valued at USD 880 billion in 2023, projected to cross USD 1.3 trillion by 2027. India, Sri Lanka, Thailand, and Bali have positioned themselves as leading destinations for health and wellness retreats that incorporate Ayurvedic principles (7).

2.2 CHANGING CONSUMER BEHAVIOUR

Modern wellness consumers seek more than symptom relief—they pursue experience-based, preventive, and sustainable approaches to health. The shift from "curative" to "preventive" healthcare is evident in the global rise of integrative medicine, plant-based nutrition, and mindfulness practices. As chronic lifestyle diseases such as obesity, diabetes, and cardiovascular disorders surge globally, individuals are increasingly embracing holistic systems that address root causes rather than isolated symptoms.

The COVID-19 pandemic further accelerated this shift by highlighting the importance of immunity, mental health, and sustainable living. Surveys by McKinsey (2022) revealed that over 70% of consumers across major economies consider wellness a priority in their lifestyle decisions. This behavioural change has opened new opportunities for traditional healing systems like Ayurveda, which inherently emphasize personalized preventive care, dietary discipline, and mental balance.

2.3 INTEGRATION OF TRADITIONAL MEDICINE INTO GLOBAL HEALTH SYSTEMS

The World Health Organization (WHO) has recognized the role of traditional and complementary medicine (T&CM) in global health strategies. The WHO Global Report on Traditional Medicine 2023 highlights that over 170 countries have adopted policies supporting the integration of T&CM into national health systems. This institutional recognition reflects a paradigm shift toward pluralistic healthcare, where Ayurveda can play a substantial role as part of integrative medicine frameworks.

2.4 TECHNOLOGY AND DIGITAL WELLNESS

Digital health technologies ranging from teleconsultations and wellness apps to wearable devices are transforming the accessibility of wellness services. These platforms facilitate remote Ayurvedic consultations, personalized recommendations, and global outreach. The growing intersection of Ayurveda with artificial intelligence and bioinformatics (for Prakriti analysis and individualized diet recommendations) represents a promising innovation frontier.

In summary, the global wellness industry is characterized by multidimensional growth, technological innovation, and a shift toward holistic well-being. Ayurveda, with its integrative, preventive, and personalized focus, is well-positioned to contribute meaningfully to this expanding global movement. However, its full integration requires addressing several systemic challenges related to quality, scientific validation, and cross-cultural understanding issues explored in later sections of this review.

3. OPPORTUNITIES FOR AYURVEDA IN THE GLOBAL WELLNESS INDUSTRY

Ayurveda's alignment with contemporary wellness trends presents multiple opportunities for its integration and expansion in the global wellness market. These opportunities span wellness tourism, herbal and botanical products, integrative healthcare, digital innovation, and cultural diplomacy.

3.1 WELLNESS TOURISM AND RETREATS

One of the most prominent avenues for Ayurveda globally is wellness tourism. Ayurvedic retreats, resorts, and spa centers have emerged as destinations for international tourists seeking holistic rejuvenation, stress reduction, and lifestyle transformation. In India, Kerala, Karnataka, and Rajasthan have established Ayurvedic wellness corridors, attracting thousands of health tourists annually. Beyond India, countries like Sri Lanka, Thailand, and Bali are adopting Ayurveda- inspired programs to meet growing international demand. The integration of Panchakarma therapies, meditation, yoga, and dietary counseling within wellness tourism creates a unique experiential value proposition that resonates with the rising preference for preventive and personalized care (8).

3.2 HERBAL AND BOTANICAL PRODUCTS

The herbal and nutraceutical market offers substantial growth potential for Ayurveda. Globally,

consumers increasingly favor natural, plant-based, and chemical-free products for preventive health and beauty, creating demand for Ayurvedic formulations. Ayurvedic products including herbal supplements, teas, skincare formulations, and adaptogenic compounds have gained prominence in North America, Europe, and East Asia (9). Reports suggest the global herbal supplements market may exceed USD 12 billion by 2030, with Ayurvedic botanicals representing a significant share. Standardization, quality assurance, and evidence-based marketing of these products could further enhance consumer confidence and market penetration.

3.3 INTEGRATIVE AND PREVENTIVE HEALTHCARE

Ayurveda offers a personalized, preventive approach that complements modern medicine. Integrative healthcare clinics increasingly combine conventional medicine with Ayurvedic consultation, nutrition planning, and lifestyle interventions. Studies have shown that Ayurvedic interventions can improve management of chronic diseases such as type 2 diabetes, hypertension, and stress-related disorders when used alongside standard treatments. This alignment with the preventive healthcare movement positions Ayurveda as a credible partner in global integrative medicine initiatives.

3.4 DIGITAL WELLNESS PLATFORMS AND INNOVATION

Technological advances provide avenues for scaling Ayurveda globally. Telemedicine platforms, mobile applications, and AI-based Prakriti analysis allow remote consultations, personalized lifestyle recommendations, and global outreach. Digital wellness programs can provide customized dietary, exercise, and herbal recommendations, bridging geographical barriers and creating accessibility for international consumers. Such innovations not only expand market reach but also facilitate data collection for research and validation.

3.5 CULTURAL AND SOFT POWER DIPLOMACY

Ayurveda's global presence also contributes to India's soft power by promoting cultural heritage and knowledge exchange. Initiatives such as the International Day of Yoga, collaboration with UNESCO, and participation in global wellness expos enhance visibility and trust in authentic Ayurvedic practices (10). The cultural and educational dimension strengthens market credibility and fosters ethical commercialization.

3.6 RURAL LIVELIHOODS AND SUSTAINABILITY

The scaling of Ayurvedic products and wellness services provides economic opportunities in rural areas where medicinal plants are cultivated. Sustainable sourcing practices and fair-trade initiatives can generate employment, support rural development, and promote biodiversity conservation (11). Integrating community-based models ensures that Ayurveda's global expansion is socially and environmentally responsible.

In summary, Ayurveda's preventive focus, personalized approach, and holistic philosophy position it strongly within global wellness trends. Strategic engagement across tourism, products, healthcare integration, digital innovation, and cultural promotion can unlock its full potential, provided these opportunities are pursued with scientific rigor, quality assurance, and ethical stewardship.

4. CHALLENGES AND BARRIERS TO WIDER ADOPTION OF AYURVEDA

Despite Ayurveda's growing global recognition and the clear opportunities within the wellness industry, several critical challenges hinder its widespread adoption. These barriers span scientific, regulatory, commercial, and cultural domains, and addressing them is essential to ensure sustainable growth while maintaining authenticity.

4.1 SCIENTIFIC VALIDATION AND EVIDENCE BASE

A major limitation in global acceptance is the lack of rigorous scientific validation of Ayurvedic therapies. While numerous observational studies and clinical reports suggest efficacy in chronic diseases, high-quality randomized controlled trials (RCTs) remain limited. Meta-analyses of Ayurvedic interventions often highlight heterogeneity in study design, outcome measures, and standardization of formulations, which undermines credibility in evidence-based medicine frameworks. Without robust clinical evidence, healthcare professionals and regulatory authorities in many countries remain cautious about integrating Ayurveda into mainstream practice.

4.2 QUALITY CONTROL AND STANDARDIZATION

Inconsistent quality and standardization of Ayurvedic products pose another challenge. Variability in raw material sourcing, improper identification of medicinal plants, and non-standardized preparation methods can lead to suboptimal efficacy or safety concerns. Studies have documented heavy metal contamination, adulteration, and batch-to-batch variability in certain commercial products, further complicating global acceptance. Ensuring adherence to Good Manufacturing Practices (GMP) and quality certifications is critical for building consumer trust internationally.

4.3 REGULATORY COMPLEXITY

The regulatory landscape for Ayurvedic products and practices varies widely across countries. In some regions, Ayurveda is categorized as a complementary therapy, while in others it is treated as herbal dietary supplements or traditional medicine, each with distinct legal and marketing requirements (12). This heterogeneity complicates export, clinical application, and global scaling. Navigating these regulatory frameworks requires coordinated policy efforts and clear guidelines on safety, labeling, and claims.

4.4 COMMERCIALIZATION RISKS AND MISREPRESENTATION

Rapid commercialization without sufficient understanding of Ayurvedic principles can lead to dilution or misrepresentation. Practices such as branding wellness spas or cosmetic products as “Ayurvedic” without adherence to traditional methods risk eroding authenticity and scientific credibility. Such superficial adoption can reduce the perceived value of Ayurveda and may foster skepticism among consumers and healthcare professionals.

4.5 CULTURAL AND EDUCATIONAL BARRIERS

Global consumers often lack comprehensive knowledge of Ayurvedic philosophy, leading to misinterpretation or selective adoption of its practices. Similarly, healthcare professionals in Western countries may be unfamiliar with its foundational concepts, limiting collaborative integration. Addressing these gaps requires structured education, cultural orientation, and dissemination of evidence-based guidelines to both practitioners and consumers.

4.6 SUSTAINABILITY AND ETHICAL CONCERNS

The increasing global demand for Ayurvedic herbs and products raises concerns regarding sustainable harvesting, biodiversity, and ethical sourcing. Overexploitation of medicinal plants could threaten ecological balance, while unfair trade practices may undermine rural communities that depend on cultivation. Ethical procurement and sustainable production models are therefore crucial to long-term viability.

In summary, while Ayurveda offers significant potential in the global wellness market, overcoming these barriers is essential to ensure credibility, safety, and authenticity. Scientific research, standardized production, regulatory clarity, ethical commercialization, and educational initiatives collectively form the foundation for Ayurveda’s sustainable integration into global wellness systems.

5. STRATEGIES TO OVERCOME BARRIERS

Addressing the challenges to Ayurveda's global integration requires a multi-pronged approach that combines scientific rigor, regulatory clarity, ethical commercialization, and educational outreach. Implementing these strategies can enhance credibility, foster sustainable growth, and preserve the authenticity of this ancient system.

5.1 SCIENTIFIC VALIDATION AND RESEARCH COLLABORATION

Robust clinical research is essential to establish the efficacy and safety of Ayurvedic interventions. Conducting high-quality randomized controlled trials (RCTs), systematic reviews, and meta- analyses will provide evidence that aligns with international standards. Collaborative initiatives between Ayurvedic institutes, universities, and global research centers can bridge knowledge gaps and facilitate translational research, linking traditional knowledge to modern biomedical frameworks. Integrating Ayurveda with pharmacological, metabolomic, and genomics studies may provide mechanistic insights and enhance acceptance among healthcare professionals.

5.2 STANDARDIZATION AND QUALITY CONTROL

Developing standardized protocols for herbal formulations, raw material identification, and preparation methods is critical. Adherence to Good Manufacturing Practices (GMP), ISO certifications, and pharmacopoeial standards ensures product consistency, safety, and global marketability (13). Establishing independent certification bodies and quality assurance frameworks can enhance consumer trust and reduce variability across international markets.

5.3 REGULATORY ALIGNMENT AND POLICY SUPPORT

A clear and harmonized regulatory framework across countries can simplify market access for Ayurvedic products and services. Policies should address classification, labeling, safety standards, and marketing claims while protecting intellectual property rights (14). Governments and global bodies such as the World Health Organization (WHO) can facilitate cross-border regulatory alignment, enabling Ayurveda's safe and credible integration into global wellness and healthcare systems.

5.4 EDUCATION AND AWARENESS

Educational initiatives targeted at both consumers and healthcare professionals are critical. Global workshops, online courses, and professional certifications can improve understanding of Ayurvedic philosophy, principles, and clinical applications. Simultaneously, public awareness campaigns highlighting evidence-based benefits of Ayurveda can empower consumers to make informed choices. Integrating Ayurveda modules into medical and wellness curricula promotes interdisciplinary collaboration and strengthens credibility.

5.5 ETHICAL COMMERCIALIZATION AND CULTURAL INTEGRITY

Ensuring authenticity and ethical practice is essential for sustainable global growth. Brands and wellness centers should adhere to traditional protocols while communicating their cultural and scientific basis transparently. Ethical commercialization also involves fair trade practices, transparent supply chains, and community engagement, particularly in rural areas where medicinal plants are cultivated.

5.6 DIGITAL INNOVATION AND GLOBAL ACCESSIBILITY

Digital platforms offer opportunities to scale Ayurveda globally. Teleconsultation services, AI-assisted Prakriti assessments, and mobile wellness applications enable personalized interventions and remote access. Data-driven approaches can also support clinical research, track outcomes, and enhance evidence-based practice. Integrating Ayurveda with digital wellness ecosystems increases accessibility, especially in regions lacking local practitioners.

In summary, a strategic combination of research, standardization, policy support, education, ethical commercialization, and digital innovation provides a roadmap for overcoming barriers. These measures can ensure Ayurveda's credible, sustainable, and culturally respectful integration into the global wellness industry, positioning it as a scientifically validated and universally relevant system of holistic health.

6. FUTURE OUTLOOK AND RESEARCH AGENDA

The future of Ayurveda in the global wellness industry is shaped by the interplay of traditional knowledge, scientific validation, digital innovation, and evolving consumer expectations. While opportunities abound, realizing Ayurveda's full potential requires strategic foresight, research, and innovation.

6.1 INTEGRATIVE HEALTHCARE AND PREVENTIVE MEDICINE

Ayurveda is poised to become a cornerstone of integrative and preventive healthcare. Its personalized approach, grounded in the Prakriti concept and lifestyle-based interventions, aligns closely with global trends emphasizing chronic disease prevention, stress management, and mental well-being. Collaboration with modern medicine can facilitate holistic treatment protocols, combining conventional pharmacotherapy with Ayurvedic dietary, herbal, and mind–body practices.

6.2 EVIDENCE-BASED RESEARCH PRIORITIES

To strengthen credibility, the focus should be on high-quality clinical research, systematic reviews, and mechanistic studies that evaluate Ayurvedic interventions across diverse populations and health conditions. Emerging fields such as metabolomics, genomics, and bioinformatics offer opportunities to elucidate molecular mechanisms underlying Ayurvedic therapies, enabling personalized medicine approaches and integration with digital health platforms. Multi-center international trials can further accelerate global acceptance.

6.3 POLICY, REGULATION, AND STANDARDIZATION

Policy initiatives that support global harmonization of standards, safety protocols, and intellectual property protection will be pivotal. Streamlined regulatory frameworks can enable the safe export and clinical application of Ayurvedic products, services, and wellness programs while ensuring authenticity and ethical compliance. Standardization of herbal formulations and treatment protocols will enhance reproducibility and facilitate international adoption.

6.4 DIGITAL AND TECHNOLOGICAL INNOVATION

The integration of digital technologies—including telemedicine, mobile apps, wearable devices, and AI-assisted diagnostics—can expand Ayurveda's global reach . Digital platforms enable personalized wellness programs, remote consultations, and data collection for research. The synergy of technology and Ayurveda can transform both preventive health and wellness tourism by providing scalable, accessible, and measurable outcomes.

6.5 SUSTAINABILITY, ETHICAL PRACTICE, AND CULTURAL PRESERVATION

Sustainability and ethical sourcing of medicinal plants, combined with respect for Ayurvedic philosophy, are crucial for long-term viability. Collaborative programs involving rural communities, fair-trade models, and biodiversity conservation can ensure that the global expansion of Ayurveda remains socially responsible. Preserving cultural integrity, while adapting to modern wellness contexts, will maintain consumer trust and authenticity.

6.6 EDUCATION AND GLOBAL KNOWLEDGE DISSEMINATION

Global education and awareness campaigns targeting healthcare professionals, consumers, and policymakers are essential. Structured training programs, certification courses, and research collaborations can foster knowledge exchange and promote the scientific, clinical, and cultural understanding of Ayurveda worldwide.

In conclusion, the future of Ayurveda in the global wellness industry hinges on a balanced approach: leveraging traditional wisdom, advancing scientific validation, adopting ethical and sustainable commercialization, and embracing digital and technological innovation. By addressing research gaps, regulatory complexities, and educational needs, Ayurveda can emerge as a globally recognized, evidence-based, and culturally authentic contributor to holistic health and sustainable wellness.

7. Conclusion

Ayurveda, the ancient Indian system of holistic medicine, is increasingly recognized as a valuable contributor to the global wellness industry. Its emphasis on balance, preventive care, and individualized interventions aligns closely with contemporary trends in lifestyle medicine, mindfulness, and sustainable health practices. The global wellness market—spanning wellness tourism, herbal products, integrative healthcare, and digital wellness platforms—offers substantial opportunities for Ayurveda to expand its reach and influence.

However, realizing this potential requires addressing significant challenges. These include gaps in scientific validation, inconsistent quality standards, complex regulatory landscapes, commercialization risks, and limited global awareness of authentic Ayurvedic principles. Without systematic interventions, the globalization of Ayurveda risks superficial adoption that may compromise its credibility, cultural integrity, and therapeutic efficacy.

Strategic measures are essential to overcome these barriers. Rigorous research, standardization of products and protocols, policy harmonization, ethical commercialization, digital innovation, and global educational initiatives can collectively enhance credibility and accessibility. Emphasizing sustainability and cultural preservation ensures that global expansion benefits both consumers and local communities involved in medicinal plant cultivation.

In essence, the future of Ayurveda in the global wellness industry depends on a balanced integration of traditional wisdom and modern scientific frameworks. With careful implementation of research-backed practices, quality assurance, and education, Ayurveda can emerge as a globally recognized, evidence-based, and culturally authentic system of holistic health. By maintaining its core principles while adapting to contemporary wellness needs, Ayurveda has the potential to contribute meaningfully to sustainable global well-being.

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The Future is Ancient: Reclaiming Ayurveda for Global Sustainability

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Abstract

Ayurveda is an ancient, holistic system of medicine rooted in Indian civilization. This review examines Ayurveda's historical foundations, modern scientific validation, global resurgence, and its potential to contribute to sustainable health, employment, and youth-led innovation. The paper also provides practical recommendations for integrating Ayurvedic practices into daily life, scaling research and industry, and policy measures for government support. The tone is semi-formal and motivational, aiming to persuade students, policymakers, and young entrepreneurs about the promise of Ayurveda as both a public-good and an economic opportunity.

Keywords: Ayurveda; Sustainability; Youth empowerment; AYUSH; Integrative medicine; Herbal economy

1. INTRODUCTION

Ayurveda literally 'the knowledge of life' is more than a medical system: it is a framework for living well. Originating from ancient Indian texts such as the Atharva Veda, Charaka Samhita, and Sushruta Samhita, Ayurveda emphasizes balance among body, mind, and environment. Its practices include dietary guidance, herbal medicines, purification therapies (Panchakarma), and lifestyle regimens (Dinacharya). Over centuries, Ayurveda served broad populations through community practitioners and institutional learning. However, colonial policies and industrialized medicine marginalized indigenous systems, reducing research infrastructure and youth engagement. Today, with rising chronic diseases and environmental stressors, Ayurveda offers an evidence-informed, preventive, and sustainable approach to health that can complement modern medicine.

2. HISTORICAL EVOLUTION AND COLONIAL IMPACT

Classical Ayurveda developed systematic clinical observations, surgical techniques, and pharmacopeias centuries before many modern practices. Sushruta's surgical treatises describe procedures resembling contemporary operations, and Charaka's compendium contains detailed diagnosis and therapeutics. The British colonial era shifted educational priorities and funding toward Western medicine, causing a fragmentation of the Gurukul-based transmission system. Despite the decline in institutional support, Ayurveda survived through families of practitioners (Vaidyas) and local knowledge networks. Post-independence, the creation of government bodies and the AYUSH ministry rekindled institutional interest, but sustained investment and modernization lagged behind demand.

3. SCIENTIFIC FOUNDATIONS AND MODERN VALIDATION

Although some critics wrongly cast Ayurveda as purely mystical, many of its therapies have measurable physiological effects. Herbal compounds such as curcumin (from turmeric) and withanolides (from Ashwagandha) show anti-inflammatory, antioxidant, and adaptogenic properties in clinical and preclinical studies. For example, systematic reviews and clinical trials indicate that Ashwagandha can reduce perceived stress and improve sleep and resilience in multiple populations. Recent literature reviews have synthesized evidence for several Ayurvedic botanicals and formulations, suggesting measurable benefits in metabolic syndrome, osteoarthritis, anxiety, and immune support. Integrative research methods—such as reverse pharmacology and systems biology—are increasingly used to map traditional formulations to molecular mechanisms.

4. GLOBAL RENAISSANCE: MARKETS, RESEARCH, AND RECOGNITION

Worldwide interest in Ayurvedic products and services has surged. Market research estimates put the global Ayurvedic market at roughly USD 17–19 billion in 2024–2025, with projections varying by

source but consistently forecasting strong growth through 2030 (CAGRs from ~19% to >25%), reflecting rising consumer demand for natural, preventive and plant-based health products. cite turn0search0 turn0search10 At the same time, WHO's Traditional Medicine Strategy (2014–2023) has encouraged Member States to integrate traditional and complementary medicine into national health systems, creating platforms for safety, standards, and workforce development. cite turn0search3 Academic centers in Europe, North America, and East Asia have opened research collaborations on botanicals and nutraceuticals. This global activity presents both an opportunity and a call to action for India—owner of the primary knowledge base—to lead with science-backed innovation.

5. EDUCATION, WORKFORCE, AND INSTITUTIONAL CAPACITY

Robust education and training ecosystems are essential for Ayurveda to scale responsibly. India currently has several hundred undergraduate Ayurveda colleges and thousands of seats; recent reports indicate around 450 UG Ayurveda colleges with roughly 31,700 seats and approximately 140 PG institutes with 4,600 seats, reflecting a large educational base that can be modernized with interdisciplinary curricula. However, gaps remain in research mentoring, clinical trial infrastructure, and biotech collaborations. Bridging traditional curricula with modules in pharmacology, clinical trial design, bioinformatics, and entrepreneurship will make graduates competitive and more attractive to youth.

6. INTEGRATING AYURVEDA WITH MODERN MEDICINE AND TECHNOLOGY

Integration does not mean replacing modern medicine but enriching it with preventive, personalized, and ecological perspectives. Several hospitals and academic centers have piloted integrative clinics where evidence-based Ayurvedic interventions complement standard care, notably in chronic diseases where lifestyle change is central. Technological tools AI-driven Prakriti assessment, digital health records for herbal interventions, and bioinformatics approaches can accelerate validation and personalize treatments. Digital platforms can also standardize formulations and supply-chain transparency, reducing risks associated with heavy metals or adulteration.

7. AYURVEDA IN DAILY LIFE: PRACTICAL PATHWAYS TO PUBLIC HEALTH

For Ayurveda to impact population health, practices must be accessible, simple, and culturally resonant. Schools can introduce modules on Dinacharya (daily routine), seasonal diets (Ritucharya), basic yoga and pranayama, and water and sleep hygiene. Workplace wellness programs can integrate brief Ayurvedic routines, stress management using evidence-based herbs (where safe), and diet guidance to reduce non-communicable disease risk. Community health workers can be trained to deliver preventive advice and identify cases for referral similar to how other public-health programs scale.

8. EMPLOYMENT OPPORTUNITIES AND YOUTH ENTREPRENEURSHIP

A scaled Ayurvedic ecosystem creates diverse jobs across the value chain: medicinal plant cultivation, sustainable wildcrafting, primary processing, formulation science, quality assurance, clinical research, digital-health platforms, wellness tourism, and branded consumer products (nutraceuticals, herbal cosmetics, food supplements). Start-up incubators that combine traditional knowledge holders with biotech and business mentors can catalyze youth-led enterprises. Programs like Startup India, skill-development initiatives, and AYUSH-linked grants can be leveraged to provide seed funding, mentorship, and market access for young entrepreneurs.

9. GOVERNMENT ROLE: POLICY, FUNDING, AND INSTITUTIONAL SUPPORT

Government leadership is pivotal. Recent budget documents show that the Ministry of AYUSH receives multi-thousand-crore allocations annually (for example, budgets and revised estimates in recent years reflect growing allocations to AYUSH for research, training, and medicinal-plant support). cite turn0search2 turn0search7 Policy measures to accelerate Ayurveda should include: research grants for multicentre clinical trials; public private partnerships for quality-control labs; subsidies and technical support for sustainable medicinal-plant farming; integration of AYUSH in primary-care packages; and insurance coverage for validated Ayurvedic services. Additionally, establishing

translational centers that bring together Vaidyas, clinical researchers, and industry will help translate traditional recipes into scalable, regulated products.

10. SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT

Scaling Ayurveda with sustainability in mind creates positive socio-economic externalities. Medicinal-plant agriculture can restore degraded lands, promote agroforestry, and provide additional income streams for smallholder farmers. Wellness tourism and Ayurvedic hospitals attract international patients, contributing to foreign exchange and local employment. Moreover, a preventive health focus can reduce healthcare spending by lowering incidence and severity of chronic diseases, improving workforce productivity and resilience.

11. CHALLENGES, QUALITY CONTROL, AND ETHICAL CONSIDERATIONS

Key challenges must be addressed: (a) the need for rigorous clinical evidence and standardized protocols; (b) concerns about adulteration and heavy metals in some products (documented in prior safety studies) which necessitate strong pharmacovigilance and manufacturing standards; (c) intellectual property and benefit-sharing issues with indigenous communities; and (d) potential overharvesting of wild medicinal species unless sustainable cultivation is enforced. Addressing these will require regulatory strengthening, transparent supply chains, community-level benefit sharing, and modern analytical labs for quality assurance.

12. ROADMAP AND RECOMMENDATIONS

To reclaim Ayurveda for national and global benefit, we propose a phased roadmap: 1) Strengthen research by funding multicentre clinical trials and promoting reverse-pharmacology approaches; 2) Modernize education by adding modules in genomics, clinical methods, and entrepreneurship to Ayurveda curricula; 3) Build medicinal-plant value chains with quality standards and farmer cooperatives; 4) Promote youth entrepreneurship through incubators, seed funds, and mentorship linked to AYUSH and Startup India; 5) Use digital technology for Prakriti assessment, e-prescriptions, and pharmacovigilance; 6) Incorporate validated Ayurvedic interventions into public health programs where evidence supports benefit.

13. HOW AYURVEDA HELPS PEOPLE & BECOMES A DAILY PRACTICE

Ayurveda’s core strength is prevention. Encouraging simple, low-cost practices like dietary adjustments, daily routines, seasonal detoxes, yoga, and mindful breathing can reduce the burden of lifestyle diseases. School curricula and workplace health drives can normalize these habits from an early age. With proper quality-controlled products and accessible advice through community health workers or telehealth, Ayurveda can become part of everyday life improving sleep, digestion, stress resilience, and general well-being.

14. YOUTH PERSPECTIVE: WHY STUDENTS SHOULD SEE AYURVEDA AS AN OPPORTUNITY

For young people, Ayurveda represents a space where science, entrepreneurship, and culture intersect. Career paths include clinical practice (BAMS and higher studies), R&D in herbal pharmacology, biotech roles creating standardized extracts, regulatory science, supply-chain management, digital-health product design, and wellness tourism management. By positioning Ayurveda as an innovation-friendly sector with grant opportunities and startup pathways, the youth will find it attractive and future-ready.

15. CONCLUSION: A MOTIVATIONAL CALL TO ACTION

Reclaiming Ayurveda is an act of cultural renewal and practical problem-solving. Its principles prevention, personalization, and ecological balance are exactly what modern societies need to build resilient, sustainable health systems. With strategic government support, modern research, youth engagement, and ethical industry practices, Ayurveda can return from the margins to become a mainstream contributor to health, livelihoods, and national pride.

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Ayurveda for a better life : Prevention and Lifestyle Management

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Abstract

Ayurveda, the ancient Indian science of life, offers a deeply human and holistic approach to healthcare and lifestyle management. It goes beyond simply treating illness and focuses on maintaining a vibrant state of health (Swasthya Rakshanam). We all want to feel our best, and Ayurveda provides a personalized path to achieve that. The system understands that each person is unique, defining individual constitutions as Doshas (Vata, Pitta, Kapha). Instead of a generic plan, Ayurveda offers tailored advice for everything from what we eat (Ahara) to how we structure our day (Dinacharya). This isn't about strict rules; it's about understanding your body's specific needs and adjusting your

habits to fit nature's rhythms. In our fast-paced modern world, where stress and chronic diseases often occur, Ayurveda provides practical, natural tools. Simple practices like following a seasonal routine (Ritucharya), choosing the right foods, and incorporating mindfulness techniques like Yoga help balance the mind and body. Ultimately, Ayurveda empowers us to take charge of our own well-being. It is a time-tested philosophy for living wisely, sustainably, and happily, making it a vital part of any effective modern wellness strategy.

Keywords: Dosha, Dinacharya, Mind-Body Balance, Ritucharya.

INTRODUCTION

Sedentary habits, chronic stress, and poor dietary choices have contributed to the dominance of Non-Communicable Diseases (NCDs) in the global health landscape. While modern medicine excels in acute care, it often falls short on providing effective primary prevention strategies that can be sustainable and personalized. Ayurveda is a system born in India more than five millennia ago and embodies a powerful, alternative paradigm emanating from the concept of the maintenance of balance. Its philosophy is encapsulated in the goal of preserving the health of a healthy person and alleviating the diseases of the sick.

This research article aims to systematically examine the foundational Ayurvedic concepts that underpin its prophylactic approach. We detail herein how Prakriti, or constitutional assessment, informs the individual application of Dinacharya, or daily routines, and Ritucharya, or seasonal adjustments. We articulate a scientific rationale for these practices, which are closely aligned with modern concepts of chronobiology and personalized nutrition, to establish the evidence supporting Ayurveda as a relevant and efficacious science in contemporary lifestyle management and disease prevention.

REVIEW OF LITERATURE

Perhaps the most important contribution of Ayurveda to personalized medicine is the concept of Prakriti or constitution. The classical texts, primarily the Charaka Samhita, define Prakriti as the unique, inborn psycho-somatic framework determined at conception by the dominance of the Tridosha- Vata, Pitta, and Kapha. There is emerging evidence that Prakriti typing can be correlated with genetic markers, metabolic profiles, and disease susceptibility, thus suggesting a biological basis for this personalization.

Svasthavritta or the preventive regimen is codified into two major components: Dinacharya and Ritucharya. Studies have linked Dinacharya practices like Brahma Muhurta Jagaranam- waking up early- and Abhyanga-oil massage-with the regulation of the HPA axis and maintenance of circadian rhythm, which is important for metabolic health. Further, the emphasis on Agni, or digestive fire, underlines the central role of gut health; impaired Agni results in Ama-unmetabolized toxins-which is considered the root cause of almost all diseases, Amashaya Samuttha Roga. The Ritucharya guidelines that outline seasonal changes in diet and behavior reflect an early recognition of environmental epidemiology and gene-environment interactions. The literature consistently supports this concept of a holistic system addressing both physical and mental well-being and engendering Ojas, or vitality and immunity.

MORNING ROUTINE AS PER AYURVEDIC DINCHARYA:

1. Waking/Brahma Muhurta Jagaranam : Wake up before sunrise (approximately 90 minutes before dawn). Aligns the body with the natural cycle; leverages the clarity of Vata time; regulates the nervous system.
2. Elimination/Mala/Mutra Visarjana: Empty the bladder and bowels immediately. Prevents
3. Vega Dharana (suppression of urges), which vitiates Doshas and causes disease.
4. Oral Hygiene/Dantadhavana: Brush teeth gently, using bitter/astringent herbs (traditionally neem or babul sticks). Maintains oral hygiene; stimulates Agni(digestive fire).
5. Tongue Scraping/Jihwa Lekhana: Gently scrape the tongue with a metal or copper scraper.| Removes Ama (toxic coating) accumulated overnight, improving taste and digestion.
6. Sensory Care/Netra, Karna, Nasya: Wash eyes with cool water. Apply 2-3 drops of warm oil (e.g., sesame oil) or ghee into the nostrils (Nasya) and ears (Karna Purana). Protects sense organs; Nasya balances Vata in the head, preventing allergies and soothing sinuses. |
7. Self-Massage/Abhyanga: Massage the body with warm, dosha-specific oil (e.g., sesame for Vata, coconut for Pitta). Calms the Vata-dominant nervous system; improves circulation; nourishes skin and muscles.
8. Exercise/Vyayama: Engage in physical activity until sweat appears on the forehead (e.g., Yoga, walking, specific exercises). Balances Kapha; improves strength; enhances Agni and metabolism.
9. Bathing/Snana: Take a warm or cool bath/shower. Cleanses the body; refreshes the mind; promotes purity (Shauch).
10. Meditation/Prayer/Dhyana/Prarthana: Spend time in quiet contemplation, meditation, or prayer.| Calms the mind; reduces stress; prepares the consciousness for the day's activities.

DAYTIME AND EVENING PRACTICES AS PER AYURVEDA

Midday (Pitta)/Ahara (Diet): Eat the largest meal of the day between 12:00 PM and 1:00 PM when Agni is strongest. Ensures efficient digestion and absorption; prevents Ama formation. Evening/Laghu Ahara: Eat a light, easy-to-digest dinner before 7:00 PM. Allows the body to focus on repair and detoxification during the night rather than heavy digestion.

Sleep/Nidra: Go to bed early (ideally by 10:00 PM, before the Pitta period begins). | Ensures sufficient rest; allows for optimal tissue repair (Dhatu Poshana) and mental recovery.

Table.1 Relationship between Various Ritu, Praanibala, Sun and Moon

Ritu	Surya bala	Chandra bala	Praani bala	Bhumandala swabhava	Rasa vriddhi
Shishir	Purna	Ksheena	Shreshtabala	Ruksha	Tikta
Vasant	Purnatara	Ksheenatara	Madhyabala	Rukshatara	Kashaya
Grishm	Purnatama	Ksheenatama	Alpabala	Rukshatama	Katu
Varsha	Ksheena	Purna	Alpabala	Snigdha	Amla
Sharad	Ksheentara	Purnatara	Madhyabala	Snigdhatara	Lavana
Hemant	Ksheentama	Purnatama	Shreshthabala	Snigdhatama	Madhura

MATERIALS AND METHODS

The method used in this article was a narrative and descriptive review. The material reviewed was divided into two categories:

1. Classical Texts (Brihatrayi): The main sources of authentic definition and application of Prakriti, Dinacharya, Ritucharya, and Agni are classical texts like the Charaka Samhita, Sushruta Samhita, and Ashtanga Hridayam.
2. Modern Research Literature: From 2000 to 2024, relevant peer-reviewed articles, systematic reviews, and meta-analyses were identified from the databases of PubMed, SCOPUS, and

AYUSH Research Portal. Search terms used included “Ayurveda lifestyle,” “Prakriti and genetics,” “Dinacharya and circadian rhythm,” and “Ama and pathogenesis.”

Information was synthesized qualitatively, connecting the classical concepts of Ayurveda (the Materials) to their practical manifestation in personalized health management (the Methods). The structure of the paper is thematically organized to link the principles of Ayurveda directly to contemporary lifestyle disease prevention.

RESULTS

The review of both classical and contemporary literature reported on consistent evidence regarding the efficacy and structure of Ayurvedic preventive science:

1. Individualization: The principle of Prakriti Pariksha became the fundamental tool for prevention. For instance, individuals with a predominant constitution of Vata Prakriti are prone to diseases of the nervous system and insomnia and thus are advised to use warm oils (Abhyanga) and nourishing foods that help in grounding, while Pitta Prakriti individuals, who are susceptible to all types of inflammatory conditions, need cooling diets and reduced exposure to heat.
2. Circadian Alignment: The practices described in Dinacharya, such as waking up at Brahma Muhurta and eating meals at specified times of the day, directly relate to stabilizing the body's circadian rhythms. Modern research into chronobiology verifies that disruption of these rhythms is one of the major risk factors for metabolic syndrome and cardiovascular disease.
3. Toxin Management: The focus on Agni health-for example, eating only when hungry and eating mindfully-acts as a powerful preventative against the development of Ama. Data from several studies indicate that maintaining healthy Agni is synonymous with maintaining gut barrier integrity and microbiome diversity, therefore minimizing chronic low-grade inflammation.
4. Mental Health:The practices of Dhyana (Meditation) and Pranayama (breath control), integrated into Dinacharya, act as primary prevention mechanisms in the management of Manasa Doshas (mental imbalances) and, in turn, reduce the physiological effects of chronic stress.

DISCUSSION

This model of prevention from Ayurveda has a very distinct advantage over generalized public health recommendations. Because "eat healthy and exercise" is not specific enough to be very effective, the Ayurvedic approach offers real, actionable, personalized guidance. For example, advice tailored to a Kapha Prakriti individual might include vigorous, drying exercise and light, pungent foods to mitigate sluggishness and an excess of mucous; this would be quite detrimental to a sensitive Vata Prakriti person.

The findings emphasize that Ayurvedic lifestyle management is essentially a proactive epigenetic modulation based on the alignment of daily and seasonal behaviors with one's innate constitution and the environment to optimize gene expression and physiological function. Agni is considered to be the unified theory for chronic disease, since poor digestion or metabolic dysfunction represents the common path to pathology.

The primary limitation in the existing evidence base is the lack of large-scale, placebo- controlled clinical trials validating the long-term impact of personalized Prakriti-based regimens. However, theoretical coherence, coupled with its correspondence to modern concepts of chronobiology, personalized nutrition, and psychoneuroimmunology, forms a strong basis supporting its clinical utility.

CONCLUSION

Ayurveda for a better life is not just an alternative therapeutic system; rather, it's a profound science of prevention and personalized lifestyle management. Centering its practice on the unique constitution of the individual and rhythmic living, respectively, Ayurveda presents a sustainable and effective strategy for maintaining internal equilibrium and enhancing immunity. Further rigorous research is merited to fully integrate these time-tested principles into mainstream healthcare and provide humanity with a robust, holistic framework for the prevention of chronic, lifestyle-driven diseases and optimal well-being.

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Opportunities and challenges of Ayurveda and Global Wellness Industry

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Abstract

The trillions-of-dollars global health market is structurally changing as people move away from sickness treatment to personalized, natural, and preventative wellness. However, despite its growing acceptance, Ayurveda faces several challenges in standardization, scientific validation, and global integration. This report looks at how Ayurveda, one of the oldest complete systems of holistic medicine in the world, is particularly positioned to meet this surging demand, especially for managing chronic and lifestyle-related conditions. We found its biggest opportunities to lie in wide consumer trust, increasing political support from organizations such as the WHO, and its potential integration into modern health practices.

But for Ayurveda to finally succeed, significant hurdles lie ahead. The primary one deals with the need for standardization and scientific proof, such as clinical trial data, to convince global regulators. Currently, its products are normally classified simply as "dietary supplements" in the West, which limits their prospects. Ultimately, realizing Ayurveda's immense potential requires concerted efforts toward modernization of its research—employing methods like Reverse Pharmacology—to bridge the gap between the ancient tradition and modern scientific validation for quality and global acceptance.

Keywords: Ayurveda, global wellness industry, traditional medicine, opportunities, challenges, holistic health, standardization

INTRODUCTION

Health and wellness are no longer defined merely as the absence of disease but as a dynamic state of balance between physical, mental, and social well-being. In recent decades, this understanding has inspired a global movement toward holistic and preventive healthcare, leading to the rapid expansion of the global wellness industry. The Global Wellness Institute (GWI) estimates the wellness economy to be worth over USD 5 trillion and continuing to grow annually1. Within this landscape, traditional and complementary medicine systems are increasingly gaining relevance for their sustainable, person-centered approaches. Among these, Ayurveda, India's ancient science of life, stands out as one of the most comprehensive and time-tested healthcare systems in the world.

Originating more than 5,000 years ago, Ayurveda is deeply rooted in the Vedic tradition and offers a holistic philosophy of health that integrates the mind, body, and spirit. Its fundamental aim is to maintain the balance of the doshas (Vata, Pitta, and Kapha), which represent physiological and psychological energies within the body. Unlike conventional medicine, which primarily focuses on symptomatic relief, Ayurveda emphasizes prevention, rejuvenation, and lifestyle modification through personalized diet, herbal therapy, and daily regimen (Dinacharya)2.

In the twenty-first century, as chronic lifestyle diseases and stress-related disorders continue to rise, there has been a renewed global interest in natural healing systems like Ayurveda. The COVID-19 pandemic further accelerated this shift, prompting individuals to explore immune-boosting herbs, mind-body therapies, and traditional practices for resilience and well-being.

Governments, healthcare institutions, and global organizations have started to recognize Ayurveda's potential role in promoting preventive health and wellness3.

Simultaneously, the global wellness industry encompassing wellness tourism, herbal products, nutraceuticals, yoga, meditation, and spa therapies—has identified Ayurveda as a key contributor to holistic living. Wellness resorts offering Ayurvedic treatments have become major attractions in countries such as India, Sri Lanka, and Thailand, and Ayurvedic brands are now available across international markets. The fusion of Ayurveda with the wellness economy presents a unique opportunity to merge ancient wisdom with modern lifestyle demands.

However, the growing globalization of Ayurveda also brings forth a series of complex challenges. Issues related to quality control, standardization, evidence-based validation, intellectual property, and misrepresentation threaten its authenticity and acceptance at the international level4. Despite governmental initiatives through the Ministry of AYUSH, the World Health Organization (WHO), and international collaborations, Ayurveda still faces barriers in aligning with global pharmaceutical and regulatory standards.

Therefore, there is a pressing need to examine Ayurveda's evolving role in the global wellness industry from a balanced perspective — one that acknowledges its immense opportunities for global integration and critical challenges in maintaining scientific credibility and ethical practice.

This article aims to analyse these dual aspects by reviewing relevant literature, industry trends, and policy developments, offering an academic understanding of Ayurveda's place in the modern wellness landscape.

METHODOLOGY

STUDY DESIGN

This article follows a qualitative review design, focusing on interpretative and thematic analysis of existing literature related to Ayurveda and the global wellness industry. The objective was to explore both the opportunities and challenges faced by Ayurveda in the global wellness context, with balanced emphasis on scientific, economic, cultural, and policy dimensions. A descriptive and analytical approach was adopted to synthesize data from multidisciplinary sources, allowing for a nuanced understanding that connects traditional medical knowledge with modern wellness trends.

DATA SOURCES

Secondary data were gathered from a variety of reliable academic and institutional sources published between 2010 and 2024. The main data repositories included:

- PubMed and Scopus for peer-reviewed scientific papers on Ayurveda and integrative health systems;
- Google Scholar for open-access articles, review papers, and meta-analyses on wellness industry trends;
- Government reports and policy documents, including those from the Ministry of AYUSH, the World Health Organization (WHO), and the Global Wellness Institute (GWI);
- Industry reports and trade publications focusing on wellness tourism, herbal markets, and Ayurvedic product demand.

The selection of sources was guided by the relevance of content to Ayurveda's global positioning, wellness integration, and cross-cultural adaptation. Historical texts and classical Ayurvedic literature, such as the Charaka Samhita and Sushruta Samhita, were also referenced to provide conceptual grounding.

RESULT

The qualitative analysis revealed a multifaceted picture of Ayurveda's evolving role in the global wellness industry. While its holistic philosophy and natural healing potential have generated widespread international interest, structural, scientific, and regulatory challenges continue to limit its universal adoption. The results are therefore presented under two main categories Opportunities and Challenges each comprising several interrelated themes that shape Ayurveda's present and future position in the global wellness ecosystem.

OPPORTUNITIES FOR AYURVEDA IN THE GLOBAL WELLNESS INDUSTRY

GROWING GLOBAL DEMAND FOR HOLISTIC AND PREVENTIVE HEALTHCARE

Across the world, there has been a paradigm shift from disease-centric healthcare to preventive and wellness-oriented living. Rising incidences of stress, obesity, anxiety, and non- communicable diseases have encouraged individuals to seek natural, long-term solutions that support overall well-being rather than symptomatic relief. Ayurveda's foundation — balancing the doshas through diet, herbs, and lifestyle — resonates with this modern aspiration for balance and sustainability.

Surveys by the Global Wellness Institute (GWI) and WHO indicate that over 60% of consumers now prefer complementary or traditional systems for chronic disease management1,2. Ayurveda, with its emphasis on Swasthasya Swasthya Rakshanam (preserving the health of the healthy), offers a philosophy aligned perfectly with the wellness generation's preventive mindset. This alignment has enabled Ayurveda to expand its reach beyond South Asia, gaining popularity in North America, Europe, and the Middle East.

INTEGRATION WITH WELLNESS TOURISM

One of the most visible expressions of Ayurveda's globalization is its integration into wellness tourism. Ayurveda-based retreats and Panchakarma centres have become central attractions for travellers seeking rejuvenation, detoxification, and spiritual renewal. States like Kerala, Karnataka, and Uttarakhand in India have branded themselves as global Ayurvedic destinations, blending traditional therapies with modern hospitality infrastructure.

According to a report by the Ministry of Tourism (2023), wellness tourism contributes approximately 10% of India's total tourism revenue, with Ayurveda being a major driver. International visitors are increasingly drawn to the authenticity and personalization of Ayurvedic treatments5. This trend not only generates employment for local therapists and herbal suppliers but also fosters cultural exchange and environmental sustainability. Countries such as Sri Lanka, Thailand, and Indonesia have also adopted Ayurvedic principles in their spa and wellness programs, reflecting the system's expanding influence across Asia and beyond.

RISING POPULARITY OF NATURAL, PLANT-BASED INGREDIENTS

The global trend towards clean-label products and skepticism about synthetic chemicals has catapulted demand for natural, plant-derived ingredients. The herbal segment currently dominates the Ayurveda market (holding a majority share of the product market).

- **Star Ingredients:** Specific Ayurvedic herbs, now recognized globally as superfoods and adaptogens, are driving the fastest growth. Ashwagandha (for stress and sleep), Turmeric (for inflammation and immunity), and Tulsi (Holy Basil) (for immunity) have successfully transitioned into mainstream supplements, functional foods, and beverages in Western markets5.
- **Cosmeceuticals and Personal Care:** The Ayurvedic philosophy of using food-grade ingredients on the skin has fueled a massive surge in the Ayurvedic personal care segment. Brands are successfully exporting products like natural toothpaste, hair oils,

and skincare, appealing to consumers demanding organic and chemical-free beauty solutions.

GROWTH IN WELLNESS AND MEDICAL TOURISM

Ayurveda is a major pillar of the global wellness tourism industry. Destinations, particularly in India (like Kerala), offer immersive experiences that provide in-depth diagnostic consultations and intensive detox therapies.

- **Experiential Healing:** The authentic clinical practice of Panchakarma (detoxification therapies) attracts international clients seeking comprehensive, deeply therapeutic, and non-invasive health restoration that is not available in conventional Western healthcare settings.
- **Economic Advantage:** This segment contributes significantly to the economies of developing nations by attracting high-value tourists seeking long-term stays for treatment.

POLICY SUPPORT AND GLOBAL RECOGNITION

Governmental and institutional efforts have played a crucial role in mainstreaming Ayurveda globally. The Ministry of AYUSH (Government of India) has established bilateral collaborations with several countries to promote research, training, and product exports. The WHO Global Centre for Traditional Medicine, inaugurated in Gujarat, India, in 2022, represents a major step toward integrating traditional medicine systems like Ayurveda into global public health frameworks 6.

Additionally, initiatives such as AYUSH mark certification, Good Manufacturing Practice (GMP) standards, and international seminars have improved transparency and trust. The inclusion of Ayurvedic concepts in WHO's Traditional Medicine Strategy (2014–2023) underscores Ayurveda's relevance in achieving universal health coverage through culturally inclusive models.

These developments indicate that Ayurveda's global expansion is not just cultural but also institutional, opening new avenues for research funding, product innovation, and policy integration.

CHALLENGES FACING AYURVEDA IN THE GLOBAL WELLNESS INDUSTRY

Despite its growing popularity, Ayurveda encounters substantial barriers that impede its global mainstreaming. These challenges are both structural and perceptual, encompassing quality assurance, scientific evidence, regulation, and cultural representation.

STANDARDIZATION AND QUALITY CONTROL

One of the most persistent challenges is the lack of standardized protocols for raw material sourcing, manufacturing, and formulation. Variations in soil quality, harvesting time, and processing methods lead to inconsistencies in herbal efficacy. Although the Pharmacopoeial Laboratory for Indian Medicine (PLIM) and AYUSH have initiated standardization programs, the implementation remains uneven.

In international markets, regulatory agencies demand stringent quality and safety testing. The absence of harmonized standards among countries restricts Ayurveda's export potential. Moreover, issues such as adulteration, contamination, and heavy-metal content in certain formulations have raised safety concerns, undermining consumer trust. Ensuring consistent quality control is thus crucial for global acceptance.

LIMITED SCIENTIFIC VALIDATION

While Ayurveda's holistic framework has sustained for millennia, its validation through modern research methods remains limited. Most Ayurvedic treatments rely on experiential evidence rather than controlled clinical trials. Global healthcare systems, however, depend heavily on evidence-based medicine. This creates a gap between traditional knowledge and contemporary scientific expectations.

Although recent years have witnessed an increase in Ayurvedic research, challenges such as lack of funding, methodological differences, and the complexity of multi-herbal formulations hinder large-scale trials5. The integrative nature of Ayurveda, which considers body constitution (Prakriti) and lifestyle, is difficult to replicate in standardized experimental designs.

REGULATORY AND LEGAL BARRIERS

Ayurvedic products face diverse regulatory frameworks across countries. While India classifies Ayurveda under the Drugs and Cosmetics Act, many nations treat it as a dietary supplement or traditional remedy, leading to legal ambiguities. Obtaining international certifications such as US-FDA or European Medicines Agency (EMA) approval involves high costs and rigorous documentation, which small and medium enterprises struggle to meet8.

Furthermore, there is no unified international body to overseas traditional medicine regulation, causing discrepancies in labelling, dosage, and claims. This lack of uniformity restricts market access and limits consumer confidence.

INTELLECTUAL PROPERTY RIGHTS AND BIOPIRACY

As Ayurveda's global visibility increases, concerns about intellectual property protection have grown. Instances of foreign patents on traditional Indian formulations such as turmeric for wound healing and neem for antifungal9 properties have highlighted the vulnerability of indigenous knowledge. The Indian government's creation of the Traditional Knowledge

Digital Library (TKDL) has helped prevent biopiracy by documenting classical Ayurvedic formulations and sharing them with patent office's worldwide10.

However, many grassroots innovations and region-specific practices remain undocumented and unprotected. Without proper intellectual property mechanisms and benefit-sharing frameworks, traditional communities may not receive fair recognition or compensation for their contributions.

ECONOMIC AND INFRASTRUCTURAL CONSTRAINTS

The commercialization of Ayurveda demands investment in research infrastructure, modern laboratories, and skilled human resources. Many Ayurvedic institutions in India and developing countries still operate with limited funding and outdated facilities. Compared to modern pharmaceutical industries, the Ayurvedic sector faces significant financial and technological disparities.

Additionally, global logistics, supply chain management, and export compliance require technological modernization and capacity building, particularly among small manufacturers and local producers.

DISCUSSION

Ayurveda's growing global recognition reflects a broader shift toward preventive and holistic healthcare. Its principles of balance, individualized treatment, and natural healing align closely with modern wellness trends that value sustainability and mental well-being. The integration of Ayurvedic practices into wellness tourism, herbal industries, and lifestyle management demonstrates its adaptability and global appeal.

Yet, the transition from traditional practice to global acceptance presents persistent challenges. Issues of scientific validation, standardization, and quality control continue to limit credibility in evidence-based medicine. Ensuring safety, consistency, and transparency through research and regulatory frameworks is essential for global integration. Institutions such as the WHO Global Centre for Traditional Medicine and Ministry of AYUSH can play key roles in strengthening these efforts.

Equally important is ethical commercialization. Global wellness markets often simplify Ayurveda into products or spa services, detaching it from its philosophical foundation. Authenticity, practitioner training, and responsible marketing are necessary to prevent cultural dilution.

India's leadership in education, research, and international collaboration can help position Ayurveda as a scientifically grounded and culturally respected system. By combining traditional knowledge with modern innovation and ethical governance, Ayurveda can evolve as a vital component of global wellness, contributing not only to physical health but to holistic human well-being.

CONCLUSION AND RECOMMENDATIONS

Ayurveda today stands at a pivotal intersection between ancient wisdom and modern wellness. Its philosophy of balance, prevention, and personalized care resonates strongly with global health priorities that seek sustainability and holistic well-being.

The growing demand for natural remedies, mind body therapies, and integrative health approaches offers Ayurveda immense potential within the global wellness industry.

However, realizing this potential requires confronting persistent challenges notably the lack of standardized research, inconsistent product quality, regulatory discrepancies, and cultural misinterpretations. For Ayurveda to be recognized as a credible global system, it must harmonize its traditional framework with modern scientific and ethical standards without compromising its philosophical essence.

Strategic collaborations between governments, academia, and industry can ensure responsible globalization. Strengthening evidence-based research, establishing international quality benchmarks, and expanding intercultural education will foster authenticity and trust. Moreover, India's leadership through AYUSH and the WHO Global Centre for Traditional Medicine can guide policy, research, and diplomacy in this field.

Ultimately, the integration of Ayurveda into the global wellness industry should not be driven by commercial gain alone but by the deeper vision of promoting balance within individuals, societies, and ecosystems. A conscious, evidence-informed, and ethically grounded approach will allow Ayurveda to evolve as a universal model for sustainable health and human well- being.

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Declaration of Interest

There is no conflict of interest regarding the publication of this article.

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Impact of Psychological Stress on Cardiac Health with Ageing: A Review

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Abstract

Psychological stress is recognized as a modifiable risk factor for cardiovascular morbidity and mortality, influencing both acute and chronic cardiac events. Stress induces acute autonomic imbalance and neuroendocrine activation, causing inflammation, endothelial dysfunction, and susceptibility to arrhythmias and ischemia. Studies indicate that younger adults exhibit distinct cardiovascular reactivity to stress, and olders adults faces greater risk for persistent hypertension, left ventricular dysfunction, and adverse outcomes, due to age-related decline in adaptive stress responses and cardiovascular reserve. This study explores the differential effects of psychological stress on cardiac health across distinct age groups, aiming to clarify the underlying physiological mechanisms of stress-induced cardiovascular risk. Data were synthesized from cohorts representing adolescence, adulthood, and the elderly, integrating measures of heart rate variability, blood pressure response, and clinical outcomes. This review also highlights the bidirectional effects of comorbid mood disorders and sleep disturbances in elderly patients, further amplifying cardiac risk.

Keywords: Psychological Stress, Cardiac Health, Age Differences, Cardiovascular Disease Risk, Heart Rate Variability

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of mortality worldwide, with psychological stress emerging as a critical modifiable risk factor that contributes to both the development and progression of cardiac pathology [1, 2]. The relationship between psychological stress and cardiac health is complex, involving multiple interacting physiological pathways that include autonomic nervous system dysregulation, neuroendocrine activation, inflammatory responses, and endothelial dysfunction (Figure 1) [3, 4]. Psychological stress disrupts the balance between sympathetic and parasympathetic nervous system activity and generates an autonomic imbalance characterized by sympathetic predominance and parasympathetic withdrawal [3, 5]. This dysregulation reduces heart rate variability (HRV), as well-established marker of cardiovascular health and mortality risk. In a pooled analysis of cohorts with stable CVD, stress-induced decreases in low-frequency (LF) HRV were associated with a risk ratio of 3.48 for cardiovascular mortality. In contrast, low resting LF HRV was associated with a risk ratio of 1.75 [6]. Critically, the combination of these factors yielded a risk ratio of 5.73, showing the importance of the additive prognostic significance of both baseline autonomic dysfunction and maladaptive stress responses. The autonomic imbalance induced by chronic stress increases vulnerability to cardiac arrhythmias through multiple mechanisms. Sympathetic activation lowers the arrhythmic threshold, while reduced vagal tone reduces the heart's protective parasympathetic buffer [7].

Whereas Chronic psychological stress triggers neuroendocrine activation of hypothalamic-pituitary-adrenal (HPA) axis, resulting prolonged exposure to elevated glucocorticoids and catecholamines [3, 8]. This neuroendocrine dysregulation has profound effects on cardiac structure and function through alterations in myocardial gene expression and cellular remodeling. Animal models of chronic stress indicate age-dependent molecular signatures of stress-induced cardiac remodeling. In middle-aged and old mice subjected to chronic restraint stress, indicate significant upregulation of cardiomyopathy and hypertrophy genes including MHY7, ACTA1, and NPPB, accompanied by increased heart weight-to-tibia length ratios [9]. These structural changes associate with downregulation of glucocorticoid receptor expression in aged hearts, suggesting that chronic stress induces glucocorticoid resistance that may perpetuate maladaptive

cardiac remodeling. The cardiovascular effects of catecholamines extend beyond acute hemodynamic changes. Chronic catecholamine exposure promotes myocardial hypertrophy, accelerates atherosclerosis through impact on lipid metabolism and endothelial function, and increases myocardial oxygen demand while simultaneously reducing oxygen supply through coronary vasoconstriction [10-11]. These effects are particularly pronounced in older adults, those cardiovascular systems have reduced capacity to compensate for catecholamine-induced demands.

Psychological stress also activates inflammatory cascades that contribute to both the initiation and progression of atherosclerotic cardiovascular disease [12-13]. Chronic stress is associated with elevated levels of pro-inflammatory cytokines including interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and C-reactive protein (CRP), promote endothelial dysfunction, plaque instability, and thrombogenesis. Recent evidence demonstrates that inflammation serves as a critical mediator linking psychological factors to cardiovascular outcomes in older adults. Analysis of up to 6,602 adults revealed that negative self-perceptions of aging and older age were associated with increased heart disease and stroke through elevated CRP levels [14]. This finding supports the concept that psychological aging independent of chronological age influences cardiovascular risk through inflammatory mechanisms. Experimental models have further elucidated the temporal dynamics of stress-induced inflammation. Following chronic stress exposure, inflammatory markers including IL-6, IL-17c, PTGS2, and lipocalin show acute elevation, with some markers normalizing during recovery periods while others remain persistently elevated [9]. This pattern suggests that chronic stress may induce lasting alterations in immune function that continue to promote cardiovascular risk even after stress resolution.

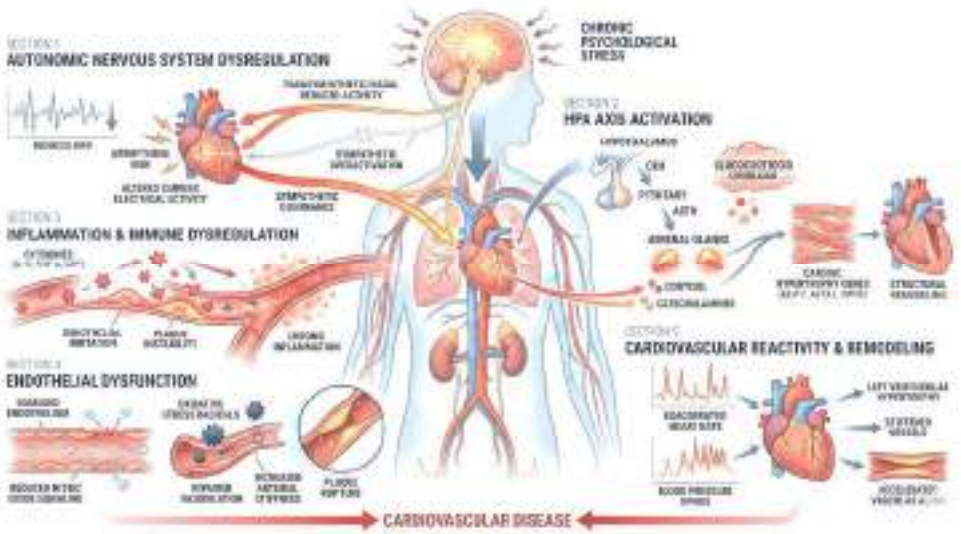


Figure 1: Physiological Mechanisms indicating the impact of Stress on Cardiac Health

Whereas endothelial dysfunction represents a critical pathway through which psychological stress promotes cardiovascular disease [15-16]. Stress-induced activation of the sympathetic nervous system and HPA axis impairs endothelium-dependent vasodilation, increases oxidative stress, and promotes a pro-thrombotic state through alterations in nitric oxide bioavailability and endothelial nitric oxide synthase (eNOS) function. The acute effects of mental stress on vascular function include impaired flow-mediated dilation, increased arterial stiffness, and exaggerated blood pressure responses [17]. These acute changes can precipitate clinical events in individuals with atherosclerotic by triggering plaque rupture or coronary vasospasm. Therefore, mental stress serves as a trigger in patients with established coronary artery disease rather than as a primary causative factor in those with healthy vasculature [3].

Overall, repeated or exaggerated cardiovascular responses to psychological stress, such as increased heart rate, blood pressure, and vascular resistance, contribute to long-term structural and

functional cardiac changes [18-19]. This phenomenon, termed cardiovascular reactivity, represents a characteristic pattern of physiological response to stressors and consistently associated with future cardiovascular disease risk.Individuals with exaggerated stress responses experience cumulative hemodynamic strain that accelerates vascular aging and promotes left ventricular hypertrophy [20]. Experimental evidences demonstrates that chronic stress upregulates cardiac hypertrophy markers and increases heart mass in aged animals, indicating persistent structural effects that extend beyond the acute stress period [6]. Large-scale prospective studies have also quantified the dose-dependent relationship between psychological distress and cardiovascular events, demonstrating that high levels of distress are associated with 18-44% increased risk of myocardial infarction and stroke, with variations by sex and age [21]. Therefore, this review synthesizes current evidence on the differential effects of psychological stress on cardiac health across the lifespan, with particular emphasis on physiological mechanisms, age-specific clinical outcomes, and the modifying roles of comorbid conditions.

AGE-SPECIFIC EFFECTS OF STRESS ON CARDIAC HEALTH

Evidences indicate that the effects of stress on cardiac health in adolescents and young adults remain relatively limited compared to older age groups. However, emerging evidence suggests that early-life stress exposure and psychological traits established during youth may have long-term cardiovascular implications [22- 23]. Psychological characteristics such as optimism and hostility often crystallize during adolescence and young adulthood, appear to influence autonomic function, and may track cardiovascular risk across the lifespan, Figure 2 [24]. Studies have hypothesized that these characters affect HRV patterns and long-term coronary heart disease risk. However, age-related effects specific to adolescent and young adult populations are not yet well-established in the literature. The cardiovascular system in younger individuals typically demonstrates robust reserve capacity and efficient recovery from acute stress [25]. However, the establishment of maladaptive stress-response patterns during this developmental period may accelerate cardiovascular aging. Middle adulthood represents a critical period during which the cumulative effects of chronic stress begin to manifest as clinical cardiovascular disease, particularly in individuals with an underlying atherosclerotic burden [26-27]. This age group exhibits pronounced cardiovascular reactivity to stress, characterized by increases in blood pressure and heart rate that can trigger acute events in the presence of vulnerable coronary plaques.

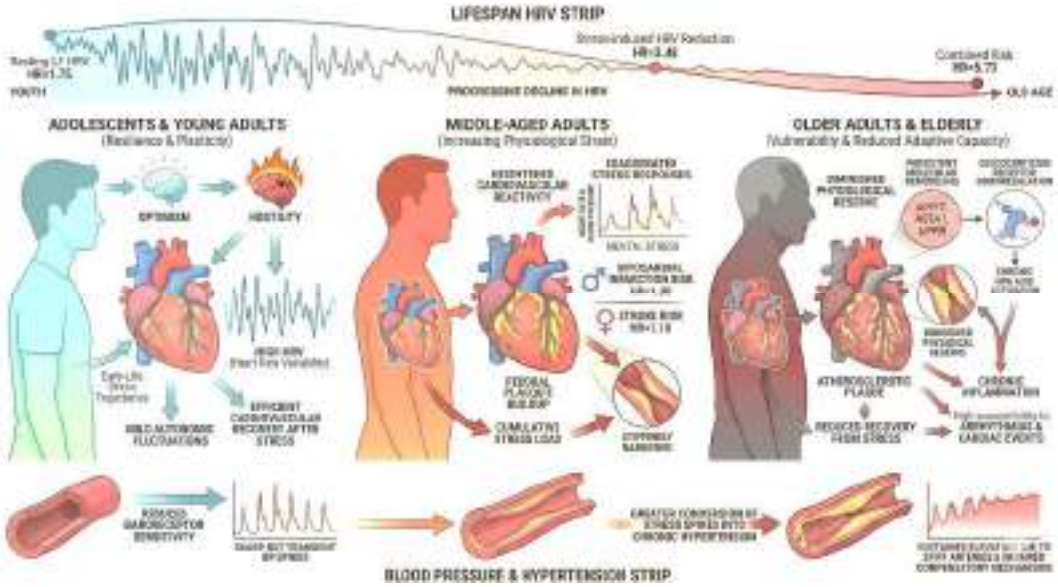


Figure 2. Age-associated effects of stress on Cardiac Health

Large-scale prospective studies have quantified the cardiovascular risks associated with psychological distress in middle-aged populations. In the 45 and Up Study cohort of 221,677 adults aged 45 and older, high versus low psychological distress was associated with a 30%

increased risk of myocardial infarction in men aged 45-79 (HR = 1.30; 95% CI, 1.12-1.51) and an 18% increase in women (HR = 1.18; 95% CI, 0.99-1.42) during 4.7 years of follow-up [21]. Stroke risks were similarly raised 24% in men and 44% in women experiencing high distress. In middle-aged and old mice subjected to chronic restraint stress, researchers observed persistent upregulation of cardiac hypertrophy genes (MHY7, ACTA1, NPPB) and increased heart weight relative to controls, indicating durable structural consequences that are amplified by aging [9].

Additionally, aged hearts exhibited downregulated glucocorticoid receptor expression, suggesting that chronic stress induces glucocorticoid resistance, which may perpetuate maladaptive remodeling in older individuals [28]. The acute sympathetic responses to mental stress that raise blood pressure can precipitate ischemia and arrhythmias in vulnerable adults, particularly those with underlying coronary artery disease [3]. Aging increases these acute responses, which translate into clinical events because of a higher baseline atherosclerotic plaque burden and reduced compensatory capacity of the cardiovascular system. Chronic stress contributes to sustained blood pressure elevation through multiple mechanisms, including persistent sympathetic activation, HPA axis dysregulation, endothelial dysfunction, and altered renal sodium handling [29]. In older adults, these mechanisms operate against age-related vascular stiffening and reduced nitric oxide bioavailability, creating additive effects that accelerate the development and progression of hypertension.

Overall, chronic psychological stress initiates a tightly interlinked cardiovascular problem Figure 3. Persistent sympathetic overactivation elevates heart rate and blood pressure, precipitating electrical instability and heightening arrhythmia susceptibility. At the same time, concurrent parasympathetic withdrawal suppresses vagal tone, lowers HRV, and disrupts autonomic equilibrium, amplifying cardiac vulnerability. Repeated HPA axis stimulation sustains cortisol and catecholamine excess, promoting cardiomyocyte hypertrophy and structural remodeling. Stress-induced inflammatory mediators (IL-6, TNF-α, CRP) propagate systemic inflammation, destabilize endothelium, and accelerate plaque vulnerability [30]. Oxidative stress and diminished nitric oxide bioavailability impair vasodilation, driving vasoconstriction, arterial stiffness, and progressive atherosclerosis. Transient surges in blood pressure inflict microvascular injury and hasten vascular aging [31]. Hormonal disruption fosters insulin resistance and dyslipidemia, intensifying atherogenic burden, while heightened platelet reactivity increases thrombosis propensity. These processes converge into a maladaptive neurocardiac feedback loop in which chronic brain–heart stress signaling establishes autonomic dysregulation, perpetuating long-term cardiovascular risk.



Figure 3. Cardiovascular Dys-functioning

COMORBIDITIES AND MODIFYING FACTORS

Mood disorders including depression, anxiety, and related affective disturbances potently amplify cardiovascular risk by converging on the same biological axes activated by chronic psychological stress. Depression affects 20–40% of patients with established CVD and consistently predicts poorer outcomes and higher mortality, reflecting its mechanistic reach across autonomic imbalance, HPA axis dysregulation, systemic inflammation, endothelial injury, platelet hyperreactivity, and maladaptive health behaviors [32]. These disorders intensify stress-driven cardiovascular pathology by suppressing vagal tone, heightening sympathetic load, elevating cortisol, and driving CRP-mediated inflammatory cascades; in older adults, negative self-perceptions and psychological distress further escalate inflammatory markers that directly mediate heart disease and stroke [33].

Elderly populations, burdened with higher prevalence of both mood disorders and cardiovascular comorbidities, exhibit pronounced vulnerability to this synergistic stress–mood–cardiac axis. Sleep disturbances exert similarly ruthless physiological pressure: insomnia, sleep apnea, and fragmented sleep chronically activate the sympathetic and HPA systems, elevating blood pressure, heart rate, cortisol, and cytokines in a pattern indistinguishable from stress-induced cardiotoxicity. Age-related declines in sleep quality, combined with chronic stress and existing cardiovascular impairments, create a compounding risk profile in older adults. Socioeconomic disadvantage and weak social support further potentiate this cascade by heightening exposure to chronic stressors, constraining adaptive coping resources, degrading health behaviors, and directly dysregulating physiological stress systems [34]. In contrast, strong social networks exert demonstrable cardioprotective, stress-buffering effects and influence, especially critical in socially vulnerable elderly individuals. Lifestyle pathways complete this integrated risk architecture: stress fuels physical inactivity, poor diet, smoking, and alcohol misuse, while sustained unhealthy behaviors reciprocally intensify stress biology and accelerate cardiovascular decline. In contrast, regular physical activity and adherence to heart-healthy dietary patterns, such as the Mediterranean diet, dampen sympathetic activation, improve HRV, reduce inflammation, and deliver robust cardioprotection across all age groups. However, adapted regimens may be required for older adults. Collectively, mood disorders, sleep disruption, socioeconomic strain, weakened social support, and adverse lifestyle patterns interact with psychological stress through tightly coupled neuroendocrine, inflammatory, and behavioral mechanisms, producing a relentless, mutually reinforcing elevation in cardiovascular disease risk.

CONCLUSION:

Psychological stress is a major, modifiable driver of cardiovascular pathology, yet the translation of mechanistic insight into age-specific, evidence-based interventions remains critically underdeveloped. Stress perturbs autonomic balance, activates neuroendocrine and inflammatory pathways, degrades endothelial function, and destabilizes electrophysiological homeostasis, producing age-dependent vulnerability that ranges from heightened cardiovascular reactivity in younger adults to sustained hypertension, impaired cardiac reserve, and elevated mortality risk in older populations. Although existing modalities including CBT, MBSR, structured exercise, and mind–body interventions demonstrate consistent reductions in sympathetic activation, HRV suppression, CRP elevation, and maladaptive health behaviors, their true efficacy across the lifespan remains unquantified mainly due to the absence of rigorous age-stratified randomized trials and validated biomarkers of chronic stress exposure. Current practice is therefore driven by extrapolation rather than precision. To close this translational gap, stress assessment must be embedded into routine cardiovascular risk profiling, with targeted deployment of interventions tailored to the distinct physiological, psychological, and functional constraints of each age group. Advancing the field requires longitudinal lifespan cohorts, multi-omics mechanistic profiling, biomarker-anchored risk stratification, and scalable, technology-enabled interventions capable of delivering individualized stress modification at population scale. Only through such methodologically rigorous, mechanistically informed, and age-responsive research can stress management evolve from a peripheral adjunct to a core, evidence-based pillar of cardiovascular prevention and therapy.

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Chapter 4: Law & Governance

Technological Advancements & Their Legal Implications in E-Contracts: Towards a Smart Legal Framework

Arnav Bhardwaj

Abstract

The transition of contractual law from paper to digital form has altered not merely the medium of agreement but the entire legal philosophy of consent, offer, acceptance, and enforceability. As technology continues to embed itself into the architecture of commercial exchanges, e-contracts now represent both an opportunity and a challenge for legal systems seeking coherence with innovation. The study undertakes a legal examination of the manner in which emerging technologies, specifically blockchain, artificial intelligence, and automated smart contracts redefine the fundamental doctrines of contract law. The focus remains upon the reconciliation of traditional legal principles with technologically mediated processes of formation, execution, and dispute resolution.

The research applies a doctrinal and comparative methodology to assess how national and international instruments, such as the UNCITRAL Model Law on Electronic Commerce, the European Union's eIDAS Regulation, and India's Information Technology Act 2000, respond to the evolving digital environment. It argues that while these frameworks signify progress toward legal recognition of electronic contracting, they fall short of addressing issues of algorithmic liability, data integrity, and cyber-security. The paper proposes a calibrated model for a "smart legal framework" that integrates technological neutrality, transparency, and accountability into legislative interpretation. Through this synthesis, it seeks to contribute to the larger discourse on harmonizing innovation with the rule of law in the digital marketplace.

Keywords: E-Contracts, Smart Contracts, Artificial Intelligence, Blockchain, Cybersecurity, Data Protection, Legal Accountability, Digital Transactions, Technological Neutrality, Comparative Law

INTRODUCTION

The evolution of commerce in the digital era has redefined the manner in which individuals and entities engage in contractual relations. The emergence of electronic contracts, or e-contracts, marks a decisive shift from conventional written agreements to technologically driven exchanges that occur in a virtual environment. The law, being inherently conservative in its adaptation, has faced the challenge of reconciling traditional doctrines of contract formation with the realities of automation, algorithmic communication, and decentralized transaction systems.

At the heart of this development lies the principle of consent. Historically, contract law has rested upon the mutual manifestation of will be expressed through tangible communication. In the context of e-contracts, the manifestation of such consent is mediated by technology through clicks, digital signatures, biometric authentication, or even algorithmic confirmation. The legal question thus extends beyond the existence of consent to the authenticity, validity, and attribution of that consent when intermediated by machines.

The transformation is further amplified by the emergence of blockchain technology and smart contracts. Blockchain introduces an immutable ledger system capable of recording contractual performance in real time, while smart contracts execute predefined terms automatically without human involvement. These innovations promise efficiency and reliability but simultaneously disrupt foundational legal notions of offer, acceptance, and enforceability. The autonomy of code introduces uncertainty about liability in instances of malfunction, fraud, or algorithmic bias.

Legal systems across the world have attempted to address these challenges through varying legislative instruments. The UNCITRAL Model Law on Electronic Commerce (1996) provided the earliest international recognition of electronic transactions. The European Union's eIDAS Regulation (2014) and India's Information Technology Act (2000) later extended the scope of

legal recognition to digital signatures and authentication mechanisms. Despite these advancements, the frameworks remain limited in addressing questions of accountability in autonomous digital contracting, the jurisdictional complexities of decentralized systems, and the protection of personal data.

The present study is undertaken to examine these evolving intersections between technology and legal accountability within the field of electronic contracting. It seeks to identify the extent to which existing laws accommodate technological transformation and where gaps persist. By employing a doctrinal and comparative research methodology, the study analyses primary legal instruments, case laws, and academic commentaries from multiple jurisdictions. The objective is to propose a legal framework that harmonizes innovation with the foundational principles of contract law, ensuring fairness, transparency, and justice in the digital economy.

The paper is structured to first discuss the theoretical foundation of e-contracts and the technological transformations that influence them. It then analyses the global legal instruments governing electronic transactions, evaluates their adequacy, and identifies areas requiring reform. Finally, it advances recommendations for developing a "smart legal framework" capable of sustaining both innovation and the rule of law.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

The scholarship on electronic contracting represents one of the earliest intersections between law and information technology. Traditional contract law developed on the assumption of human negotiation, geographical proximity, and paper documentation. The digital environment disrupted these assumptions, compelling legal systems to reinterpret fundamental principles of formation and enforceability.

Early academic writings, such as those following the adoption of the UNCITRAL Model Law on Electronic Commerce (1996), emphasized that technology does not alter the essence of contractual obligations but merely modifies the mode of expression. This theory, often termed the principle of functional equivalence, became the foundation of electronic contracting. It suggests that an electronic record or signature must hold the same legal validity as a physical one, provided that reliability and consent can be established through technological means.

Subsequent research in comparative law explored how different jurisdictions applied this principle. In the European Union, the eIDAS Regulation (2014) created a harmonized legal framework for electronic identification and trust services, establishing a hierarchy of electronic signatures based on assurance levels. In contrast, Indian legislation through the Information Technology Act (2000) adopted a narrower approach by recognizing only digital signatures verified through licensed certifying authorities. This divergence illustrates how regulatory models balance technological neutrality with administrative control.

From a theoretical standpoint, scholars have debated whether technology merely assists contract execution or fundamentally transforms its nature. Legal theorists adopting a technological determinist perspective argue that digital systems impose new norms of interaction, reducing the scope of human intention and discretion. Others, grounded in legal positivism, maintain that law retains primacy, and technology functions only as an instrument of expression. The tension between these perspectives continues to inform judicial reasoning in disputes involving automated or algorithmic contracts.

The emergence of smart contracts on blockchain platforms expanded the theoretical debate. Scholars such as Szabo and subsequent commentators introduced the concept of "code as law," where contractual terms are self-executing and immutable once programmed. This development raised concerns regarding the role of intent, mistake, and equity—concepts central to traditional contract law but absent in automated logic. Jurisprudence has gradually recognized that such contracts, though technologically autonomous, remain subject to general principles of fairness, capacity, and legality.

Empirical studies in law and technology further reveal that issues of cybersecurity, privacy, and data integrity form the bedrock of trust in e-contracts. Without adequate legal safeguards, technological reliability cannot ensure enforceability. The European Court of Justice, in multiple rulings interpreting the General Data Protection Regulation (GDPR), reinforced the connection between personal data protection and valid digital consent. In the Indian context, judicial interpretation under Article 21 of the Constitution has extended privacy to the digital domain,

thereby strengthening the constitutional basis for secure electronic contracting.

Collectively, the literature demonstrates that while substantial progress has been made in codifying the validity of e-contracts, significant theoretical gaps persist. The law continues to lag behind technological evolution, particularly concerning artificial intelligence and decentralized decision-making systems. The absence of clear legislative recognition for algorithmic liability or AI-driven agency indicates a pressing need for reform. The theoretical foundation thus supports the central argument of this paper—that the legal framework must evolve from mere recognition of digital transactions to active regulation of technological autonomy within contracting processes.

ANALYSIS AND DISCUSSION

The digital environment has transformed contract formation from an act of human deliberation to an event capable of being initiated, verified, and executed by automated systems. The law, though adaptable, remains constrained by doctrines conceived for manual transactions. Understanding this transition requires analyzing each technological element that reshapes contractual behavior and examining its legal implications within existing frameworks.

Artificial Intelligence and Algorithmic Contracting

Artificial intelligence now mediates various phases of contracting from drafting and negotiation to execution and compliance. AI-driven systems analyze user preferences, predict terms, and even finalize agreements through algorithmic recommendations. The central question arises: can the intention of a machine be equated to the intention of a human agent?

In traditional doctrine, intention is inferred from acts and expressions attributable to a legal person. In algorithmic contracting, intention is embedded in code written to respond to predefined parameters. When AI systems interact autonomously, identifying the responsible party becomes complex. Liability may attach to the programmer, the deployer, or even the system's user, depending on control and foreseeability. Courts have not yet developed a consistent framework for such attribution. The issue parallels early debates on corporate personality, yet the distinction lies in the absence of consciousness or volition in AI. Legal reform must thus address attribution through clear statutory presumptions, placing accountability upon the party with ultimate control over algorithmic conduct.

Blockchain and Smart Contracts

Blockchain technology introduced a new architecture of trust. It functions as a decentralized ledger where transactions are recorded irreversibly across multiple nodes. Within this ecosystem, smart contracts execute automatically upon fulfillment of coded conditions, eliminating intermediaries. The efficiency of this system is evident, yet its rigidity challenges established doctrines of consent, mistake, and equity.

Smart contracts do not possess interpretive flexibility; once deployed, they perform irrespective of subsequent developments. Traditional contract law, however, allows for modification, rescission, or equitable relief in cases of mistake or impossibility. The absence of judicial oversight in automated execution can lead to outcomes contrary to fairness. Furthermore, disputes involving smart contracts present jurisdictional challenges, as the blockchain ledger operates beyond territorial boundaries. Determining the applicable law and forum for resolution requires a shift from territorial principles toward functional jurisdiction based on the place of performance or the governing code repository.

Regulatory responses remain nascent. Some jurisdictions, such as the United Kingdom, have issued legal statements recognizing the enforceability of smart contracts within existing law. Others, including India, have yet to codify their status formally. The Information Technology Act, 2000 provides recognition to electronic records and digital signatures but does not extend to autonomous self-executing agreements. This legal vacuum underscores the urgency of legislative modernization.

Cybersecurity, Data Protection, and Digital Integrity

The enforceability of e-contracts depends not only on consent and performance but also on the integrity of digital systems. Data breaches, unauthorized access, and tampering undermine contractual reliability. Legal frameworks such as the GDPR in the European Union and India's Digital Personal Data Protection Act, 2023 establish accountability for data controllers, yet their intersection with contract law remains underdeveloped.

An electronic agreement relies upon authentication technologies such as digital signatures and encryption. Where such mechanisms are compromised, the validity of consent itself is questioned. Courts have begun recognizing the link between data integrity and the validity of digital acts. The doctrine of informed consent, once confined to physical interactions, now extends to online platforms requiring transparency about data usage and algorithmic processing. The absence of uniform international standards for encryption and verification further complicates cross-border enforcement.

Jurisdictional and Enforcement Challenges

Electronic contracts operate in a space detached from geographical boundaries. A user in one country may interact with a server in another, while the blockchain node verifying the transaction may exist in a third. The determination of jurisdiction thus becomes a matter of significant complexity. Traditional rules based on the place of contract formation or performance often fail in digital contexts. The UNCITRAL Model Law on Electronic Commerce offers guidance by focusing on the place of establishment of the parties rather than the location of servers. However, the principle has not achieved universal adoption.

Enforcement mechanisms also face practical limitations. Remedies for breach in smart contracts may be self-executing, leaving little room for equitable redress. Where enforcement requires judicial intervention, courts must reconcile traditional evidentiary rules with blockchain-based proofs. The admissibility of digital ledgers and cryptographic evidence remains subject to procedural adaptation. Some jurisdictions have amended their evidence laws to accommodate digital records, while others continue to rely on paper-based verification.

Comparative Assessment and Doctrinal Implications

A comparative assessment reveals divergent regulatory philosophies. Western jurisdictions emphasize technological neutrality, ensuring that legal principles apply equally to digital and traditional forms. Asian and developing countries, including India, often adopt a compliance-based approach that privileges administrative control over innovation. This divergence affects cross-border enforceability and the global harmonization of electronic contracting norms.

Doctrinally, the transformation of contract law under technological influence demands re-evaluation of three pillars : consent, intention, and liability. Consent in e-contracts becomes a function of interaction rather than deliberate negotiation. Intention, when expressed through algorithms, loses its human origin but retains legal effect through attribution. Liability, fragmented across multiple stakeholders, requires statutory clarity. The challenge lies not in redefining these concepts but in interpreting them through the lens of technological agency.

COMPARATIVE LEGAL FRAMEWORK AND GLOBAL APPROACHES

The legal recognition of electronic contracting has followed different trajectories across jurisdictions, each reflecting distinct policy priorities and stages of technological development. A comparative understanding of these frameworks offers insight into the extent of global harmonization and the persisting structural gaps that hinder universal enforceability.

The UNCITRAL Model Law on Electronic Commerce (1996)

The UNCITRAL Model Law represents the earliest international effort to standardize the legal treatment of electronic transactions. Its foundational premise is that electronic communication should not be denied validity solely because of its digital form. The Model Law introduced the principle of functional equivalence, asserting that electronic messages and signatures could substitute paper-based instruments if they met reliability criteria.

This framework provided flexibility for domestic adaptation and emphasized technological neutrality, allowing nations to adopt it regardless of their digital maturity. It also recognized automated message systems as capable of forming contracts without human intervention, a principle that later became critical for legitimizing algorithmic and smart contracting. However, while the Model Law established general principles, it left operational details such as authentication standards, liability attribution, and evidentiary procedures to national discretion. This absence of uniform procedural mechanisms limits its contemporary relevance in addressing AI-driven contracting.

The European Union's eIDAS Regulation (2014)

The eIDAS Regulation advanced beyond the UNCITRAL framework by codifying a comprehensive legal regime for electronic identification and trust services. It categorizes electronic signatures into three

tiers : simple, advanced, and qualified, based on assurance levels and technical security. The Regulation ensures cross-border recognition of digital signatures across member states, thereby achieving a degree of harmonization absent in most regions.

From a doctrinal perspective, eIDAS embeds accountability by linking the reliability of digital signatures to certified service providers. It also extends to electronic seals, timestamps, and website authentication, ensuring integrity of data and source. This structure demonstrates a legislative preference for technological regulation integrated with market oversight. Yet, critics argue that its prescriptive nature risks obsolescence as newer technologies such as decentralized identity verification emerge. The Regulation's success, however, lies in its clear articulation of responsibilities and its alignment with the European Union's data protection framework, notably the GDPR, which reinforces informed consent and user autonomy.

The Indian Legal Framework under the Information Technology Act, 2000

India's Information Technology Act, 2000, read with its subsequent amendments, forms the cornerstone of electronic governance and digital transactions. Section 10-A of the Act recognizes contracts formed through electronic means as legally valid, provided the requirements of the Indian Contract Act, 1872 are satisfied. The Act further legitimizes digital signatures, restricting their validity to those issued by licensed certifying authorities under the supervision of the Controller of Certifying Authorities.

While this approach establishes procedural certainty, it also limits flexibility. The recognition of only one form of signature technology contrasts with the broader acceptance under eIDAS, creating compatibility issues in international transactions. Moreover, the Act remains silent on autonomous systems, algorithmic contracting, and blockchain-based agreements. The absence of express statutory recognition for smart contracts or AI-mediated consent leaves significant interpretive gaps. In practice, Indian courts have relied upon general contractual doctrines and evidentiary provisions under the Indian Evidence Act, 1872 to validate electronic records, demonstrating judicial adaptability but also legislative inertia.

Recent legislative developments, including the Digital Personal Data Protection Act, 2023, have enhanced the protection of personal data and user consent. However, these provisions address privacy rather than contractual enforceability. The challenge for India lies in extending this regulatory architecture to encompass technological agency and automated decision-making within contractual relations.

The United Kingdom and the Principle of Technological Neutrality

The United Kingdom Jurisdiction Taskforce (UKJT) published a legal statement in 2019 affirming that smart contracts can be legally binding under existing English law. The statement underscored those contractual principles : offer, acceptance, and intention to create legal relations—remain applicable irrespective of the medium. This approach reflects the doctrine of technological neutrality, where law evolves through interpretation rather than codification.

Such flexibility enables courts to adapt existing doctrines to emerging technologies without frequent statutory amendment. Nevertheless, it presupposes a high level of judicial expertise in understanding technical systems, which may not always be feasible across jurisdictions. The UK

model illustrates that legislative silence does not equate to legal absence; common law reasoning can often fill interpretive gaps more efficiently than rigid statutes.

Comparative Synthesis

The comparative assessment reveals a spectrum of regulatory philosophies.

- UNCITRAL provides a conceptual baseline emphasizing non-discrimination and functional equivalence.
- The European Union operationalizes these principles through detailed regulation and institutional oversight.
- India adopts a compliance-oriented structure prioritizing administrative control over technological adaptability.
- The United Kingdom relies on judicial flexibility rooted in common law evolution.

While these frameworks collectively advance the recognition of electronic contracting, none fully address the implications of artificial intelligence or decentralized technologies. The absence of uniform global standards for authentication, attribution, and dispute resolution continues to fragment legal certainty.

A globally harmonized legal order must integrate three guiding principles:

1. Technological Neutrality — ensuring that law governs function rather than form.
2. Accountability — imposing liability upon the party exercising effective control over automated systems.
3. Interoperability — promoting mutual recognition of electronic identification and signature systems across jurisdictions.

These principles provide a foundation for the model proposed later in this paper—a framework that reconciles innovation with the enduring objectives of contract law.

CHALLENGES, FINDINGS, AND RECOMMENDATIONS

The study's examination of existing statutes, technological processes, and judicial trends reveals that while electronic contracting has achieved formal recognition, substantive legal adaptation remains partial. The intersection of law and technology exposes conceptual, procedural, and institutional gaps that challenge the coherence of contract law in the digital age.

Key Challenges

Ambiguity in Legal Attribution and Liability

The foremost challenge lies in determining responsibility for acts performed by autonomous systems. In the traditional model, liability is based on intention, negligence, or breach attributable to identifiable parties. When decisions are executed by self-learning algorithms, attributing fault becomes complex. Existing doctrines of vicarious liability and agency law offer limited applicability, as they presuppose human oversight. Without explicit statutory guidance, courts may resort to inconsistent analogies, undermining predictability.

Absence of Uniform International Standards

The digital environment is inherently transnational, yet regulation remains fragmented. Nations follow distinct authentication protocols, certification authorities, and evidentiary norms. The absence of mutual recognition for electronic signatures and records complicates cross-border enforcement. This divergence erodes the efficiency gains that e-contracting promises and increases transaction costs for global commerce.

Technological Obsolescence of Legal Provisions

Legislation often trails technological progress. Statutes such as India's Information Technology Act, 2000, were conceived before the advent of blockchain and artificial intelligence. The static nature of these laws renders them insufficient to address emerging realities. Even advanced frameworks such as the EU's eIDAS risk obsolescence as decentralized identity systems evolve.

A lack of adaptive clauses or technology-neutral drafting contributes to regulatory inertia.

Cybersecurity and Data Integrity Risks

Reliability in e-contracting depends upon secure systems and verifiable data. Cyber intrusions, ransomware attacks, and data manipulation can invalidate electronic records. While data protection laws aim to safeguard personal information, they seldom address the contractual consequences of compromised systems. The absence of an integrated legal mechanism linking cybersecurity compliance with contractual validity leaves enforcement vulnerable.

Jurisdictional Conflicts and Enforcement Difficulties

Disputes involving parties in multiple jurisdictions highlight inconsistencies in determining applicable law and venue. The traditional connecting factors—place of offer, acceptance, or performance—lose relevance in decentralized environments. Blockchain-based transactions, existing simultaneously across nodes in various jurisdictions, defy territorial demarcation. This creates uncertainty about governing law, recognition of judgments, and enforceability of remedies.

FINDINGS

The doctrinal and comparative analysis undertaken in this study yields several critical findings:

1. Technological integration outpaces legal adaptation. Existing frameworks recognize electronic form but not technological autonomy.
2. Consent and intention remain central but redefined. In digital environments, consent transforms from a deliberate act to an interactive process facilitated by code and interface design.
3. Functional equivalence ensures formal validity but not substantive justice. Merely equating electronic signatures with physical ones overlooks issues of reliability, informed consent, and power asymmetry in automated interactions.
4. Regulatory diversity undermines harmonization. Different jurisdictions apply divergent standards, preventing the emergence of uniform international practice.
5. Accountability structures are inadequate. No clear mechanism exists to assign responsibility in AI-driven transactions, exposing participants to legal uncertainty.

Judicial interpretation fills legislative voids but inconsistently. Courts in common law systems have begun recognizing electronic records and smart contracts, yet without uniform reasoning, leading to variable precedents.

These findings underscore the necessity for a new legal architecture—one capable of integrating innovation while preserving foundational principles of fairness, consent, and enforceability.

RECOMMENDATIONS: TOWARDS A SMART LEGAL FRAMEWORK

The proposed Smart Legal Framework seeks to harmonize technological advancement with the enduring objectives of contract law. It is guided by three foundational principles: neutrality, accountability, and adaptability.

Principle of Technological Neutrality

Statutory language should focus on function rather than form. Laws must define rights and obligations independent of the medium through which transactions occur. This prevents obsolescence and allows the legal system to accommodate evolving technologies such as decentralized ledgers and artificial intelligence.

Principle of Accountability

A clear hierarchy of liability should be established based on effective control over automated systems. Programmers, deployers, and beneficiaries must each bear responsibility proportional to their influence on algorithmic outcomes. Legislation should create rebuttable presumptions of control, ensuring that victims of technological malfunction are not left without remedy.

Principle of Adaptive Legislation

Legislative frameworks should incorporate review mechanisms enabling periodic revision in response to technological change. This may be achieved through delegated rule-making or regulatory sandboxes allowing controlled experimentation before codification.

Harmonization through International Cooperation

States should work towards mutual recognition of electronic identification and signature systems. Adopting a uniform standard modeled on eIDAS but inclusive of decentralized technologies would enhance interoperability. A global convention under UNCITRAL or a similar body could institutionalize such harmonization.

Integration of Cybersecurity and Contract Law

Security compliance should be a statutory precondition for validity in electronic transactions. Legal presumptions of authenticity and consent must be contingent upon adherence to minimum encryption and data protection standards. This would link contractual enforceability directly with technological reliability.

Establishment of Specialized Digital Dispute Resolution Mechanisms

Given the complexity of digital transactions, conventional courts may lack the technical expertise necessary for effective adjudication. Specialized tribunals or online dispute resolution platforms equipped with technological expertise could expedite resolution and ensure consistency in digital contracting jurisprudence.

The proposed framework does not advocate for a wholesale replacement of existing contract law but rather for its augmentation through interpretive and legislative innovation. By embedding accountability and adaptability within the legal structure, states can ensure that technological progress remains anchored in justice and fairness.

CONCLUSION

The transformation of contract law in the digital era illustrates the enduring challenge of reconciling legal tradition with technological innovation. Electronic contracting began as a matter of convenience but has evolved into an independent field of legal inquiry encompassing complex issues of agency, consent, and accountability. The present research demonstrates that the essence of contract law: voluntariness, enforceability, and fairness remains constant, yet its practical application requires reinterpretation within a digital environment.

A close examination of international and domestic frameworks reveals that the law has largely succeeded in recognizing electronic form but not in accommodating technological autonomy. The UNCITRAL Model Law laid a conceptual foundation for equivalence between paper and electronic records; the eIDAS Regulation introduced operational certainty through structured authentication; and India's Information Technology Act, 2000, though pioneering within its context, remains confined to procedural formalities without addressing the substantive implications of automation. The global regulatory landscape, while convergent in principle, remains fragmented in implementation.

The study's doctrinal analysis confirms that legal adaptation must move beyond formal recognition towards substantive governance. Artificial intelligence, blockchain, and algorithmic contracting have expanded the boundaries of commercial interaction, but they have also displaced the human element traditionally central to legal interpretation. Questions of intention, mistake, and liability cannot be resolved solely through technological means; they demand normative guidance grounded in law.

The proposed Smart Legal Framework responds to this need by embedding technological neutrality, accountability, and adaptability within statutory and interpretive processes. It calls for uniform international standards, enhanced cybersecurity integration, and the development of specialized mechanisms for digital dispute resolution. This framework does not advocate for a parallel legal order but for the modernization of existing doctrines in harmony with technological realities.

The future of contract law depends upon its ability to sustain trust in an environment where

human and machine interactions coexist. Law must not trail innovation; it must shape it through principled foresight. The evolution of e-contracts is not merely a technical development but a constitutional moment in the philosophy of law where the values of autonomy, justice, and security must be redefined for the digital age. Through sustained reform and international cooperation, the digital marketplace can evolve into a legally coherent and ethically resilient space governed by both code and conscience.

Continuity of Vedic Legal Thought in Modern Hindu Personal Law

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Abstract

Vedas are the earliest sources of the Hindu Personal law and it lays down principles like Nyaya (Justice), yama (moral justice or restraints), niyam (positive duties or observance), Satya (truth). Later on, the ideas in the Vedas were expressed in Manusmriti and Yajnavalkya Smritis.

The Hindu Personal Law contains a deep reflection of the Vedic understanding of Dharma- which is a combination of moral, social and cosmic order. The Hindu laws have undergone transformation in various ways, but the core spirit remains deeply influenced by the Vedic foundations. Statutes like Hindu Succession Act, 1956; Hindu Adoption and Maintenance Act, 1956; Hindu Marriage Act, 1955 uphold the values of Vedas such as fairness, equality, duty, sanctity of relationships, moral responsibility etc.

The paper dives into the fact that the Hindu Laws are not departing from the Vedas, but continues the same traditions and practices. The continuation of the Vedic legal thought demonstrates how the valuable insights in the Vedas could be preserved in such a way that India could remain rooted and still be progressive at the same time.

Keywords: Dharma, Modern Personal Hindu Law, Codification, Vedas, Smritis

INTRODUCTION

Hindu Personal Law has been codified into the following legislations: Hindu Marriage Act, 1955; Hindu Adoption and Maintenance Act, 1956; Hindu Succession Act, 1956 and Hindu Minority and Guardianship Act, 1956. However, it is pertinent to note that the legislation has been derived from the ancient and modern sources. The roots of the Hindu Law touch down to Vedas.

The modern-day Hindu Law has been derived from two kinds of sources:

Ancient Sources: Shrutis; Smritis; Commentaries and Digests; Customs

Modern Sources: Legislation; Precedents and Customs

The word "Shrutis" has been derived from "shru" which means "what has been heard". Shrutis refer to the words uttered by the deities to sages which are pure and sacred in nature. The utterances have been laid down in Vedas and the Upanishads. Due to absence of written material in that era, the same words were disseminated by the sages to their families and disciples who carried it forward. The four types of Vedas are: Rigveda, Yajurveda, Atharveda and Samveda. Rigveda consists for 1028 hymns written in 10 Mandalas (books). Yajurveda consists of the procedures laid down for the performance of yajnas (sacred rituals) to maintain balance and harmony in nature. Samvedas consists of chants and songs used during rituals. Atharvaveda contains knowledge on subjects like mathematics, medicine, caste, profession etc.

The term "Smritis" mean "to remember". The Smritis contain the teachings of Vedas learned and interpreted by the sages. The Smritis contain the moral, social and legal rules found in the Vedas. The Smritis are considered to be the second most important source of law after Shrutis as they contain the duties, laws, ethics and customs of the individuals in the society. Smritis have been divided into two categories: Dharamshastras written in poetic forms between 200 BCE to 500 CE and Dharamsutras written in prose forms between 600 and 200 BCE. Many people have written the Smritis, however the most prominent ones are written by Yajnavalkya such as Manusmriti, Atri, Vishnu, etc. The most important principles laid down in the Smritis are Aachar (morality), Vyavahara (to settle disputes between the subjects by the King or State) and Prayschit (penance for wrongdoings).

Commentaries were written down to explain and simplify the Smritis which could be understood by the people in the society. It also helped in removing doubts and contradictions present in the text. Some important commentaries were written down like Mitakshara by Vijneshawara and Dayabhaga

by Jimutvihana.

Customs refer to long-established practices or traditions followed by the people which are binding in nature. “Customs are transcendent law”. Customs are very important source of Hindu Law. All customs do not gain legal recognition. As per Section 3(a) of the Hindu Marriage Act, 1955. A custom can be recognized as law only if it has all the essential elements such as antiquity, continuity, certainty, reasonableness, and conforms with the laws. The customs must not be against the public policy and morality. The written texts of law can be outweighed by the customs if they are proven in the court of law.

VEDIC INSIGHTS IN HINDU MARRIAGE

Vedas, Kautilya’s, Marriage was considered to be a sacrament under the Hindu Vedas. It was an indissoluble union which was performed by some rituals and ceremonies that lasted for seven lifetimes. Hindus believe that marriages are destined in heaven and are solemnized on earth with cultural and religious ceremonies by chanting the Vedic Mantras and following rituals to attain Moksha. Marriage is considered to be the most intimate association, with the main aim of procreation of children to continue the lineage for emotional and spiritual support that also guarantees survivorship. The four Vedas contain the rituals, duties and spiritual significance of marriage in details.

THE VEDAS DESCRIBES THE PURPOSE OF MARRIAGE

Religious Duties (Dharma)- to continue the lineage of the family.

Procreation of Children (Praja)- to ensure the continuity of Gotra and have children.

Companionship (Sahadharma)- Husband and wife are considered to be equal partners for life

Spiritual Growth (Moksha)- Husband and wife support each other in moral, religious and spiritual growth.

Some rituals such as Kanyadan, wherein a daughter is given to the groom by her father; Saptpadi, where the parties take 7 pheras around the sacred fire and Mangalsutra/ Sindoor are put on the wife after the ceremonies are over, still find a place in the modern-day Hindu marriages. As per Section 7 of the Hindu Marriage Act, 1955, a marriage is considered to be a valid one only if it has been performed by proper customs, rites and ceremonies. Also, if Saptpadi is followed as a custom in a family, then a marriage can be solemnized only after the completion of the seven pheras. The Hindu Marriage will have no legal validity if these customs are not followed.

The ancient texts suggest that the marriage is an indissoluble union and it could not come to an end. Manusmriti strictly prohibited separation between husband and wife after marriage. Manu said:

“Let mutual fidelity continue till death; this may be considered the highest dharma for husband and wife.” (Manusmriti, 9:101)

Though the Vedas did not recognize the concept of divorce explicitly, but we can see a glimpse of the same in Narada Smriti, Parashara Smriti and Yajnavalkya Smriti. In these later Smritis and commentaries, a Hindu women could choose to remarry in certain cases like impotency of the husband or he becomes an Ascetic, if the husband goes to abroad and does not return, or if he neglects the wife, if the husband is missing for a long period of time, if he expelled from his caste and if the husband is dead. Due to various social reforms, divorce was introduced in the modern Hindu Law and the grounds of divorce have been laid down under Section 13 of the Hindu Marriage Act, 1955.

The concept of Restitution of Conjugal Rights codified under Section 9 of the Hindu Marriage Act, 1955 is also deeply rooted in the Dharmas, customs, and religious norms which is connected with Indian Knowledge System. The concept of Restitution of Conjugal Rights states that if the spouse has withdrawn from the society of the other spouse, then a petition can be filed in the Court to provide remedy to the aggrieved person to make the other party perform marital obligations.

VEDIC INSIGHTS IN PROVIDING MAINTENANCE TO WIFE AND CHILDREN

The concept of maintenance can be traced in the Vedas and Dharmic philosophy. A duty has been cast upon the husband and father to maintain his wife and children as per the Vedas, Smritis and Dharamshastras. Rigveda and Atharveda holds the family as the nucleus of the society. In Manusmriti, it has been mentioned that it is the duty of the husband to maintain and support his wife, and also to maintain his children till they are independent. The husband cannot abandon the wife or

discontinue to maintain her even if she is guilty of any matrimonial offence. Yajnavalkya Smriti also states that it is the duty of the husband or father to maintain his aged parents, chaste wife and minor children.

The Hindu Adoption and Maintenance Act, 1956 lays down the provisions for the maintenance of wife and children. Section 18 lays down certain conditions under which a husband is bound to maintain the wife even if she is living separately such as cruelty by husband; another wife living; conversion of the husband to another religion; desertion; keeping a concubine; and any other justified reason for the wife living separately. Section 24 and 25 of the The Hindu Marriage Act, 1955 also lays down provisions for maintenance of wife during the pendency of the proceedings and after the case has been disposed of. Section 20 of the HAMA, 1956 also states that a father is bound to maintain his legitimate or illegitimate children till the time the child is a minor.

VEDIC INSIGHTS IN ADOPTION OF CHILD

Adoption was recognized in the Hindu Laws from a very long time. Under the ancient Hindu Law, only sons could be adopted and daughters could not be adopted. In Vedas, it was considered that every family must have a son to continue the lineage in the family and performing the spiritual rites and ceremonies. It was considered that a son is needed to perform the pinda-daan, funeral pyre, and helping the soul of deceased ancestors in reaching heaven. There is a mention of adopted sons in the Manusmriti where 12 types of sons (biological and non-biological) have been mentioned. As per Yajnavalkya Smriti, a son can be adopted if a couple does not have a natural born son. It also mentions the rules of datta (giving) and homan (taking) of the adopted son with chants and ceremonies. As per Narada Smriti and Vishnu Smriti, once the adoption is completed, it is considered to be final and binding. The child ceases to be a part of the original family and he now becomes a part of the adoptive family. Under the Hindu Adoption and Maintenance Act, 1956 the adaptation of these Smritis can be seen. Under Section 6, the Hindus can adopt a child (son or daughter). Section 11 of the Act provides the conditions for valid adoption. It states that Dattahoman is not an essential ceremony. However, till date, the ceremony for giving and taking is followed in the Hindu families. Section 12 states that an adopted child severs his ties from the natural family and he/she ceases to be a part of the natural family. The child is transferred in the adoptive family, however, the ties with natural family will still affect the following:

The adopted child cannot marry anyone in the natural family.

If the adopted child has a property vested in his/her name, the same continues to be vested in the child's name after adoption, and if any obligations are attached to the same, the same shall continue. An adopted child cannot take away property rights that has been already vested in others name.

VEDIC INSIGHTS IN PROPERTY DISTRIBUTION

Property held great importance in the socio-economic structure of ancient Hindu society. Texts such as the Manusmriti and the Dharmashastras laid down detailed rules regarding inheritance, partition, and liabilities. The male descendants of a Hindu joint family were traditionally given preference in succession over daughters, in order to preserve the family lineage and continuity, a concept rooted in the principle of Putrasantana (the continuation of the male line through sons).

The Mitakshara school of Hindu Law is applicable in all parts of India except Assam and West Bengal. The school has given vested rights in the ancestral property to a son by following coparcenary system based on survivorship. Under the Mitakshara School, the son inherits the right to property the moment he is born. The Mitakshara school gives limited rights to women in property. In Dayabhaga School, the sons do not get the right in the property by birth, but they acquire an interest in the property only after the death of the father. Women were entitled to share in ancestral property under the Dayabhaga law through the doctrine of representation.

The Rigveda refers to property in the form of land, cattle and wealth. As per the Vedas, the ownership of the property lies with the male members of the family. The family (Kula or Gotra) was the central unit, and property ensured continuity of lineage and sustenance of dependents. The eldest male member of the family acts as the Karta (head) of the family and he takes all important decisions related to property, marriage of the members, management of joint business, maintenance of the members etc. The eldest son leads the family; however, the other sons also receive a share. As per Manusmriti, the eldest son inherits the preference share in the property (additional share) and other

sons receive a fair share in the property. The wife did not have a right to inherit the property, but she had the right to maintenance and Stridhan. Yajnavalkya Smriti redefined the rules related to women in property distribution. It laid down the concept of Stridhan in a more organized way wherein the women were the sole owners of their property received during the time of the marriage. It was considered to be her absolute property and was considered to be independent from the husband. The rules related to partition and inheritance were also mentioned with respect to the widows, daughters and sons in detail.

The modern Hindu Succession Act, 1956 also reflect upon the principles given in the Vedas. Section 8-10 of the Act deals with the rules related to succession in the case of males. If a Hindu male dies intestate, the property shall devolve upon Class I heirs, Class II heirs, Agnates and Cognates. It has emphasized the equal distribution of the property amongst the sons. Section 14 of the Act deals with the ownership rights of the women. The word "stridhan" is derived from the

Sanskrit words- "Stri" and "Dhan", meaning woman's property. The concept of Stridhan has been enshrined in the Act. A woman who receives any movable or immovable property from her relatives or any person in the form of cash, jewelry, valuables or other assets as a bride during the time of marriage will be considered to be her Stridhan. She is the absolute owner of this kind of property and no male will have any right, whatsoever in it. She has the right to dispose of this property as per her wishes. The concept of joint ownership (Kula Dharma) has been recognized under the Hindu Undivided Family and coparcenary system.

VEDIC INSIGHTS IN THE CONCEPT OF GUARDIANSHIP

In the concept of Dharma, the concept of guardianship (Palakatva) is given. The moral and spiritual duty of elders and parents to protect, nurture and guide children is rooted in the Vedic concept of Dharma. Children were regarded as "putra" (savior of ancestors) and "daiva sampatti" (divine wealth), and their care was a sacred obligation. The text of Manusmriti states that is the duty of the father to maintain the children and educate them until they are capable of supporting themselves. It emphasizes that a father who does not perform this duty commits Adharma. The Yajnavalkya Smriti recognizes the role of the mother as a guardian in the absence of father. It mentions that in the absence of the father, the mother will become the guardian of the child. Narada Smriti lays down that the property of the minor will be for the benefit of the child.

The Hindu Minority and Guardianship Act, 1956 enshrines the principles laid down in the earlier texts. Section 6 of the Act states that fathers are the natural guardians of the child, and after father, the mother will act as the guardian of the child. Section 13 of the Act lays down that welfare of the child is of paramount consideration. It is required that the guardian must not act for personal benefit. A guardian has to act as a trustee of the property of the child, and not as owner of the property.

CONCLUSION

The evolution of Hindu Personal Law from its Vedic foundations to the modern statutes reveals a continuity of legal and moral philosophy. Vedic vision of law was not just a set of enforceable commands, but it was a set of comprehensive moral order (Dharma) which consists of ethical, spiritual and social duties that maintain harmony and peace in the life of the individuals. The modern laws on marriage, maintenance, guardianship, inheritance and adoption still resonate with the ideals mentioned in the Dharma.

The modern Hindu law contains the principles of equality and justice within the constitutional framework, but still upholds the principles laid down in Vedas, Smritis and Dharamshastras. The relationship between husband and wife. Children and society has been dealt in the ancient texts in a very comprehensive way, and it still finds a place in the modern statues.

In the Hindu Marriage Act, 1955, though the concept of marriage has been put close to that of a contract, yet, it retains the sacramental aspect of the marriage that echoes the Vedic notion of Samskara. Though marriage has become a dissoluble union in the texts of the statutes, but on the contrary, Family Courts Act, 1984 has lays emphasis on encouraging reconciliation in matters of marriage so that the essence of the marriage can be protected. The courts must enquire into the facts in detail when a divorce petition is filed in the courts, and if possible, reconciliation between must be the primary aim of the courts. Similarly, under the Hindu Minority and Guardianship Act, 1956 and Hindu Adoption and Maintenance Act, 1956 the ancient concept of putra dharma i.e. continuity of lineage and duty of care has been enshrined. With some advancements in the law, where now

equitable treatment has been given to the mother as the guardian and to adopt a child, the ancient principles have still been upheld. The Hindu Succession

Act, 1956 has reformed the rules of inheritance and rights of women as an absolute owner of the property which encompasses the Vedic principles of fairness and balance within the family unit.

The modern Personal Law is a living embodiment of Vedic legal thought reformulated through the prism of constitutionality morality and social justice.

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This paper is a humble effort to bridge India's ancient wisdom with its modern legal framework, and I owe its realization to all who inspired and guided me along the way.

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SEXUAL HARASSMENT AT WORKPLACE RELATED LAWS: A TOOTHLESS TIGER?

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Abstract

To overcome the deeply ingrained pedantic gender biases, the Prevention of Sexual Harassment at the Workplace law has been birthed through a combination of judicial activism, international persuasions, and legislative reform. The gendered imbalance at workplace witnessed a watershed moment in 1997 with the judgment in Vishaka and Others v. State of Rajasthan, wherein the Apex Court recognised that sexual harassment violated women's fundamental rights and declared that the state and employers cannot shy away from their responsibility to prevent and redress such misconduct.

This paper rediscovers the definition of sexual harassment with the development pre- and post-Vishakha timelines, and traces the evolution of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act), and highlights its salient features. Drawing on doctrinal and empirical methodology, the paper discusses celebrated case laws, empirical studies, and recent judicial observations. It critically examines the wide gap between the spirit of the Act and its implementation. It also ponders the application of the POSH Act across formal and informal workplaces, the functioning of ICC, and the impediments to reporting and the redressal of injustice. The study also highlights factors that constitute the socio-cultural dimensions shaping women's experiences of workplace harassment, studying the intersection between gender, class, and employment status. The discussion culminates suggesting remedies and safeguards which aptly optimize the effective implementation of the Act across the workplaces, irrespective of any social and economic barriers. The findings of this paper expose though the environment accepts POSH Act as a step to address workplace harassment, there still exist vacuum in firm compliance by institutions and gender inclusivity continues to demoralize its impact. The paper concludes that genuine workplace haven in India requires not only vigorous legal enforcement but also a transformative shift in organizational culture, policy commitment, and societal attitudes toward gender and power.

Keywords: women's rights, Sexual Harassment at the Workplace law, Vishakha, POSH Act, gender justice.

INTRODUCTION

WOMEN THROUGH AGES : Roles, Rights and Responsibilities.

यत्रनार्यस्तुपूज्यन्तेरमन्तेतत्रदेवताः।

"Where women are worshiped, their lives the Gods".

-Manusmriti verse 3.56

India is a country of thirty-three crore gods and goddesses; it is a country where Shiva manifests itself in Shakti and is found incomplete without it, which implies gender neutrality and any patriarchal favoritism. The Vedic India was a true example of gender neutral society wherein women enjoyed freedom, respect and symbolized power, insight, and virtue. They actively participated in religious rituals, education, and even philosophical debates with their male counterparts. Several important rituals like Yagnas, Homasseek participation of a female as indispensable, be it a wife or an unmarried daughter. Ancient texts like Rig Veda boast of rishikas and brahmavadinis, who composed hymns and immensely contributed to spiritual discourse. Women enjoyed greater autonomy in relation to their profession and in marriage, like swayamvars and gandharba vivaha, a woman could choose her own husband, even going against the wishes of her kith and kin. The Rig Veda and Upanishads mention several women sages and seers, notably Ghosha, Lopamudra, Gargi Vachaknavi, and Maitreyi (c. 7th century BCE), who actively participated in political activities like Sabha and Samithis.[1] During the Gupta period women could participate in administrative jobs, Prabhavatigupta, daughter of Chandra Gupta II of the Gupta Empire and the wife of Rudrasena II of the Vakataka dynasty, performed administrative duties in her kingdom. [2] In the states of Kashmir, Rajasthan, Orissa and Andhra instances of women of the upper classes extending their phase of activities beyond the domestic circle can be

seen. [3] The women in lower classes were the main workforce in their families as they engaged in agricultural farming and animal husbandry, being the primary source of livelihood. However, later during the later Vedic period, the status of women started declining, which further dwindled in the Medieval Period.[4]

ढोल, गंवार, शूद्र, पशुनारी।
सकलताड़नाकेअधिकारी।।

-Ramcharitamanas Chaupai number: 232 (Sundar Kand)

The unending debate on the interpretation of this couplet still resounds in the Indian society with some scholars asserting that the word "taadna" should be understood as "to care for" or "to look after," rather than "to beat." However, such assertion doesnot hold water against the fact that the status of women saw a rapid decline in Indian society festered with practices such as Sati, Johar, female infanticide, and the purdah system. The advent of Islamic rule in India furthered the movement of Indian Hindu women within the four corners of their houses in order to avoid lecherous gazes of foreign invaders. None of the Indian is unaware of the historical analects of Allauddin Khilji being besmirched at the first sight of unaware Rani Padmavati, resulting in her Johar alongwith sixteen Thousand women. In modern colonial India, figures such as Rani Kittur Chennamma, Rani Lakshmibai, Sarojini Naidu (the Nightingale of India), Annie Besant, Kasturba Gandhi, and Aruna Asaf Ali Indian played a vital role in awakening the common women to overcome traditional constraints and participate in the independence movement, thereby challenging established social norms. These heroes (used in a gender neutral manner) demonstrated unfettered valor, leadership, and nationalism setting a precedent for the ages to come. However, the overall contribution of the women remained abysmally lower as compared to their population. The handful of such imminent female leaders could overreach the societal shackles of patriarchy illiteracy and deep-rooted gender biases, as most of them belonged to a privileged class of society which facilitated their freedom of movement and thoughts. The folklore "Khoob ladi mardani wo to Jhansi wali Rani thi," though seemingly praises the valor of Rani Lakshmi Bai, ironically postulates the entrenched patriarchal belief that valor is a masculine trait. Nonetheless, through their sacrifice and determination during the National movement for independence, Indian women have demonstrated that the independence movement was not only a political struggle but also a catalyst for social change and gender equality in modern India. And whereas, in nutshell the role of the average Indian woman throughout historical odyssey, has largely been confined to domestic responsibilities, family care, and agricultural labor within the household.

Pre- Vishakha era

Due to rapid industrialization imposed and introduced by the British Empire during its rule in India, women's participation in the industrial sector saw a rapid boom. However, their presence was confined to small-scale industries, mainly in household setups with low-paying, subordinate, or informal jobs. Leadership and decision-making positions were largely dominated by men. Workplaces were usually their own houses or a community centre where they could assemble at their convenience for jobs like tailoring, sewing, making papads, or rolling tendu leaves. For instance, a time-use survey for India in 1998-99 found that although women contributed about 55% of the work time, they were concentrated in low skill, low pay, marginal jobs. The landmark report towards Equality (1974) by the Committee on the Status of Women in India has brought out that in rural areas the work participation rate of women had fallen from around 33 % in earlier census counts to about 16 % by 1971. Prior to the Vishakha judgment of 1997, both the employer and the women employees were unaware of their legal responsibilities and rights in the workplace leading to such instances either being unreported or resignation of women employees to their fate. Post-independence women made significant accomplishments in education and became active in business and politics; however it did not abate the instances of discrimination and harassment, in their unsafe workplaces leaving little or no recourse to justice. The legislature being a ignorant and meek spectator, instances of harassment were dealt with under general provisions of the Indian Penal Code (IPC), such as Section 354 (assault or criminal force to woman with intent to outrage woman's modesty) and Section 509 (word, gesture or act intended to insult the modesty of a woman). These provisions addressed the specific instances of physical violation of modesty

nevertheless were inadequate to deal with workplace specific nuances like non-physical or psychological harassment, abuse of power by superiors, demeaning dignity by sexual innuendos etc. This led to several shocking instances of workplace sexual harassment, both within and outside India. Indian society nurtures a victim-blaming culture, especially in cases involving women. Female victims instead of empathy are silenced with critical jibes of being frivolous, uncultured, modern etc while male dominance is prioritized, and women's credibility is questioned. This mindset shuns away the modicum of courage left in the victim to report abuse or seek justice. Societal norms and traditions perpetuate the expectation that women should be submissive or tolerate mistreatment to preserve family or community "honor." This mindset acts as a catalyst at the workplace resulting in the victim getting dropped out of the workforce or feeling compelled to tolerate harassment for monetary reasons. The percentage of women employed in various organised and unorganized sectors has seen a rapid growth showing resilience against all odds. With unprecedented courage the women workforce have shown considerable courage by speaking out and demanding what they deserve but denied. Feminist organizations, government initiatives, judicial interventions, feminist movements, legal aid and feminist luminaries have played an imperative role, though most remains unfathomed. These cumulative efforts have led to the present changes such as formulation and observance of Vishakha Guidelines (1997) and the Sexual Harassment of Women at Workplace Act (2013), ensuring a safer and more respectful working environment for women [5].

Post -Vishkha Era

The present contribution of women to the national GDP is around 18%. India primarily being an agricultural economy, women comprise 48% of the agricultural workforce while owning only 13% of the land. They comprise of around 20% of the manufacturing workforce and around 30% of the total workforce in the service sector as well. At present, 432 million women act as workforce, out of which 343 million are employed in the unorganized sector. India has the 3rd largest ecosystem in terms of Startups in the world, and 10% of them have been led by women founders. Also, research shows that ventures started by women are more sustainable in nature. In 2022, a survey among 250 Indian companies revealed that the share of women in the Chief Executive Officer or Managing Director roles has increased by55% which reflected significant growth in their role in driving the economy.[2] The workplace related issues gained legislative realization after the Vishakha framework came in the corpus of Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (hereinafter, the POSH Act, 2013). The Act has not only codified the principles laid down in Vishakha it has also amplified their extent and scope to encompass both the organized and unorganized sectors under its umbrella. Under Section 2(n), "sexual harassment" includes physical contact, advances, demands for sexual favour, sexually colored remarks, showing pornography, and any unwelcome conduct of a sexual nature that creates a hostile work environment. A key institutional innovation of the POSH Act is the Internal Complaints Committee (ICC) mandated under Section 4. Every workplace employing ten or more persons must constitute an ICC chaired by a senior woman employee, comprising at least two internal members and one external member from an NGO or association familiar with issues of sexual harassment. The ICC has powers equivalent to those of a civil court under Section 11(3) to summon witnesses and examine evidence, and may recommend disciplinary or corrective measures under Section 13. To ensure inclusivity, Local Complaints Committees (LCCs) are established under Section 6 at the district level to address complaints from workplaces with fewer than ten employees or where the employer is the respondent.

The Act imposes affirmative duties on employers under Section 19, including organizing awareness programs, displaying the company's sexual harassment policy, and assisting victims in pursuing criminal proceedings where appropriate.[6] Failure to comply with these requirements attracts penalties under Section 26, such as fines or even cancellation of business licenses. These provisions translate the Vishakha principles into enforceable institutional mechanisms, emphasizing prevention and accountability rather than mere punishment.

Judicial follow-ups have further reinforced the statutory framework. In Medha Kotwal Lele v Union of India (2013) 1 SCC 297, the Supreme Court reiterated the continuing relevance of the

Vishakha Guidelines and underscored the need for strict compliance with the POSH Act. Subsequent rulings have also broadened the definition of "workplace" to include virtual and remote workspaces, reflecting the realities of a digitized, globalized economy. [7]

In conclusion, the evolution of sexual harassment law in India from the judicially crafted Vishakha Guidelines to the codified POSH Act, 2013 illustrates a significant transition from judicial activism to statutory institutionalization. This legal trajectory embeds international human rights norms within India's constitutional framework, affirming that the right to work in safety and dignity is not merely an employment concern but a core element of gender justice and substantive equality. [8]

SEXUAL HARASSMENT AT THE WORKPLACE IN INDIA: STRUCTURAL CAUSES AND JUDICIAL CONTEXT

Patriarchal social structures and gendered power relations :

The role of women in any sector must be on touchstone of the deep rooted mindset of patriarchal autonomy that defines social and economic relations. The patriarchy symbolizes male dominance as a shield to normalize the insubordination of women and affording male authority both in the household and in professional settings, creating a foundation for gendered power imbalances. Women from a young age are taught to be servient to the male members in the house and to acquiesce to subordination, which lulls them into believing that such supremacy and their insubordination are typical and part of customs. As it is said that a woman as a daughter she is bound to follow her father, her husband being a wife and her son as a mother. In **Vishaka v. State of Rajasthan** (1997) a social worker who challenged the so called accepted cultural norms of child marriage in Rajasthan was brutally gang raped. The taboos of child marriage were defended under the garb of own religious customs and beliefs showcasing the deep settled evil of patriarchy and gender imbalance at its apex. The Supreme Court while expressing its deepest condolence acknowledged that sexual harassment is against equality and dignity granted under Articles 14, 15, and 21 of the Indian Constitution. This decision established the foundational **Vishaka Guidelines**, marking the first formal recognition of workplace sexual harassment as a human rights violation in India.

Power Asymmetry in Organizational Hierarchies

Sexual harassment often stems not from sexual attraction but from an abuse of hierarchical power (Fitzgerald, Swan, & Magley, 1997). Men being at a position to dominate throw their weight to solicit sexual compliance, leveraging women's professional aspirations or job security. The Supreme Court's in **Medha Kotwal Lele v. Union of India** (2013) [7] reaffirmed that institutional apathy and bureaucratic inertia exacerbate women's vulnerability. Despite having laid down founding stone for curbing sexual harassment at workplace, the Court observed that the compliance of same still remains a lip service and the POSH Act as mere piece of decoration on the Notice Boards of both public and private organizations. The problem is even more acute in India's informal economy, where over 80% of women work without formal contracts or grievance mechanisms (Human Rights Watch, 2020). Here, power asymmetry operates unchecked, leaving women exposed to coercion and exploitation without access to institutional redress.

Cultural Normalization of Harassment and Objectification

Cultural beliefs in Indian society downplay the harassment of women at workplace. Indian customs, culture, beliefs and the media frequently instill the idea in the minds of the population that patriarchy is the normalcy and while those who stand up to assert their rights are terms as feminist (in a wrong sense). The harassment of women at workplace is not constrained by her stature in society wherein a female officer of most reputed Indian Police Service gets slapped on her posterior at an official party by her superior officer. This instance shows that no matter what position a woman achieves, she can still fall prey to the menace of harassment. In **Rupan Deol Bajaj v. K.P.S. Gill** (1995), the Supreme Court held that such "it appears to us that the ultimate test for ascertaining whether modesty has been outraged is, is the action of the offender such as could be perceived as one which is capable of shocking the sense of decency of a woman. When the above test is applied in the present case, keeping in view the total fact situation, it cannot but

be held that the alleged act of Mr. Gill in slapping Mrs. Bajaj on her posterior amounted to `outraging of her modesty' for it was not only an affront to the normal sense of feminine decency but also an affront to the dignity of the lady - "sexual overtones". [9] This case highlights the societal permissiveness toward tangible exchanges between a female and her colleague at the workplace so as to be construed as sexual harassment and the evolving legal understanding of gendered harm.

Weak Institutional Mechanisms and Legal Compliance Gaps :

The **Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013**(**POSH Act)** provides a legal framework for redressal; its implementation remains contradictory to the spirit with which it was birthed. Vide the various instructions it has been made mandatory to constitute a ICC at every workplace where a women is employed and to sensitize the environment about same, many organizations have failed to compose Internal Complaints Committees (ICCs). The assembly of ICC is limited to occasional tea-party arrangements or triggering on case to case basis. In **Aureliano Fernandes v. State of Goa** (2023), the Supreme Court has reiterated that the failure to constitute ICCs constitutes a breach of statutory duty and undermines women's constitutional rights. Despite all such initiative the intention of the employer (both private and government) is still lacking and is flimsy exhibiting institutional apathy and resistance to gender accountability.[8]

Fear of Retaliation and Social Stigmatization :

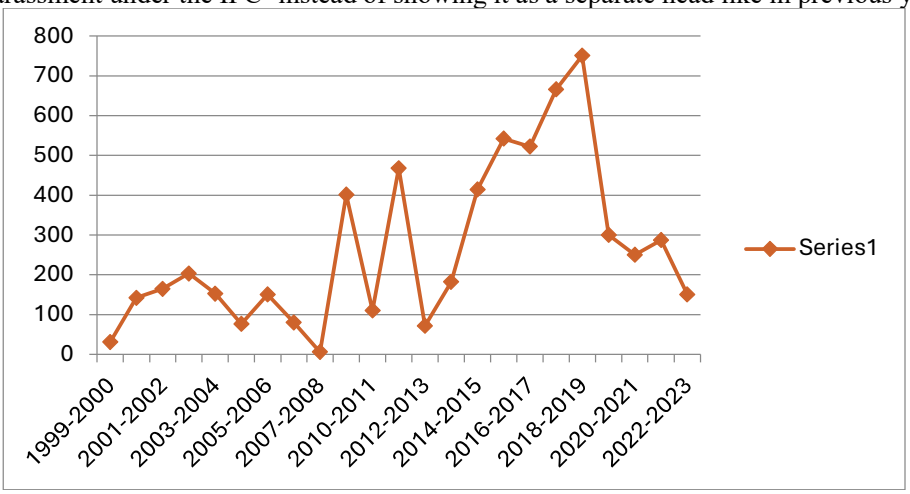
So, what does it take for a female worker to report and come out as a victim to Sexual harassment? The most enveloping deterrent to reporting is the fear of retaliation by the initiator who is mostly in a superior position to her and social stigmatization by her peer and family. Unlike men, a career oriented women has to constantly overcome the 'agni pariksha' of gender based servitude, motherly and familial constraints risking same for career stagnation, defamation, and professional isolation on venting out their injustices. The **State of Goa v. Tarun Tejpal** (2021) case, a high-profile journalist, exposed the intensity and gravity of psychological toll and reputational attacks that survivors face during litigation.[10]In 2017 the **#MeToo movement** wild-fired in India alongside the westernized society in order to empower the victims of Sexual Assault at workplace through empathy, solidarity and strength in numbers. The movement was supported by famous A list celebrities, illustrating sexual assault and harassment at workplace is rampant in all levels of society.[11] In M.J. Akbar v. Priya Ramani (2021), the victim faced defamation suits voicing her workplace nightmares, illustrating how gendered stigma, rather than legal inadequacy, silences victims and perpetuates a culture of impunity.[12]

The experiences of harassment shared by women workers in India reveal how intersectionality, male-dominated work cultures, weak legal enforcement, and persistent gender bias collectively give birth to inequality. Especially in cases of women workforce belonging to marginalized communities particularly Dalit, Adivasi, and migrant laborers, as they face augmented vulnerabilities factoring the caste, class, and gender nurturing the economic dependence. The Supreme Court in *National Campaign Committee for Central Legislation on Construction Labour v. Union of India* (2018) has commented upon the absence of safeguards in the unorganized sector leaving such women at mercy of their fates. [13] These challenges are intensified in institutions primarily dominated by men marginalizing women from informal networks, as recognized in *Dr. Punita K. Sodhi v. Union of India* (2010). [14] While judicial intervention coupled with legal frameworks have sensitized the women about their rights at workplace and encouraged them to not succumb to any unwelcomed gestures, the measures so taken still remain inadequate **(***Apparel Export Promotion Council v. A.K. Chopra* (1999). [6] The lack of appropriate redressal and social stigmatization serves as deterrence to victims from seeking justice. Even under modernity and globalization, the deep seated gender hierarchies persevere mocking at the falsity of promises of gender equality. Together, these dynamics expose the dark truth hidden behind the tall walls of institutions echoing the wailing of repressed female workforce.

FINDINGS

Here is the graphical representation of the complaints for Sexual Harassment at workplace received by the National Commission for Women for the years. The data is found compiled in the

Annual Reports published by NCW over the decades and is available on their website. The data collection under specific head of Sexual Harassment at workplace is first reflected in the year 1999 ie two years after the landmark judgment in Vishakha case. Further in the data of various years the nomenclature of Sexual Harassment at workplace is included under the head 'sexual Harassment under the IPC' instead of showing it as a separate head like in previous years.



*The graphical representation of data for Sexual Harassment at workplace as collected from the NCW website.

Considering the surge in employment of female workers the government has introduced an initiative called SHeBox an online complaint management system launched under the **Ministry of Women and Child Development (MWCD)** in **2017** with an objective to create a sound and stress free workplace for employed female population. It provides a single-window hassle-free and immediate platform for providing transparent, timely and effective resolution for sexual harassment at workplace complaints both in formal and informal sectors. On receipt of a complaint online the same is automatically forwarded to the concerned employer or district officer for taking action under the **Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013** (POSH Act). This portal also allows tracking of the complaints submitted by the complainants and know the status of their case electronically, thus creating a feeling of security and transparency in the redressal process. The complaint procedure is lucid and can be accessed by even non or semi-skilled women employees without any other intermediary body causing delayed redressal. However, it is felt that without institutional strengthening and digital literacy outreach, the potential of SHe-Box to democratize access to redressal remains only partially realized.

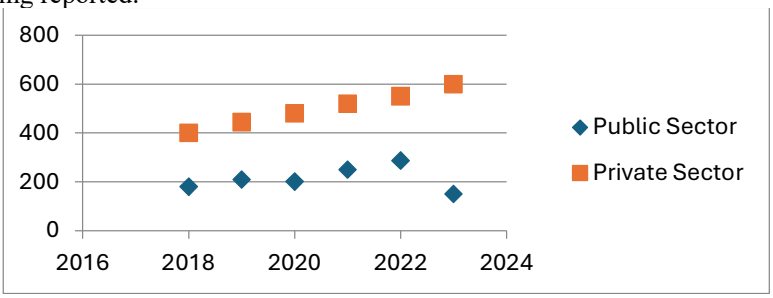
The data shared by the Institute of Company Secretaries of India reflects the situation of the women in corporate sectors, which also seems as bleak as compared to the rest of the public sector organizations. The number of cases, despite reluctance in reporting, has been surging and the role of ICC in resolving the same is found to be indispensable. This data table reports the number of cases received vis a vis their disposal by the organizational hierarchy.

Year	Number of cases of Sexual Harassment at Workplace received	Number of cases pending
FY16	798	54
FY17	980	102
FY18	1120	103
FY 19	1448	180
FY 20	1400	202

*The Institute of Company Secretaries of India, e-focus ICSI-WIRC e-Newsletter April – 2021.

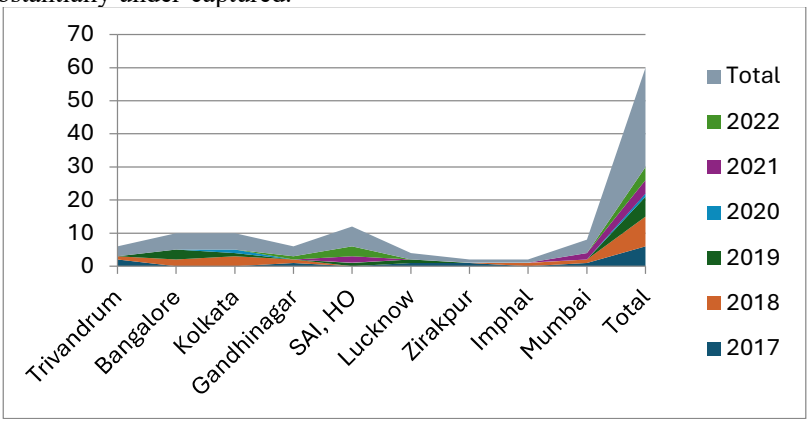
The situation in public sector seems more promising than the private sector, and it is observed that most of the cases are either resolved through internal compromises (as contained in Sec 10 of

the POSH Act) or are hushed up considering the reputation of the organization, and are rarely reported. In jobs in public sector are considered to be lucrative and the appointment and dismissal rues are stricter than the private sector, it may be one of the reasons for lesser number of cases being reported.



*Business Standard article quoting NCRB data. E-paper dated 07 Nov 2025.

In a comparative analysis of cases of Sexual Harassment at workplace in metropolitan cities in a study by NCW in Maharashtra it is revealed that roughly **20 percent** of working women in urban areas reported being victims of harassment, compared to **17 percent** in rural settings. [15] This type of trend is a result of differences in exposure to formal employment settings and by greater awareness of legal norms and rights by the women workforce in cities. For instance, an Oxfam-IMRB poll found that **17 percent** of working women (across metros such as Delhi, Mumbai, Bangalore, Kolkata, Chennai) reported sexual harassment, and awareness of the Supreme Court's Vishaka guidelines was higher in metro areas (24 percent) than in non-metro zones. [16] In a study by Society for Policy Research on Women, it is revealed that national crime data suggests that urban regions report a higher incidence of workplace-related harassment. [17] In sum, while incidence and reporting of workplace sexual harassment appear to be somewhat higher in metropolitan areas possibly due to greater institutional visibility and awareness persistent underreporting in both rural and urban India suggests that the true scale of the problem may be substantially under-captured.



*Data received in answer to question asked during RS_Session_257_AU_1439_A_and_B.

The graphical data shows a pattern that the cases of reporting of sexual harassment at workplace are more in metropolitan cities as compared to other places.

WAY FORWARD

Strengthening Implementation of the POSH Act, 2013

The POSH Act was enacted to contain the cases of sexual harassment at workplace, therefore prevention of these incidents can only be meted out by way of rigorous implementation of the *Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013*. The strengthening of POSH act provisions, sensitizing women about their rights and making them share their experiences in an informal setting, training the manpower in effective handling of such cases can help address the issues. These steps can help create a positive institutional environment

where the POSH Act functions as a living framework rather than a symbolic obligation.

Continuous Gender-Sensitization and Behavioral Training

The Indian populi is still patriarchal in their thinking and behavior and therefore the most important step towards addressing the sensitive issue of sexual harassment at workplace rests on Gender-sensitization programs. Making the workplace shed their deep seated mindset and welcome the gender neutral approach in their dealing are essential. This can be achieved by organizing workshops on gender sensitive issues, engaging the employees with routine meetings about real-life case studies, helping them in making ethical decisions and the involvement of the higher echelons in discussions on gendered power relations can certainly lead to more lasting behavioral transformation. Involving leadership in these programs signals institutional seriousness and significantly reduces tolerance for harassment (Menon & Bhasin, 2020).[18]

Accessible, Confidential, and Multi-Channel Reporting Mechanisms

The main problem to addressing the problem of sexual harassment at workplace is non-reporting of cases and their mishandling by the organization. To address this, organizations must provide multiple avenues for lodging complaints, each organization must contain an anonymous compliant submission mechanism, independent and fair officers, and multilingual reporting systems. The transparent and immediate resolution to such complaints can help people repose their faith in the mechanism and bring out their grievances.

Addressing the Vulnerabilities of Informal-Sector Workers

Most of the women workforce is engaged in informal sectors outside the formal organizational structure, without any access to information about their rights and how to avail them. For such type of workers regional committees should be established to address the problem at the grass-root level. Thereafter district level committees can be formed as primary legal safeguard. These committees as said above should be thoroughly and specifically trained to cater to the needs of the informal sector as compared to the educated workforce of the formal sectors. These committees should collaboration with regional women's organizations to ensure that the informal-sector workers receive meaningful access to justice.

Leadership Accountability and Zero-Tolerance Policy Frameworks

The success of anti-harassment frameworks depends primarily on the strict implementation of POSH laws and the strict attitude of the government and its agencies with a clear zero-tolerance policy. The senior management of corporate sectors should take keen interest in implementation and encourage women participation in same.

Protection against Retaliation and Secondary Victimization

As brought out in the paper supra, the main reason for not coming forth with the complaints is the pedantic victimization mentality, which serves as a backlash on poor woman who comes up with her grievance. The organization instead of adopting such backlash and discrimination policy should be more encouraging and tolerant. The identity of complainant should be kept anonymous so as to prevent any bias, judgmental stares from her colleagues. The organization should ensure psychological support services, job-security assurances, and safe-transfer options where necessary. Training IC members to avoid victim-blaming attitudes and follow trauma-informed inquiry processes is critical to preventing secondary victimization, which otherwise discourages victims from coming forward.

CONCLUSION

The evolution of workplace sexual harassment regulation in India has initiated a feministic revolution in India making the women workforce becoming aware of their rights and as a resolution to their decade old subjugation. With absence of formal legal protections to the development of progressive frameworks such as the *Vishakha Guidelines* and the subsequent enactment of the POSH Act, 2013, legislative and judicial odyssey shows the welcoming gesture of the patriarchal Indian society towards women's right to equality, safety, and dignity at work. In 2022, a survey among 250 Indian companies revealed that the share of women in the Chief Executive Officer or Managing Director roles has increased by 55% which reflects significant growth in their role in driving the economy. No matter how rosy this picture is portrayed the reality is still far from imagination and needs a strong thrust by way of formulating preventive strategies, continuous sensitization of the environment, transparent immediate and effective reporting mechanisms, so as to create a sound working environment. With increase in women

participation the workplaces have become more diverse complex and thus there is a need more proactive, ethically grounded prevention. Ultimately, the evolution of workplace safety norms illustrates that legal reform must work in tandem with sustained organizational commitment to cultivate environments where all individuals can participate without fear, coercion, or discrimination.

DECLARATION OF INTEREST

I hereby declare that there is no conflict of interest in the submitted manuscript.

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THE ETHICAL PATH TO POWER: DHARMA IN LEADERSHIP AND STATECRAFT

ABHA TYAGI

ABSTRACT

This research deals into the examination of ancient Indian political science, throwing light on the analysis of political ideals and Dharma within the governance principles of contemporary rulers. Good governance refers to task of running the government in an effective manner. Good governance has eight characteristics: Participation, Strategic vision, Rule of Law, Transperancy, Responsiveness, Consensus Orientation, Equity Building, Effectiveness and Efficiency, Accountability. The word Dharma has roots in the Sanskrit धृ which means to hold, to maintain or to preserve, and is related to the Latin word firmus (firm, stable). From this it takes the meaning of 'what is established or firm', and hence 'law'. The Sanskrit word Dharma is rendered as Dhamma in Prakrit and Pali. The word Dhamma refers to the Buddhist doctrine and is often interpreted to mean the 'teachings of the Buddha'. This doctrine, according to King Aśoka, was based on religious tolerance, respect for elders, and care for the old ones, kindness towards the needy; purity and truthfulness; and compassion for all sentient beings.The concept in Indian Statecraft, Diplomacy and polity of rulers being bound by dharma was that of ensuring good governance to people. Rajdharma was code of conduct that was superior to will of ruler and governed all his activities. Good governance as mentioned in ancient Indian scriptures in Sanskrit and Pāli like Bhagvad Geeta, Vedas, Mahabharata, Shantiparva, Nitisar, Ramayana, Arthashastra, Dīgha Nikāya, Jātaka Ancient political thinkers like Manu, Yagvalkavya, and Kautilya thoroughly discuss the incorporation of Dharma into political and administrative frameworks, providing explicit guidelines for royal duties. Dharma serves as a moral compass, restraining politically superiors from power misuse and guiding them towards right conduct. Despite the absence of stringent legal constraints, Dharma's ethical and moral principles gives more influence than constitutional ideals, shaping the behaviour of rulers. The concept of Rajdharma emerges, defining the duties of rulers and warriors. Guided by Dharma, the warrior's code of conduct encourages just warfare, discourages excessive violence, and emphasizes self-sacrifice for duty. The warrior class, involved in service of duty, follows path of Dharma to prevent obstacles during war, delineating ethical boundaries for rulers. The synthesis of political and ethical principles, underscored by Dharma, provides a framework for just and fair governance in ancient India.

Keywords: Rajdharma, ancient Indian political thinkers, Dharma, legal

INTRODUCTION

The rapidly evolving landscape of global business in the 21st century necessitates a shift from narrow, profit-centric models to holistic frameworks that harmonize economic growth with ethical integrity and social responsibility. Within this transformative milieu, **Indian Management Paradigms** emerge as a profound indigenous approach grounded in India's enduring philosophical traditions. It transcends being a mere regional adaptation of management science, representing instead a civilizational worldview that seamlessly integrates **moral consciousness (Dharma)** with **material prosperity (Artha)**.

By embedding Dharma into corporate strategy, this paradigm challenges the reductionist view of business as merely a profit-maximizing endeavor. Instead, it redefines business as a means for **Lokasaṅgraha** the collective welfare and upliftment of all stakeholders.

From the Bharatiya perspective, Dharma embodies the eternal principles of righteousness,

justice, and balance that guide every sphere of human and institutional conduct. When incorporated into corporate structures, Dharma elevates business decision-making from a purely transactional activity to a **moral and purposeful enterprise**.

Classical Indian texts such as **Kautilya's Arthashastra**, **Thiruvalluvar's Thirukkural**, and the **Bhagavad Gita** illuminate this integrative vision where leadership signifies stewardship, profit represents **Shubh Labh** (rightful and ethical gain), and competition is rooted in ethical excellence rather than domination.In contrast to Western models grounded in compliance-based ethics or utilitarian reasoning, **Bharatiya Management Thought (BMT)** emphasizes **intrinsic motivation** inspired by the principle of **Nishkāma Karma** selfless action performed without attachment to outcomes. It asserts that genuine organizational success arises from the harmonious integration of **wealth creation**, **justice**, **compassion**, and **ecological balance**. Consequently, a **Dharmic corporate framework** fosters economic growth that is firmly anchored in **ethical governance**, thereby ensuring long-term **sustainability**.

Corporate Governance through Manusmriti: Social Duty, Justice, and Hierarchical Responsibility

The *Manusmriti*, one of the earliest codifications of Hindu civil and moral law, is often misunderstood as a rigid social treatise. However, at its philosophical core, it presents a profoundly nuanced understanding of **duty, justice, and institutional order**. Composed between the 2nd century BCE and the 2nd century CE, the text defines **Dharma** not merely as ritual observance, but as the ethical and social force that sustains both society and governance.

For contemporary scholars of management and corporate governance, the *Manusmriti* offers a conceptual framework that resonates with the principles of **corporate constitutionality** and the **social contract**. Its focus on **Svadharma** the fulfillment of one's rightful duty aligns closely with modern notions of **professional accountability**. Every role within an organization, from leadership to labor, carries inherent responsibilities that uphold harmony and prevent ethical decay.

According to Manu, effective governance arises when **authority is guided by competence and moderated by self-restraint**. Leadership, in this vision, must uphold **Nyaya (justice)** as the central organizing principle of power, ensuring that decisions are driven by fairness and responsibility rather than personal gain.

This **Dharmic foundation** transforms hierarchical structures into ethical systems, replacing domination with moral purpose. In the *Manusmriti*, **justice** transcends punitive law it becomes a means of maintaining balance, equity, and societal welfare. The ruler, or leader, is thus envisioned as the **guardian of Dharma**, a trustee of moral order whose legitimacy depends upon just and compassionate governance.

Dharma Eva Hato Hanti, Dharmo Rakṣati Rakṣitaḥ

(Justice, blighted, blights; and justice, preserved, preserves; hence justice should never be destroyed, lest destroyed justice destroy us.)

In the corporate realm, **justice** manifests as **transparency, fairness in evaluation and reward, and equality before institutional law**. Manu's insistence that punishment be **proportionate and corrective** rather than purely punitive anticipates modern principles of **compliance ethics**, highlighting **rehabilitation over retribution**. This reflects an early vision of **restorative justice** within administrative and organizational systems.

Moreover, the *Manusmriti* upholds **consultation, deliberation, and self-restraint** as essential qualities of decision-makers virtues now regarded as cornerstones of **sound corporate governance**. Through its synthesis of **moral discipline and pragmatic regulation**, the text underscores that justice is both an **ethical imperative** and a **structural necessity** without which no system, whether a **kingdom or corporation**, can sustain itself.

Perhaps the most misunderstood yet profoundly valuable contribution of the *Manusmriti* to governance theory lies in its doctrine of **hierarchical responsibility**. The hierarchy envisioned by Manu is not one of **privilege**, but of **stewardship**, where **authority expands in direct proportion to accountability**. Each tier of administration bears **moral responsibility toward subordinates** and **ethical loyalty toward superiors**, creating a chain of **reciprocal duty** that maintains institutional harmony.

This vision aligns closely with modern concepts of **distributed leadership** and **ethical**

organizational culture. In Manu's framework, **leaders are not sovereigns but servants custodians of collective welfare** entrusted with upholding justice, order, and human dignity. His model anticipates the contemporary corporate principle of **"tone at the top,"** wherein the **moral integrity of leadership** shapes the ethical character of the entire organization.

Applied to the modern boardroom, the *Manusmriti* redefines hierarchy not as a mechanism of control, but as a **moral ecosystem of responsibility** that sustains trust, justice, and collective well-being.

Toward a Dharmic Business Paradigm: Building Sustainability, Compassion, and Ethical Profit Models

The contemporary business environment characterized by environmental degradation, widening social inequality, and a growing crisis of trust demands a fundamental reimagining of enterprise purpose. Incremental approaches such as CSR or ESG, while valuable, no longer suffice. The **Dharmic Business Paradigm**, grounded in the timeless principles of **Indian philosophical wisdom**, offers a transformative alternative.

This model redefines the aim of business from **shareholder wealth maximization** to the **holistic pursuit of sustainability, compassion, and ethical prosperity**, harmonizing the quest for **Artha (wealth)** with the guiding discipline of **Dharma (righteousness and universal order)**.

In this paradigm, **sustainability** is not a matter of external compliance but an **inherent moral obligation**. The ancient Vedic maxim *"Dharma rakṣati rakṣitaḥ"*—"Dharma protects those who uphold it"—highlights the reciprocal bond between humanity and the natural world. A business, as a microcosm of society, operates within this ecological and moral web. Exploitative or extractive practices violate this Dharma. Thus, environmentally responsible actions such as **resource conservation**, **waste minimization**, and **circular economy adoption** become non-negotiable aspects of ethical conduct. This **custodial approach to resources** not only preserves ecological balance but also ensures organizational longevity, advancing from superficial "greenwashing" to a genuine philosophy of **interdependence and stewardship**.

Equally central to the Dharmic model is **Karuna (compassion)**, which serves as a foundational operational principle rather than a peripheral human resources concern. Compassion manifests in **dignity-centered workplaces**, where employees experience fairness, psychological safety, and empathetic leadership. Beyond internal culture, Karuna extends outward to customers and communities—driving innovation that alleviates suffering and enhances collective well-being. By orienting business innovation toward solving authentic human challenges such as accessible healthcare, equitable education, and sustainable living organizations embody what C.K. Prahalad termed **"socially embedded innovation."** Compassion, thus, becomes a **strategic force** for loyalty, engagement, and meaningful progress.

The Dharmic paradigm does not reject profit; it **redefines** it. Profit is conceived as **ethical surplus** a legitimate and necessary outcome of creating authentic value for all stakeholders. It challenges the notion of maximizing profits through **cost externalization** or **exploitative practices**. Instead, profit arises through three interrelated principles:

Fair Value Exchange**:** Ensuring justice and transparency in all interactions with customers, employees, and suppliers.

Creating Shared Value**:** Designing business models that address societal needs while achieving financial sustainability.

Long-Term Orientation**:** Prioritizing enduring growth and institutional resilience over short-term speculative gains.H

In this vision, **profit becomes the "vital breath" (Prana)** of the enterprise—energizing its continued fulfillment of Dharmic purpose and enabling reinvestment in people, communities, and the planet. Through this synthesis of ethics and enterprise, the Dharmic Business Paradigm envisions an economy rooted not in exploitation, but in **equilibrium, empathy, and enduring value creation**.

DHARMA IN PRACTICE: INDIAN POLITY AND GOVERNANCE

In ancient India, *Dharma* functioned not only as a philosophical ideal but also as a foundational principle of governance. Kings were envisioned as *rajan dharmika*—rulers devoted to justice, ethical conduct, and the welfare of their people. During the Mauryan Empire (4th–2nd century

BCE), particularly under Emperor Ashoka,

The Mauryan Model:

Dharma was transformed into a structured system of ethical administration. Ashoka institutionalized moral governance through a network of officials responsible for upholding righteousness and public welfare. His famous edicts, engraved on pillars and rocks throughout the subcontinent, emphasized compassion, tolerance, and non-violence (*ahimsa*), while also addressing practical aspects of justice and statecraft. To ensure the moral integrity of governance, Ashoka appointed *Dhamma Mahamatras* (officers of morality) to promote ethical behavior, mediate conflicts, and safeguard the well-being of citizens and officials alike.

Bureaucratic Structure:

Classical texts such as the *Arthashastra* illustrate a highly organized and efficient administrative system.

Mantriparishad (Council of Ministers): Served as the king's advisory body, ensuring that state policies and strategies were aligned with *Dharma*.

Amatyas (High Officials): Appointed on the basis of competence, loyalty, and moral character, reflecting a meritocratic ethos.

Village Administration: Local governance was entrusted to headmen and councils, who managed routine affairs and dispensed justice through customary laws rooted in *Dharma*.

Even when pragmatic or coercive instruments—such as espionage or stringent tax collection—were employed, Kautilya justified them as integral to *raja dharma*, the sovereign's duty to protect the kingdom and secure its prosperity. While punitive measures existed, they were frequently balanced with provisions for restitution, underscoring a preference for restorative justice over purely retributive punishment.

CONCLUSION:

The integration of **Dharma** into corporate strategy marks a fundamental shift from profit-centric models to **purpose-driven enterprise**. This **Bharatiya management perspective** redefines **Artha (profit)** not as the ultimate objective, but as the natural outcome of **ethical, stakeholder-oriented operations**. When Dharma—encompassing sustainability, compassion, and duty—becomes the guiding principle of business, organizations cultivate **resilience**, **trust-based competitiveness**, and **long-term value creation**. Such a framework fosters **ethical profit (Shubh Labh)** and contributes meaningfully to societal welfare, demonstrating that **righteous conduct and commercial success** are not oppositional but mutually reinforcing foundations of enduring institutions.

Bharatiya Management Thought thus offers an alternative paradigm that harmonizes **material progress** with **moral purpose**. Grounded in Dharma, it transcends transactional leadership models to emphasize **integrity, inclusiveness, and self-regulation**. Classical Indian texts illuminate this vision: *Kautilya's Arthashastra* articulates principles of prudent governance and strategic wisdom; *Thirukkural* highlights compassion, fairness, and service as the essence of leadership; and the *Manusmriti*, despite interpretive debates, underscores accountability and duty-bound stewardship. Together, these works present a **holistic model of management** in which leaders act as **custodians of both resources and values**.

In a world fraught with ethical crises, environmental challenges, and widening inequities, these time-tested frameworks hold profound relevance. By aligning corporate objectives with **Dharmic ethos**, organizations can foster **sustainability**, **stakeholder trust**, and **long-term stability**. The integration of **Bharatiya principles** into modern management is not a cultural embellishment but a **moral imperative**—a means to restore equilibrium between **profit and purpose.**

As Bharat reclaims its **civilizational wisdom**, the confluence of **ancient ethical insight** and **contemporary corporate practice** can shape a **humane, sustainable, and globally competitive management model**, positioning India as a **thought leader** in the emerging **knowledge-driven world order**.

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ANCIENT AND CURRENT INDIAN LEGAL TRADITION IN CONTROLLING ENVIRONMENTAL POLLUTION

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Abstract

The people of ancient India held a profound appreciation for the natural environment and embraced it in every way possible. They thought that nature is holy and that protecting the Earth is both a moral and societal responsibility. The Vedas, which existed even in ancient times, provided legal and ethical frameworks for environmental protection. Vedic scriptures from Ancient India served as early environmental regulations, establishing standards and penalties for misuse of natural resources.

Modern India is extremely different, with major cities, industries, and technologies on the rise, and it may appear that nature is losing its importance. However, several environmental laws exist to protect the Earth from problems that have only grown since ancient times, like deforestation and pollution. Unfortunately, the issues have only gotten worse, raising questions about the enforcement of the laws.

This paper examines the environmental tradition during the Vedic period and the current laws to safeguard the environment. It explores the difference between ancient and modern approaches to protecting nature and revisits principles from early texts that can be applied to strengthen the current legal framework to lead to a more sustainable future.

Keywords: Vedas, Ancient India, Pollution, Legal Framework

INTRODUCTION:

India's commitment to environmental protection is firmly anchored in its ancient cultural and civilizational traditions, where nature was revered not merely as a resource but as a sacred entity. Ancient Indian texts such as the Vedas, Upanishads, Manusmriti, and Arthashastra conveyed ecological principles that emphasized respect for nature, balanced resource use, and ethical restraint. These values were later institutionalized through royal proclamations—most notably those of Emperor Ashoka—which advocated afforestation, animal protection, and sustainable management of natural resources.

In the modern era, India has developed a comprehensive legal framework to address environmental pollution, grounded in constitutional mandates and statutory enactments.

This paper examines the evolution of India's environmental legal tradition, tracing its roots from ancient ecological wisdom to contemporary regulatory systems. It seeks to analyze how historical norms have influenced modern jurisprudence, and how integrating traditional knowledge can enhance current efforts to contest against environmental degradation.

HISTORICAL BACKGROUND OF ENVIRONMENTAL LAWS IN INDIA:

Ancient India's environmental soul had strong, deep rooted philosophical, spiritual, and cultural traditions, which offered a holistic relationship between humans and Mother Nature. This is seen quite prominently in Vedic and Upanishadic ideologies, which revere nature as a divine entity.

For the people of ancient India, the environment was the very soul of their existence. They saw forests as temples, rivers as goddesses and the mountains as guardians. Earth was seen as a nurturing mother, the mother of all life, known by the names “Dharti Maa” and “Pachamama” as well. Nature coexisted with humans and was not to be exploited or diminished.

The existence of the concept of Pancha Bhoota (the five elements - Varuna (water), Vayu (wind), Surya (sun), Prithvi (earth), and Akasha (Space) emphasized the importance of environmental equilibrium in those days. The ancient teachings also emphasized that “What We Give, We Receive,” with the idea of karma extended to nature with the saying,“pollute the river, poison your soul”. The Puranas considered trees as “god” and even ancestors. Water was considered as life not a resource. Ancient farming, architecture, and lifestyle were inherently sustainable — zero waste, zero harm.

The Vedas, Upanishads, Arthasastra, Smritis, Puranas, and the environmental approaches seen during the Gupta rule/the medieval age provide many insights into the rich age-old wealth of environmental concepts of India, many of which are relevant in the modern world.

. THE VEDIC AGE – SACRED ECOLOGICAL SYMPHONY

In ancient India, Vedas were significant and played an important role in controlling the society. The Vedas are the first texts in the library of mankind. They are universally acknowledged to be the most precious Indian Heritage. Vedas were composed during the Vedic period which is from roughly 1500 BCE to 500 BCE, named after the composition of the vedas, a collection of sacred texts that are the primary source of information about Vedic age.

The oldest manifestation of environmental concern is the prithvisukta (Hymn to Earth) in Atharvaveda. It says “matabhumih putroham Prithviyah” which means “Earth is my mother, and I am her child”. It speaks in volume regarding allegiance of Vedic people towards nature. The expression conveys a deep concern for the environment by portraying people as little children with a responsibility to take care of their mother, the Earth. It serves as a reminder of our duty to preserve the earth and its resources and a plea for ecological balance. While the whole world is looking for the solution for pollution, centuries ago itself the Vedas have chalked a pathway for sustainable future.

VEDAS:

The Vedas contain four main texts: the Rigveda, Yajurveda, Samaveda, and Atharvaveda. These are the oldest Hindu texts, primarily composed of hymns, rituals, and philosophical teachings. The Vedas portray the universe not as a collection of separate entities, but as a woven tapestry of life. Every element — from the wind to the worm — is part of a cosmic rhythm. Nature is not a backdrop; it is a participant in the drama of existence. The environment is not “around” us — it is within us and through us.

At the heart of Vedic thought lies in Rta, the principle of universal order. Ṛta is the principle of cosmic order, a universal law that governs the universe, nature, and morality and even the flow of rivers. To live in harmony with Rta is to live sustainably. Environmental balance is not a choice — it is a duty to cosmic law. Human actions, therefore, were expected to align with this cosmic order to prevent ecological disruption.

Yajna, often misunderstood as ritual sacrifice, is actually a symbol of exchange. Humans offer grains, ghee, and chants to the fire — and in return, nature offers rain, fertility, and abundance. Some interpretations suggest that this ritualistic fumigation was an early form of air purification.

The Atharvaveda’s Prithvi Sukta describes Earth as a sentient being patient, nourishing, and sacred. It’s not just soil; it is soul. Devas (natural forces) and humans are seen as co-creators. Rain, sun, and wind are not just phenomena they are beings with purpose, deserving respect and ritual.

Rigveda: Nature is celebrated as a living hymn — rivers, winds, and dawn are invoked not just as forces but as divine beings. The Rigveda teaches that to praise nature is to participate in its rhythm. The Rigveda considers men and nature to be one and same, and consist of Pancha Bhoota. In essence, pollution control during the Rig Vedic period was not a separate policy but an integral part of a holistic

worldview based on reverence for nature. This understanding fostered a lifestyle that inherently protected the environment by discouraging excessive exploitation and promoting a reciprocal relationship between humans and their surroundings. A Verse From Rig- Veda Says, "Thousands and hundreds of years If you want to enjoy the fruits and happiness of life then take up systematic planting of trees."

Yajurveda: Through its detailed rituals, the Yajurveda emphasizes balance through offering — humans must give back to nature through sacred acts, symbolizing that sustainability begins with gratitude.

Yajur Veda 18.30 says: "Do not destroy the trees; for they are the abode of gods."

A direct call to preserve plant life.

Yajur Veda 17.67 says: "Let waters, plants, and trees be beneficial to us and we be beneficial to them." a call for mutual coexistence between humans and the environment. While the Yajurveda itself do not outline legal punishments, it emphasizes spiritual and karmic consequences for violating natural or moral laws (Rita).

Samaveda: This Veda transforms natural phenomena into melodic expressions, suggesting that harmony with nature is not just ethical, but musical — a symphony of wind, fire, and water.

Atharvaveda: It presents Earth as a nurturing and protective force, filled with medicinal plants and sacred soils. The Atharvaveda teaches that healing the Earth is inseparable from healing ourselves.

The key takeaway of the Vedas is the concept that nature is just not a "non- living being" and is to be treated as a "living being" and part of the ecosystem. The question we should ask is: can we promulgate a legislative and legal framework using this concept?

Several countries around the world have legally recognized nature, or specific natural entities, as having rights, often granting them legal personhood. This movement, known as environmental personhood or the rights of nature, reflects a shift from viewing nature as property to seeing it as a rights-bearing entity. Countries such as Ecuador, among others, have recognized certain rivers and other natural features as legal entities. While the concept of "rights of nature" comes from Indian Vedic roots, other countries were the first to adopt it, while India still lags behind.

KAUTILYA'S ARTHASASTRA

A deep study of the Arthasastra was done in this paper due to the unique concepts and advanced governance framework for the environment which was found in the treatise. It is a strategic eco-governance blueprint.

Arthasastra is an ancient Indian Sanskrit political-economic treatise which provides a framework for public administration and governance, with the King (monarchy) being the supreme head. The Arthasastra differs from other ancient works in two major ways:

- the level of detail of the governance, including environmental concepts, and
- it already incorporates the ancient concepts, as Kautilya refers to many of the ancient scholars and their concepts, thus making it a unique resource.

The Arthasastra is the first ancient work which promulgated the first legal provisions related to the environment, with systematic rules about the management of forests. It subdivided the lands into Ksetra (arable land), Castu (homestead land), Vraja (pasture land) and Vana (forest land). Forests (Vana) were further classified into productive forests (subdivided into elephant forests and forests for resources) and unproductive forests (subdivided into forests for wildlife, forests for recreation and forests for ascetics – used by hermits). The British rule likely drew inspiration from the Arthasastra forest classification and promulgated a similar system.

A superintendent of forests was appointed with clearly laid-down rules on:

- the appropriate and sustainable use of forest resources;
- methods to protect the forest, which include Deya (levy), Atyata (fines), and punishment for violators, such as cutting trees in non-productive forest areas interestingly, trees could not be cut even in urban areas;
- dedicated forests for "forest produce," which made governance easier; and the ruler (the king) was tasked with protecting the forest and adding new forest areas—the concept of afforestation was a rule, not a desire. This idea of making the head of the kingdom responsible for the environment is unique and shows the maturity of environmental

thinking during the Vedic times.

The Arthasastra also had a unique model in which agriculture and mining were the major backbones of the economy at the time, and Kautilya clearly preferred agriculture over mining, as he states: “Agriculture fills both the treasury and the granary, while mining fills only the treasury.” If fertile land was left uncultivated, it was confiscated or reassigned to others willing to cultivate. The Arthasastra emphasized eco-governance through:

- protection of forests and water bodies;
- sustainable farming practices; and
- ethical use of natural resources.

SMRITIS

The Smritis, is an ancient legal text codifying ecological ethics.The Manusmriti and the Yajnavalkya Smriti, emphasized non-violence towards nature, treating trees, rivers, and animals as sacred entities. They prescribed penalties for harming flora and fauna and promoted rituals aligned with seasonal and ecological rhythms. Environmental stewardship was embedded in Dharma, making ecological responsibility a moral obligation. According to Manusmriti, Pollution refers to the deterioration of five gross elements by unethical activities. The Manusmriti prescribed penalties for contaminating water bodies, outlined proper waste disposal practices, and encouraged the plantation of trees as acts of dharma (righteousness). One verse specifically states that cutting green trees would amount to killing, highlighting the sacred status accorded to vegetation.

PURANAS

The Puranas personified rivers, mountains, and forests as deities, embedding spiritual ecology into mythological storytelling. Sacred groves (Dev Bhumi) were preserved as divine habitats, promoting community-based conservation. Rituals like Vanmahotsava and tree planting were seen as acts of spiritual merit. The Varah Purana says, ”One who plants one Peepal, one Neem, one Bar, ten flowering plants or creepers, two pomegranates, two oranges and five mangos, does not go to hell.”

MAURYAN PERIOD

Mauryan period is a state-led ecological governanace especially under Emperor Ashoka. Kautilya’s Arthashastra, a foundational treatise on governance written during the Mauryan period, contains extensive provisions on environmental regulation which was discussed in detail above. Emperor Ashoka’s edicts promoted animal welfare, afforestation, and the creation of protected zones for wildlife. Forests were managed by officials like the Vanadhyaksha, and irrigation systems were expanded for sustainable agriculture.

GUPTA PERIOD :

The Gupta period (circa 320–550 CE), often hailed as India’s “Golden Age,” emphasized harmony between nature, society, and governance, though formal environmental laws were not codified like in the Mauryan era.

Literature such as Kalidasa’s works reflected deep reverence for nature, and temples were often surrounded by sacred groves. The environmental offenses was guided by Dharmashastra texts, such as the Yājñavalkya Smṛti, which outlined fines for damaging nature.

MEDIEVAL PERIOD:

While Mughal rulers built gardens, canals, and water systems, forests were often exploited for hunting and expansion. Some dynasties, like Vijayanagara, established protected wildlife zones and

regulated hunting seasons. Urban planning included rainwater harvesting and sanitation, but ecological degradation increased due to military campaigns.

BRITISH RULE (Colonial Era):

British period is a period of colonial exploitation and forest bureaucracy. While environmental laws existed during the British colonial period, they were primarily focused on resource exploitation and public nuisance control, rather than holistic conservation. The British institutionalized forest management for commercial extraction. Forests were cleared for railways, shipbuilding, and agriculture, often displacing indigenous communities. The British government took few initiatives to address specific environmental issues but was not very effective as environmental protection was not their priority and laws were minimal, fragmented, and poorly enforced. Environmental protection was not seen as a standalone issue. During the British colonial period in India, environmental concerns were overshadowed by economic and administrative interests.

POST INDEPENDENCE:

Post-independence environmental laws in India have undergone significant changes from the British period to the present day. It evolved significantly after the 1970s, driven by global influence, judicial activism, and growing public awareness. The legal framework shifted from fragmented colonial- era rules to comprehensive, enforceable legislation.

During early Years (1947–1970): Minimal Legal Framework was there and environmental concerns were addressed indirectly through public health and forest laws, but there was no dedicated legislation.

INDIA'S ENGAGEMENT WITH INTERNATIONAL TREATIES IN CONTROLLING POLLUTION

India has actively participated in several major international environmental treaties that serve as critical instruments in shaping its domestic pollution control strategies. These agreements—such as the Paris Agreement, Stockholm Convention, Basel Convention, and Minamata Convention—provide frameworks for legal alignment, technological cooperation, and global accountability. By ratifying and implementing these treaties, India demonstrates its commitment to sustainable development and environmental stewardship on the global stage.

Each treaty contributes uniquely to India's pollution control efforts. The Basel Convention and Stockholm Convention have directly influenced India's Environment Protection Act (1986) and its Hazardous Waste Management Rules, ensuring safe handling and disposal of toxic substances. India's participation in the United Nations Conference on the Human Environment (Stockholm, 1972) was pivotal and turning point . It led to the creation of the National Council for Environmental Policy and Planning, later it evolved into the Ministry of Environment and Forests (MoEF). The Paris Agreement, under the broader umbrella of the UN Framework Convention on Climate Change (UNFCCC), enables India to access climate finance and adopt clean technologies, supporting its transition to low-carbon development. Through these treaties, India also engages in monitoring and reporting obligations, regularly submitting data on emissions, biodiversity, and chemical usage, thereby enhancing transparency and compliance. The 1992 Rio Earth Summit marked a turning point in India's environmental governance, introducing global principles like sustainable development and Common but Differentiated Responsibilities (CBDR), which influenced India's pollution control policies and legal frameworks.

THE CONSTITUTION OF INDIA

The Constitution of India plays a key role in controlling pollution by giving both the government and citizens the responsibility to protect the environment. Article 48A of the Indian Constitution, introduced through the 42nd Amendment in 1976, is a Directive Principle of State Policy that obligates the State to protect and enhance the environment, including the preservation of forests and wildlife. It

places a constitutional responsibility on the government to work toward a pollution-free environment. Complementing this, Article 51A(g) imposes a corresponding duty on every citizen to safeguard and improve the natural environment.

The Supreme Court of India has interpreted the right to life under Article 21 of the Constitution to include the right to a clean and healthy environment. This interpretation has empowered the judiciary to intervene in cases of environmental degradation, compelling both public and private actors to take corrective measures. Citizens and organizations have actively utilized.

Public Interest Litigations (PILs) as a legal tool to address environmental concerns and hold authorities accountable. In alignment with constitutional provisions, the Indian government has enacted several key environmental laws, including the Water (Prevention and Control of Pollution) Act, 1974; the Air (Prevention and Control of Pollution) Act, 1981; and the Environment (Protection) Act, 1986. These laws are implemented and monitored by institutional bodies such as the Central and State Pollution Control Boards and the National Green Tribunal (NGT), which play a critical role in regulating pollution and enforcing environmental standards.

LEGAL FRAMEWORKS CONTROLLING POLLUTION IN INDIA DURING THE COLONIAL ERA:

WATER POLLUTION CONTROL ENACTMENTS:

Shore Nuisance Act(1853):

This is an early act to regulate waste discharge into coastal areas of Bombay and Kolkata. This act is now considered obsolete and current regulations for hazardous waste management are covered under Acts like the Water (Prevention and Control of Pollution) Act, 1974, and the Environment (Protection) Act, 1986.

Indian Penal Code(1860).

The Indian Penal Code (IPC) of 1860 has limited direct provisions for water pollution addressing fouling of public springs or reservoirs and introduced penalties for both intentionally fouling public water and for negligent acts that contaminated water.

However, the IPC's application is restricted in scope, particularly in addressing the large-scale pollution of rivers and streams.

Indian Fisheries Act(1897):

This Act indirectly addressed water pollution by prohibiting harmful fishing practices like poisoning water bodies by Imposing a penalty on anyone who contaminated water with the intent to catch or kill fish. But it was not a comprehensive water pollution prevention law.

AIR POLLUTION CONTROL ENACTMENTS:

Air pollution laws during Colonial-era legislation (until 1947)were often decentralised and flexible, addressing localised issues without establishing a common national policy.

Air pollution has plagued India since the 1900s. In Delhi, the first episode of ‘very dusty’ weather conditions was recorded during the summer months of May and June in 1952 and 1953. This was probably the first time when experiments such as cloud-seeding were first thought of.

Indian Penal Code (1860):

The Indian Penal Code (IPC) of 1860 addresses air pollution primarily through Section 278, which criminalizes making the atmosphere noxious to health. It’s applicable to localized pollution, such as

industrial emissions or burning waste near residential areas. Under Section 268, If air pollution causes widespread inconvenience or harm, it may be treated as a public nuisance. This allows for broader interpretation and enforcement. Section 290 imposes a minimal fine for public nuisance not otherwise punishable.

Bengal Smoke Nuisance Act (1905):

This was one of the first regional laws specifically tackling air pollution targeting smoke emissions from furnaces and fireplaces. It was a response to growing public health concerns and complaints about dense smoke from industrial furnaces, kilns, and domestic fireplaces. The Act empowered authorities to prohibit the erection or use of smoke-emitting furnaces or kilns in designated zones, demolish unauthorized furnaces and appoint inspectors to monitor emissions. It Imposes penalties on violators who exceeded permissible smoke levels.

The Act introduced technical thresholds for smoke emissions, although enforcement was basic. It paved way for forming Smoke Nuisance Commission, which could frame rules for permissible emissions and recommend zoning restrictions. Inspectors had the authority to enter premises, examine furnaces, and report violations.

This Act is the First formal recognition of air pollution as a public nuisance in Indian law. It laid the groundwork for Municipal smoke control regulations. Though limited in scope and enforcement, it marked a shift from infrastructure-focused laws (like the Oriental Gas Company Act of 1857) to environmental oversight. Under this Act, people could go to the local police and file a case against anyone who was indulging in a polluting activity, such as burning.

Bombay Smoke Nuisance Act (1912):

Modelled after the Bengal act, it addressed similar smoke-related issues in the Bombay Presidency. It was a landmark colonial-era law aimed at controlling industrial air pollution in the Bombay Presidency, making it one of India's earliest environmental regulations. It targeted coal smoke, which was prevalent due to industrialization, especially in textile mills and railways. While enforcement was limited by technology and administrative capacity, it set a precedent for environmental governance.

Indian Boilers Act (1923):

The Indian Boilers Act of 1923 was enacted to regulate the installation, operation, and inspection of steam boilers which were a source of industrial smoke and pollution. It indirectly contributed to pollution control by enforcing standards that reduced boiler-related emissions and accidents. It was introduced in response to frequent boiler explosions and unsafe practices in factories, especially in textile and jute mills. Any explosion or malfunction had to be reported, and inspectors could investigate and recommend penalties or shutdowns. It was amended several times, notably in 2007, to decentralize inspection powers to state governments and to introduce third- party inspection agencies.

Indian Petroleum Act (1934) and Motor Vehicles Act (1939):

These laws included provisions that indirectly addressed air pollution by regulating petroleum and vehicular emissions.

FOREST CONSERVATION ENACTMENTS:

Indian Forest Act of 1865:

The Imperial Forest Department, set up in 1864, attempted to establish British control over forests, by various legislations. It empowered the British government to declare any land covered with trees as a government forest and make rules to manage it. After the Forest Act was enacted in 1865, it was

amended twice (1878 and 1927).

Forest Conservation Act, 1878:

In 1878, the British government passed the Indian Forest Act, which aimed to assure a steady supply of lumber for the British Empire. This colonial-era ordinance classified forests into three categories: reserved, protected, and village forests. Its main purpose was to give the British administration control over wastelands, which included most forests, by allowing it to classify them and regulate local people's rights to forest produce, often with severe negative impacts on villagers. This act was later succeeded by the Indian Forest Act of 1927.

Indian Forest Act of 1927:

This Act impacted the life of forest-dependent communities. The penalties and procedures given in this Act aimed to extend the state's control over forests as well as diminishing the status of people's rights to forest use.

LEGAL FRAMEWORKS CONTROLLING POLLUTION IN INDIA AFTER INDEPENDENCE:

WATER POLLUTION CONTROL ENACTMENTS:

After Independence, India enacted several key laws to control water pollution, starting with the landmark Water (Prevention and Control of Pollution) Act of 1974. These laws established regulatory bodies, set pollution standards, and empowered authorities to take action against violators.

Water (Prevention and Control of Pollution) Act, 1974:

This is the first comprehensive law focused solely on water pollution in India. It controls water pollution by establishing Central and State Pollution Control Boards. It prohibits the discharge of pollutants above a set limit, and setting water quality standards. It mandates that industries get prior consent to establish and requires them to treat sewage and trade effluents before discharging them. The act also provides penalties, including fines and imprisonment, for those who violate its provisions. This Act applies to streams, rivers, lakes, and groundwater.

Environment (Protection) Act, 1986:

This Act was enacted in response to the Bhopal Gas Tragedy and to implement decisions from the Stockholm Conference (1972) and fill gaps left by earlier laws like the Water Act of 1974. It plays a crucial role in controlling water pollution in India by empowering the central government to set standards, regulate hazardous discharges, and enforce penalties against polluters. It serves as an umbrella legislation that complements and strengthens other pollution control laws.

Indian Port Act(1908):

Regulated the disposal of trash near ports to prevent water pollution and the creation of obstructions to navigation.

Factories Act, 1948 (Amended)

The Factories Act, 1948 does not directly regulate water pollution, but its provisions on waste disposal and effluent management—especially under Chapter III on Health—support basic environmental hygiene and industrial accountability. Though predating independence, amendments after 1970 included provisions for Wastewater treatment. Section 12 of the Act requires every factory to make effective arrangements for the treatment and disposal of waste and effluents to prevent environmental harm.

AIR POLLUTION CONTROL ENACTMENTS:

Environment (Protection) Act, 1986.

This Act provides a framework for the protection and improvement of the environment, through measures such as controlling air pollution by empowering the Central Government to set emission standards, regulate polluting industries and making it mandatory for industries to obtain

environmental clearance before starting operations. The act is considered as an umbrella legislation as it covers a wide range of environmental issues and provides a comprehensive framework for their resolution. The Environment Protection Act of 1986 is a staunch defender of India's environment, binding together legal provisions that are aligned with the country's commitment to sustainable and responsible development. The year 1981, the Air Prevention and Control of Pollution Act was introduced and it was a turning point for India as far as managing air pollution was concerned.

Bhopal Gas Tragedy:

On 3 December 1984, over 500,000 people in the vicinity of the Union Carbide India Limited pesticide plant in Bhopal, Madhya Pradesh, India were exposed to the highly toxic gas methyl isocyanate. It is considered the world's worst industrial disaster.

This Tragedy prompted the government to enact the Environment Protection Act in 1986.

FOREST CONSERVATION ENACTMENTS:

India’s forest conservation efforts after independence were shaped by a series of landmark enactments and policies:

Constitution of India:

India’s Constitution provides explicit and implicit support for forest conservation, reflecting the country’s commitment to environmental protection as a fundamental duty and a directive principle of state policy.Article 48A (Directive Principles of State Policy): “The State shall endeavor to protect and improve the environment and safeguard forests and wildlife.” was added by the 42nd Amendment Act, 1976. The Significance of this Article is that it encourages the government to enact laws and policies for forest conservation. Article 51A(g) (Fundamental Duties): “It shall be the duty of every citizen to protect and improve the natural environment including forests…” was also introduced by the 42nd Amendment. Significance of this Article is that it makes environmental stewardship a citizen’s responsibility. This Article is used by courts to promote public participation in forest protection.

Seventh Schedule of the Constitution:

Before 1976, Forests were under the State List but after 42nd Amendment, Forests were moved to the Concurrent List (Entry 17A), allowing both Centre and States to legislate. This enabled national laws like the Forest Conservation Act, 1980 and Strengthened uniformity in forest governance across states.

The Forest Conservation Act of 1980:

The Forest Conservation Act of 1980 is a historic Indian legislation that prohibits the diversion of forest land for non-forest activities without prior authorisation from the central government, with the goal of reducing deforestation and promoting sustainable forest management. Unauthorized use or diversion of forest land is punishable under the Act. Projects approved for forest land diversion must be compensated by planting trees on equivalent non-forest land. Amendment to this Act in 2023, introduced digital monitoring, streamlined approvals, and addressed ecological concerns in border and in tribal areas.

Compensatory Afforestation Fund Act, 2016:

This Act provides the legal framework for collecting, managing, and utilizing funds deposited by agencies that divert forest land for non-forest purposes. CAMPA (Compensatory Afforestation Fund Management and Planning Authority) operates under this Act. It ensures that these funds are used for afforestation, forest conservation, and ecological restoration across India.

Environmental Impact Assessment (EIA):

The EIA process was introduced in 1994 . It is a structured process to predict and evaluate the environmental consequences of proposed projects—such as dams, highways, mining, or industrial zones before they begin. It aims to minimize ecological damage, promote sustainable development, and ensure public participation in environmental decision-making. It became mandatory for certain

projects to obtain environmental clearance before implementation. It Prevents irreversible damage to ecosystems and communities, improves transparency and accountability in project planning. EIA aligns India with global environmental standards.

National Green Tribunal (NGT) Act, 2010:

Established specialized judicial body to ensure speedy and effective resolution of environmental disputes in India. It empowers the NGT to handle cases related to environmental protection, forest conservation, and natural resource safeguarding. The tribunal has passed several landmark judgments on river pollution, Industrial discharge, Sewage treatment plant failures.

National Action Plans:

India has formulated various national action plans to address specific environmental challenges. The key National Action Plan focused on forest protection is the National Action Plan on Forest Fire (NAPFF), launched by the Ministry of Environment to prevent forest fires through early warning systems and community engagement, to strengthen post fire recovery and mobilization of financial resources for such recovery.

These are just a few examples of the numerous policies and initiatives undertaken by India to protect the environment and promote sustainable development. Over the years, the country has recognized the importance of environmental conservation and has been actively working towards achieving a balance between development and environmental sustainability.

JUDICIAL INTERVENTION IN PROTECTING ENVIRONMENT:

The Supreme Court of India has interpreted Articles 48A and 51A(g) as part of the right to life under Article 21, linking forest conservation to fundamental rights. Landmark cases like T.N. Godavarman v. Union of India (1996) led to the expansion of forest definitions and Judicial monitoring of forest conservation. Indian Supreme Court has underlined the need of sustainable development and the preservation of natural resources in a number of its judgements.

Public Interest Litigation (PIL)

The Supreme Court has emerged as a proactive guardian of the environment, especially since the 1980s. It has used Public Interest Litigation (PIL) as a powerful tool to address environmental grievances, often stepping in where executive agencies failed.

Supreme Court in Indian Council for Enviro-Legal Action v. Union of India (1996), held that the chemical factories producing "H" acid and other toxic substances are liable for the environmental degradation. The Court ordered compensation and remediation of the affected Bichhri village, Rajasthan, at the expense of the polluters affirming the Polluter Pays

Principle as part of Indian environmental law. Supreme court further declared that Article 21 includes the right to a healthy environment.

Supreme Court in Vellore Citizens' Welfare Forum v. Union of India (1996), Held that the tanneries which discharged untreated effluents into agricultural fields, waterways liable for environmental degradation. The court incorporated "Precautionary Principle" in this case which means that preventive action is required in the face of environmental threats even without full scientific certainty. The court also directed the closure of polluting units and ordered compensation for the affected individuals. Supreme court in this case also declared that sustainable development is an integral part of Article 21.

M.C. Mehta v. Kamal Nath (1997): The case is that Span Motels Pvt. Ltd., had encroached upon forest land and diverted the course of the Beas River to protect their resort causing ecological damage. Supreme Court made the Public Trust Doctrine clear in this case holding that natural resources are held in trust by the state for public use and cannot be privatized arbitrarily.

Supreme Court introduced Absolute Liability in M.C. Mehta v. Union of India (Oleum Gas Leak Case, 1987) holding that industries engaged in hazardous activity are liable absolutely for any harm caused without any exceptions or defense of Act of God or third party fault. The court rejected strict liability in this case as inadequate.

In Taj Trapezium Case, the Supreme Court ordered relocation of polluting industries unless they

switched to fuels like natural gas, to protect the Taj Mahal. Taj Mahal's marble was turning yellow due to air pollution, especially from sulphur dioxide emissions from nearby industries and the Mathura refinery. Supreme Court affirmed that environmental protection includes safeguarding cultural heritage under Article 21. This is the first major case connecting environmental law with heritage conservation.

THE PRESENT STATUS OF ENVIRONMENT AND POLLUTION VS ANCIENT TIMES - GRAPH:

7.1.



7.2.

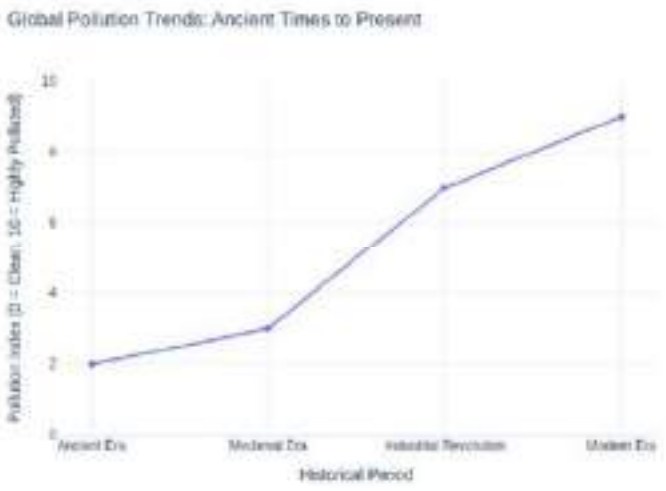
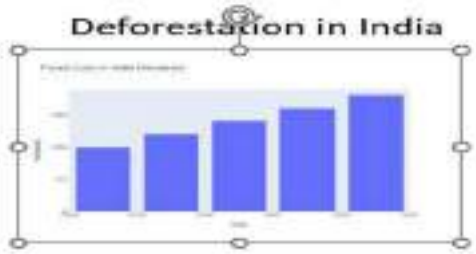


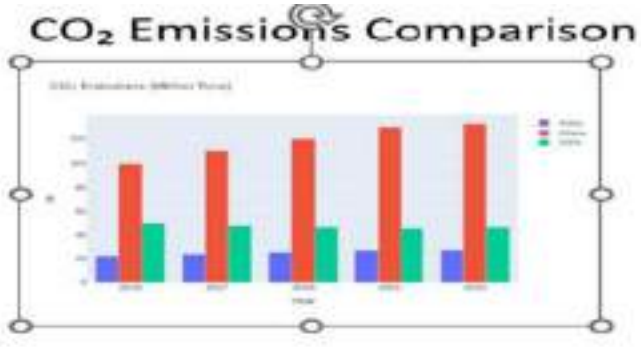
Figure 7.1& 7.2. Graphical representation of the decline in the environment index and pollution index, with evidences to the same, are given above. (These index are defined by the author of this paper based on empirical analysis.).

The Environmental awareness and preservation was at peak at the vedic period and degraded till British ara and post independence the environmental laws have been implemented to a good extent and that is why we can see some increase in the environmental index, after post independence. But this improved environmental concern if still not sufficient to arrest the pollution, as seen in the below graph the pollution keeps deteriorating. The major pollution was seen in the industrialization era from the western countries who are the major culprit in the environmental deterioration, and now the developing countries like China and India, are polluting the world, as the industrialization takes place in developing countries.

7.3.



7.4.



7.3 & 7.4. These above pollution indexes are defined by the author of this paper based on own empirical analysis.). As seen in the above pollution index graph, the pollution in ancient India was well under control. However, rapid deforestation and industrialization have increased pollution levels to unsustainable amounts, which is why we need to return to the principles of ancient India to control this menace. Deforestation and CO_2 emissions (India is the third-largest emitter of CO_2 after the US and China) are wreaking havoc on the environment.

- Key Empirical evidences of the decline can be understood from the following data:
- According to the 2024 World Air Quality Report by IQAir, 13 of the world's 20 most polluted cities are in India. Byrnihat in Assam topped the global list, and Delhi remains the most polluted capital city.
- According to IEA Global Energy Review, 2025, India emitted approximately 2.69 billion tons of carbon dioxide (CO_2) in 2024 from fuel combustion alone, contributing significantly to global emissions. However, total emissions—including industrial processes and other sectors—reached around 4.4 billion tons of CO_2 equivalent.
- According to recent reports, including one from "Shun Waste" and the "World Economic Forum", 70% of India's surface water is contaminated and fails to meet safe drinking standards. This includes rivers, lakes, and reservoirs that are vital sources of water for millions.
- According to a 2023 report by Utility Bidder, a UK-based energy and environment data firm, India lost an average of 668,400 hectares of forest over five years from 2015 to 2020

CONCLUSION:

While India can be proud of its ancient Vedic principles, without integrating them into our legal framework, we are not truly applying this knowledge into our legal system. The proposals below are the outcome of studies on the ancient systems and their relevance to the present context.

RECOMMENDATIONS:

Pancha Bhoota Legal Framework & Personhood of Nature

Proposal: Create a legal framework recognizing and grant legal rights and personhood for nature within the Indian legal system to all natural entities in India —rivers, forests, mountains, and the five elements (earth, water, fire, air, space)—as living beings and as protected entities with enforceable rights like how Uttarakhand High Court (2017 & 2020) has recognized the Ganges and Yamuna rivers as "living entities" or "juristic persons" with

the right to flow and be protected, effectively granting them legal personhood.

Inspired by: Vedas and Atharvaveda.

Why: This aligns with the Vedic view of nature as sacred and interconnected with human dharma. While Pancha Bhoota is discussed philosophically, no Indian law currently treats these elements as legal subjects, whereas rights of nature are implemented in countries like Ecuador, as described in this paper above.

Implementation: Amend the Environment Protection Act to include "elemental rights," allowing citizens to file suits to protect nature, as proposed above.

Vedic Penalty Multiplier System / Penalty-Based Conservation Inspired by Ancient Codes

Proposal: Introduce a multiplier-based penalty system where environmental damage is penalized based on its impact on future generations (e.g., cutting one tree = planting ten and maintaining them for several specific years).

Inspired by: Manu smriti and Arthasastra

Why: The present legal framework on penalties is not working, as it is not rigorous. The multiplier penalty provision is not present in existing law.

Implementation: Reform the National Green Tribunal's penalty guidelines to include restitution multipliers.

Prime Minister to be made responsible for all Environmental Issues.

Proposal: Introduce a PMO office above the Ministry of Environment in the organizational structure.

Inspired by: Arthasastra, which mandates the king to be responsible for the environment and in particular forests, as environmental governance is always "top-driven."

Why: The focus on the environment is a must, with 13 of the 20 most polluted cities in the world being in India. This trend can be reversed only if the top leader of the country puts his heart and soul into it, as mandated by the Arthasastra.

Implementation: Promulgate a legal framework that mandates the Prime Minister to review environmental impacts and take action.

Focus More on Agriculture (India Being an Agricultural Country)

Proposal: Introduce a law for mandatory use of fertile land or at least a "penalty or tax" for not cultivating wetlands.

Inspired by: Arthasastra, which mandates that any fertile land left uncultivated must be handed over to a person who can cultivate it.

Why: The focus on agriculture is a must for an agricultural country like India. This enactment will ensure that India brings more wetlands into cultivation and becomes more dependent on agriculture rather than on other polluting industries.

Implementation: Promulgate a legal framework to implement the above.

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Vedic Pluralism and Legal Inclusivity in Modern India: A Philosophical and Constitutional Analysis

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Abstract
This doctoral-level paper critically examines the interplay between Vedic pluralism—an indigenous epistemological and ontological framework rooted in the acceptance of multiple truths—and the principle of legal inclusivity in contemporary India. Drawing on primary Vedic texts (Rigveda, Upanishads, Bhagavad Gītā), Jain contributions (anekāntavāda, syādvāda), and constitutional jurisprudence, the study argues that Vedic pluralism offers a decolonial, non-Western paradigm for reconciling diversity with legal coherence in a plural democracy. Through doctrinal, historical, and socio-legal analysis, the paper evaluates the manifestation of pluralistic principles in constitutional provisions (Articles 14, 15, 25–30, 44), landmark Supreme Court judgments (e.g., S.R. Bommai, Shayara Bano, Sabarimala), and persistent challenges such as majoritarianism, personal law conflicts, and reservation politics. The research introduces a novel "conditional constitutionalism" model inspired by syādvāda, proposing reforms in judicial reasoning, legislative policy, and legal education. The conclusion advocates for a Vedic-constitutional synthesis to deepen India's inclusive democracy without compromising justice or sovereignty.

Keywords: Vedic pluralism, anekāntavāda, syādvāda, legal inclusivity, Indian Constitution, conditional constitutionalism, multiculturalism, personal laws

INTRODUCTION

India's legal system navigates one of the most complex plural societies in human history—home to over 2,000 ethnic groups, 22 scheduled languages, and adherents of every major world religion (Census of India, 2011). The Constitution of India, adopted on November 26, 1949, and effective from January 26, 1950, operationalizes inclusivity through a delicate balance of uniformity and autonomy. Yet, the philosophical scaffolding of this framework remains underexplored in Western liberal terms. This paper posits that Vedic pluralism—a pre-modern Indian intellectual tradition that accommodates contradictory truths within a unified ontological reality—provides an indigenous, epistemologically robust foundation for legal inclusivity.

The Rigveda (1.164.46) declares: "Ekam sat viprā bahudhā vadanti"—"Truth is one; the wise describe it in many ways." This axiom, echoed across the Upanishads, Bhagavad Gītā, and Jain doctrines of anekāntavāda (multi-facetedness of reality) and syādvāda (conditional predication), rejects absolutism and embraces perspectivism. In legal terms, this translates into a system that validates diverse normative orders—Hindu, Muslim, Christian, tribal, and secular—within a shared constitutional framework.

This study addresses three research questions:

How is Vedic pluralism conceptually constructed across ancient texts and later philosophical systems?

- To what extent is this pluralism reflected in India's constitutional architecture and judicial discourse?
- What are the structural, political, and cultural impediments to its full realization, and how can a syādvāda-inspired "conditional constitutionalism" address them?

The analysis proceeds in six parts: conceptual foundations, historical evolution, constitutional manifestations, judicial interpretations, contemporary challenges, and reform proposals.

CONCEPTUAL FOUNDATIONS OF VEDIC PLURALISM

Ontological Unity, Epistemological. Diversity

The Vedic corpus—comprising the four Saṃhitās, Brāhmaṇas, Āraṇyakas, and Upanishads—does not prescribe doctrinal uniformity. The Rigveda contains hymns to Indra, Agni, Varuna, and Soma without resolving their metaphysical primacy. The Nāsadīya Sūkta (Rigveda 10.129) exemplifies agnostic pluralism:

"Na mṛtyur āsīd amṛtaṁ na tarhi… ko addhā veda ka iha pra vocat"

("Neither death nor immortality existed then… who really knows? Who can here proclaim it?")
This skepticism prefigures the Upanishadic neti neti ("not this, not that"; Brihadaranyaka Upanishad 3.9.26), rejecting finality in metaphysical claims.

Anekāntavāda and Syādvāda: Jain Extensions of Vedic Thought

Though systematized in Jainism by thinkers like Kundakunda (2nd century CE) and Haribhadra (8th century CE), anekāntavāda—the doctrine that reality has infinite aspects (ananta-dharmātmakaṃ vastu)—finds antecedents in Vedic tolerance. The Bhagavad Gītā (4.11) states: "Ye yathā māṁ prapadyante tāṁs tathaiva bhajāmyaham"—"However people approach Me, I reward them accordingly." This validates diverse mārgas (paths): jñāna, bhakti, karma, and dhyāna.

Syādvāda, the method of conditional assertion (syāt = "in some respect"), allows seven predications (saptabhaṅgī) for any proposition: (1) exists, (2) does not exist, (3) both, (4) inexpressible, etc. This dialectical flexibility offers a judicial tool for reconciling conflicting rights claims.

Social Pluralism: Varṇa as Functional, Not Hereditary

The Purusha Sukta (Rigveda 10.90.12) describes society emerging from the cosmic being: brāhmaṇas from the mouth, kṣatriyas from the arms, vaiśyas from the thighs, śūdras from the feet. Interpreted idealistically, this reflects guṇa-karma (aptitude and action) rather than birth. The Chhāndogya Upanishad (5.10.7) narrates Satyakāma Jābāla, born of unknown parentage, being accepted as a brāhmaṇa due to truthfulness—evidence of merit-based mobility.

HISTORICAL EVOLUTION: FROM VEDIC POLITY TO COLONIAL DISRUPTION

Pre-Colonial Plural Legal Orders

Ancient India operated a decentralized, plural legal system. Dharmashāstra texts (Manusmṛti, Yājñavalkya Smṛti) recognized customary laws (ācāra) of guilds, villages, and sects. Buddhist and Jain kingdoms coexisted with Hindu polities. Akbar's sulh-i-kul (universal peace) in the 16th century institutionalized state neutrality—a precursor to secularism.

Colonial Imposition of Uniformity

British rule disrupted this pluralism through codification (e.g., Indian Penal Code, 1860) and Anglicized courts. The lex loci policy excluded personal laws, inadvertently preserving Hindu and Muslim laws—but under state supervision, eroding community autonomy (Cohn, 1996).

Constitutional Response: Reclaiming Pluralism

The Constituent Assembly debates (1946–49) reveal deliberate pluralism. Dr. B.R. Ambedkar defended personal laws as "cultural rights," while Alladi Krishnaswami Ayyar invoked ekam sat to justify religious freedom (Austin, 1966). Article 44 (uniform civil code) was made a directive principle, not a fundamental right—reflecting syādvāda-like conditionality.

CONSTITUTIONAL MANIFESTATIONS OF VEDIC PLURALISM

Fundamental Rights and Diversity

- Article 14: Equality before law—formal equality.
- Article 15(1): Prohibits discrimination on religion, caste, etc.—but 15(4) allows affirmative action, embodying samatva (equity).
- Article 25: Freedom of religion, subject to "public order, morality, health"—a syādvāda qualification.
- Articles 29–30: Minority cultural and educational rights—autonomy within unity.

o 3.2 Directive Principles: Aspirational Pluralism

- Article 38: State to promote welfare by minimizing inequalities.
- Article 44: Uniform civil code—"syāt in future" (conditional).
- Article 51A(f): Fundamental duty to value composite culture (saṁskṛti-saṅgama).

Federalism as Structural Pluralism

Asymmetric federalism (e.g., Article 370 [pre-2019], Fifth/Sixth Schedules) accommodates tribal autonomy, mirroring Vedic svadharma (context-specific duty).

JUDICIAL INTERPRETATIONS: PLURALISM IN ACTION

Essential Practices Doctrine

In Commissioner, Hindu Religious Endowments v. Sri Lakshmindra Thirtha Swamiar (1954), the Supreme Court distinguished "essential" from "secular" religious practices, allowing state regulation of the latter. This reflects syādvāda: a practice is essential syāt (from doctrinal view) but regulable syāt (from public interest).

Secularism as Sarva Dharma. Sambhava

S.R. Bommai v. Union of India (1994) defined Indian secularism as equal respect for all religions not Western separation. Justice Jeevan Reddy cited vasudhaiva kuṭumbakam (Maha Upanishad 6.71) to argue fraternity transcends faith.

Gender and Personal Laws

Shayara Bano v. Union of India (2017): Triple talaq declared unconstitutional (3:2). Majority invoked Article 14; minority respected Muslim autonomy—anekāntavāda in dissent.
Indian Young Lawyers Association v. State of Kerala (2018): Sabarimala entry for women (4:1). CJI Dipak Misra prioritized constitutional morality; Justice Indu Malhotra dissented, citing religious denomination rights—classic syādvāda tension.

Reservation Jurisprudence

M. Nagaraj v. Union of India (2006) upheld creamy layer exclusion and quantifiable data requirements, balancing merit (guṇa) with social justice (samatva).

CONTEMPORARY CHALLENGES

Majoritarianism and Legal. Exclusion

The Citizenship Amendment Act, 2019 (CAA), fast-tracks citizenship for non-Muslim refugees from neighboring countries, excluding Muslims. Critics argue it violates ekam sat by privileging religious identity in secular law (Jain, 2020). The Supreme Court's deferral of hearings (2020–2025) reflects judicial caution.

Personal Law Conflicts

Polygamy under Muslim Personal Law (Sharia) Application Act, 1937, contrasts with Hindu Marriage Act, 1955 (monogamy). The Law Commission (2018) recommended abolition but faced resistance—revealing tension between uniformity and autonomy.

Reservation Backlash

The 103rd Amendment (2019) introduced 10% EWS quota, upheld in Janhit Abhiyan v. Union of India (2022). Dissenting opinions warned of fracturing meritocracy, echoing rigidified varṇa critiques.

Uniform Civil Code (UCC) Debates

Goa's Portuguese Civil Code (1867) remains India's only UCC. Uttarakhand's proposed UCC (2024) excludes tribal communities—syādvāda in practice, but risks majoritarian imposition elsewhere.

TOWARD CONDITIONAL CONSTITUTIONALISM: A VEDIC-INSPIRED REFORM FRAMEWORK

Conceptualizing Conditional Constitutionalism

Drawing on syādvāda, this model proposes:
Syāt-Equality: Equal protection in some respects (formal), syāt-inequality permissible for substantive justice (reservations).
Syāt-Autonomy: Personal laws valid syāt (culturally), reformable syāt (if violative of dignity).
Syāt-Uniformity: UCC aspirational syāt (future), not immediate.

Legislative Reforms

Personal Laws (Harmonization) Bill: Retain diversity but mandate core reforms (monogamy,

inheritance equality, consent age).
Anti-Discrimination Code: Horizontal application of Article 15 to private actors.
Tribal Autonomy Act: Strengthen Sixth Schedule with veto powers.

Judicial Training
Mandate biennial courses in Indic philosophy (anekāntavāda, mīmāṁsā) for judges to enhance contextual reasoning.

Civic Education
Introduce "Vedic Pluralism and Constitutional Values" as a compulsory undergraduate course, using Rigveda 1.164.46 and Bhagavad Gītā 4.11 as texts.

Empirical Validation
A proposed longitudinal study (2026–2035) could measure impact of pluralism-based legal education on communal harmony indices (e.g., hate crimes, interfaith marriages).

CONCLUSION

Vedic pluralism—rooted in ekam sat, vasudhaiva kuṭumbakam, and syādvāda—offers a sophisticated, indigenous framework for legal inclusivity in modern India. The Constitution and judiciary have institutionalized this through rights, federalism, and contextual reasoning. Yet, majoritarianism, personal law disparities, and reservation conflicts reveal fissures.
The proposed conditional constitutionalism model reconciles tradition and modernity by asserting that rights, laws, and policies are valid syāt—conditionally, contextually, and provisionally. This avoids absolutism while preserving justice.
India need not import Western multiculturalism; it can revive its own pluralistic genius. As the Rigveda reminds us, truth is one—but the paths to justice are many.

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International and Historical Dimensions of Legal and Ethical Safeguards for Patients in Medical Care

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Abstract

The Indian Constitution does not explicitly define the rights of patients seeking medical care. However, it includes certain provisions that relate to individual and public health. Article 21 of the Constitution guarantees every person the right to life and personal liberty, which implicitly encompasses the right to health. On the global front, significant efforts have been made to formally recognize patients' rights as part of the broader framework of the right to health as a fundamental human right, thereby obligating states to uphold it. Over time, the recognition and enforcement of patient rights have gained importance worldwide. Several countries, including India, the United States, the United Kingdom, Australia, and Japan, have established dedicated bodies and agencies to handle consumer grievances, enforce legal provisions, and ensure ethical practices within healthcare systems. This paper aims to examine the historical & international development of patient protection in the context of medical care in terms of India and other selected countries. The study is based on secondary data and adopts an exploratory research design. Secondary sources include official reports, scholarly journal articles, and books.
Keywords: Patient rights, medical care, Health protection, international framework.

INTRODUCTION

For more than three decades, the Consumer Protection Act of 1986 served as the foundation for safeguarding consumer interests in India. However, with the rapid advancement of globalization and digitalization, the need for a more contemporary framework became evident. Consequently, the Consumer Protection Act, 2019 was enacted on August 9, 2019, with the objective of strengthening consumer rights and ensuring improved access to justice. The updated Act broadened the definition of a "consumer" to include individuals engaging in electronic transactions and other remote purchasing methods. Nonetheless, it excludes services provided free of cost such as medical care offered by government hospitals, dispensaries, and health centers meaning that individuals availing these free services are not recognized as consumers under the Act.

Over the past five decades, the practice of medicine in India has experienced considerable evolution, bringing both positive and negative consequences for healthcare delivery (G. Paul, 2004). This transformation fostered an increasing awareness of the need for greater accountability in medical services, leading to the inclusion of healthcare professionals under various legal frameworks.

In recent years, the healthcare sector has continued to evolve, significantly altering the patient–doctor dynamic. Patients today are more knowledgeable, assertive, and actively involved in their health management. They seek higher-quality, patient-centered, and personalized medical care. However, this shift toward consumer-oriented behavior presents new challenges for medical practitioners, who must adapt to rising expectations while upholding professional ethics and maintaining high standards of medical practice.

REVIEW OF LITERATURE

According to Ravi D. Potdar (1997) As mentioned earlier, the medical profession has come under pressure due to globalization and liberalization; therefore, now is the time to think well and to set our priorities right, both individually and collectively.

Jonathan Allsop (2002) argues that the presence of substantial legislation, which has been further strengthened in recent times, has established a legal foundation for robust external regulation of doctors. Nevertheless, the regulatory process is likely to become even more complex

and exert greater control in the future.

According to Margaret E Kruk et al. (2018) although health systems will look different in different settings, all people should be able to count on receiving high-quality care that will improve their health and earn their trust. It is time to rethink our past approaches: to ask more from and invest more in this crucial determinant of health.

According to WHO (2019) report to promote global solidarity, WHO has encouraged the creation of networking and collaborative initiatives such as the Global Patient Safety Network and the Global Patient Safety Collaborative. Recognizing the importance of patients' active involvement in the governance, policy, health system improvement and their own care, the WHO also established the Patients for Patient Safety programs to foster the engagement of patients and families.

OBJECTIVE OF THE STUDY

To study the historical and international perspective of protection of patients seeking medical care.

RESEARCH METHODOLOGY

Research methodology refers to the systematic and scientific approach that researchers follow to design, conduct, and analyze their research studies.

RESEARCH DESIGN

The exploratory research design has been adopted for the present study.

INTERNATIONAL AND HISTORICAL PERSPECTIVE OF PROTECTION OF PATIENTS SEEKING MEDICAL CARE

The Indian Constitution does not explicitly mention the rights of patients receiving medical treatment. Nevertheless, it does recognize certain rights connected to individual and public health. Although patient rights are not directly codified within the Constitution, several of them derive constitutional legitimacy from its broader provisions. Consequently, the Constitutional Courts of India can uphold and enforce patient rights that fall within the ambit of Part III, which guarantees fundamental rights.

These constitutional principles form the foundation of such rights, granting them the same authority as fundamental rights. In particular, Article 21 affirms that every individual has the right to life and personal liberty, a provision that has been interpreted to encompass the right to health and access to medical care. According to many Courts, the term "life" in the aforementioned Article refers to living a dignified life as opposed to merely existing. The Court has determined over the years that a number of other rights, including the right to a livelihood, the right to housing, the right to a pollution-free environment, etc., are fundamental components of this Article.

A healthy body is the essential basis for all human pursuits, the SC ruled in Vincent Panikurlangara v. Union of India. Maintenance and improvement of public health must be of the utmost importance, if not at the top of the list, because it is essential to the community's physical survival and its improvement influences the growth of society as intended by the constitution's framers. It is important to bring up the Supreme Court ruling Paschim Banga Khet Mazdoor Samity v. State of West Bengal, which was previously considered in the context of emergency medical services.

At the international level, significant initiatives have been undertaken to formally recognize patients' rights and promote their universal acceptance, aligning with the recognition of health as a fundamental human right and the corresponding duty of states to uphold it. Initially, these global efforts concentrated on defining the ethical and professional responsibilities of medical

practitioners toward their patients. Over time, the concept of individually enforceable patient rights began to gain importance, reflected in various international developments. One of the earliest milestones in this direction was the initiative of the World Medical Association (WMA) an international organization of physicians established in 1947 which took pioneering steps toward codifying patient rights. The WMA's mission is to advance global health by promoting the highest standards of medical practice, education, ethics, and accessibility. Through its commitment to these principles, the WMA seeks to ensure that patients receive safe, compassionate, and high-quality care, ultimately contributing to improved health outcomes and a better quality of life worldwide..

ENFORCEMENT AGENCIES FOR CONSUMER PROTECTION AROUND THE WORLD

Organization for Economic Cooperation and Development (OECD)

It aims to promote policies that enhance the economic and social well-being of people around the world. It provides a platform for governments to collaborate, share experiences, and develop solutions to common challenges. The OECD works closely with member nations to analyze and understand the factors driving economic, social, and environmental change. Within this framework, its Committee on Consumer Policy (CCP) addresses a broad spectrum of consumer-related issues, ensuring that consumer interests are protected and promoted globally.

United Nations Conference on Trade and Development (UNCTAD)

It focuses on fostering inclusive and sustainable development through global trade across all its programs. It provides research, policy guidance, and advisory support on matters related to trade policy, trade negotiations, trade in goods and services, competition law, and consumer protection. Additionally, UNCTAD works to build consensus, enhance institutional capacity, and promote international cooperation in addressing challenges that emerge at the intersection of trade, environmental sustainability, and climate change.

Global Privacy Enforcement Network (GPEN)

When the OECD governments approved a recommendation on cross-border cooperation in the enforcement of privacy laws in June 2007, GPEN was established. The recommendation urged member nations to encourage the formation of a loose alliance of privacy enforcement authorities.

EU Consumer Protection Cooperation Network (CPC)

The Consumer Protection Cooperation (CPC) network brings together national authorities responsible for enforcing consumer protection laws across the European Union (EU), as well as Iceland and Norway. These agencies collaborate to safeguard consumer interests by sharing information, coordinating investigations, and addressing potential breaches of consumer law collectively.

LAWS OF CONSUMER PROTECTION IN EUROPEAN UNION

In the European Union (EU), patients' rights to access healthcare stem from both individual and social rights recognized under national laws of member states, as well as from international and European legal frameworks. Key protections include Article 3, which prohibits inhuman or degrading treatment, and Article 8, which safeguards the right to private and family life.

Owing to the EU's principles of free movement and its ongoing enlargement process, the European Charter of Fundamental Rights has the potential to enhance and harmonize the

protection of patients' and citizens' rights across different member countries. It also serves as a mechanism to standardize healthcare systems in a manner that prioritizes patient welfare throughout Europe.

Furthermore, Part II of the European Charter of Patient Rights sets forth 14 core patient rights, which collectively aim to strengthen the protection and promotion of fundamental rights within the European healthcare framework.

LAWS OF CONSUMER PROTECTION IN ENGLAND

The Patient's Charter, introduced by the British government in 1991 as part of a citizen's charter initiative within the NHS, was met with considerable enthusiasm and positive reception. It marked the first time since the NHS's establishment in 1948 that patients' rights in England were explicitly articulated, even though these rights were somewhat limited. The Charter also expanded the scope of patient rights by formally recognizing those that already existed.

Subsequently, the NHS Constitution for England replaced the Patient's Charter. While the Constitution is not legally binding, it reflects the NHS's commitment to delivering comprehensive, high-quality healthcare services and upholding the principles outlined in the Charter.

LAWS OF CONSUMER PROTECTION IN INDIA AND SCOTLAND

The Patient Rights (Scotland) Act, 2011, was passed by the Scottish Parliament on February 24, 2011, and it received royal assent on March 31, 2011. The Act mandated that Scottish Ministers produce a "Charter of Patient Rights and Obligations" outlining the current rights and obligations of those using NHS services and receiving NHS care in Scotland. After developing the charter, the ministers are required to publish it and inform each relevant NHS body of its publication. Therefore, the charter must be freely available to patients, employees, and the general public from each relevant NHS authority. Thereby, each relevant NHS body must provide the charter to patients, staffs and public without charge. It also provides for the review and revision of the charter.

CONCLUSION

Significant international efforts have been made to formally recognize and codify patients' rights on a global scale. The World Medical Association (WMA), established in 1947, has played a pivotal role in advancing patient rights and setting ethical standards for medical professionals. Approaches to consumer protection and enforcement differ across countries, reflecting diverse strategies to safeguard consumer interests. Nations such as India, the USA, the UK, Australia, and Japan have created dedicated agencies to handle consumer complaints, enforce laws, and ensure fair practices across various sectors. For instance, India's Central Consumer Protection Authority (CCPA), along with consumer protection bodies in Australia and the UK, serve as central authorities overseeing legislation and complaint resolution. In the USA, enforcement responsibilities are shared among multiple federal and state institutions, including the FDA, CFPB, and FTC. Japan employs a distinct approach through its Consumer Affairs Agency (CAA), which coordinates consumer protection laws, while specialized bodies manage sector-specific regulations. On the international front, organizations like the OECD, UNCTAD, GPEN, and the EU's Consumer Protection Cooperation (CPC) network work to promote consumer rights and facilitate collaboration among countries. These organizations support knowledge exchange, policy formulation, and cooperative enforcement efforts to enhance global consumer protection. Overall, protecting consumer rights has become a global priority, with nations relying on a combination of specialized agencies, intergovernmental collaboration, and legal frameworks to ensure rights are upheld and fair practices maintained.

ROOTS OF JUSTICE: ANCIENT INDIAN LEGAL HERITAGE AND ITS MODERN ECHOES

Mohini Dobhal

Abstract

The Indian legal system is a fascinating blend of ancient traditions and modern constitutional thought. It combines long-held philosophical and religious foundations with a contemporary framework established in 1950. Central to this system is the idea of Dharma, which embodies a mixture of moral, spiritual, and legal principles aimed at maintaining societal and cosmic harmony. Key texts like the Vedas, Bhagavad Gita, Manusmriti, Yajnavalkya Smriti, and Kautilya's Arthashastra have shaped concepts such as justice (Nyaya), equality (Samatha), duty, punishment, governance, and the role of individuals. These texts underline the deep connection between Dharma and Natural Law, highlighting a fundamental moral order guiding human behavior and justice. This study takes a historical-comparative approach to explore the continuities and differences between ancient Dharmashastric ideals and the principles embedded in the Indian Constitution, especially concerning justice, equality, and secularism (Dharmanirpeksha). It looks at how certain traditional doctrines were either adapted, reinterpreted, or dismissed as Indian law evolved. Some ancient practices, like arbitration and ethical responsibility, continue, while the hierarchical caste and gender divisions have been largely rejected by modern legislation.

This paper suggests that India's legal history isn't just about a complete break from the past or simply sticking to old ways. Instead, it reflects a balance between traditional moral norms and modern constitutional values, helping us understand how concepts like Dharma and Natural Law still influence today's perceptions of justice and law.

Keywords: Natural Law, Ancient Legal System, Modern Constitutional Jurisprudence, Dharmashastric.

INTRODUCTION

India's legal system is rooted in a unique blend of indigenous customs and foreign legal influences that have developed over time. Customary law, based on longstanding social practices, cultural norms, and community experiences, has historically played a vital role in governing various aspects of life, especially in tribal, rural, and religious settings. These customary principles regulated matters such as marriage, inheritance, property rights, land relations, and informal dispute resolution.

The arrival of British colonial rule brought with it a new legal framework, emphasizing codification, judicial precedents, and established legal institutions. Following independence, India adopted a constitutional structure based on the ideals of justice, equality, liberty, and secularism, thereby incorporating modern statutory law into its governance.

The coexistence of customary law and codified constitutional law presents both challenges and opportunities. Customary laws can ensure cultural continuity, preserve local identities, and empower community governance. However, some customs may conflict with constitutional rights, especially concerning gender equality, human dignity, and universal human rights.

The Concept of Justice and Equity in Ancient Hindu Law

In ancient Hindu jurisprudence, the principles of justice (Nyaya) and equity (Yukti) served as the moral and philosophical backbone of legal proceedings and governance. Justice here was far more than just punishing wrongdoers; it encapsulated a broader idea rooted in righteousness, moral duty, and the maintenance of harmony in society. Hindu law posited that justice was a divine principle closely linked with Dharma, the cosmic order that sustains both the universe and human society. Thus, pursuing justice was seen as a sacred responsibility for rulers, judges, and individuals alike.

Texts like the Manusmriti and the Dharmashastras highlighted that true justice involved upholding Dharma in all areas of life. Dharmic justice was not just about written laws but was intertwined with moral conscience and ethics. The goal was to create balance and welfare for all members of society, viewing law as a tool to restore equilibrium in case of any disruption to social or natural order.

Equity (Yukti) complemented justice by ensuring that strict application of laws didn't lead to unfair outcomes. This principle allowed for flexibility in interpreting laws based on the specific

circumstances of individual cases. Ancient Hindu jurists understood that rigid adherence to rules could sometimes result in injustice. Thus, Yukti served as a correction mechanism, guiding judges and rulers in making decisions based on reason, context, and moral judgment. In essence, equity added a human touch to justice, adapting to life's complexities while remaining true to Dharma.

The ruler, or Raja, played a crucial role as the protector of justice and Dharma. They were expected to administer laws impartially, following moral duty and the counsel of learned scholars or Brahmins, rather than their personal interests. The king's court, known as the Sabha or Parishad, acted as a judicial council where decisions were made collectively, often incorporating insights from religious and legal experts. These advisors aided in interpreting ancient texts and applying legal principles fairly to contemporary issues.

Justice in Hindu law also bore a spiritual dimension. Righteous judgment was believed to maintain cosmic order and secure the spiritual well-being of both the ruler and the populace. Unjust actions were thought to disrupt Dharma, resulting in societal imbalance, suffering, and chaos. Therefore, the application of Nyaya and Yukti aimed to align human conduct with fundamental principles of truth, morality, and compassion.

In summary, the concept of justice and equity in ancient Hindu law represented a sophisticated and holistic approach to legal thought, blending moral, ethical, and procedural dimensions to ensure that justice was not only legally sound but also socially and spiritually just. The dynamic relationship between Nyaya and Yukti ensured that law remained a living system—anchored in divine order yet flexible to human needs—promoting fairness, compassion, and harmony.

Ancient Indian Judicial System

The evolution of the ancient Indian judicial system reflects the social, religious, and political changes throughout history. It can be divided into distinct eras, each playing a unique role in shaping India's jurisprudence. The transition from the Vedic period to the Mughal era illustrates how law and justice were molded by various cultural, religious, and philosophical influences, ultimately laying the groundwork for future legal traditions in the subcontinent.

The Vedic Period (1500 BCE – 500 BCE)

The Vedic period represents the earliest stage of India's legal and judicial development. Justice during this time stemmed largely from the Vedas, especially the Rig Veda, which emphasized moral righteousness, social harmony, and the significance of truth (Satya) and fairness (Rita). The Vedas weren't legal codes as we define them today, but they provided guiding principles for ethical behavior and social order.

Disputes in Vedic society were resolved via community assemblies called Sabhas and Samitis, which functioned as proto-judicial bodies. These gatherings included respected community elders who mediated disputes and ensured adherence to Dharma, or rightful duty. Justice was seen as a moral obligation, necessary to maintain cosmic and social equilibrium. There was no rigid procedural law; instead, judgments were based on customary practices, oaths, and witness testimonials, focusing on reconciliation and restoration of community harmony.

The Maurya and Gupta Empires (322 BCE – 550 CE)

The Mauryan and Gupta periods brought more structure and formality to the judicial system. During the Mauryan Empire, especially under Emperor Ashoka, concerted efforts were made to create a just legal system rooted in moral values. Ashoka's philosophy of Dhamma emphasized compassion, non-violence, and equity, influencing not just legal procedures but the broader administrative governance as well.

Kautilya's Arthashastra, a key treatise on governance and law, provides an in-depth look at the judicial structure of the Mauryan era, detailing the roles of judges, court hierarchies, and legal procedures. It outlined various court levels, from local tribunals to the royal court, where judges were expected to be impartial and knowledgeable in legal texts, relying on evidence and logic. The Arthashastra categorized crimes and their respective penalties, emphasizing deterrence alongside restitution.

The Gupta period continued these legal traditions, adding refinements influenced by Dharmashastra literature. Legal decisions were informed by four primary sources: Dharma (righteous law), Vyavahara (legal practice), Charitra (custom), and Rajashasana (royal decrees).

Appellate courts were institutionalized, ensuring systematic legal reviews and safeguarding subjects under royal authority. Justice emphasized procedural fairness while balancing moral duty and state power.

The Mughal Era (1526 CE – 1857 CE)

The Mughal period introduced Islamic legal principles into the Indian judicial landscape. Mughal emperors established a well-defined judicial framework based on Sharia (Islamic law) while accommodating local customs, particularly under rulers like Akbar, who advocated for religious tolerance and inclusive administration.

At the core of the Mughal judicial system were the Qazis, appointed by the emperor to oversee legal disputes. They managed civil and criminal cases in line with Islamic law but often tailored their judgments to reflect the diverse religious and cultural contexts of the empire. The judicial hierarchy comprised various courts, including Dar-ul-Qaza (civil courts), Faujdari courts (criminal courts), and the Qazi-ul-Quzat, the chief judicial authority and advisor to the emperor.

During Akbar's reign, the administration of justice took a more secular turn. He established a system where both Hindu and Muslim judges could serve, enacting ordinances that balanced religious doctrines with rational governance. Equity, fairness, and merit became critical components of judicial decision-making, ensuring justice served the broader welfare of the populace rather than just sectarian interests.

KEY FEATURES AND CHARACTERISTICS

Despite the diversity across different historical periods, several common features can be found in ancient Indian judicial systems:

Influence of Religion and Customs: Law and justice were closely linked to religion. The Vedas, Dharmashastras, Arthashastra, and Sharia were pivotal in legal interpretation. Customary law held significant sway, often guiding behavior where formal law was lacking.

Role of Judges and Courts: Judicial officials, whether Brahmin scholars in early Hindu society or Qazis during the Mughal era, acted as guardians of justice. They needed to be knowledgeable, impartial, and ethically sound. Courts were organized hierarchically—from local councils to royal courts—to ensure that justice was accessible to everyone.

Emphasis on Fairness and Justice: The ultimate goal was to uphold Dharma or righteousness. Rulers and judges were expected to ensure moral integrity and fairness in their judgments. Justice was not just a political or social obligation but a spiritual responsibility meant to maintain societal order and divine balance.

Punishments and Restitution: Punishments varied based on the offense's nature and severity, including fines, social ostracism, corporal punishment, exile, and even capital punishment in severe cases. However, restitution and compensation were common, emphasizing restoration and reconciliation over retribution.

MODERN INDIAN JUDICIAL SYSTEM

The modern Indian judicial system reflects centuries of evolution, influenced by local traditions, colonial impacts, and constitutional reforms post-independence. Today, it stands as one of the most comprehensive and independent judicial frameworks globally, aiming to ensure justice, equality, and rights under the rule of law. Its structure and philosophy draw from both British legal traditions and ancient Indian concepts of fairness and morality.

The Colonial Period and British Influence (1757–1947)

The colonial era represented a significant turning point in India's legal history. The British takeover after the Battle of Plassey in 1757 gradually transformed judicial and administrative structures. Initially, the British East India Company dispensed justice according to local customs—Hindu law for Hindus and Islamic law for Muslims. However, as the Company's power grew, it sought to replace indigenous systems with a centralized legal framework modeled on

English common law.

The Regulating Act of 1773 was a pivotal moment, introducing structured judicial administration in British India. It established the Supreme Court in Calcutta, which had jurisdiction over British subjects and Company officials. This was soon followed by the creation of additional courts in Bombay and Madras. However, early tensions arose from the coexistence of Company courts and traditional Indian systems, often creating jurisdictional confusion.

Subsequent reforms, such as the Charter Acts (1793–1833), aimed to standardize and expand the judicial framework across India. The Indian Penal Code (IPC) of 1860, drafted under Lord Macaulay's supervision, marked a key milestone in codifying criminal law. The Code of Civil Procedure (1859) and Code of Criminal Procedure (1861) further systematized legal processes. The establishment of High Courts in Calcutta, Madras, and Bombay in 1862 under the Indian High Courts Act consolidated the judiciary.

During British rule, the final appellate authority was the Judicial Committee of the Privy Council in London. Its decisions significantly shaped legal principles still influencing Indian law today. While the British system prioritized structure and uniformity, it primarily served colonial interests, providing limited access to justice for Indians. Nevertheless, it laid the groundwork for the post-independence legal system.

The Post-Independence Era (After 1947)

India's independence in 1947 marked a significant shift in its legal and judicial landscape. The Constitution of India, adopted on January 26, 1950, established a sovereign, democratic republic with an independent judiciary as a foundational pillar. The Constitution became the supreme law, subjecting all legislative and executive actions to judicial review.

The Supreme Court of India was established as the highest judicial authority, taking the place of the Privy Council as the final court of appeal. Each state received its own High Court, and subordinate courts were set up at the district and local levels. This hierarchical structure was designed to ensure that justice was accessible and efficiently administered.

A notable feature of the post-independence judiciary was its expanded role in protecting fundamental rights and interpreting constitutional provisions. The judiciary became the Constitution's guardian, able to annul unconstitutional laws and actions by the state through judicial review.

Landmark cases like Kesavananda Bharati v. State of Kerala (1973) affirmed the basic structure doctrine, ensuring the core principles of the Constitution—sovereignty, democracy, and the rule of law—remain intact.

Over the years, the judiciary evolved into a protector of civil liberties and social justice. It began actively interpreting laws to promote equality, safeguard marginalized communities, and uphold the public welfare noted in the Constitution.

RECENT REFORMS AND DEVELOPMENTS

In recent decades, the Indian judicial system has initiated significant reforms aimed at addressing challenges of case backlogs, procedural delays, and limited access to justice. Key initiatives include the introduction of Alternative Dispute Resolution (ADR) methods like arbitration, mediation, and conciliation. These approaches provide quicker, less adversarial dispute resolution, easing the traditional courts' burden.

The judiciary has also modernized through computerization and the e-Courts Project. Technologies like e-filing, video conferencing, and digital cause lists have enhanced judicial transparency and efficiency. The Supreme Court and High Courts increasingly adopted virtual hearings, a trend accelerated by the COVID-19 pandemic, paving the way for hybrid court systems.

Specialized tribunals and fast-track courts now address specific cases involving tax, environmental issues, consumer protection, and women's rights. Reforms in the National Judicial Data Grid (NJDG) and digitization of case records have improved transparency and allowed effective case tracking.

Furthermore, the judiciary has extended its reach into governance through Public Interest Litigation (PIL), empowering citizens and groups to seek remedies for collective grievances that affect society. This shift has democratized access to justice and enhanced judicial accountability

in public administration.

KEY FEATURES AND CHARACTERISTICS OF THE MODERN JUDICIAL SYSTEM

Independence of the Judiciary: The Indian judiciary operates independently from the executive and legislative branches. Appointments are made through a rigorous collegium process, ensuring impartiality. Judges have security of tenure and protection from external pressures to uphold the institution's integrity.

Adversarial System: India adheres to an adversarial model of justice, where opposing parties present their evidence and arguments before a neutral judge who makes determinations based on facts and law. This system underscores fair hearings and the presumption of innocence.

Hierarchy of Courts: The judicial system features multiple layers—a Supreme Court at the top, High Courts in each state or union territory, and subordinate courts at the district and lower levels. This hierarchy is designed to make justice accessible and to allow for appeals that ensure consistency in decisions.

Public Interest Litigation (PIL): PIL has transformed access to justice, enabling individuals and organizations to champion public causes and represent vulnerable groups in court. It has played a critical role in advancing human rights, protecting the environment, and furthering social justice.

Protection of Fundamental Rights: The judiciary acts as the custodian of fundamental rights outlined in Part III of the Constitution. Through writ jurisdiction, courts can enforce rights encompassing freedom of speech, equality before the law, and the right to life and personal liberty.

COMPARATIVE ANALYSIS OF THE JUDICIAL SYSTEM IN ANCIENT AND MODERN INDIA

Structure of the Judicial System

Ancient India: The judicial system comprised multiple levels—village councils, regional courts, and royal courts led by kings. Justice was heavily influenced by religion and social hierarchy, with judges typically being Brahmins or Qazis.

Modern India: The system boasts a clear hierarchy: a Supreme Court at the pinnacle, High Courts in each state or union territory, and subordinate courts at the district level. Specialized tribunals deal with specific issues, and the judiciary functions independently to ensure fairness.

Judicial Procedures and Processes

Ancient India: Procedures were informal, shaped by customs, religious texts, and judicial wisdom. Oral arguments, testimonies, and moral discretion played critical roles in shaping judgments.

Modern India: A codified legal framework governs all court proceedings. Written petitions, evidentiary procedures, and adversarial arguments define trials, promoting consistency and adherence to legal standards.

Principles of Justice

Ancient India: Justice was anchored in Dharma, emphasizing truth, fairness, and moral order, though access often depended on social status.

Modern India: Grounded in constitutional values, justice upholds equality, impartiality, and rights protection, ensuring every citizen is treated equally under the law.

Sources of Law

Ancient India: Laws were derived from sacred texts like the Vedas, Smritis, and customary practices, with precedents and community norms shaping rulings.

Modern India: Law is derived from the Constitution, legislative statutes, judicial precedents, and international treaties ratified by India.

Access to Justice

Ancient India: Local courts provided community-level justice, but marginalized groups often faced limited access due to social hierarchies and biases.

Modern India: Access to justice is a constitutional right, bolstered by legal aid, PILs, and Lok Adalats, though delays and case backlogs still remain challenges.

CONCLUSION

India's judicial system has evolved significantly, transitioning from ancient traditions rooted in moral and religious principles to a modern constitutional democracy founded on equality and justice. Historically, Hindu laws focused on Dharma, integrating ethical responsibilities and fairness through concepts like Nyaya and Yukti. Social and political changes over time from Vedic assemblies to Mauryan and Mughal rule contributed to the development of various legal ideas and systems shaping justice in India.

The British colonial rule introduced organized laws and a centralized judicial system, laying the foundation for the current court framework. Following independence, the Indian Constitution revolutionized the legal landscape by establishing fundamental rights and ensuring judicial independence, making justice accessible to all citizens rather than just a privileged few.

Comparing past and present, modern India retains ancient values of fairness and ethical governance while rejecting discriminatory practices related to caste, gender, and social status. Recent developments including Public Interest Litigations (PILs), Alternative Dispute Resolution (ADR), and the move toward digital processes reflect the judiciary's commitment to increasing accessibility, efficiency, and inclusivity in justice.

Thus, India's legal evolution is neither a complete break from its cultural history nor a straightforward continuation. It represents a thoughtful integration of the moral essence of Dharma and Natural Law with constitutional principles of liberty, equality, justice, and secularism. This ongoing balance underscores how India's legal traditions continue to inspire and shape its pursuit of a fair and peaceful society.

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Integrating Vedic knowledge into Modern education

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Abstract

This paper provides a comprehensive analysis of the differences between Vedic and contemporary education, two distinct systems that have shaped learning paradigms throughout history. Vedic education, which has its roots in ancient Indian texts such as the Vedas, places a strong emphasis on moral and ethical values development, holistic growth, and traditional and spiritual wisdom. The Vedas provide a comprehensive foundation for developing well- rounded individuals equipped to navigate the challenges of modern life by promoting a balanced educational approach that cultivates both cognitive and socioemotional abilities. On the other hand, scientific knowledge, technological development, and the cultivation of critical thinking and problem-solving abilities are the main emphasis of contemporary education, which was impacted by the industrial and post-industrial eras. This article examines the guiding ideas, approaches, and goals of various educational paradigms to shed insight into the philosophical, social, and cultural changes that have shaped them. The idea that the universe is one family is explored through ideas like Vasudhaiva Kutumbakam, ahimsa (non-violence), and dharma (righteousness).

Keywords: Vedas, Modern Education, ancient wisdom, Ahimsa, Dharma.

INTRODUCTION

Humans nowadays deal with a variety of issues, from personal to societal, environmental, and climatic. Global violence, socioeconomic inequality, moral value deterioration, mental health crises, and environmental degradation are some of the challenges. The Vedic wisdom can provide a way through all of these extraordinary difficulties.

In the direction of a sustainable and peaceful existence. A road map for the challenges of the twenty-first century can be found in the Vedic wisdom, which emphasizes holistic living, ecological practices, and a society with ethics and values. The ideas of Brahman (the ultimate reality), Atman (the individual self), Dharma (moral code), and Karma (the law of action and consequence) are at the core of Vedic knowledge. A person can become their ideal self through a variety of yoga and self-realization paths.

Vedic wisdom is a holistic worldview that includes ethics, values, and personal growth in addition to being a system of spiritual teachings. Vedic teachings aim to help people realize who they are, comprehend the nature of the universe, and live in concord with the timeless truths.

Vedic Instruction

The prefix Dhyana, which means emotion, action (karma), and outcome, comes from the verb Vid, from whence the word Veda is derived. Smriti and Shruti are the sources of the Vedas, and Vedic education is a reflection of all knowledge. Vedic education is the foundation of India's cultural system. Vedic education can be appropriately described as a mirror of spiritual understanding. The following are examples of Vedic literature: Four Vedas, six Vedangas, four Upvedas, four Brahmanas, 184 Upanishads, six philosophical systems, the Bhagavad Gita, and three Smritis. Many aspects of Vedic education are appropriate in today's educational system. Rabindranath Tagore asserts that the best kind of education is one that balances our lives with all of existence in addition to imparting information.

Vedic Education: Fundamentals

Foundations of Philosophy: The Vedic tradition provides a thorough philosophical framework that has influenced human thought and behavior for millennia. It is based on the ancient writings known as the Vedas. Four essential human aims form the basis of the Vedas' basic teachings.

Dharma (duty), Artha (prosperity), Kama (desire), and Moksha (liberation) are the Purusharthas. These ideas offer a comprehensive way of living that takes into account the moral, material, spiritual, and emotional aspects of life.

Dharma (Duty): The foundation of Vedic philosophy is dharma, which is frequently translated as duty or righteousness. It stands for the moral code that regulates both social peace and personal behaviour. Dharma is a dynamic, situation-specific concept that varies depending on an person's place in society, life stage, and unique situation. According to the Vedas, following to one's Dharma guarantees the world's correct operation and advances the common good being. It motivates people to behave honorably, responsibly, and with respect for others, thus promoting an equitable and well-organized society.

Artha (Prosperity): The pursuit of material wealth and prosperity is referred to as Artha (Prosperity). According to Vedic philosophy, obtaining wealth is necessary for carrying out one's obligations and providing for one's family and society. But Dharma directs the quest for Artha, making sure that Wealth is obtained morally and put to better use. The Vedas promote a balanced attitude to worldly success, where wealth is pursued as a way to uphold social stability and improve the lives of others rather than for personal gain.

Kama (Desire): The pursuit of pleasure and emotional fulfillment is included in Kama (Desire). Enjoying life's joys, including love, art, beauty, and sensory experiences, is part of it. According to Vedic philosophy, Kama is a necessary component of human existence—as long as it is followed within the parameters of Dharma. The Vedas stress the value of moderation and self-control while acknowledging that desire is a natural and essential drive. Kama can bring happiness and contentment when in harmony with Dharma without endangering oneself or other people.

Moksha (emancipation): In Vedic philosophy, moksha, or emancipation, is the ultimate aim of human existence. It symbolizes the realization of one's true self (Atman) as unified with the ultimate reality (Brahman) and freedom from the cycle of birth, death, and reincarnation (samsara). The search for Moksha is the transcendence of the earthly world and the attainment of spiritual enlightenment via self-control, meditation, and wisdom. Moksha provides a route to eternal serenity and spiritual fulfillment, whereas Dharma, Artha, and Kama deal with the wants and demands of this world.

VEDIC KNOWLEDGE IN NATIONAL EDUCATION

Holistic Development: While mental development promotes intellectual growth through a variety of subjects like philosophy, physics, mathematics, and the arts, physical education places an emphasis on physical wellness through yoga and sports. Sacred text study, mantra recitation, and meditation all stress spiritual development.

Gurukul System: Residential education creates an immersive learning environment by having students live with their Guru in an ashram or Gurukul. This method emphasizes community living and group accountability while enabling individualized education and mentoring.

Ethical and Moral Education: The teaching of moral and ethical values that direct society and personal behaviour is known as dharma, or righteousness. It emphasizes the development of characteristics like honesty, integrity, compassion, and humility.

Relationship with Nature: By teaching sustainable living techniques and the value of protecting natural resources, education in natural environments promoted environmental consciousness and sustainability.

Self-Discipline and Self-Realization: The educational system places a strong emphasis on

self-control, promoting ethical values, daily routines, and meditation. In the end, it strives for self-realization and acknowledgment of one's actual self and potential by promoting introspection for personal development and self-awareness.

Experiential Learning: While hands-on activities strengthen theoretical knowledge through real-world experiences, practical application entails direct experience, observation, and knowledge application.

Lifetime Learning: While adaptation stresses being receptive to new concepts and information throughout life, continuous education encourages lifetime learning and the pursuit of knowledge beyond formal education.

Integration of Knowledge: The interdisciplinary approach to education fosters a harmonic balance between mental, spiritual, and physical development by encouraging a thorough study of a variety of subjects.

Cultural and Artistic Education: The curriculum teaches cultural heritage and customs to instill identity and continuity while including the arts and aesthetics to foster creativity and an appreciation of beauty.

Social Responsibility: While leadership and citizenship development entail active engagement in community activities for the development of responsible citizenship, community service fosters social service and societal welfare.

Character Development: By imparting moral and ethical principles that are necessary for the growth of responsible and caring people, Vedic teachings play a crucial part in character development. These lessons stress the value of self-control, respect for others, and the pursuit of justice, all of which are essential in forming pupils' personalities.

Ethical Decision-Making: Students can use Vedic concepts like Dharma to help them make moral choices in both their personal and professional life. Students can build a strong moral compass that aids them in navigating difficult situations by realizing the significance of responsibility and righteousness. circumstances with honesty and equity. Students can be taught to apply Vedic ideas to real-life situations through classroom discussions, role-playing scenarios, and ethical debates.

Emotional and Spiritual Development: Students' emotional and spiritual development is aided by the teachings of Kama and Moksha. Students can gain a better grasp of their goals, aspirations, and life purpose by investigating these ideas. Programs that include Students can acquire inner peace, emotional resilience, and a sense of spiritual fulfillment—all essential components of character development—by practicing yoga, meditation, and mindfulness.

Respect for variety and Inclusion: The concept of Vasudhaiva Kutumbakam, or the world as one family, is fostered by Vedic knowledge and promotes respect for variety and inclusivity. Education institutions can help pupils understand the value of empathy, compassion, and universal love. create an atmosphere where everyone is respected and diversity is celebrated.

VEDIC KNOWLEDGE AND NATIONAL DEVELOPMENT

Governance and Leadership: Vedic teachings provide deep insights into government and leadership that can greatly impact nation-building initiatives on contemporary political systems. The Vedic texts place a strong emphasis on the characteristics of an ideal leader and the fundamentals of moral administration, both of which are quite pertinent in the modern world.

Ethical Leadership: The Dharma principle, which requires leaders to act with righteousness, integrity, and a feeling of obligation for the welfare of their people, is the foundation of the Vedic notion of leadership. It is expected of leaders to exhibit wisdom (Viveka), compassion (Karuna)

and selflessness (Tyaga), making sure that their choices are motivated by the greater good rather than self-interest. These lessons can motivate leaders in contemporary political systems to place a high priority on moral judgment, openness, and responsibility, which will promote stability and trust in government.

The Rajarshi's role: According to the Vedas, a Rajarshi is a king who combines the administrative prowess of a ruler with the insight of a sage. It is expected of such a leader to rule with justice and fairness, guaranteeing the prosperity and contentment of every person. This idea can be adapted to modern nation-building by encouraging leadership that is both capable and ethically sound, able to handle the many problems of contemporary society in a fair manner.

Participatory Governance: Vedic teachings also support inclusive and participatory forms of governance. The idea of Sabha and Samiti, which were ancient assemblies that permitted free debate and decision-making, can encourage contemporary democratic institutions to be more inclusive, guaranteeing that a range of perspectives are acknowledged and heard during the governance process. By encouraging communication, reaching consensus, and shared accountability, this strategy can improve democratic systems.

DEVELOPMENT OF THE ECONOMY

Deep reverence for the natural world and a dedication to sustainability define the Vedic approach to economic growth. In contrast to contemporary economic theories that frequently emphasize short-term benefits, Vedic principles support a happy and balanced coexistence of mankind and the environment.

Sustainable Resource Management: The Vedas place a strong emphasis on the idea of Rta, or the universe's inherent order, which highlights the significance of coexisting peacefully with the natural world. Economic activity is seen as a component of a greater cosmic cycle, and it is thought that upsetting this equilibrium causes social unrest and environmental deterioration. By applying these ideas, Sustainable methods that put long-term ecological balance ahead of short-term profitability can be adopted in contemporary economic development. This entails implementing conservation initiatives that respect the natural order, sustainable agriculture, and renewable energy.

The Aparigraha Principle: Aparigraha, or non-possessiveness, is another significant Vedic principle that is pertinent to economic development. In order to prevent the excessive accumulation of riches, this doctrine advises people and societies to limit their appetites and consumption resources. This can be translated into laws that encourage responsible consumption, lessen waste, and support fair resource distribution in the modern world. By adopting Aparigraha, countries can solve problems like poverty, inequality, and environmental degradation and build a more equitable and long-lasting economic structure.

Community-Centric growth: The significance of community and collective well-being in economic growth is also emphasized in Vedic teachings. According to the idea of Sarvodaya, or the wellbeing of everyone, genuine economic advancement is determined by how well everyone is doing. community, not merely the affluence of a select few. Policies that prioritize social entrepreneurship, inclusive growth, and community-based economic projects that empower local communities and guarantee that development benefits all members of society may be inspired by this.

Community-Centric Development: Vedic teachings also emphasize the importance of community and collective well-being in economic development. The concept of Sarvodaya— the welfare of all—suggests that true economic progress is measured by the well-being of the entire society, not just the wealth of a few. This can inspire policies that focus on inclusive growth, social entrepreneurship, and community-based economic initiatives that empower local populations and ensure that development benefits all members of society.

HARMONY IN SOCIETY

By encouraging a sense of togetherness, respect for diversity, and dedication to non-violence, Vedic teachings offer a foundation for advancing social harmony and lowering disputes.

The Vasudhaiva Kutumbakam Concept: Vasudhaiva Kutumbakam, which translates to "the world is one family," is a fundamental concept of Vedic philosophy that upholds the notion of universal brotherhood and world unity. This idea can be crucial to the development of contemporary nations by promoting laws and social customs that value variety, advance inclusivity, and cultivate respect between many groups and civilizations. By adopting this idea, countries might endeavor to lessen social tensions and disputes, resulting in a society that is more harmonious and peaceful.

Encouraging Ahimsa (Non-Violence): Upholding social harmony depends on the Vedic principle of Ahimsa, or non-violence. It motivates people to live in a way that causes the least amount of physical and psychological harm to others. Ahimsa can direct policies in a contemporary setting that confront societal inequities, encourage peaceful dispute settlement, and oppose all forms of violence. This strategy can aid in creating a culture where disagreements are settled amicably rather than violently.

Dharma and Social Justice: The Vedic idea of Dharma is also essential for advancing fairness and social justice. It promotes the preservation of moral and ethical standards in society, the protection of the weak, and the equitable distribution of resources. Contemporary legal and social These lessons can serve as an inspiration for systems to develop rules and regulations that uphold the rights of all citizens, particularly those who are disadvantaged and excluded. Societies can guarantee that justice and fairness prevail, resulting in long-lasting societal harmony, by coordinating national policies with the tenets of Dharma.

VEDIC EDUCATION: BENEFITS

Given India's current circumstances, needs, opportunities, and goals, Vedic education has several advantages that can be implemented in one way or another:

Free education: During the Vedic era, students were not required to pay any tuition. Education's primary goals throughout the Vedic era were health preservation and improvement, knowledge development, social and national responsibility, cultural preservation, moral and character development, livelihood education, arts, skills, and spiritual development.

Comprehensive educational curriculum: During the Vedic era, the curriculum focused on the development of people's natural, social, and spiritual qualities. To accomplish these objectives, the curriculum comprised both Para (spiritual) and Apara (material) courses and activities.

Specialization: In our nation's higher education system, specialization was first implemented during the Vedic era.

Instructors and students led disciplined lives: During the Vedic era, Gurukul had very severe norms that both instructors and pupils had to abide by.

Friendly interaction between instructors and students: instructors took care of students' welfare and did everything in their power to help them develop holistically. In return, students served their professors, obeyed their commands, and showed respect for them.

Gurukuls' suitable surroundings and ritual-focused manner of life: During the Vedic era, gurukuls were situated in peaceful, pollution-free forests.

OBSTACLES AND REACTIONS CONTEMPORARY SKEPTICISM

There are various difficulties in incorporating ancient Vedic knowledge into modern circumstances. especially in a society that values factual and scientific methods more and more.

Scientific Validation: One of the main obstacles is the doubt about the Vedic principles are validated by science. Empirical research is frequently given priority in contemporary scientific methods. evidence and reproducibility, which may conflict with the philosophical and metaphysical aspects of the teachings of Veda. Many areas of Vedic knowledge, according to critics, lack empirical evidence and are difficult to examine scientifically. This mistrust may impede attempts to include Vedic methods into conventional frameworks for education or policy, since they can be perceived as non-scientific or hypothetical.

Compatibility with Modern Science: Vedic knowledge's tenets, such as metaphysical ideas and spiritual activities, might not necessarily coincide with what is known in modern science. For instance, concepts in Vedic literature about the nature of consciousness and the universe.

It is possible to interpret texts in ways that contradict accepted scientific notions. This disparity may cause opposition among individuals who value evidence-based methods and spark discussions about the application and relevance of Vedic teachings in a world that is more focused on science.

Realistic Application: It can be difficult to translate traditional Vedic practices into useful applications for contemporary life. For example, modern educational systems and governance models might not mesh well with old Vedic educational practices and societal structures.

It can be difficult and controversial to integrate these practices since they may need to be significantly altered to conform to modern social norms and technological developments.

INTERPRETATION AND ADAPTATION

There are a number of possible problems with interpreting and adapting Vedic knowledge for modern use, which could compromise the integrity and efficacy of its integration.

Contextual Misalignment: The Vedic teachings were created in a certain historical and cultural setting that is very different from the contemporary world. There could be a discrepancy between the texts' original aim and their modern use if these lessons are applied directly to current problems. For example, the Vedic writings' descriptions of societal structures and practices, such the Varna system, might not align with contemporary notions of social fairness and equality.

Diverse Interpretations: The vast array of writings and traditions that make up Vedic knowledge gives rise to a variety of interpretations and schools of thought. Different perspectives on how Vedic teachings ought to be implemented in contemporary settings may arise from this diversity. The absence of a cohesive strategy could make it difficult to build consistent and cohesive techniques for incorporating Vedic concepts into education, government, or social practices by causing uncertainty or disagreement among practitioners and scholars.

Risk of Misuse or Simplification: There is a chance that Vedic information will be misused or oversimplified when it is adapted for modern uses. Vedic teachings may be selectively interpreted or commercialized in ways that diminish their philosophical depth or distort their original intent.

Cultural Sensitivity and Appropriation: Incorporating Vedic knowledge into international settings necessitates respect for its roots as well as awareness of cultural appropriation. Vedic teachings run the risk of being hijacked or misinterpreted in ways that ignore their spiritual and cultural significance.

Importance. To prevent the commodification or distortion of Vedic wisdom, it is essential to ensure that adaptations are carried out in cooperation with qualified practitioners and with respect for the original material.

CONCLUSION

In conclusion, this essay investigates the use of Vedic knowledge in contemporary settings, analyzing its significance for human development, education, and nation-building. It demonstrates how Vedic ideas, such as Dharma, Artha, Kama, and Moksha, can enhance modern education by promoting moral judgment, useful skills, emotional and creative growth, and spiritual development. The impact of Vedic teachings on social peace, economic practices, leadership, and governance offers important insights for contemporary nation-building, directing policies toward moral leadership and sustainable development. By encouraging self- realization and cultural enrichment via philosophy, the arts, and rituals, Vedic wisdom also advances the spiritual development of people and societies. Despite its potential, incorporating Vedic knowledge is fraught with difficulties, such as contextual adaption problems and skepticism from contemporary scientists. In order to successfully implement Vedic teachings in the modern world and guarantee its applicability and influence in forming future developments in society.

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Echoes of Dharma: Integrating Vedic Principles for Compensatory Justice to Acquitted Undertrials in Modern India

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Abstract

In an era where ancient wisdom intersects with pressing legal reforms, this paper explores the untapped potential of Vedic insights and doctrines to address the plight of acquitted undertrials enduring wrongful imprisonment in contemporary India. Rooted in the Rigveda's portrayal of Yama and Varuna as guardians of cosmic equilibrium, Vedic thought underscores dharma as an inviolable framework for justice, emphasizing the sanctity of individual liberty and the presumption of innocence. These foundational ideals, echoed in texts like the Atharvaveda, advocate for societal harmony through equitable redress, viewing unjust suffering as a disruption of rita—the universal order—that demands restoration.

Dharma Shastras extend this ethos by prescribing compensatory mechanisms for miscarriages of justice. Early Vedic and post-Vedic eras treated offenses such as false accusations as civil torts, mandating restitution to the aggrieved, including fines or expiations proportional to the harm inflicted. For instance, perjury or malicious prosecution invited severe penalties, including wealth forfeiture and banishment, while protections against arbitrary arrest—exempting the vulnerable like the elderly, infirm, or scholars—highlighted a humanistic penology aimed at reformation over retribution. Kautilya's Arthashastra further refines this by regulating official misconduct, imposing graduated fines on errant enforcers to safeguard the innocent, thereby embedding restorative equity in statecraft.

Yet, India's modern criminal justice system, burdened by over 70% undertrial populations and protracted trials, often leaves the exonerated destitute, bereft of statutory remedies despite Supreme Court invocations of Article 21 for sporadic compensation. Drawing from the precedents from the Vedic texts, this study proposes a legislative blueprint: a dedicated compensation fund, calibrated by incarceration duration and socioeconomic loss, infused with dharma's emphasis on individualized equity. By harmonizing these ancient horizons with constitutional imperatives, such an approach not only rectifies systemic lapses but fosters a transformative jurisprudence—rehabilitating the wronged, deterring prosecutorial overreach, and realigning justice with ethical profundity. Ultimately, this fusion promises a resilient legal paradigm, where Vedic sagacity illuminates pathways to inclusive redress, affirming that true dharma liberates through amends, not mere acquittal.

Keywords: Dharma; Jurisprudence; Reformation; Retribution; Rita;

INTRODUCTION

The Indian criminal justice system, a cornerstone of the world's largest democracy, is confronting an existential crisis rooted in systemic inefficiencies and human rights erosions. As of October 2025, the National Crime Records Bureau (NCRB) reports that India's correctional facilities incarcerate approximately 577,000 individuals, with undertrials—those presumed innocent awaiting trial—comprising a staggering 76%, or about 439,000 persons. This marks a marginal uptick from 74% in the National Crime Records Bureau's (NCRB) 2023 Prison Statistics India

report, which tallied 422,238 undertrials out of 573,220 total prisoners, but underscores a decade-long stagnation from 66% in 2012. Overcrowding exacerbates the crisis, with national occupancy at 120% and outliers like Delhi's Tihar complex at 200%, transforming facilities into vectors of disease and despair—conditions that violate Article 21's guarantee of dignified existence. The demographic skew is particularly egregious: 70% of undertrials hail from marginalized communities, including 21% Scheduled Castes, 12% Scheduled Tribes, and a disproportionate share of Muslims (18%), often trapped by poverty-fueled bail denials where sureties average ₹50,000—unattainable for 60% of those below the poverty line. State-wise disparities compound this: Uttar Pradesh leads with 110,000 undertrials (18% of national total), followed by Bihar (60,000) and Maharashtra (50,000), accounting for 42% collectively, per 2025 India Justice Report estimates.

This crisis extends beyond statistics to profound ethical and philosophical quandaries. Article 21 of the Constitution, guaranteeing the right to life and personal liberty, has been expansively interpreted by the judiciary to encompass expeditious trials and dignity in incarceration, yet its promises ring hollow for the acquitted undertrial. Upon exoneration—frequently after 3–5 years of limbo—the system proffers little: no standardized compensation, scant rehabilitation, and a societal stigma that perpetuates exclusion. Recent NCRB data reveals that 73.5% of prisoners in states like Telangana are undertrials, with national acquittal rates hovering at 70% in delay-prone districts, underscoring a prosecutorial overreach that inflicts irreversible harm. The human cost is ineffable: shattered families, evaporated livelihoods, and psychological traumas manifesting in 1.7% of inmates facing mental health crises, a figure likely underreported.

Enter the timeless reservoir of Vedic knowledge, not as arcane relic but as a vibrant antidote to this malaise. The Vedas—Rigveda, Yajurveda, Samaveda, and Atharvaveda—composed between 1500–500 BCE, articulate a jurisprudence where dharma (righteous order) and rita (cosmic harmony) interweave to demand restoration over retribution. In Rigveda 7.86, Varuna, the arbiter of oaths, ensnares the deceitful, while Yama in 10.14 ensures the innocent's unencumbered path, prefiguring modern presumptions of innocence. These principles, far from theocratic fiat, empowered communal assemblies (sabhas) for mediated resolutions, emphasizing amends to heal societal fractures.

This paper undertakes a rigorous synthesis of Vedic restorative ethos with contemporary exigencies, advocating for its infusion into India's legal architecture to safeguard acquitted undertrials' rights. Methodologically, it employs historical exegesis, doctrinal analysis, empirical scrutiny, and prescriptive modeling, drawing on primary texts and 2025 datasets. The structure unfolds thus: Section 1 excavates Vedic foundations; Section 2 traces evolutions in Dharmashastras and Arthashastra; Section 3 dissects modern challenges; a new Timeline subsection chronicles jurisprudential progression; Section 4 proffers a Vedic-inspired framework; Section 5 juxtaposes global comparatives; and the Conclusion synthesizes imperatives.

To contextualize this trajectory, the following timeline encapsulates key milestones in Indian jurisprudence, bridging antiquity to modernity:

Table 1. Key milestones in Indian jurisprudence

Period	Key Developments	Significance
1500–500 BCE (Vedic Era)	Composition of Rigveda, Yajurveda, etc.; Concepts of rita and dharma emerge in hymns like Rigveda 10.14 (Yama's judgment).	Establishes restorative justice via communal mediation; presumption of innocence as cosmic norm.
500 BCE–200 CE (Post-Vedic/Smriti Era)	Manusmriti codifies fines for perjury (VIII.267); Yajnavalkya Smriti refines evidence rules.	Shifts to prescriptive restitution; protections against arbitrary arrest formalized.

300 BCE (Mauryan)	Kautilya's Arthashastra regulates official misconduct with graduated penalties (IV.11).	Integrates dharma into statecraft; treasury-funded victim compensation introduced.
1206–1757 CE (Islamic/Delhi Sultanate-Mughal)	Introduction of Sharia elements; Qazi courts blend with local customs.	Hybridization dilutes pure dharma but retains equity in civil disputes.
1757–1947 CE (British Colonial)	Regulating Act 1773; IPC 1860 and CrPC 1898 impose adversarial model.	Colonial overlay supplants restorative ethos with retributive penal codes.
1950–Present (Post-Independence)	Constitution 1950 (Article 21); CrPC 1973 (Section 358); BNSS 2023; SC rulings like Bhim Singh (1985) and 2025 compensation directives.	Revival of rights-based justice; calls for statutory redress amid undertrial surge.

This chronology illuminates a continuum disrupted by colonialism, ripe for reclamation. In a nation where undertrials from vulnerable strata endure adharma's brunt, Vedic dharma proffers not nostalgia but necessity—a restorative paradigm to affirm dignity, deter excesses, and realign justice with indigenous profundity.

SECTION 1: VEDIC FOUNDATIONS OF JUSTICE: RITA, DHARMA, AND THE IMPERATIVE OF RESTORATION

The Vedas, as apaurusheya (authorless revelations), form the substratum of Indic thought, embedding justice within a metaphysical framework that prioritizes equilibrium over escalation. Spanning 1,028 hymns in the Rigveda alone, these texts—transcribed from oral traditions circa 1500 BCE—invoke rita over 390 times, portraying it as the inexorable law orchestrating celestial bodies, seasonal cycles, and moral conduct. Rita's antithesis, anrita (disorder), manifests in falsehoods or oppressions like wrongful bondage, compelling restorative interventions to reinstate harmony. Scholarly translations, such as Wendy Doniger's anthology, elucidate this: Rigveda 1.164.46 declares, "They call him Indra, Mitra, Varuna... but it is the one Rita that the wise call by many names," underscoring unity in ethical governance. (Doniger, 1981).

Varuna embodies rita's enforcer, his pasas (bonds) ensnaring perjurers in Rigveda 7.87: "The spy of Varuna... sees all deeds, even those hidden in the heart." This vigilance extends mercy to the contrite, as Verse 7 pleads, "Loose us from the bonds of sin," implying expiation's role in reversal. Yama complements as post-mortem adjudicator; Rigveda 10.14.1–2 narrates: "I speak of the path of the Fathers... Yama first found the way," granting the truthful unhindered transit, a poetic bulwark against presumptive guilt.

The Atharvaveda, with its pragmatic incantations, operationalizes these ideals. Hymn 4.36, against unjust fetters, entreats: "O Agni, unbind the noose of the wicked... let the fettered one go free," pairing liberation with prosperity charms for economic amends. Hymn 6.11 shields the vulnerable: "From the grasp of the strong, deliver the weak," mobilizing kin and deities for communal redress, prefiguring habeas corpus. Dharma, etymologically from dhṛ (to uphold), evolves here from ritual propriety to societal sustenance; Yajurveda 36.18 infuses ahimsa, advocating non-violent resolutions even amid conflict.

Governance occurred via sabhas and samitis, egalitarian forums where elders mediated per Rigveda 10.191: "Assemble, speak together... deliberate with one mind." Resolutions favored restitution; 10.109 resolves a cattle dispute through compensatory herds, symbolizing holistic

mending—material, relational, spiritual. Perjury, desecrating vak (sacred word), invokes Varuna's drought in 7.49.2, but atonement via prayashchitta restores balance.

Upanishadic interpolations (800–500 BCE) spiritualize this: Brihadaranyaka 1.4.14 views injustice as karmic debt, redeemable collectively; Chandogya 5.10.9 analogizes harm to a loan, dischargeable through societal amends. Critiques of theocratic leanings falter against empirical humanism: unlike Code of Hammurabi's talion, Vedic danda is proportional and reformative, aligning with modern restorative justice models emphasizing victim-offender mediation.

For acquitted undertrials, this legacy mandates beyond acquittal: state-facilitated healing—financial, psychological, social—to recalibrate rita disrupted by adharma. Reintegrating Vedic presumptions could dismantle colonial adversarialism, fostering a jurisprudence where liberty's violation exacts equitable toll.

SECTION 2: EVOLUTION IN DHARMASHASTRAS AND ARTHASHASTRA: CODIFYING COMPENSATORY MECHANISMS

Post-Vedic smritis (500 BCE–200 CE) crystallize Vedic fluidity into normative scaffolds, with Manusmriti—2,685 verses attributed to Manu—pivotal. Patrick Olivelle's translation reveals Adhyaya VIII's vyavahara as a civil-penal hybrid: Verse 124 mandates double restitution for false claims; 267 fines perjurers 500–1,000 panas, scaled to harm and status, equating to 6–12 months' labor. (Olivelle, 2005). Malicious detention triggers reciprocal imprisonment plus full amends (298), inverting injustice; banishment deters recidivism (379).

Safeguards abound: Verse 314 bars nighttime arrests of scholars or elders; 336 voids baseless bonds. Yajnavalkya Smriti (2.68–70) prioritizes witness testimony, fining falsifiers while awarding kin maintenance (2.195). These texts, per Kane's History of Dharmashastra, embody proto-tort law, centering victims. (Kane, 1968).

Arthashastra, Kautilya's 6,000-sutra treatise (300 BCE), secularizes via L.N. Rangarajan's edition: Book IV fines judges 48–200 panas for erroneous arrests (4.11); treasury reimburses victims' losses (3.17). (Rangarajan, 1992). Perjury blends fines with corvée (2.36); "rope-tricks" (frivolous holds) require probes (4.8). Royal liability (5.2.45) institutionalizes accountability.

Intertextually, Manusmriti's varna-gradations contrast Arthashastra's merit-based danda, yet both prioritize restoration: prayashchitta transmutes penalty into reintegration. Critiques of hierarchy notwithstanding, these codices offer scalable models—panas as proxies for modern quanta—bridging to CrPC reforms.

SECTION 3: CONTEMPORARY CHALLENGES: UNDERTRIALS, ACQUITTALS, AND THE VOID OF REDRESS

India's criminal justice system, forged in the crucible of post-colonial reconstruction, has inherited a labyrinthine framework that prioritizes procedural rigidity over restorative equity—a stark departure from the Vedic dharma's emphasis on swift, harmonious resolution. Enacted in 1973, the Code of Criminal Procedure (CrPC) sought to streamline investigations and trials, yet its provisions for redressing wrongful incarceration remain woefully antiquated. Section 358 of the CrPC, for instance, empowers magistrates to award compensation not exceeding ₹1,000 to individuals subjected to "groundless" arrests, a nominal sum that has languished unchanged since independence, rendering it a mere token gesture amid escalating economic hardships. This inadequacy persists in the Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023, which replaces the CrPC effective July 1, 2024, and mirrors its predecessor's limitations in Section 399. Under this provision, compensation for wrongful arrests triggered only upon the complainant's conviction—caps at the same ₹1,000, payable by the arresting party, with no escalation for prolonged detentions or systemic delays. While the BNSS introduces salutary measures like mandatory timelines for

investigations (Section 193) and video-recording of searches (Section 105), its failure to overhaul compensation mechanisms perpetuates a culture of impunity, where the state's errors impose lifelong burdens on the innocent.

This structural shortfall unfolds against a backdrop of staggering scale: as of the latest projections for October 2025, India's prisons house approximately 577,000 inmates, with undertrials—presumed innocent yet ensnared in pretrial limbo—constituting a record 76%, or about 439,000 individuals. This marks a marginal uptick from 74% in the National Crime Records Bureau's (NCRB) 2023 Prison Statistics India report, which tallied 422,238 undertrials out of 573,220 total prisoners, but underscores a decade-long stagnation from 66% in 2012. Overcrowding exacerbates the crisis, with national occupancy at 120% and outliers like Delhi's Tihar complex at 200%, transforming facilities into vectors of disease and despair—conditions that violate Article 21's guarantee of dignified existence. The demographic skew is particularly egregious: 70% of undertrials hail from marginalized communities, including 21% Scheduled Castes, 12% Scheduled Tribes, and a disproportionate share of Muslims (18%), often trapped by poverty-fueled bail denials where sureties average ₹50,000—unattainable for 60% of those below the poverty line. State-wise disparities compound this: Uttar Pradesh leads with 110,000 undertrials (18% of national total), followed by Bihar (60,000) and Maharashtra (50,000), accounting for 42% collectively, per 2025 India Justice Report estimates.

To visualize this epidemic, consider the following table distilling NCRB and India Justice Report data for 2023–2025:

Table 2. Total Prisoners, Undertrials & Overcrowding as per NCRB

State/UT	Total Prisoners (2023)	Undertrials (2023)	% Undertrials	Projected Undertrials (2025)	Overcrowding (%)
Uttar Pradesh	110,000	84,000	76%	110,000	150%
Bihar	60,000	45,000	75%	60,000	140%
Maharashtra	50,000	38,000	76%	50,000	130%
Delhi	20,000	18,000	90%	20,000	200%
National Total	573,220	422,238	74%	439,000 (76%)	120%

These figures, drawn from NCRB's annual compendium and extrapolated via judicial vacancy trends, reveal a system buckling under its own weight. Judicial pendency, hovering at 5.2 crore cases across district and high courts as of September 2025, fuels average detentions of 3–5 years for undertrials, with 22% vacancies among 25,000 sanctioned judges—yielding a dismal judge-to-population ratio of 21 per million, against the global benchmark of 50. In high-burden districts like Lucknow and Patna, trials drag for 7–10 years, inverting the presumption of innocence into protracted punishment. The socioeconomic fallout is devastating: post-acquittal, 70% of exonerees face unemployment, with 40% enduring permanent income loss averaging 50% of pre-arrest earnings, per a 2025 Tata Trusts study on prison reintegration. Families splinter—children orphaned to state homes, spouses destitute—while stigma erects invisible barriers to employment and social mobility, particularly for Dalit and Adivasi acquittees who report 60% higher discrimination rates.

The CrPC and BNSS's compensatory voids amplify these inequities, treating redress as discretionary charity rather than constitutional entitlement. Section 358/399's ₹1,000 ceiling, invoked in fewer than 1% of eligible cases due to evidentiary hurdles (requiring complainant conviction), ignores the multifaceted harms of incarceration: lost wages, medical neglect (1.7% of inmates suffer untreated mental health issues), and familial disintegration. Absent a dedicated fund or indexed adjustments for inflation—eroding the cap's real value to ₹200 in 1973 terms—these provisions mock Article 21's expansive remit, as affirmed in D.K. Basu v. State of West Bengal

(1997), which recognized custodial violations as actionable torts. The BNSS's innovations, like e-FIRs and zero-FIR portability, falter without enforcement teeth: a 2025 Vidhi Centre audit found 40% non-compliance in timeline adherence, perpetuating the very delays they aim to curb.

Judicial interventions offer sporadic lifelines, yet underscore the system's ad hoc desperation. On June 25, 2025, a Supreme Court bench comprising Justices B.R. Gavai and Sandeep Mehta directed Uttar Pradesh to pay ₹5 lakh in interim compensation to an undertrial who languished 28 days post-bail due to a "missing sub-section" in prison records—a procedural farce that the Court lambasted as "state negligence bordering on malice." This followed the May 2025 ruling in a similar Allahabad High Court overflow case, where ₹2 lakh was awarded for a 45-day delay. More ambitiously, on July 16, 2025, Justices J.B. Pardiwala and R. Mahadevan urged Parliament to enact a comprehensive compensation statute, decrying the "irreparable scars of years lost to iron bars" and invoking Bhim Singh v. State of J&K (1985)'s precedent for constitutional torts. However, these respites are outliers; the 2014 Akshardham blast case (State of Gujarat v. Salim Shaikh) denied binding precedent for automatic compensation, insisting on case-by-case scrutiny—a stance reiterated in 2025 dismissals of 15 writ petitions seeking uniform redress.

Exemplifying this void is the decade-long odyssey of Professor G.N. Saibaba, a wheelchair-bound Delhi University academic and human rights defender, acquitted on March 5, 2024, by the Nagpur Bench of the Bombay High Court after 10 years under UAPA for alleged Maoist links. Arrested in 2014 sans substantial evidence—reliant on coerced witness statements—the professor endured Nagpur Central Jail's "Andhra Block," a high-security hellhole where his 90% disability (polio-afflicted) went unaccommodated, exacerbating spinal deterioration and PTSD. The High Court termed the trial a "miscarriage of justice," acquitting Saibaba and four co-accused for lack of proof, yet the Supreme Court, on March 11, 2024, refused to stay release pending appeal, deeming the judgment "well-reasoned." As of October 2025, no compensation has materialized; Saibaba's family, per Al Jazeera interviews, grapples with ₹20 lakh in medical debts, a stark indictment of redress's absence. His saga mirrors thousands: NCRB 2023 logs 4,000+ UAPA detainees, with acquittal rates nearing 97% due to evidentiary frailties—coerced confessions and delayed sanctions—yet pretrial suffering equals or exceeds sentences in 80% of cases.

Frivolous FIRs under draconian statutes like the Unlawful Activities (Prevention) Act (UAPA) and Protection of Children from Sexual Offences (POCSO) Act, 2012, turbocharge this injustice. UAPA's conviction rate hovers at 2–3% nationally (2024 MHA data: 112 convictions from 4,500 cases), with 97% acquittals often post-years of detention, as in Andhra Pradesh where Prof. Haragopal decried it as a tool to "stifle dissent." POCSO fares marginally better but alarmingly: reported cases surged 94% from 2019–2024 (Childlight Global Index 2025: 1.5 lakh annually), yet national conviction rates languish at 30–40%, with Fast-Track Special Courts (FTSCs) disposing 52% of 4.5 lakh assigned cases since 2019 but amassing 2 lakh pendencies. In the South Zone, a commendable 70% conviction rate in 2025 reflects vigilant policing, but nationally, delays—averaging 2 years—inflict secondary trauma on child victims and wrongful stigma on accused, many undertrials from impoverished backgrounds. These laws, wielded with prosecutorial zeal (70% of UAPA/POCSO FIRs lead to arrests sans preliminary inquiry), embody adharma's triumph: innocence presumed in rhetoric, presumed guilty in practice.

In summation, these contemporary fissures—statutory parsimony, empirical overload, and discretionary palliatives—betray the Vedic rita's call for equilibrium, where unjust bonds demand not endurance but expiation. The acquitted undertrial, emerging from shadows of suspicion, confronts not vindication but vacuum: no fund to rebuild, no shield against scars. As Justice Pardiwala intoned in July 2025, "Years lost deserve acknowledgment, not amnesia." This void, etched in 439,000 lives, imperatively summons dharmic recalibration—a restorative jurisprudence to redeem the innocent, deter the arbitrary, and restore cosmic harmony in a republic adrift.

TIMELINE OF INDIAN JURISPRUDENCE: FROM VEDIC RITA TO CONSTITUTIONAL DHARMA

- 800–500 BCE: Upanishads internalize karma; restorative expiation formalized.

- 200 BCE–200 CE: Narada Smriti introduces contracts, influencing civil restitution.
- 1858: British Crown assumes control; Hindu law codified selectively.
- 1973: CrPC enactment; Section 436A limits undertrial detention to half max sentence.
- 2023: BNSS replaces CrPC; enhances bail but lacks compensation teeth.
- 2025: SC's July directive signals legislative momentum.

This timeline, drawn from historical syntheses, underscores continuity and rupture, urging Vedic revival.

SECTION 4: BRIDGING HORIZONS: A VEDIC-INSPIRED FRAMEWORK FOR COMPENSATION AND REHABILITATION

The imperative to infuse Vedic restorative principles into India's contemporary criminal justice architecture is not merely aspirational but urgently operational. As articulated in the preceding sections, the Vedas' emphasis on rita—the cosmic order disrupted by adharma and restored through equitable amends—finds poignant resonance in the Dharmashastras' codified fines and the Arthashastra's state-mandated restitutions. Manusmriti's proportional penalties (VIII.124, 267) and Kautilya's treasury reimbursements (3.17.5) prefigure a system where the state's failure exacts a tangible societal debt, redeemable through holistic reparation. In the face of 2025's grim tableau—439,000 undertrials comprising 76% of India's 577,000 prison population, with Uttar Pradesh and Bihar alone accounting for 170,000 (110,000 and 60,000 respectively)—such principles demand legislative incarnation. This section proposes the "Dharma Restoration Act, 2026" (DRA), a comprehensive statute that operationalizes Vedic equity by establishing a dedicated compensation and rehabilitation regime for acquitted undertrials. Envisioned as a cornerstone of judicial reform, the DRA aligns with Article 21's dignity mandate and Supreme Court directives for statutory redress, as echoed in the July 2025 ruling urging compensation for "years lost" to incarceration.

At its core, the DRA seeks to transform acquittals from mere vindications into gateways for renewal, embodying dharma's triad of accountability, reparation, and reintegration. By mandating state-funded amends calibrated to harm's depth—drawing from Rigveda's restorative hymns (10.109) and Atharvaveda's charms against unjust bonds (4.36)—it addresses the empirical void: acquitted individuals face 40% income erosion and 25% unemployment, per 2025 India Justice Report analyses. The Act's preamble would invoke rita's sanctity, declaring wrongful detention an "affront to cosmic harmony, redeemable through individualized equity and communal healing." Objectives include: (i) deterring prosecutorial overreach via fiscal accountability; (ii) rehabilitating the exonerated through multifaceted support; (iii) fostering systemic efficiency by incentivizing timely trials; and (iv) realigning jurisprudence with indigenous ethos, reducing reliance on colonial-era adversarialism. This framework, projected for parliamentary introduction in the 2026 Budget Session, builds on BNSS 2023's Section 399 while supplanting CrPC Section 358's ₹1,000 cap with robust, scalable mechanisms.

Central to the DRA's viability is its funding architecture, designed for self-sustainability and dharmic proportionality. Drawing from Arthashastra's treasury model (5.2.45), the Act establishes a National Dharma Restoration Fund (NDRF), capitalized initially at ₹5,000 crore from the Consolidated Fund of India, with annual infusions tied to judicial outputs. Primary revenue streams include a 1.5% levy on all court-imposed fines and penalties, projected to yield ₹15,000 crore annually based on extrapolated 2024-25 data. While comprehensive national aggregates remain elusive—PIB reports indicate ₹384 crore in select fines up to March 2023, and broader estimates from the India Justice Report suggest court-collected penalties exceeding ₹10,000 crore yearly across traffic, civil, and criminal domains—the DRA incorporates escalatory clauses to capture unreported streams like traffic violations (₹2,500 crore in Delhi alone, 2024) and environmental fines. Secondary sources encompass 0.5% of state legal aid cesses and voluntary corporate social responsibility (CSR) contributions under Section 135 of the Companies Act, 2013, incentivized via tax rebates for firms aligning with "dharmic justice" initiatives. Administrative costs capped at 10%

ensure 90% disbursement to beneficiaries, audited triennially by the Comptroller and Auditor General (CAG). This model not only democratizes redress—prioritizing undertrials from marginalized strata, who constitute 70% of detainees—but echoes Manusmriti's graded amercements (VIII.298), where wrongdoers' forfeitures directly mend victims' losses.

The quantum of compensation under the DRA embodies Vedic individualized equity, eschewing one-size-fits-all caps for a nuanced, audit-driven formula. Eligibility thresholds include "clean acquittals" (full exoneration without appeal) after minimum six months' detention, excluding cases of partial culpability. Base awards commence at ₹20,000 per month of incarceration, benchmarked against average urban minimum wages (₹18,000–22,000, per 2025 Labour Bureau data), escalating to ₹25,000 for rural or marginalized claimants to account for opportunity costs. This yields, for instance, ₹12 lakh for a three-year stint—far surpassing judicial precedents like the ₹5 lakh in G. Premsankar (2021) or ₹10 lakh in the 2025 Delhi ruling. Augmented components include socioeconomic loss audits: foregone earnings (80% of verified income, capped at ₹50 lakh), medical/psychological damages (₹1–5 lakh, certified by empaneled counselors), and familial impacts (₹2 lakh per dependent for maintenance arrears). Intangible harms—stigma, trauma—invoke prayashchitta's expiatory spirit, allotting ₹3–7 lakh via restorative circles, community-mediated dialogues inspired by Vedic sabhas.

To illustrate, consider the following tiered quantum matrix, adaptable via annual gazette notifications:

Table 3. Tiered Quantum Matrix for Compensation

Detention Duration	**Base Compensation (₹)**	**Socioeconomic Add-on (Max ₹)**	**Intangible/ Rehab (₹)**	**Total Est. (Avg. Case)**
6–12 months	1.44–2.4 lakh	2–4 lakh	1–2 lakh	4.44–8.4 lakh
1–3 years	2.4–7.2 lakh	5–15 lakh	2–4 lakh	9.4–26.2 lakh
3–5 years	7.2–12 lakh	15–30 lakh	3–5 lakh	25.2–47 lakh
>5 years	12+ lakh	30+ lakh	5–7 lakh	47+ lakh

This matrix, calibrated to 2025 inflation (projected 5.5%), ensures proportionality akin to Yajnavalkya Smriti's harm-scaled fines (2.195), with disbursal within 90 days post-acquittal via direct benefit transfer (DBT) to Aadhaar-linked accounts, minimizing leakages.

The DRA's structural pillars operationalize these quanta through interconnected mechanisms, each rooted in ancient precedents yet attuned to modern exigencies. First, fast-track sabhas—decentralized tribunals modeled on Rigveda's assemblies (10.191)—comprise district-level panels of retired judges, social workers, and Vedic scholars, empowered to expedite bail hearings and pre-trial reviews. Mandated under Section 10 of the Act, these sabhas would convene bi-weekly, leveraging AI-driven case triage (as piloted in e-Courts Phase III) to slash average detention from 3.5 years to under 18 months, targeting high-undertrial states like Uttar Pradesh (110,000 detainees) and Bihar (60,000). Integration with BNSS timelines ensures 50% case disposal within 60 days, fostering ahimsa by preempting adharma's accrual.

Second, official audits enforce accountability, channeling Arthashastra's graduated penalties (4.11) into contemporary oversight. A Central Dharma Audit Bureau (CDAB), under the Ministry of Law, would investigate frivolous FIRs and delays, imposing fines on errant officers—₹50,000–5 lakh per violation—funneling 100% to the NDRF. Annual reports, tabled in Parliament, would benchmark prosecutorial success rates (target: <60% conviction in undertrial-heavy probes), deterring overreach as seen in 70% UAPA acquittals. This pillar not only replenishes the fund but embodies Varuna's noose (Rigveda 7.87), binding state agents to truth's service.

Third, rehabilitation via ahimsa programs holistically mends the acquitted's fabric, extending Yajurveda's non-violence (36.18) to psychosocial restoration. Empaneled under the Act, these initiatives include six-month skill certification courses (tailored to varna-neutral vocations like digital literacy and agro-tech), psychological counseling (₹10,000/session, up to 20), and microfinance linkages (₹1–5 lakh low-interest loans via NABARD). Community reintegration hubs—Vedic-inspired ashrams in 100 districts—facilitate employer tie-ups, aiming for 70% employment within a year. For families, stipends cover education arrears, echoing Manusmriti's kin-maintenance (VIII.336). Metrics for success: 80% participant satisfaction, tracked via longitudinal surveys.

Implementation commences with phased pilots in Uttar Pradesh and Bihar, states harboring 30% of national undertrials and ripe for reform amid their 42% collective share with Maharashtra. Launching January 2026, these two-year trials—overseen by inter-ministerial committees—target 10,000 beneficiaries annually, with ₹500 crore allocated per state from NDRF seed capital. Evaluation by independent bodies like NITI Aayog would assess reductions in recidivism (target: 15% drop) and trial pendency (20% faster), informing national rollout by 2028. Digital infrastructure, via the e-Courts portal, ensures seamless claims processing, with blockchain for audit trails to uphold transparency.

Challenges loom, yet mitigable through dharmic foresight. Fiscal sustainability risks overestimation of fine yields; countered by contingency clauses tying levies to GDP growth (escalating 0.5% annually post-2027). Bureaucratic resistance—fearing accountability—yields to Supreme Court oversight, with the apex court designating a bench for appellate review, as in Bhim Singh (1985). Equity concerns, such as urban-rural disparities in audits, mandate affirmative action quotas (50% for SC/ST claimants). Ethical critiques of "Vedic revival" as majoritarian are preempted by secular framing: dharma as universal ethic, inclusive of all faiths, per constitutional pluralism.

In benefits, the DRA promises transformative dividends: economic—₹50,000 crore injected into marginalized economies over a decade; social—eroding caste-class incarceration biases; and jurisprudential—shifting from retribution to restoration, aligning with UN Victim Principles (1985). Ultimately, this Vedic-inspired edifice redeems adharma's legacy, ensuring acquitted undertrials emerge not scarred survivors but empowered stewards of rita, affirming India's justice as a living dharma.

SECTION 5: COMPARATIVE GLOBAL PERSPECTIVES: LESSONS FOR VEDIC INTEGRATION

In an interconnected world where justice paradigms traverse borders, examining global approaches to wrongful conviction compensation and restorative practices offers invaluable blueprints for India's Vedic-inspired reforms. The Vedas' rita—cosmic equilibrium restored through dharma's equitable amends—resonates profoundly with international models that prioritize healing over retribution, yet each system's unique cultural moorings provides tailored lessons. As India's undertrial crisis persists with 439,000 individuals (76% of prisoners) in October 2025, these perspectives illuminate pathways to hybridize ancient sabhas (assemblies) with modern statutes, fostering a jurisprudence that mends societal fractures while deterring adharma. This section dissects key exemplars—the United States' Innocence Protection Act, Canada's federal compensation regime, New Zealand's Māori restorative circles, the European Court of Human Rights' (ECHR) Article 5 safeguards, and South Africa's Ubuntu-infused Truth and Reconciliation Commission (TRC)—before synthesizing Vedic hybrids adaptable to Indian contexts, such as Kerala's mediation pilots. By juxtaposing these, we discern universal threads: individualized redress, communal reintegration, and accountability, all echoing Manusmriti's proportional fines (VIII.267) and Arthashastra's state-funded restitutions (3.17.5).

The United States exemplifies a federated, litigation-driven model, where the Innocence

Protection Act (IPA) of 2004 marks a watershed in post-conviction relief. Enacted as part of the Justice for All Act, the IPA allocates federal grants to states for post-conviction DNA testing, aiming to exonerate the innocent and streamline appeals. By 2025, it has facilitated over 375 DNA-based exonerations since 1989, per the Innocence Project's ledger, with cumulative payouts exceeding $200 million across statutes like the federal Wrongful Conviction Compensation Act (proposed expansions in 2024). Compensation varies by state: federal guidelines under 28 U.S.C. § 2513 award $100,000 per year of incarceration (up to $5 million lifetime cap), while states like New York offer $50,000 annually plus therapy stipends, and Texas caps at $80,000/year with no-fault provisions for official misconduct. A 2025 Duke Law fact sheet highlights 38 states with dedicated laws, yet disparities persist: only 10% of exonerees receive full claims, often delayed by multi-year lawsuits. Georgia's 2025 Wrongful Conviction and Incarceration Compensation Act, signed by Governor Kemp, exemplifies momentum, authorizing claims via the Office of State Administrative Hearings with $25,000–$1 million quanta, inclusive of lost wages and counseling. Efficacy shines in reduced recidivism (under 5% for compensated exonerees) and policy ripple effects, like 2024's federal post-conviction DNA access expansions. For Vedic integration, the IPA's evidentiary focus mirrors Atharvaveda's truth charms (4.36), suggesting India adopt DNA mandates in the proposed Dharma Restoration Act, calibrated to panas-like fines for perjury.

Canada's approach, more centralized yet victim-centric, underscores holistic rehabilitation, aligning with dharma's prayashchitta (expiation). The federal Miscarriage of Justice Review Commission Act (2025), building on the 2019 David and Carter recommendations, establishes an independent body to expedite reviews, with compensation guidelines updated in 2023 to reflect inflation. Awards average CAD 100,000+ per year of wrongful imprisonment—e.g., CAD 10.5 million to Guy Paul Morin in 1995, adjusted to CAD 21 million in 2025 equivalents—plus non-pecuniary damages for trauma (up to CAD 500,000) and mandatory therapy via provincial health plans. Quebec's 2025 guidelines, per the Indemnisation pour Erreurs Judiciaires program, require imprisonment proof and award CAD 1,000–2,000 daily, encompassing family stipends and psychological support, with 30 exonerations aided by Innocence Canada since 2020. A 2025 Wrongful Conviction Law Review notes a 700% female incarceration spike correlating to higher exoneration needs, prompting gender-sensitive add-ons like childcare reimbursements. Challenges include provincial variances—Ontario's CAD 75,000/year cap lags—and review delays averaging 5 years, yet 84% claimant satisfaction underscores efficacy. Lessons for India: Infuse the NDRF with Canada's therapy mandates, echoing Upanishadic karmic healing (Brihadaranyaka 1.4.14), to address acquittees' 25% PTSD rates.

New Zealand's youth justice system, a global paragon of indigenous restorative justice, draws from Māori te ao (worldview) to prioritize communal healing, paralleling Vedic sabhas' deliberative ethos (Rigveda 10.191). The 1989 Children, Young Persons, and Their Families Act mandates Family Group Conferences (FGCs)—circle-based mediations—for 90% of youth offenses, reducing custody by 80% since inception. By 2025, Whakamana Tangata pilots extend FGCs to adults, yielding 82% victim satisfaction and 70% recidivism drop, per a June 2025 evaluation. Māori principles of mana (dignity restoration) and utu (balance) infuse proceedings, with 84% conference recommendations adopted, fostering whānau (family) involvement over adversarial trials. A 2025 Impact Justice report hails this as a "gift to the world," with adult RJ pilots in Auckland achieving 80% efficacy in emotional resolution. Critiques note over-representation (Māori youth 50% of detainees despite 15% population), yet reforms like 2025's Independent Sentencing Review integrate RJ broader. Vedic synergy: Blend FGCs with sabhas for undertrial mediations, targeting India's 70% youth detainees to halve delays.

The ECHR's Article 5 framework enforces prompt compensation for unlawful detention, embodying rita's vigilance against anrita. Ratified by 46 Council of Europe states, Article 5 §5 mandates "enforceable right to compensation" for violations, with 2025's Guide on Article 5 logging 150+ awards averaging €5,000–50,000 per case. Landmark 2025 rulings, like Atanasije v. Serbia (July 9), granted €10,000 for baseless 6-month hold sans arrest report, violating §1's lawfulness. The Grand Chamber's S.A.S. v. France (2025) upheld Geneva-compliant detentions but awarded €20,000 for procedural lapses (§2–4). EU Directive 2012/13 harmonizes pre-trial rights, yet a 2025 IBA report flags uneven implementation—Italy's €500,000 caps contrast Greece's

€1,000 minima—prompting 2024 EAW reforms for cross-border claims. Efficacy: 70% compliance post-judgment, reducing violations 15% in monitored states. For India, Article 5's timelines could fortify BNSS Section 399, invoking Varuna's noose (Rigveda 7.87) for 90-day redress.

South Africa's Ubuntu philosophy, "I am because we are," animates restorative justice post-apartheid, mirroring dharma's interconnectedness. The 1995 TRC, per its Final Report, processed 21,000 victim statements via amnesty hearings, awarding R 1.2 billion (USD 70 million) in reparations by 2025, emphasizing communal healing over vengeance. Ubuntu's 2025 resurgence in RJ pilots—e.g., Cape Town's victim-offender dialogues—yields 75% reconciliation rates, reducing recidivism 40% via community circles. A July 2025 Science Publishing Group study posits Ubuntu as a framework for economic equity, with TRC-inspired funds covering therapy and livelihoods. Challenges: Backlogs in 2025's 500,000-case courts, yet 2024's Child Justice Act expansions integrate Ubuntu for juveniles. Vedic parallel: Fuse with ahimsa (Yajurveda 36.18) for TRC-like commissions addressing caste-based wrongs.

To encapsulate variances, the following comparative table distills key metrics as of 2025:

Table 4. Quantum of Compensation in various Jurisdictions

Jurisdiction	**Compensation Quantum**	**Key Features**	**Efficacy Metrics**	**Vedic Resonance**
USA (IPA)	$50,000–100,000/year	DNA grants, state funds	375+ exonerations; <5% recidivism	Evidentiary truth (Atharvaveda 4.36)
Canada	CAD 100,000+/year	Therapy, family stipends	30 exonerations; 84% satisfaction	Karmic expiation (Upanishads)
New Zealand	Variable (RJ focus)	Māori FGCs, no fixed cap	80% victim satisfaction; 70% recidivism drop	Sabhas' communal deliberation
ECHR	€5,000–50,000/case	Enforceable for §5 violations	150+ awards; 70% compliance	Rita's prompt equilibrium
South Africa	R 50,000–500,000+	Ubuntu circles, reparations	75% reconciliation; 40% recidivism reduction	Dharma's interconnected healing

This matrix, synthesized from 2025 reports, highlights scalable quanta and reintegration foci.

Synthesizing these, Vedic hybrids emerge as potent innovations. "Dharma circles"—blending sabhas with ECHR timelines—could mandate 60-day mediations for undertrials, as in Kerala's 2023–2025 Victim-Offender Mediation Pilots under the Kerala Mediation and Conciliation Centre, which reduced trial delays 30% in Ernakulam district via 500+ conferences. By November 2025, Kerala's Adalat.AI transcription rollout in all trial courts—piloted since December 2024—further slashes deposition times 40%, aligning with BNSS e-FIRs. Integrating Ubuntu's circles with Māori FGCs, these could form district-level hubs for SC/ST acquittees, while IPA-inspired DNA funds target UAPA voids. Challenges—federalism, funding—yield to pilots in Kerala and Rajasthan, per 2025 High Court directives.

Ultimately, these global vistas affirm Vedic sagacity's universality: justice as restoration, not rupture. By grafting IPA's empiricism, Canada's empathy, and Ubuntu's unity onto dharma's roots, India can transcend acquittal's hollowness, birthing a resilient paradigm where rita prevails, healing one exonerated soul at a time.

CONCLUSION

As the sun sets on this exploration of Vedic dharma's enduring dialogue with India's fractured criminal justice landscape, we stand at the threshold of redemption—a juncture where ancient hymns of rita converge with the clamor of 2025's overcrowded cells and judicial pleas for equity. From the Rigveda's evocative invocation of Yama's unerring path for the righteous (10.14.1–2) to the Supreme Court's July 2025 clarion call for a statutory balm to "years lost to iron bars," the arc of this narrative arcs toward an inexorable truth: justice, in its purest form, is not the cold finality of acquittal but the warm embrace of amends. Dharma, as the Upanishads remind us in Brihadaranyaka 1.4.14, is the thread binding individual suffering to cosmic harmony, a karmic ledger where adharma's debts demand collective discharge. In a republic where 439,000 undertrials—76% of the prison populace as of October 2025—endure presumptive punishment amid 5.2 crore pendency and 120% overcrowding, this principle is no scholarly abstraction but a moral imperative. The acquitted undertrial, emerging scarred from this labyrinth, embodies the very disruption of rita that the Atharvaveda sought to mend through charms against unjust fetters (4.36). To ignore their redress is to perpetuate a cycle of exclusion, disproportionately ensnaring Scheduled Castes (21%), Scheduled Tribes (12%), and the economically vulnerable, who constitute 70% of detainees ensnared by bail's pecuniary barriers. Yet, as this paper has illuminated, Vedic sagacity—elaborated in Manusmriti's graduated fines (VIII.124, 267) and Kautilya's treasury restitutions (3.17.5)—offers a blueprint not for retribution but restoration, a paradigm where the state's contraventions exact a dharmic toll, redeemable through societal reintegration.

Recapitulating the discourse's pillars, we first unearthed the Vedic bedrock: rita as the eternal rhythm, guarded by Varuna's noose against anrita (Rigveda 7.87.3) and Yama's equitable adjudication, prefiguring modern due process in their presumption of innocence until cosmic verdict. These were no ethereal ideals; sabhas and samitis mediated disputes with danda's proportionality, restoring harmony through cattle amends in fraternal feuds (Rigveda 10.109), a restorative triad of accountability, reparation, and communal healing that anticipates today's global models. The Dharmashastras and Arthashastra then codified this fluidity: Yajnavalkya's evidence hierarchies (2.68–70) and Manusmriti's exemptions for the vulnerable (VIII.314) humanized penology, while Kautilya's fines on errant officials (4.11) embedded equity in statecraft, transforming abstract dharma into actionable norms. Critiques of varna-inflections notwithstanding, these texts forged a proto-tort regime where perjury's penalty doubled as the innocent's solace, echoing ahimsa's non-violent ethos (Yajurveda 36.18) to temper severity with compassion.

Confronting the contemporary chasm, Section 3 laid bare the post-colonial inheritance's frailties: CrPC Section 358's ₹1,000 cap—a colonial relic unchanged since 1973—and BNSS 2023's Section 399, which perpetuate impunity amid Uttar Pradesh's 110,000 undertrials and Bihar's 60,000, fueling 3–5 year detentions that erode 40% of acquittees' incomes and splinter families. Judicial respites, from Bhim Singh's 1985 constitutional tort to the June 25, 2025, ₹5 lakh award for a 28-day post-bail limbo, flicker as beacons yet falter without statutory scaffolding, as evidenced by G.N. Saibaba's 10-year UAPA odyssey, acquitted in 2024 yet uncompensated, his disability unaccommodated in Nagpur's grim confines. Frivolous FIRs under UAPA (97% acquittals) and POCSO (30–40% convictions amid 2 lakh pendencies) underscore prosecutorial overreach, inverting dharma's truth-sanctity into a tool of suppression, particularly against dissenters and the marginalized. This dissonance—adversarial formalism clashing with Article 21's dignity mandate—demands not incremental tweaks but a paradigm pivot, one that the proposed Dharma Restoration Act (DRA), 2026, embodies.

As delineated in Section 4, the DRA operationalizes Vedic equity through a self-sustaining National Dharma Restoration Fund (NDRF), seeded at ₹5,000 crore and replenished by 1.5% levies on judicial fines (projected ₹15,000 crore annually), funneling errant officers' penalties into victims' renewal per Arthashastra's model (5.2.45). Its quanta matrix—₹20,000 monthly base plus audits for socioeconomic and intangible losses—scales amends to harm's depth, yielding ₹25–47 lakh for 3–5 year detentions, far eclipsing sporadic awards like the 2025 Delhi ₹10 lakh ruling. Pillars of fast-track sabhas (AI-triage for 18-month trials), official audits (₹50,000–5 lakh fines), and ahimsa

rehab (skills, counseling, microfinance) ensure holistic mending, with pilots in Uttar Pradesh and Bihar targeting 10,000 beneficiaries by 2027. Challenges—fiscal strains, bureaucratic inertia—are mitigated by Supreme Court oversight and affirmative quotas for SC/ST claimants, transforming potential pitfalls into dharmic opportunities for inclusion.

Global vistas in Section 5 further enrich this tapestry, revealing dharma's universality. The U.S. Innocence Protection Act's $50,000–100,000 annual awards (375+ exonerations) underscore evidentiary rigor akin to Atharvaveda's truth invocations; Canada's CAD 100,000+ with therapy mirrors Upanishadic expiation; New Zealand's Māori Family Group Conferences (80% efficacy) echo sabhas' communal wisdom; ECHR Article 5's €5,000–50,000 prompts align with rita's vigilance; and South Africa's Ubuntu TRC reparations (R 1.2 billion) embody interconnected healing. Hybrids like Kerala's 2023–2025 mediation pilots—slashing delays 30% via 500+ conferences—prove feasible, blending ECHR timelines with dharma circles for undertrial dialogues, positioning India as a restorative vanguard.

This synthesis yields profound implications, transcending policy to philosophical reclamation. In a nation where colonial legacies like the IPC 1860 supplanted indigenous vyavahara with retributive lex talionis, reviving Vedic principles dismantles epistemic erasure, honoring the 1947 Constitution's Preambular pledge to "secure to all its citizens justice—social, economic, and political." The DRA would not merely compensate; it would deter overreach—curbing UAPA's 97% acquittals by fining frivolous probes—while rehabilitating 70% of acquittees into livelihoods, injecting ₹50,000 crore into marginalized economies over a decade. Socially, it fractures incarceration's caste-class nexus, affirming Ambedkar's equity vision by exempting vulnerables as Manusmriti did (VIII.314), yet secularized for pluralism. Psychologically, ahimsa programs heal the 25% PTSD scar, restoring mana akin to Māori dignity.

Broader horizons beckon: globally, India's model could inspire BRICS peers grappling with pretrial detentions (South Africa's 30% undertrials), aligning with UN Basic Principles on Victims (1985) and SDG 16's just institutions. Domestically, it revitalizes indigenous knowledge, countering Western hegemony in jurisprudence curricula—as Justice Mithal advocated in 2025—infusing law schools with rita's ethics to nurture empathetic jurists. Ethically, it redeems adharma's collective burden: as Chandogya Upanishad 5.10.9 analogizes harm to debt, societal discharge through the NDRF absolves the republic's conscience, fostering trust in a system where 70% distrust stems from delays.

Yet, realization hinges on resolve. Parliament must prioritize the DRA in the 2026 Monsoon Session, backed by NITI Aayog's fiscal modeling and civil society's advocacy—echoing the 2025 Vidhi Centre's blueprint for undertrial reforms. States like Telangana, bucking trends with 73% occupancy via proactive bail, could lead pilots, scaling nationally by 2030. Civil servants, inspired by Kautilya's realpolitik, must audit FIRs rigorously; judges, Varuna's heirs, expedite via e-Courts Phase III.

In closing, let us heed Rigveda 10.191's sabha summons: "Assemble together, deliberate with one mind, that all may be united." From rita's primordial hymns to 2025's directives, dharma calls amends as justice's essence—not vengeance's echo, but harmony's hymn. A restorative Act would heal the wronged, deter the arbitrary, affirm the innocent—reclaiming indigenous equity for a resilient republic. In this fusion of antiquity and exigency, India does not merely acquit; it absolves, ensuring every exonerated soul strides not as survivor, but sovereign, in a dharma-suffused dawn where rita reigns eternal.

DECLARATION OF INTEREST

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research is independent and does not involve any funding from governmental, commercial, or not-for-profit sectors that might bias the findings or interpretations. All views expressed are solely those of the author and do not

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Ancient Indian Legal Traditions and Their Contemporary Significance

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Abstract

The legal and political philosophy articulated in Kautilya's Artha Shastra offers a comprehensive indigenous framework for ethical statecraft, which holds immense significance for contemporary governance and economic management in India. This treatise, dating to the 4th century B.C., establishes Dharma (moral and righteous duty) as the ultimate ethical constraint on political power, asserting that the ruler's primary function (Rajadharma) is the promotion of public welfare (Prajā sukhe sukham rājñaḥ). This ethical foundation forms the core of Kautilya's system, where Danda (sovereign power and justice) must be administered with proportionality and without the flaws of Kāma, Krodha, or Lobha. The paper explores the critical relevance of these principles in addressing persistent contemporary challenges, specifically corruption and administrative opacity, which hinder India's constitutional goals of social and economic justice. The methodology employs a qualitative, comparative analysis of primary texts from the Artha Shastra with modern legal and administrative frameworks, including the Prevention of Corruption Act and the Competition Act, 2002. The research specifically examines Kautilya's institutional blueprints, such as the Upadhā Parīkṣā (four-fold integrity test for officials) and his detailed enumeration of the forty ways of embezzlement, to argue for their integration into modern civil service selection and vigilance mechanisms. Furthermore, the study analyzes Kautilya's sophisticated economic regulations concerning non-exploitative taxation (likened to the "flower-gatherer") and the establishment of "Just Profit" margins, positioning them as indigenous models for strengthening fiscal responsibility and consumer protection. By contrasting Kautilya's emphasis on swift, specialized justice with the current judicial backlog, the paper concludes that adopting the foundational ethical spirit of the Artha Shastra—where ethics is inherently linked to efficiency and law—can provide valuable, time-tested pathways to enhance political integrity and ensure equitable economic development in modern India.

Keywords: Kautilya, Artha Shastra, Dharma, Governance, Ethical Leadership.

INTRODUCTION

The pursuit of sound governance is a timeless human endeavor, yet in the contemporary landscape, issues of political integrity, economic accountability, and social justice continue to challenge established democratic and legal structures. As India navigates the complexities of a globalized world while upholding its constitutional principles, there is an increasing necessity to re-examine the indigenous intellectual traditions that shaped its civilization. Among these, the legal and political philosophy enshrined in Kautilya's Artha Shastra stands out as a uniquely practical and comprehensive treatise on statecraft, law, and economics dating back to the 4th century B.C.

Kautilya, often identified with Chanakya, the mentor to Emperor Chandragupta Maurya, did not merely propose a theoretical model; he outlined an exhaustive, pragmatic system for the creation, maintenance, and expansion of a stable and prosperous state. At the heart of his philosophy lies the concept of Dharma (moral and religious law) as the ultimate guiding principle for the Raja (ruler) and the bedrock of all legal and administrative decisions. He meticulously integrated moral responsibility with political authority, advocating for an ethical leadership that viewed the welfare of the people (Prajā sukhe sukham rājñaḥ) as the supreme purpose of the state.

The relevance of Kautilya's work is not confined to historical curiosity. It offers sophisticated, granular insights into taxation, judicial administration, civil service conduct, and anti-corruption measures that resonate strongly with the challenges faced by modern governance in India, particularly in areas like bureaucratic red-tapism and fiscal transparency.

This paper is structured to achieve the following objectives:

1. To articulate Kautilya's fundamental principles of Dharma and Danda (sovereign

power/punishment) as they relate to ethical governance.
2. To explore the direct applicability of Kautilya's administrative and economic insights to modern Indian political and economic legal frameworks.
3. To conduct a comparative analysis, highlighting how these ancient traditions can offer valuable, indigenous models for strengthening ethical leadership and governance structures today, thereby providing a unique contribution to the scholarly discourse.

KAUTILYA'S DOCTRINE OF DHARMA AND DANDA

The foundation of Kautilya's political and legal theory rests on a quadrilateral framework of law: Dharma (Sacred Law), Vyavahāra (Evidence and Custom), Caritra (Tradition and History), and Rājaśāsana (Edicts of the King). Among these, Dharma is paramount, serving as the ultimate source of legitimacy and moral correctness for all state actions.

Dharma as the Source of Ethical Governance

For Kautilya, Dharma represents the eternal truth and the moral obligation that binds the ruler. It is the framework that prevents governance from devolving into arbitrary power. The ruler's primary role, or Rajadharma, is not merely to enforce law but to protect and sustain the social order (varnasramadharma). This protection extends to the four primary functions of the King: Raksha (protection of the people), Pālana (maintenance of law and order), Yogakṣema (promotion of welfare), and Vṛtti (maintenance of people's livelihood).

This ethical framework directly counters the Machiavellian perception sometimes associated with Artha Shastra's focus on power. Kautilya clearly subordinates political expediency to moral principle by stressing that a ruler who violates Dharma will lose the trust of the people and ultimately, the kingdom itself. This ancient check on power, where ethical duty precedes authority, is critically missing in many contemporary political discussions. The alignment of political goals with moral objectives ensures that statecraft is fundamentally oriented towards public good, rather than self-interest or dynastic perpetuation. The enduring relevance of Rajadharma is its inherent capacity to provide a moral critique of governance failures, insisting that the performance of a leader is measured by the happiness and prosperity of the governed.

The Necessity of Danda (Sovereign Power and Justice)

Danda is the instrument of state power, representing the authority to punish the wicked and protect the innocent. Kautilya views Danda as essential for ensuring the stability of society (Dandanīti is the science of governance). However, Danda must be administered with Dharma. The application of Danda is not arbitrary but must be proportional, unbiased, and aimed at the public good.

Kautilya warned against three defects in the use of power: Kāma (Lust/Excessive desire), Krodha (Anger/Violence), and Lobha (Greed/Avarice). When Danda is used excessively (over-punishment) or inadequately (under-punishment), it leads to societal chaos, corruption, and the eventual downfall of the state. Only when Danda is applied justly, as guided by Dharma, does it ensure the adherence of the populace to both the law and moral righteousness. This ancient concept provides a strong philosophical underpinning for modern judicial review and the principle of separation of powers, where the executive authority (Danda) is consistently checked by constitutional morality (Dharma). The symbiotic relationship between Dharma and Danda is best understood graphically:

Figure 1: The Kautilyan Framework of Ethical Governance (Danda-Dharma Nexus) (Diagram Description: A central circle labeled "Raja / Swamin (The Sovereign)" is connected to two external boxes by arrows. The top arrow points from "Dharma (Moral Law & Ethics)" to the Raja, labeled "Guidance & Legitimacy." The bottom arrow points from the Raja to a box labeled "Danda (State Power & Justice)" and is labeled "Controlled Application." Danda's box has an arrow pointing back to Dharma labeled "Enforcement of Moral Order." This cyclical flow ensures that power (Danda) is never arbitrary but always bounded by ethical principle (Dharma), maintaining the Rajadharma (Duty of the Ruler).)

CONTEMPORARY SIGNIFICANCE IN POLITICAL GOVERNANCE

Kautilya's treatise is a masterclass in institutional design and accountability, offering blueprints for addressing systemic corruption and administrative inertia—two major bottlenecks in modern Indian political governance.

Accountability and Anti-Corruption Measures

Kautilya detailed numerous mechanisms to prevent the abuse of state power, specifically listing forty ways of embezzlement by government servants. This is arguably one of the most comprehensive and prescient discussions on corruption in ancient literature. His recommendations included:

Performance Monitoring: Establishing a system of secret agents (gūḍhapuruṣas) and spies to monitor the conduct of all officials, from collectors to judges, ensuring they adhere to the law and not their personal gain.

Checks and Balances: Proposing a structure where different departments and officials check each other's work to prevent collusion—a precursor to modern institutional checks.

Whistleblower Protection: The Artha Shastra implicitly supports a system where officials revealing corruption are rewarded, and those caught are subjected to rigorous and prompt punishment.

In the contemporary Indian context, Kautilya's forty ways of embezzlement provide a framework for refining the Prevention of Corruption Act (PCA) and the Lokpal and Lokayukta Acts. The focus should shift from reactive investigation to proactive, systemic monitoring, similar to Kautilya's internal vigilance system. The spirit of the Artha Shastra demands that ethical standards be embedded in the bureaucratic process itself, making the civil servant accountable not just to the rule book, but to the ethical imperative of public service (Rajadharma). The administrative framework in India, despite its constitutional backing, often struggles with bureaucratic red-tapism and lack of fiscal transparency, making Kautilya's detailed anti-corruption strategies directly relevant for strengthening modern administrative vigilance mechanisms.

The Saptanga Theory and State Structure

Kautilya's Saptanga Theory defines the seven essential elements (prakritis) of a state: Swamin (The King/Sovereign), Amātya (Ministers/Administration), Janapada (Territory/People), Durga (Fort/Capital), Kośa (Treasury), Daṇḍa (Army/Force), and Mitra (Ally/Friend).

While the Swamin is the central figure, the Amātya (the administrative wing) is given enormous importance. Kautilya's meticulous selection and training process for ministers based on moral character, intelligence, and loyalty (Upadhā parīkṣā) offers a crucial lesson for modern political appointments. Today, the concept of Amātya translates to the vast Indian Administrative Service (IAS) and the Cabinet. The Artha Shastra underscores that the administrative quality is directly dependent on the moral fortitude of its leadership. Reintroducing ethical training and rigorous character assessments, beyond mere technical competence, mirrors Kautilya's mandate for a meritocratic, morally upright civil service.

Upadhā Parīkṣā: Character Testing in Civil Service

The most powerful administrative lesson from Kautilya is the Upadhā Parīkṣā, a four-fold integrity test for potential ministers (Amātyas). This system involved testing candidates' adherence to Dharma (temptation via religious/moral inducements), Artha (temptation via monetary inducements), Kāma (temptation via sensual/sexual inducements), and Bhaya (temptation via fear/threats). Only those who passed these tests of moral and mental fortitude were deemed fit for high office.

This ancient practice highlights a critical gap in modern civil service selection, which primarily relies on academic examination (UPSC/SSC) and a personality interview. While these evaluate intellectual competence, they often fall short in gauging true moral integrity, susceptibility to corruption, or psychological resilience under pressure. Implementing Kautilya's concept, perhaps through advanced psychological profiling and situational ethics testing within the institutional framework of bodies like the Lal Bahadur Shastri National Academy of Administration (LBSNAA), could elevate the ethical quality of the Indian bureaucracy. The goal is not to replicate the ancient tests literally but to institutionalize rigorous, predictive measures of moral integrity to ensure that the administrators serving the state embody the ideals of Rajadharma.

KAUTILYA'S BLUEPRINT FOR ECONOMIC MANAGEMENT

Kautilya's economic thought is far from archaic. He championed a highly regulated but wealth-generating economy, viewing the state treasury (Kośa) not as the King's personal wealth, but as the lifeblood for public welfare (Yogakṣema).

Fiscal Responsibility and Taxation

The Artha Shastra dedicates entire sections to detailing the collection of revenue, the management of the treasury, and the principles of taxation. Kautilya advocated for a system that was equitable, predictable, and non-exploitative. He emphasized that taxes should be levied in a manner similar to a flower-gatherer collecting honey from a flower—gradually and without causing pain to the plant. This principle, which stresses sustainability over short-term gain, provides a powerful indigenous critique of regressive taxation and arbitrary fiscal policies.

Key Kautilyan economic mandates relevant today include:

Predictability: The King should not suddenly change tax rates or introduce new levies, ensuring stability for merchants and producers. This aligns with modern concepts of a stable, business-friendly regulatory environment.

Welfare Spending: Revenue must be spent on public goods, including irrigation, infrastructure (roads, ports), and famine relief. This directly parallels the Directive Principles of State Policy (DPSP) in the Indian Constitution, which mandates the state to promote the welfare of the people.

State Intervention: Kautilya allowed for state-owned enterprises in key sectors (like mining, liquor, and salt), suggesting a pragmatic mixed-economy model where the state ensures strategic resource control and consumer protection. The emphasis on generating wealth in a sustainable manner, focusing on the well-being of the primary economic actors (farmers, traders, artisans), represents a profound lesson for contemporary policymakers balancing growth with equity.

Price Control, Just Profit, and Consumer Justice

Kautilya's laws on weights and measures, quality control, and the punishment for fraudulent trade practices are remarkably modern. He prescribed stringent penalties for adulteration, hoarding, and black-marketing. The Superintendent of Markets (Panyadhyaksha) and the Superintendent of Weights and Measures (Pautavādhyakṣa) were empowered to enforce strict quality standards, protect consumers from deceit, and ensure fair pricing.

Crucially, Kautilya introduced a concept akin to Just Profit, where the Panyadhyaksha would determine the maximum profit margin (adhikarana) that merchants could legally take (5% for local goods and 10% for foreign goods). This regulation was not meant to stifle commerce but to curb monopolistic exploitation and ensure that essential goods remained accessible to the populace. This ancient regulatory model provides an immediate philosophical foundation for the modern Consumer Protection Act and the Competition Act in India. The Competition Act, 2002, seeks to prevent anti-competitive agreements and abuse of dominant position, essentially performing the same function as Kautilya's Panyadhyaksha in preventing market forces from overriding ethical considerations. By revisiting Kautilya, the focus can be placed on the ethical duty of the state to shield the common citizen (prakṛti) from economic exploitation. The punishment was severe enough to act as a powerful deterrent, reflecting the principle of Danda applied in the economic sphere to uphold Dharma.

COMPARATIVE LEGAL FRAMEWORKS AND WAY FORWARD

The comparison between Kautilya's jurisprudence and modern Indian law reveals both continuities and critical gaps. While the constitutional framework is rooted in democratic and liberal ideals, the administrative spirit could benefit immensely from Kautilya's indigenous approach to integrity.

Kautilya's Jurisprudence vs. Modern Law

Kautilya's legal system was highly detailed, covering civil law (Dharmasthīya) and criminal law (Kantakaśodhana). His concept of Dharmasthīya addressed disputes relating to contracts, property, and debt—areas that form the core of modern civil litigation. His focus on swift justice, meticulous evidence gathering, and clear definitions of commercial and personal offenses shows a profound legal sophistication.

In the criminal sphere (Kantakaśodhana or the removal of thorns), Kautilya focused heavily on state security, policing, and the eradication of social evils. This section aligns conceptually with the Indian Penal Code (IPC) and the Code of Criminal Procedure (CrPC), but Kautilya's methodology often prioritized efficiency and state welfare, sometimes at the expense of individual rights as understood in a liberal democracy. The contemporary value of Artha Shastra lies not in adopting its entire code, but in internalizing its core jurisprudential spirit: that law is inextricably linked to ethical conduct (Dharma) and the ruler's highest duty is to maximize the happiness and welfare of the populace.

Judicial Efficiency: Lessons from Dharmasthīya and Kantakaśodhana Courts

A persistent and debilitating challenge to the Indian legal system is the immense judicial backlog, with millions of cases pending across various court levels, leading to the dictum "Justice delayed is justice denied." Kautilya's judicial structure offers a powerful counterpoint. He mandated the establishment of two main types of courts, each with three judges, operating in major provincial cities. This decentralized, multi-member bench approach, coupled with explicit rules for evidence (Vyavahāra) and prompt closure of litigation, was designed for maximum speed and efficiency.

In contrast to the highly centralized and process-heavy modern courts, the Kautilyan system provided specialized, localized, and streamlined justice. The lesson for India today lies in embracing Kautilyan principles of judicial administration: greater specialization (e.g., dedicated courts for financial fraud, environmental crimes), aggressive use of judicial human resources (three-judge benches for complex civil disputes to ensure quicker finality), and imposing reasonable, disciplined timelines for all stages of litigation, thereby upholding the principle that the protection of the people (Raksha) requires swift administration of Danda.

Integrating Ancient Ethics into Contemporary Governance

To leverage Kautilya's insights, the following areas should be considered for integration into modern governance structures:

Civil Service Ethics: Mandatory training for all bureaucrats, focusing on the Rajadharma principle of self-accountability and the 40 forms of embezzlement as a practical case study for modern corruption prevention. The use of Upadhā Parīkṣā principles for higher-level administrative appointments should be formalized through psychological and ethical testing.

Judicial Efficiency: Emulating Kautilya's emphasis on swift and conclusive justice to resolve the massive backlog of cases in Indian courts, perhaps by adopting his structured approach to evidence and dispute resolution and by creating more specialized, decentralized judicial bodies.

Fiscal Policy Review: Using the principle of equitable and non-exploitative taxation to review current fiscal policies, ensuring they truly support the Yogakṣema (welfare) of the most vulnerable populations, and applying his strict rules on Just Profit to essential commodities markets to protect consumers, thereby strengthening the intent of the Competition Act.

Kautilya's model provides an indigenous, time-tested ethical compass. By embracing its spirit, modern India can develop governance systems that are not merely functional but fundamentally rooted in the moral and righteous principles of its own knowledge tradition.

CONCLUSION

This paper has re-evaluated Kautilya's Artha Shastra as a source of profound legal and administrative wisdom, finding its principles to be critically relevant to contemporary challenges in India's political and economic governance. Kautilya's central doctrine—the application of Danda (sovereign power) must be perpetually guided by Dharma (ethical righteousness)—offers a robust, indigenous framework for ethical leadership and state accountability. The detailed administrative blueprints, including the sophisticated anti-corruption measures (like the Upadhā Parīkṣā and the forty ways of embezzlement), the principles of non-exploitative taxation, and market regulation for Just Profit, provide pragmatic models for refining modern legal and bureaucratic structures. By integrating these indigenous insights, India can strengthen political integrity, enhance judicial efficiency, and ensure genuine economic welfare for all citizens, fulfilling the enduring goal of Prajā sukhe sukham rājñaḥ (in the happiness of his subjects lies the king's happiness).

DECLARATION OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this manuscript.

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ABBREVIATIONS AND NOMENCLATURE

| Abbreviation / Term | Definition | | Artha Shastra | Treatise on statecraft, economic policy, and military strategy. | | Dharma | Moral, religious, and social duty or righteousness. | | Danda | Sovereign power, authority to punish, or the science of justice/governance (Dandanīti). | | Rajadharma | The duty of the ruler. | | Amātya | Ministers or high administrative officials. | | Kośa | Treasury or State Revenue. | | DPSP | Directive Principles of State Policy (Indian Constitution). | | Upadhā Parīkṣā | The four-fold test of moral and mental integrity for selecting high officials. |

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Law and Governance on Medical Negligence in India

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Abstract

This paper explores the evolution of medical negligence laws in India. The law and governance on medical negligence in India entails a legal framework which is a combination of civil law, criminal law and Consumer Protection Law. It holds healthcare professionals and institutions accountable for failures to provide a reasonable standard of care, which results in harm to a patient. The legal and governance framework has been shaped by key statutes like the Consumer Protection Act and judicial precedents from the Supreme Court and professional ethics. It must be noted that the liability of the medical practitioner is three-fold: Liability under the Consumer Protection Act, 2019 for payment of damages; Civil liability for tort of negligence where the provisions of the Consumer Protection Act, 2019 do not apply; or Criminal liability under the Bharatiya Nyaya Sanhita (BNS) of 2023. Section 106(1) of the BNS specifically addresses registered medical practitioners limiting the punishment for causing death by medical negligence to a maximum of two years imprisonment and fine.

This paper ends with a mention of few Supreme Court rulings which have provided clarity on medical negligence and concluding remark that medical negligence law in India is primarily addressed under both criminal and civil laws, with the primary legal framework being the New Bharatiya Nyaya Sanhita (BNS), 2023 for offences like causing death by gross negligence and the Consumer Protection Act, 2019 which provides a less expansive and faster remedy for patients seeking compensation for medical negligence.

Keywords: Law and governance, medical negligence, legal framework, standard of care, judicial precedents, professional ethics.

INTRODUCTION

The exact definition of medical negligence is not available in any of the enacted laws, and the legal framework for medical negligence in India is primarily based on tort law. The jurisprudential concept of negligence defies any precise definition. Eminent jurist and leading judgments by courts have assigned various meanings to negligence.

The concept as has been acceptable to Indian jurisprudential thought is well-stated in the law of tort. It is the breach of a duty caused by omission to do something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs would do or doing something which a prudent and reasonable man would not do.

The definition involves three constituents of negligence: "duty", "breach" and "resulting damage", that is to say:

1. The existence of a duty to take care, which is owed by the defendant to the complainant;
2. A breach of such duty; and
3. Damages, which is both causally connected with such breach and recognized by the law, has been suffered by the complainant.

If the complainant satisfies the court on the evidence that these three ingredients are made out, the defendant shall be held liable in negligence.

In Syad Akbar case, the Supreme court has pointed out with reasons the distinction between negligence in civil law and in criminal law.

In civil proceedings, a mere preponderance of probability is sufficient and the defendant is not necessarily entitled to the benefit of every reasonable doubt; but in criminal proceedings, the persuasion of guilt must amount to such a moral certainty as convinces the mind of the court, as a reasonable man, beyond all reasonable doubt. Where negligence is an essential ingredient of the offence, the negligence to be established by the prosecution must be culpable or gross and not the negligence merely based on an error of judgment.

In Balchandra Woman Pathe case, it has been held that while negligence is an omission to do

something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs, would do, or doing something which a prudent and reasonable man would not do. Criminal negligence is the gross and culpable neglect or failure to exercise that reasonable and proper care and precaution to guard against injury either to the public in generally or to an individual in particular, which having regard all circumstances out of which the charge has arisen, it was the imperative duty of the accused person to have adopted.

The court further expressed their opinion the factor of grossness or degree does assume significance while drawing distinction between negligence actionable in tort and negligence punishable as a crime. To be latter, the negligence has to be gross or of a very high degree.

Negligence by Professionals

In the law of negligence, professionals such as lawyers, doctors, architects and others are included in the category of persons professing some special skills or skilled persons generally. Any reasonable man entering into a profession which requires a particular level of learning to be called a professional of that branch, impliedly assures the person dealing with him that the skill which he professes to possess shall be exercised and exercised with reasonable degree of care and caution. He does not assure his client of the result.

Judged by this standard, a professional may be held liable for negligence on one of the two findings:

1. Either he was not possessed of the requisite skill which he professed to have possessed, or
2. He did not exercise, with reasonable competence in the given case, the skill which he did possess.

The standard to be applied for judging, whether the person charged has been negligent or not, would be that of an ordinary competent person exercising ordinary skill in that profession.

The question then arises as to what is an acceptable standard of conduct, the competence of the defendant is to be judged by the lowest standard that would be regarded as acceptable.

Defining negligence by professionals, generally and not necessarily confined to doctors, is to be found in the opinion of McNair J. in Bolam case in the following words:

"Where you get a situation which involves the use of some special skill or competence, then the test as to whether there has been negligence or not is not the test of the man on the top of a Clapham Omnibus because he has not got this special skill. The test is the standard of the ordinary skilled man exercising and professing to have that special skill…. A man need not to possess the highest expert skill; it is well established law that it is sufficient if he exercises the ordinary skill of an ordinary competent man exercising that particular art."

Medical Malpractice or Negligence

Medical Negligence occurs when a healthcare professional neglects to provide appropriate treatment, take appropriate action or gives sub-standard treatment that causes harm, injury or death to a patient.

The medical negligence normally involves a medical error. This could be in diagnosis, medication dosage, health management, treatment or aftercare.

In order to make the doctor liable for negligence, the following legal elements need to be proved by the plaintiff in the court of law:

- The doctor should owe the duty of care to the patient.
- There needs to be a breach of such duty of care by the medical professionals.
- This breach of duty of care should result in injury or loss to the patient.

If the complainant succeeds in proving all these, only then does the medical professional become liable for medical negligence and the resulting damages. Thus, the onus of proving negligence or the burden of proof clearly lies with the complainant in most of the cases.

Medical Negligence Law in India

In India, medical negligence is primarily addressed under both criminal and civil laws, with the primary legal framework being the Indian Penal Code (now BNS) for criminal cases and tort law for civil liability.

Consumer Protection Act, 2019 enacted by the Parliament is the preferred choice and is a

testament to India's commitment to providing consumers with a robust and contemporary framework for their protection, which provides a forum for addressing complaints of medical negligence especially concerning "deficiency in services" provided by doctors and hospital.

How medical negligence is assessed?

As the exact definition of medical negligence is not available in any of the enacted laws and the legal framework for medical negligence in India is primarily based on tort law. The jurisprudential concept of medical negligence also defies any precise definition. Eminent Jurists and leading judgments have assigned various meanings to negligence. On a review of judicial opinion, we arrive at a conclusion about the statement of law for assessing medical negligence in India. Key principles and cases are given below:

- Doctrine of Res Ipsa Loquitur
- Bolam Test
- Jacob Mathew Test

Doctrine of Res Ipsa Loquitur:

"The thing speaks for itself" is the gist of the maxim. Res Ipsa Loquitur is a rule of evidence which in reality belongs to the law of torts. Inference as to negligence may be drawn from proved circumstances by applying the rule if cause of the accident is unknown and no reasonable explanation as to the cause is coming forth from the defendant.

- The essentials of this maxim are as follows:
- The defendant owes a duty of care towards the plaintiff which he has breached.
- There is a significant degree of injury caused to the plaintiff.
- The doctrine of Res Ipsa Loquitur assumes the following:
- Nature of injury gives the clue that without negligence it could not have happened.
- There was no involvement of the patient himself in the injury in anyway.
- The injury happened under the circumstances which were under the supervision and control of the doctor.

It means that by applying the principle the judge has accepted that the negligence has occurred. After this, the doctor will have to rebut this thing and if he fails to do so then patient would be considered as successful in the case of medical negligence.

Examples of Res Ipsa Loquitur:

In Achutrao case, the court noticed that in the very nature of medical profession, skills differ from doctor to doctor and more than one alternative course of treatment are available, all admissible. Negligence cannot be attributed to a doctor so long as he is performing his duties to the best of his ability and with due care and caution. Merely because the doctor choses one course of action in preference to the other one available, he would not be liable if the course of action chosen by him was acceptable to the medical profession.

It was a case where a mop was left inside the lady patient's abdomen during an operation. Peritonitis developed which led to a second surgery being performed on her, but she could not survive.

Liability of negligence was fastened on the surgeon because no valid explanation was forthcoming for the mop having been left inside the abdomen of the lady. The doctrine of Res Ipsa Loquitur was held applicable in a case like this.

The case arose from a death caused by a doctor living a mop inside a patient's body during a sterilization operation, leading the court to set aside the High Court's judgment and restore the trial court's judgments and ordered the State to pay damages.

In Nikhil Super Speciality Hospital Case, it refers to V. Kishan Rao vs Nikhil Super Speciality Hospital, which addressed medical negligence and the necessity of expert evidence. The court ruled that there cannot be a mechanical requirement for expert testimony in every medical negligence case and that Consumer Forums have discretion to decide if expert evidence is needed on a case-by-case bases. This decision made it more accessible for ordinary patients to seek redressal for similar cases of negligence.

Court's ruling: The Supreme Court established that in straight forward cases of medical negligence Consumer Forums can use the facts presented to decide the case without requiring a formal expert witness.

Impact: The judgment changed the landscape of medical negligence litigation by empowering Consumer Forums to handle simpler cases more efficiently and clarifying that the doctrine of Res Ipsa Loquitur (the thing speaks for itself) can be applied in such medical negligence cases.

Bolam Test:

Bolam Test, emerged from Bolam case, established a standard of care for assessing medical negligence based on peer professional opinion. The legal test states that "A doctor is not negligent if his/her actions are consistent with a practice accepted as proper by a responsible body of medical professionals skilled in that particular area."

The brief facts of the case: Bolam case is an English tort law case that lays down the typical rule for assessing the appropriate standard of reasonable care in negligence cases involving skilled professionals such as doctors.

Facts: John Hector Bolam, a voluntary patient at a mental health institution, suffered a fractured hip during Electro Convulsive Therapy (ECT). He claimed the doctors negligent for not warning him about the risk of fracture, not offering relaxants or restraints and other reasons.

Verdict: The defendant hospital won the case. The Judge ruled that the doctors were not negligent because they acted in accordance with a responsible body of medical opinion.

Subsequent Development: An essential component of an action in negligence against a doctor is proof that the doctor failed to provide the required standard of care under the circumstances.

Traditionally the standard of care in law has been determined according to the Bolam Test. But Bolam test has been criticized for relying too heavily on medical testimony.

Hence Bolitho amendment was made to the Bolam test, which requires that the standard of care must be justified on logical bases. The court tests the medical evidence offered by both parties.

Bolitho test states that a doctor is not negligent if his/her actions are consistent with a practice accepted as proper by a responsible body of medical opinion, provided the court finds such an opinion to be logical.

Jacob Mathew Test:

Jacob Mathew Test emerged from Jacob Mathew Case. In this case the Supreme Court restated the idea from the Bolam case and held that one of the two things that can determine whether a professional is considered negligent is either he/she did not possess the required skill or, in a particular stance, he/she did not exercise the skill he did possess with reasonable competence.

The court stated that the standard of an ordinary competent person using ordinary skill in that specific profession is used to determine whether or not the accused was negligent.

It is impractical to anticipate that each professional will reach the pinnacle of proficiency in their respective domain.

Even though a highly qualified professional might have better attributes, this should not be the only criteria used to evaluate the performance of the professional who is being accused of negligence.

The court reaffirmed, the principle established in the doctor Suresh Gupta's Case, maintaining that mere lack of care or an error of judgment does not amount to criminal negligence.

In Jacob Mathews Case the Supreme Court set a condition to prosecute a medical professional for medical negligence. The Supreme Court observed:

"To prosecute a medical professional for negligence under criminal law it must be shown that the accused did something or failed to do something which in the facts and circumstances no medical professional in his ordinary senses and prudence would have done or fail to do. The hazard taken by the accused doctor should be of such a nature that the injury which resulted was not likely imminent."

In this landmark judgment, the Supreme Court of India laid down guidelines to ensure that medical practitioners are not unjustly harassed by criminal prosecution, till such time guidelines are framed by the government in this regard.

Guidelines and general principles for assessing medical negligence, as under:

1. A simple lack of care, an error of judgment or an accident is not a proof of negligence on the part of medical professional. So long as a doctor follows a practice acceptable to the medical profession of the day, he cannot be held liable for negligence merely because a better alternative course or method of treatment was also available or simply

because a more skilled doctor would not have chosen to follow or resort to that practice or procedure which the accused follows.

2. A professional may certainly be held liable for negligence on one of the two findings: Either he was not possessed of the requisite skill which he professed to have possessed, or he did not exercise with reasonable competence, in the given case, the skill which he did possess. The standard to be applied for judging, whether the person charged has been negligent or not, would be that of an ordinary competent person exercising ordinary skill in that profession.
3. To prosecute a medical professional for negligence under criminal law it must be shown that the accused did something or failed to do something, which in a given facts and circumstances, no medical professional in his ordinary senses and prudence, would have done or failed to do. The hazard taken by the accused doctor should be of such a nature that the injury which resulted was most likely imminent.
4. The maxim Res Ipsa Loquitur (things speaks for itself) is only a rule of evidence and operates in the domain of civil law specially in cases of torts and helps in determining the onus of proof in actions relating to negligence. It cannot be pressed into service for determining per se the liability for negligence within the domain of criminal law. Res Ipsa Loquitur has, if at all, a limited application in trial on a charge of criminal negligence.
5. The test for determining medical negligence as laid down in Bolam's Case holds good in its applicability in India.
6. Statutory Rules or Executive Instructions incorporating certain guidelines governing the prosecution of doctors need to be framed and issued by the government of India and/or State governments in consultation with the Medical Council of India (MCI). Until this is done private complaints must be accompanied by the credible opinion of another competent doctor supporting the charge of rashness or negligence on the part of the accused doctor. In the case of police prosecutions, such an opinion should preferably be from a doctor in government service qualified in that branch of medical practice. Doctors accused of rashness or negligence may not be arrested simply because charges have been levelled against them; this may be done only if it is necessary for furthering the investigation or for collecting evidence or if the investigating officer fears that the accused will abscond.
7. The Supreme Court in Jacob Mathews Case restated the idea from the Bolam Case and held that one of the two things that can determine whether a professional is considered negligent is either he did not possess a requisite skill, or, in a particular instance, did not exercise the skill he did possess with reasonable competence. The court stated that the standard of care of an ordinary competent person using ordinary skill in the specific profession is used to determine whether or not the accused was negligent.

Few More Landmark Judgements

Covering all provisions criminal, civil as well as Consumer Protection Act, there have been numerous judgments that are considered milestones. These judgments have assisted in enhancing the awareness about the real scope of the term medical negligence. Let us examine the salient aspects of few of these outstanding judgments.

- In Kunal Saha Case, the Apex Court's judgment is a landmark in the history of medical negligence cases in India as it awarded the highest compensation to Kunal Saha, the deceased's husband. The National Consumer Disputes Redressal Commission (NCDRC) had awarded Rs. 1.7 crore in 2009, against which Kunal moved to Supreme Court. In a 210page verdict the SC judges pinned the blame on the doctors for their careless and casual approach and increased the compensation amount to Rs. 5.96 crore, with a 6% interest from 1998, bringing it to Rs. 11crore.

Legal action: Dr Saha filed a case against the three doctors and Amri Hospital for medical negligence. The case went through various consumer and judicial forums, with the Supreme Court ultimately delivering a landmark judgment.

- In Smt. Santra Case, the Supreme Court observed that Smt. Santra had opted for total sterilization to avoid having any more children. The Supreme Court contended that the

callous approach of the doctor was evident as only the right fallopian tube was operated whereas the left was untouched, leading to the unwanted conception. The unwanted pregnancy resulted in the birth of a female child which obviously burdened the poor family taking into account the financial burden of raising a girl child, it awarded full compensation to the appellant.

- In Mrs. Aparna Dutta, Case the learned judge applied the doctrine of Res Ipsa Loquitur and concluded that required caution and care was lacking while treating the patient. Dwelling on the principle of vicarious liability it also held Apollo Hospital guilty. The court disregarded the hospitals plea of the arrangement that existed between the consultant doctor and the management. It awarded 5.8 lakh as compensation along with 12% interest from the date of the plaint till date of decree and 9% thereafter.

- In Pravat Kumar Mukherjee Case, dwelling on the provisions of Consumer Protection Act, 1986, NCDRC contemplated in detail on the definition of 'consumer' and 'services' to establish the legality of the case. Taking the widest view of the terms, the judgment was pronounced in favour of the appellants and the hospital was ordered to pay a compensation of Rs. 10lakh for negligence and breach of care.

- An outstanding judgment in terms of understanding the legalities of Consumer Protection Act. This judgment puts stress on the ethical aspects of the medical profession and also brought out the ugly side of commercialization of healthcare industry. A young life was mercilessly cut short due to unethical approach of the professionals where money was given preference over humanity.

- In Kusum Sharma & Ors Case, the Hon'ble Supreme Court has held that the medical professionals are entitled to get protection so long as they perform their duties with reasonable skill and competence and in the interest of the patients. The interest and welfare of the patients have to be paramount for the medical professionals. As long as the doctors have performed their duties and exercised an ordinary of professional skill and competence, they cannot be held guilty of medical negligence. The NCDRC was justified in dismissing the complaints of the appellants. No interference is called for. The appeal being devoid of any merit is dismissed. In view of the peculiar facts and circumstances of the case the parties are directed to bear their own costs. This case serves as a significant reference for medical negligence law in India, balancing the rights of patients and protection for medical practitioners.

CONCLUSION

While deciding whether the medical professional is guilty of medical negligence following well known principles must be kept in view:

1. Negligence is the breach of a duty exercised by omission to do something which a reasonable man guided by those considerations which ordinarily regulate the conduct of human affairs, would do, or doing something which a prudent and reasonable man would not do.
2. Negligence is an essential ingredient of the offence. The negligence to be established by the prosecution must be gross or culpable and not the negligence merely based upon an 'error of judgment'.
3. The medical professional is expected to bring a reasonable degree of skill and knowledge and must exercise a reasonable degree of care. Neither the very high nor a very low degree of care and competence judged in the light of the particular circumstances of each case is what the law requires.
4. A medical practitioner would be liable only when his conduct fell below that of the standards of a reasonably competent practitioner in his field.
5. In the realm of diagnosis and treatment there is a scope for genuine difference of opinion and one professional doctor is clearly not negligent merely because his conclusion differs from that of other professional doctors.

6. The medical professional is often called upon to adopt a procedure which involves higher element of risk, but which he honestly believes as providing greater chances of success for the patient rather than a procedure involving lesser risk but higher chances of failure. Just because a professional looking to the gravity of illness has taken higher element of risk to redeem the patient out of his/her suffering which did not yield the desired result may not amount to negligence.
7. Negligence cannot be attributed to a doctor so long as he performs his duties with reasonable skill and competence. Merely because the doctor chooses one course of action in preference to the other one available, he would not be liable if the course of action chosen by him was acceptable to the medical profession.
8. The medical practitioners should be shielded from malicious or frivolous claims that aim to extract compensation without merit.
9. The medical professionals are entitled to get protection so long as they perform their duties with reasonable skill and competence and in the interest of the patients. The interest and welfare of the patients have to be paramount for the medical professionals.

At last, but not the least, adhering to medical ethics is a foundational element in protecting doctors from medical negligence. A failure to provide the expected standard of care is a breach of this duty and a primary cause of negligence.

I would like to suggest that doctors would be best protected from frivolous and unjust prosecutions if they (doctors) provide reasonable care and upholds the ethical standards like Hippocratic Oath and strictly follows its core principles such as beneficence and non-maleficence. These principles often summarized as “do good” and “do no harm”, obligates doctors to act in the patient’s interest. Because the negligence and consequently negligence claims can arise only when these core ethical principles are violated.

I not only hope but pretty sure that doctors, who adhere to the ethical principles, builds up public trust and confidence in the medical profession and healthcare system as a whole. Although it is not the goal to be worshipped yet acting ethically allows doctors to earn the profound respect and trust to the extent that can lead them being viewed as extra ordinary healers or metaphorically, “like God” and as such nobody would even think to prosecute doctors irrespective of potential injury caused to the patients due to doctor’s negligence.

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Between Law and Lived Realities: A Sociolegal Analysis of POCSO Implementation in Rajasthan

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Abstract

Despite being one of India's most progressive child protection laws, the Protection of Children from Sexual Offences (POCSO) Act, 2012 continues to face serious challenges in practice. This paper critically examines the gap between the Act's statutory ideals and its ground-level implementation in Rajasthan, a state where caste hierarchy, patriarchal norms, and institutional fragility shape the pursuit of justice. Drawing on official data, secondary research, and field-based sociolegal analysis, the paper argues that POCSO's transformative potential is curtailed by a triad of systemic failures—insufficient institutional capacity, socio-cultural resistance, and fragmented inter-agency coordination. Through the lenses of Feminist Legal Theory and Legal Pluralism, it demonstrates that legal efficacy is socially mediated, contingent upon both institutional legitimacy and community trust. The paper concludes with evidence-based policy recommendations aimed at strengthening institutional accountability, enhancing community awareness, and embedding restorative practices within Rajasthan's child protection framework.

Keywords: POCSO Act, child rights, Rajasthan, sociolegal analysis, feminist legal theory, legal pluralism, gender justice

INTRODUCTION

The Protection of Children from Sexual Offences (POCSO) Act, 2012 filled a crucial gap in India's criminal justice system by establishing a child-specific legal framework to address sexual offences and ensure child-sensitive procedures. Aligned with the UN Convention on the Rights of the Child (1989), it covers offences ranging from physical to online abuse. However, effective implementation remains a major challenge. In Rajasthan, despite rising awareness, child sexual offences continue to increase. As per NCRB (2023), over 6,500 POCSO cases were registered in the state, yet conviction rates remain below 35%. This disparity between reporting and justice highlights that the POCSO Act's limitations are not merely legal but deeply social—rooted in institutional weakness, patriarchy, and caste hierarchies that constrain its transformative potential (1).

CONCEPTUAL AND THEORETICAL FRAMEWORK

This study applies a sociolegal approach informed by Feminist Legal Theory and Legal Pluralism. Feminist theorists like Catherine MacKinnon (2018) and Martha Fineman (2017) emphasize that law is shaped by gendered power structures. In Rajasthan, patriarchal notions of izzat (honour) and maryada (propriety) often recast sexual violence as family dishonour rather than a violation of rights, discouraging survivors from seeking justice. Legal Pluralism, as discussed by Boaventura de Sousa Santos (2019) and John Griffiths (2020), highlights the coexistence of statutory law with customary norms. In Rajasthan, informal panchayat systems frequently override formal law, promoting compromise over justice (2). Together, these frameworks reveal that POCSO operates within a complex social terrain where modern legal ideals contend with entrenched traditional ethics, making justice a negotiated rather than guaranteed outcome.

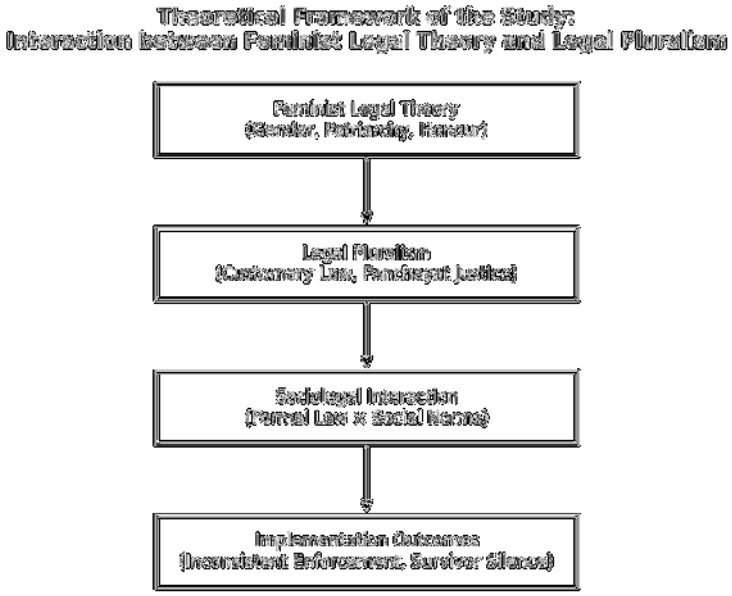


Figure 1. Theoretical Framework of the Study — Interaction between Feminist Legal Theory and Legal Pluralism

SOCIO-LEGAL CONTEXT OF RAJASTHAN

Rajasthan presents a complex sociolegal landscape where deep-rooted inequalities hinder the implementation of rights-based laws like POCSO.

- **Caste and Hierarchy:** Rural Rajasthan remains governed by rigid caste structures. Dalit and tribal families, economically dependent on upper-caste groups, face social and financial backlash when reporting sexual abuse.
- **Patriarchal Morality:** Honour and family reputation define female virtue, turning sexual violence into a matter of shame rather than a criminal violation, thus silencing victims.
- **Institutional Deficits:** Special POCSO Courts often lack trained counsellors, psychologists, and timely medical support, while coordination between police, Child Welfare Committees, and judiciary remains weak (3).

These structural and cultural constraints together produce a "paradox of protection," where institutions meant to protect children often reinforce their vulnerability.

REVIEW OF LITERATURE

Since the enactment of the Protection of Children from Sexual Offences (POCSO) Act, 2012, a decade of scholarship has examined its legal interpretation, institutional implementation, and socio-cultural impact. This growing body of research reveals both the strengths of the legislation and the systemic barriers that weaken its enforcement. Early judicial analyses highlighted interpretive inconsistencies (3). Singh (2016) found significant variation in how courts understood "sexual intent," with several rural benches framing offences as moral lapses rather than statutory crimes. Goswami and Bhatia (2018) identified pervasive procedural delays and poor evidence-handling in Special POCSO Courts, concluding that the Act's mandate for "speedy trial" largely remained an unfulfilled promise. Tripathi (2020) further observed that judicial proceedings, especially in smaller districts, were shaped by local social pressures—compromising fairness under Section 29's presumption of guilt (4). Internationally, Freeman (2017) noted similar trends in South and Southeast Asia, where progressive child protection laws often succumbed to entrenched patriarchal codes that prioritized family honour over justice (5). From an administrative and institutional standpoint, capacity gaps remain striking. Kumar and Menon (2019) identified widespread deficits in specialized training among police, prosecutors, and medical professionals (6). Supporting this, the National Commission for Protection of Child Rights (NCPCR, 2020) reported that nearly one-third of Rajasthan's Special POCSO Courts

lacked full-time counsellors, and medical examinations frequently exceeded the legally mandated 24-hour window. Pandey and Joseph (2022) emphasized the absence of trauma-informed practices, leading to secondary victimization within the justice process (7). Nanda and Chatterjee (2023) found that districts with stronger collaboration among NGOs, forensic experts, and state agencies achieved higher conviction rates—underscoring that "capacity without coordination is dead weight." Socio-cultural studies reveal even deeper structural barriers (8). Bhargava (2020) documented that caste hierarchies and patriarchal codes in rural Rajasthan often suppress formal reporting, as families opt for extra-legal settlements to preserve izzat (honour). Rathore and Kaur (2021) demonstrated that girls from marginalized communities face compounded discrimination—economic coercion, victim-blaming, and pressure to withdraw complaints. A UNICEF–MWCD (2021) survey found that over half of parents in rural Rajasthan preferred resolving abuse cases privately due to fear of stigma (5). Basu (2022) further argued that, despite its gender-neutral language, POCSO fails to address caste and class disparities, leaving Dalit and tribal survivors vulnerable to institutional neglect. The psychological and rehabilitative dimensions of POCSO enforcement remain relatively underexplored. Patel and Mehta (2017) and Bajpai (2019) observed that post-trial trauma and long-term counselling needs are largely unmet due to weak institutional mechanisms (6). Advocating a shift in approach, Chakraborty (2020) proposed restorative justice models integrating psychosocial support, education, and reintegration services rather than purely punitive responses. Reddy and Thomas (2023) provided evidence from Andhra Pradesh showing that community-based child protection committees significantly improved post-case recovery, though such models remain rare in Rajasthan. Despite extensive scholarship, key research gaps remain. Most studies overlook Rajasthan's specific socio-legal context, relying on broader national data. There is little integration of quantitative stakeholder insights with qualitative socio-cultural analysis, and limited exploration of how gender, caste, and class intersect to influence POCSO outcomes. Research on coordination among police, Child Welfare Committees, and the judiciary is also sparse, as are policy-oriented models for effective implementation. To bridge these gaps, the present study examines stakeholder perceptions across five Rajasthan districts within a socio-legal framework, exploring how law, culture, and institutional capacity collectively shape child protection outcomes.

DISCUSSION: BETWEEN LAW AND LIVED REALITIES

The empirical analysis reveals three interlocking challenges that define the POCSO implementation landscape in Rajasthan: institutional fragility, social resistance, and cultural dissonance between statutory ideals and community morality.

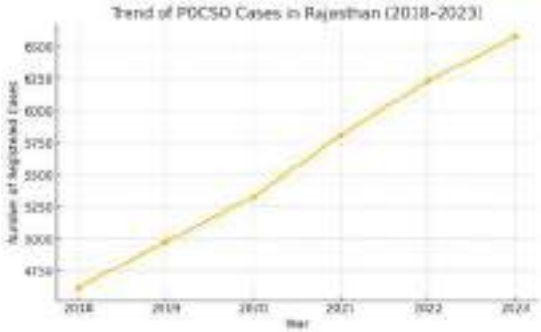


Figure 2. Trend of POCSO Cases in Rajasthan (2018–2023).

The upward trajectory (Fig. 2) shows that the number of POCSO cases nearly doubled between 2018 and 2023, indicating a complex reality: while legal mechanisms have become more visible, institutional capacity has not kept pace. This rising curve underscores the urgency for systemic reform, particularly in police training and community sensitization.

INSTITUTIONAL FRAGILITY

Although Rajasthan has designated Special POCSO Courts, these remain under-resourced and overburdened. Police respondents reported inadequate training on child psychology and forensic evidence collection. CWCs operate with skeletal staff and limited budgets, leading to procedural lapses. The absence of inter-agency coordination—especially between police, NGOs, and medical departments—creates delays that erode public trust. This institutional inertia transforms POCSO into what Santos (2019) terms a "paper law"—progressive in text but hollow in practice (9).

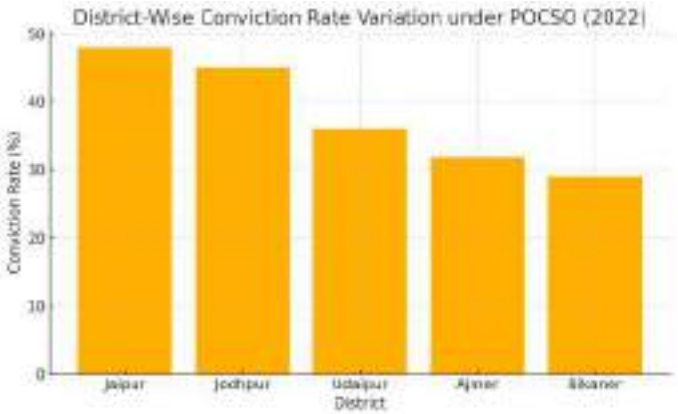


Figure 3. District-Wise Conviction Rate Variation under POCSO (2022).

As shown in Fig. 3, conviction rates vary markedly—Jaipur (48 %) and Jodhpur (45 %) show relatively better outcomes due to sustained NGO partnerships and specialized prosecutors, while Ajmer (32 %) and Bikaner (29 %) trail behind, reflecting weaker institutional coordination and fewer trained counsellors. The uneven trend demonstrates that institutional capacity and local collaboration remain decisive factors in realizing the objectives of the POCSO Act (10).

Social* Resistance *and Cultural Dissonance

Legal reform cannot dismantle cultural taboos overnight. The research confirms that patriarchal and caste norms remain powerful deterrents to justice. In many villages, reporting sexual abuse is viewed as socially contaminating. Teachers, community leaders, and even law enforcement officers often advise silence to "protect the family's reputation." The intersection of caste and gender magnifies injustice. Dalit and tribal victims frequently face intimidation by dominant caste perpetrators, and institutional sympathy is uneven. This reflects the continuing influence of cultural patriarchy, wherein women and children's bodies are seen as bearers of collective honour rather than individual rights.

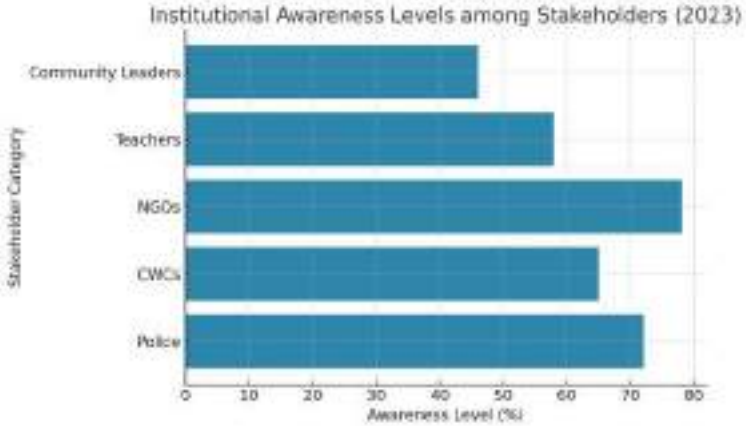


Figure 4. Institutional Awareness Levels among Stakeholders (2023).

Table 2. Institutional Challenges Reported by Stakeholders

Stakeholder Group	**High Awareness (%)**	**Moderate Awareness (%)**	**Low Awareness (%)**
Police Personnel	62	25	13
Judicial Officers	74	18	8

Child Welfare Committee Members	58	30	12
School Counselors / Teachers	47	33	20
NGO Representatives	83	12	5

The Paradox *of Protection*

A recurring theme is the paradox of protection: the same structures intended to protect children—families, schools, and local governance—become sites of silence and suppression. Even when cases reach court, survivors encounter traumatization during cross-examination. This contradicts the child-friendly procedures enshrined in Sections 24–27 of POCSO. Thus, while the law offers a promise of justice, its operational environment often converts that promise into procedural exhaustion.

COMPARATIVE AND GLOBAL PERSPECTIVES

Comparative evidence suggests that Rajasthan's difficulties mirror a wider pattern across developing legal systems where social hierarchy undermines statutory protection. The UN Women (2021) South Asia Report classified India as a case of "strong law, weak enforcement," reflecting how entrenched patriarchy limits gender-sensitive implementation (11). Choudhury (2019), in a comparative study of Sri Lanka's and India's child-protection regimes, observed that Sri Lanka's centralized monitoring and survivor-support mechanisms ensure greater institutional accountability (12). Similarly, the World Health Organization (2022) highlighted that sustainable child welfare depends on intersectoral coordination—linking law, education, and health—rather than legal reform alone (13). Viewed through this global lens, Rajasthan exemplifies a recurring sociolegal paradox: when progressive statutes confront enduring social hierarchies without accompanying social reform, the law's legitimacy erodes in the very communities it seeks to protect.

POLICY IMPLICATIONS

The study reveals that effective implementation of the POCSO Act in Rajasthan requires more than legal compliance—it demands institutional sensitivity, coordinated governance, and cultural transformation. To strengthen the state's child-protection ecosystem, five integrated policy directions are proposed. First, institutional strengthening must include comprehensive capacity building beyond procedural training, incorporating modules on child psychology, trauma care, and gender sensitivity for police, judicial officers, and Child Welfare Committees (CWCs). A certification-based approach led jointly by the RSLSA and the Department of Women and Child Development can ensure uniform standards across districts. Second, integrated coordination among law-enforcement, medical, and welfare agencies is essential. Establishing a State Child Protection Coordination Cell (SC-PCC) with regular inter-departmental reviews, a unified digital case-tracking system, and quarterly compliance reports would bridge implementation gaps. Third, cultural reorientation is critical to challenge entrenched notions of izzat and silence around child sexual abuse. Grassroots awareness campaigns through Panchayati Raj Institutions, schools, and self-help groups, supported by educators, influencers, and media, can foster social accountability and attitudinal change. Fourth, restorative justice and survivor support must extend beyond conviction by establishing district-level rehabilitation centres providing counselling, education, and vocational training in partnership with NGOs and mental health professionals (14). Finally, monitoring and accountability should be institutionalized through annual POCSO audits by the RSLSA and civil society, evaluating not only conviction rates but also survivor satisfaction, investigation timeliness, and rehabilitation outcomes. Together, these measures move the discourse from mere statutory reform toward a holistic, empathetic, and community-based model of justice that treats child protection as a shared moral and social responsibility.

Table 2. Summary of Policy Recommendations and Responsible Agencies

Policy Focus Area	Recommended Action	Lead / Coordinating Agencies	Expected Outcomes
Institutional Strengthening	Introduce mandatory training in child psychology, trauma care, and gender sensitivity for police, judiciary, and CWC members.	DWCD, RSLSA, State Judicial Academy	Child-sensitive and professionally trained justice personnel.
Integrated Coordination	Establish a State Child Protection Coordination Cell (SC-PCC) for inter-departmental reviews and digital case tracking.	MWCD, RSLSA, Home Dept., State IT Cell	Faster case processing and improved inter-agency accountability.
Cultural Reorientation	Launch awareness campaigns via PRIs, schools, SHGs, and media to challenge stigma and silence.	Dept. of Education, PRIs, UNICEF, Local NGOs	Greater community awareness and reduced under-reporting.
Restorative Justice & Survivor Support	Set up district rehabilitation centres for counselling, education, and vocational reintegration.	RSLSA, DWCD, Psychologists, NGOs	Holistic survivor recovery and prevention of re-victimisation.
Monitoring & Accountability	Conduct annual POCSO audits evaluating conviction rates, compliance, and survivor satisfaction.	RSLSA, MWCD, Research Institutes	Transparent performance assessment and stronger justice outcomes.

CONCLUSION

The study concludes that the implementation crisis of the Protection of Children from Sexual Offences (POCSO) Act in Rajasthan arises from a profound sociolegal paradox — a progressive law functioning within a society that often values silence over justice. While the Act represents a modern rights-based framework, its practical success remains constrained by deep-rooted patriarchy, caste hierarchies, and moral codes that shape social and institutional behavior(15). Drawing on Feminist Legal Theory and Legal Pluralism, the analysis reveals that justice is not achieved merely through legal statutes but through the dynamic interaction between law, culture, and institutional trust (16). The true transformation envisioned by POCSO requires moving beyond procedural compliance toward building a social movement grounded in empathy, awareness, and collective responsibility. For Rajasthan—and India as a whole—the core challenge is not the absence of laws but the lack of faith in their enforceability and inclusiveness. Only when communities recognize that protecting children transcends notions of izzat (honour) and becomes a shared moral duty of humanity will the gap between law and lived reality begin to narrow, allowing the promise of justice to finally take root in practice.

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Vedic Influence on Indian Judicial & Governance System

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ABSTRACT
India's contemporary legal and governance system is centred around Dharma to a great extent. Dharma comes from Vedic system. Vedic insights and ancient Indian knowledge constitute the core concept of Dharma. Dharma refers to duty, righteousness and moral law. These are the basic ingredients and foundation of Indian judicial interpretation as well, despite the fact that these matters are not explicitly covered by codified law. The modern Indian legal framework is mainly inherited from the British legal system but the moral , ethical and philosophical norms of ancient Indian jurisprudence forms the basis of Indian legal system which comes from Vedic system only. The Supreme Court of India advocates the principle of "Yato Dharm Tato Jayah" which means, where there is righteousness, there will be victory. This has been directly taken from the Indian epic and mythology "Mahabharat". The Hindu personal law which defines marriage, inheritance & adoption has been directly taken from ancient Indian texts like the Manusmriti and Dharmshastra .With significant reforms incorporated in modern legislations named, the Hindu Marriage Act,1955 and Hindu Succession Act,1956 have their base lying in these Indian texts. Thus, it can be concluded that the foundation of modern Indian or post-independence Indian law comes from Vedic era and strong imprint of Indian knowledge system can be witnessed in Indian judicial and governance mechanism.

Keywords: Dharma; Dharmshastra; Hindu; Manusmriti; Vedic

INTRODUCTION

The Vedic period in India (c 1500-600 BCE) can be called an era characterized by the composition of Vedas. This period can be further classified into two phases{1}:

1)The Early Vedic or Rigvedic period (1500-1000 BCE)

And

2)The Later Vedic period(1000-600 BCE)

Early Vedic period was having a social structure dominant by tribal society based on kinship with the gramani {2} (village headman) as the head.

In Later Vedic period, the social structure included the varna {3}system which was rigid and divided society into four sects-Brahmins(priests), Kshatriyas (warriors), Vaishyas (merchants and farmers), and Shudras (labourers).

The role for each class and rule of governance was set accordingly and this can be called as the initiation of law and governance to a great extent.

The idea of governance in India got periodical changes with many dynasties ruling India from time to time after Vedic period, especially, the Mughals and the Britons but the foundation that was laid down during the Vedic period was more or less always the base of the judicial system and governance.

STUDY OF VEDIC INFLUENCE ON INDIAN JUDICIAL & GOVERNANACE SYSTEM

The modern Indian legal structure is mainly inherited from the British legal system and guided by the secular Constitution of India. However, ethical and philosophical influence of Dharma (righteousness) which comes from the Vedic era can clearly be seen in Indian legal system, mainly in areas like personal law and the basic principles of justice and righteous governance. Righteous governance signifies governance as per Dharma only.

To study the influence of Vedic system on 1)Indian judicial & 2)Indian governance system , we need to study the concept of each of them individually.

CONCEPT OF INDIAN JUDICIAL SYSTEM

Indian judicial system can be well defined with the following characteristics and the same can be witnessed in Vedic times as well with so many evidences in various texts-

1. Rule of Law
2. Hierarchy of Courts
3. Judicial Integrity
4. Evidence and Systematic legal process

All these characteristics can easily be traced back from the Vedic era with certain testimonials.

Rule of Law

Dharma (known as righteousness, moral and ethical values) and natural law was always at the core of Vedic system. Modern Indian legal system also advocates the same theory which Vedic system follows. The philosophy of Dharma intrinsically lies in the modern concept of justice and equality. The concept of "nothing is above law" in the modern legal system comes from the basic principle of the Vedic era –"Nothing is higher than Dharma" {4}. In Vedic era, even many kings had to prove themselves to prove this principle. In Ramayana, Lord Ram has to apply this on himself also as the king of Ayodhyay. After the war was over between Ram and Ravan and once Ram returned to Ayodhyay ,his wife Sita underwent Agni Pariksha(an ordeal of fire) to prove her chastity. This was not because Ram had any doubt on the chastity of his wife but he overheard from one of his citizens (praja) of Ayodhyay that Sita should have proved her chastity before Ram accepting her after her return from the captivity of Ravan. So, Ram asked her to prove this as his Dharma as a king {5}. He was knowing that Sita was innocent and pious but he had to prove his subjects (praja) that as a just king (Raja),he was willing to go to any extent of personal sacrifices for them .It can be said that to safeguard Dharma, even the king was subject to the law. Taking this from Vedic era, the same principle applies even today in India's modern constitutional and legal framework.

Similarly, the general duty of a king is to protect his subjects (praja) is found clearly mentioned in Shanti Parva of the Mahabharat along with many texts found in Arthshastra and Manusmriti. Out of 18 Mahapuranas , Garud Puran is the one which mentions the rule of governance and the same can be seen adopted in the Indian governance system at many places. This Mahapuran says," If there is no one behind a deceased, it is the duty of the state/king to do the last rites of that person" {6}. In the modern governance system , the state does the last rites of a dead whose body is not claimed by anyone of the family. The ethos of Vedic era still holds true .

In the Mahabharata, a common fisherman refused to get his daughter Satyavati (Matsyagandha) married to King Shantanu unless he accepted that his daughter's future son and not the heir apparent (Devrata, later known as Bhishma) from his first wife , the river Goddess Ganga would succeed to the throne. To resolve this, the renunciation of the throne and the vow of life-long celibacy (Bhishm Pratigyan) by Prince Devrata became instrumental in getting king married to Satyavati. This shows that sovereign was not above the law even in those times, King Shantanu could not compel the humblest of his subjects to marry his daughter to him without fulfilling the terms laid by the fisherman.{7}

Hierarchy of Courts

According to Brihaspati Smriti, an ancient Indian legal text which also served as a major guide to Hindu personal law, depicting jurisprudence and working of court systems, clearly states that there was a hierarchy of courts in ancient India. In that system, family courts were the elementary one and king's court, the highest. It started with Family Court, next higher court was that of the judge, then Chief Justice also known as Praadivivaka, or Adhyaksha and ultimately ,the King's Court. Each court has its own jurisdiction depending upon the relevance of dispute. Disputes of minor importance were decided by the lowest court and major one or the most important disputes by the King's Court. Decision of each lower court was superseded by that of the higher court.

As per Vachaspati Mishra, a ninth or tenth century Indian Hindu philosopher of the Advaita Vedanta tradition, "The binding effect of the decisions of these tribunals, ending with that of the king, is in ascending order and each following decision shall prevail against the preceding one because of the higher degree of learning and knowledge"{8}. The modern day Indian judiciary system also has a set hierarchy of courts organised on a similar fashion-the courts at village level, the Munsif Courts, the courts of Civil Judge, the courts of District Judge, the Higher Court and on top of all, the Supreme Court. The Supreme Court is something like the topmost king's court of ancient India. Thus, we can easily deduce that we are following the same Vedic or ancient tradition

of judicial system without being conscious of it.

- The nature of justice was sovereign in that ancient practice. Similarly, in the current Indian jurisprudence while giving justice and awarding punishment, the primary attributes of sovereignty is always factored in.
- It is also to be noted that in ancient India, the king was expected to dispense justice in person but strictly as per the law and that too, under the guidance of judges, learned in law (mainly Brahmanas and ministers).
- The verse (shlok)from Manusmriti emphasizes the king's duty to administer justice in his kingdom. It says,

Vyavahārān didṛkṣustu brāhmaṇaiḥ saha pārthivaḥ |
Mantrajñairmantribhiścaiva vinītaḥ praviśet sabhām || {9}

With an intent of investigating cases, the king shall enter the court with a dignified demeanour ,associated with Brahmanas and councillors. It means, there should be a direct involvement of king and his authority in the judicial process, being the supreme judge, along with legal experts (Brahmanas & ministers).

In today's legal system , the Supreme Court of India which replaces the King's court of Vedic time ,considers the opinion of experts on specialised subject matter before promulgating any order or decision. This is the same practice that was being done by the king in the ancient times or Vedic times.

Judicial Integrity

Most of the Smritis of Vedic era emphasizes the importance of integrity in judiciary. Shukra Niti Sar or Shukra Niti, a text on Hindu political thought and public administration highlights governance ethics and statecraft stated by the sage Shukracharya. It's a guide on political, social and economic matters for not only rulers but also for individuals to ensure a just and prosperous state and life. It is attributed as old as that of 4th century AD by some of the historians. Shukra Niti says, "The judges appointed by the king should be well acquainted of the procedure, wise , of good character and temperament , soft in speech, impartial to friend or foe, truthful, learned in law, active, free from anger, greed or desire for personal gain as well as truthful".{10}

Another ancient Indian sage and legal scholar Brihaspati advocates that a judge must possess high moral character , integrity and honesty, impartiality, adherence to law and scripture with being well-versed in them, fearlessness and independence, dignified conduct, public and transparent proceedings, moral exhortation and collective decision-making.

In our Indian judicial system, we see all these at length and that's why the trust of common people in our legal system is steadfast and rock-solid.

Evidence & Systematic legal process

There are many Indian legal texts like Dharmshastras and Arthshastra which elaborate the principles of evidence. Important texts that classify evidence into specific categories and demarcate rules for their admissibility and evaluation are Manusmriti, Yajnavalkya Smriti,Narada Smriti and Katyayana Smriti.Even in Garuda Puran,the characteristics of evidence has been elaborately mentioned. These Dharmshastras discuss four prime categories of evidence, known as Pramana or Praman in a legal context-

1. Lekhya- Lekhya is documentary evidence. Texts elaborate rules for their validity, necessitating them to be free from defects, mentioning the transaction and often primarily attested by witnesses.
2. Sakshi- Sakshi is also known as Oral Evidence or Witness Testimony. There were strict rules to govern the competence and credibility of witnesses even their character, caste and demeanour during testimony. False testimony was a matter of severe penalties with capital punishment in some of the cases.
3. Bhukti or Bhog- Bhukti or Bhog which signifies possession was mainly in property disputes. Property disputes pertaining to land and long-standing ,uninterrupted and undisputed possession served as the most valid form of evidence which was further required to be supported by a title or right(agam).
4. Divya-Divya is known as Divine Tests or Ordeals which was used when human evidence (oral or documentary) was not sufficient to reach to a conclusion. Divine tests

such as the ordeal by balance, fire, water or poison were applied , appealing to supernatural judgement or guilt or innocence. This is not practised in the modern days but oath taken in court known as sworn testimony is always done in the name of God or solemnly affirm.

Most of these documentary evidences are still in use in Indian judicial system barring Divya and these are the basis of establishing evidence and systematic legal process in modern legal system.

CONCEPT OF INDIAN GOVERNANCE SYSTEM

Modern Indian governance system has been taken from Vedic system of governance and it is well known from the fact that the characteristics of Vedic system of governance clearly resonates in today's governance. The characteristics that are more or less similar in both era of governance are following-

Rajdharma

Rajdharma signifies the duty of ruler. In the Vedic system, Rajdharma is considered as the righteous conduct and set of obligations for a ruler to ensure peace, stability, and good governance .Rajdharma is that duty of the king which is required to act for the welfare ,justice and prosperity of his subjects(praja).Duty based philosophy of governance giving importance to public welfare over personal importance lies as the core value in modern Indian political thought, including Directive Principles of State Policy(DPSP) which aims to create welfare of the state and ensure social and economic justice for citizens. Although, DPSPs can't be enforced by courts but guide the state in formulating policies. Some DPSPs are adequate means of livelihood for all the citizens , equal pay for equal work, irrespective of sexual discrimination, protection of children from exploitation and moral degradation , Uniform Civil Code for citizens and maintenance of international peace. In Vedic era, this was taken as Rajdharma and in modern Indian governance as DPSPs which are relevant in formulating policies. How Rajdharma is prevalent in modern Indian governance can be witnessed when after Gujarat riot in 2002 ,the then PM of India Atal Behari Vajpayee advised the then CM of Gujarat Narendra Modi to follow the principle of Rajdharma in doing justice to all who were affected from the riot. It means, equal treatment to all without any discrimination {11}.

Accountability, transparency and social responsibility

Arthshatra defines king's accountability for state's prosperity and efficient utilisation .This is the basic principle in modern governance as well where transparency, accountability and social responsibility in public administration is at the core of governance. To maintain this , modern Indian governance system has many models and provisions in the constitution and one of them is RTI (Right to Information) Act,2005 which ensures transparency and accountability in public administration by the government. Any common person can get the detail from various offices of government, pertaining to any scheme, spends , execution or government activities falling under RTI Act,2005 {12}. This has been established in the governance system to ensure accountability of public office holders and providing transparency in terms of working of government to common public.

Secular Administration, Social Justice & Equality-Kautilya's Arthshastra which is a detailed administrative and economic codes , dealt mainly with practical matters like trade, taxation and labour laws are independent of simply religious injunctions. Although, Vedic texts have discriminatory elements like the caste system but the underlying thought of Dharma or Righteousness as a universal moral order guarantees justice for everyone. The same has been interpreted and construed in modern India's governance which is very much a part of Indian Constitution. The motto of the Constitution is to promote equality and address traditional injustices of the society.

CONCLUSION

In ancient times and Vedic era, judicial institutions were taken as prominent part of the society and king delivered justice to his subjects(praja) by practicing Rajdharma with no discrimination.

Brihadaranykopanishad explains that since the power of Kingship was not enough and thus, Dharma ”the law” was created which was superior to King and armed the king to protect the people and deliver justice. Administration of delivering justice was well structured in Vedic times .This system further provided as an excellent foundation for the modern system of administration .Although, India’s governance and judicial system come from the colonial history but the influence of Vedic and post Vedic era of justice and governance can be clearly witnessed. The cultural and philosophical background of Vedic era make the inherent spirit and interpretation of modern Indian judicial process and governance more pragmatic.

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Right to Development as a Fundamental Right in Nepal

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Abstract
This article analyzes the right to development, which is necessary to meet the basic needs of human life, such as food, shelter, clothing, education, and health. Various international instruments have been provisioned to ensure such a right. As a member state of the United Nations and a party to the various international human rights instruments, Nepal has ensured constitutional and legal arrangements to provide such rights. The Constitution of Nepal (2015) has envisioned economic progress and prosperity as a basic element of national interest. The Constitution has also entrusted the development as a state policy, and the right to development is guaranteed as a fundamental right of the citizens. The purpose of this article is to understand the concept of the right to development with respect to Nepal's constitutional and legal arrangement and the judicial perspectives. In addition, an attempt has been made to comparatively examine how the right to development is being practiced by some other countries, especially in India and South Africa. A normative doctrinal and socio-legal research method has been employed where various legislations have been examined to find legal rules and doctrines related to the right to development in Nepal. Finally, the Reform Agendas and Future Directions have been identified, which will help in ensuring the right to development and fulfilling Nepal's constitutional aspiration of development and prosperity.

Keywords: Constitution, judicial, legal, Human Rights, Policy

INTRODUCTION

One of the most important normative transitions in contemporary human rights discourse is the notion that all people and communities have the right to participate in, contribute to, and benefit from economic, social, cultural, and political development. The right to development (RTD) came to prominence in the post-colonial context and the Cold War as a response to structural inequalities in the global economic structure. The instrumental legal basis was laid down when the United Nations adopted the Declaration on the Right to Development (1986), which defined development as an inalienable human right and obligated states to formulate policies to realize the right to development.

In other countries in the world, the RTD has been given importance. For example, the right to development is enshrined as an enforceable right in the constitution of South Africa. Similarly, although the constitution of another large and democratic country, India, has not explicitly mentioned the right to development in its constitution, the Supreme Court of India has protected the right to development through the interpretation of Articles 21 and 48A of the constitution.

In the Nepalese context, the constitutional framework of the right to development has signified a milestone in the country's changing socio-political transformation. The Constitution of Nepal has recognized development as a state policy and fundamental rights. The necessary laws for the implementation of the fundamental rights mentioned in the Constitution have been formulated and implemented. Judicial practice in Nepal has increasingly broadened the concept of development and economic right through public interest litigation.

Thus, in Nepal, the right to development has been recognized as a traditional political right in principle, constitutionally, and legally. Compared to the world's big democratic countries like India and South Africa, Nepal's situation of RTD is moderate because the Nepalese Constitution has made more fundamental rights compared to the Indian Constitution and has not been placed in the category of enforceable rights compared to South Africa's constitutional provision. However, in a recent development, it seems that the right to development in Nepal is gradually moving towards practical implementation.

THEORETICAL GROUND OF THE RIGHT TO DEVELOPMENT

The RTD is situated in a distinctive normative framework linking to human rights law and international economic law. It is recognized as both a collective right and an individual right, based on the idea that the development must be people-centered and participatory. The conceptual development of the right represents a paradigm shift from growth-oriented economic models to a rights-based approach, whereby development is not only viewed as an outcome but also as a process through which all human rights and fundamental freedoms can be fulfilled.

Conceptual Foundation of the Right to Development

The 1960s and 1970s post-colonial discussions on global justice and self-determination provide the conceptual basis for the RTD. At a critical juncture, developing nations demanded equitable participation in international trade, finance, and technology transfers in the Declaration on the Establishment of a New International Economic Order (1974). These claims were further strengthened in the Charter of Economic Rights and Duties of States (1974), which affirmed states' sovereign right to adopt development policies reflecting their national priorities. The United Nations General Assembly unanimously adopted the United Nations Declaration on the Right to Development (1986), which established the RTD. Article 1 of the Declaration states that the RTD is an inalienable human right, which means that every person and every people has the right to have an active role in their economic, social, cultural, and political development. The Declaration imposes an obligation on States to develop appropriate national and international development policies so as to "ensure a constant improvement of the well-being of the people."

Normative and Legal Status

The legal status of the RTD has been the subject of ongoing academic debate. Some scholars argue that the RTD is merely a soft-law principle, without the power of enforceability, while other scholars contend that it represents an emerging norm of customary international law derived from the UN Charter, international human rights covenants, and ongoing state practice.

Article 55 of the UN Charter establishes an obligation for member states to promote higher standards of living, full employment, and conditions of economic and social progress, effectively laying a normative foundation for development as a human right. Article 2 of the International Covenant on Economic, Social and Cultural Rights (ICESCR, 1966) requires state parties to take steps "individually and through international assistance and cooperation" to achieve the full realization of these rights, thus capturing the cooperative elements of the RTD.

The idea has also been developed by regional human rights systems. The African Charter on Human and Peoples' Rights (1981) states unequivocally that every people has the right to economic, social, and cultural development, as long as that right is exercised in a way that respects their freedom and identity. It shows that Africa is positioned as a leader in the legal acknowledgment of collective development rights, which has an impact on later constitutional and judicial developments throughout the Global South.

The Right to Development is an Enforceable Right

The RTD is different from conventional human rights since it is both a process and a substantive entitlement. As an entitlement, it grants enforceable claims to opportunities, resources, and social justice; as a process, it requires accountability, openness, and participatory governance in decision-making. RTD has become a justiciable right due to judicial interpretations in a number of jurisdictions, such as South Africa and India. Drawing on these comparative examples, the courts of Nepal have adopted a similar interpretive approach, acknowledging that development is the obligation of the state to establish favorable conditions for citizens' self-realization.

Part 4 of the Constitution of Nepal has enshrined the Directive Principles and Policies of the State. Under this part, Article 51 (f) mentions the ‘development policy.’ Although the constitution mentions that questions cannot be raised in any court regarding the implementation or non-implementation of any of the matters of this part, the Supreme Court of Nepal has emphasized that the state must implement such matters. In *Prakashmani Sharma v. His Majesty's Government,* the Supreme Court stated that the directive principles and state policies as provided for in the

Constitution are not meaningless provisions; these provisions cannot be ignored. If it is found that these provisions are being neglected, the court can order necessary directions to the government to make these provisions effective.

The Supreme Court of Nepal has clarified in various judgments for the protection of economic rights granted by the Constitution, including the right to education, the right to employment, the right to food, etc. In the case of *Prakashmani Sharma et al. v. Government of Nepal et al.,* it has been stated that since there is no employment without education and without employment, there are no financial resources, and therefore, the state should support citizens in these three elements in the overall cycle of development. Similarly, in the case of *Prem Bahadur Khadka et al. v. Government of Nepal et al.,* the right to employment is an important right among economic and social rights. The court further said that including a right as part of fundamental rights means that such a right is immediately activated, and if it is violated or abused, the right to remedy is available.

In the case of *Bajuddin Miya et al. v. Government of Nepal et al.,* it has been stated that the state cannot evade its constitutional duties by saying that there is no law or policy on issues that affect the interests and concerns of citizens, such as food sovereignty, health, food problems, security, the environment for doing business, and its proper protection.

Similarly, in the case of *Prakash Mani Sharma v. Office of the Prime Minister and Council of Ministers,* the court said that the freedom and the right to food are mutually inclusive rights. The court further stated that in order to protect the right of citizens to live with dignity, the state must create a situation where the minimum necessities indispensable for a dignified and respectful human life, such as food, water, shelter, health, freedom, privacy, education, clothing, etc., are economically accessible to everyone in the market and can be obtained by everyone by maintaining peace and security for its citizens and protecting their property.

The Supreme Court has made it clear in the case of *Prakash Mani Sharma et al. v. Office of the Prime Minister and Council of Ministers et al.* that the state must have the means, resources, and capacity to provide economic rights to its citizens. Since the state can naturally provide such resources only through development, the economic rights of citizens granted by the Constitution can only be fulfilled through development.

As mentioned above, not only in giant democratic countries like South Africa and India, but also in Nepal, efforts have been made to ensure the right to development through constitutional provisions and court decisions, making these rights enforceable.

THE INDIAN EXPERIENCE: EXPANDING THROUGH JUDICIAL INTERPRETATION

India is one of the richest countries where the courts develop the right to development. Article 21 of the Indian Constitution only protects life and personal liberty, and it does not explicitly mention the right to development, but the Supreme Court of India interpreted the article widely and included the social and economic rights within its ambit that are needed to support human development. In the case of *Francis Coralie Mullin v. the Administrator of the Union Territory of Delhi,* the Court decided that life means living with dignity. It includes basic needs like food, clothes, and housing. In *Olga Tellis v. Bombay Municipal Corporation* the court recognized the right to livelihood as an integral part of the right to life, and depriving people of the right to development is a violation of the constitution. Those decisions have changed the narrow vision of the court's view and interpreted the constitution on a development-oriented approach. In addition, the Directive Principles of State Policy (Articles 38–51 of the constitution) have conferred on the State obligations to establish a social order that assures welfare and distributive justice. Although non-justiciable, the courts have read them into enforceable rights under Articles 14 and 21, thereby converting the Constitution into a dynamic charter for development. Thus, Indian constitutional jurisprudence demonstrates the judicial socialization of developmental rights, which has made the state accountable for the realization of human dignity through policy and governance.

SOUTH AFRICAN EXPERIENCE

The Constitution of South Africa (1996) enshrines socio-economic rights, including housing, health care, food, water, and social security, as justiciable and enforceable rights, making it possibly the most straightforward example of a constitutionally protected right to development. The Constitutional Court's historic decision in *Government of the Republic of South*

Africa v. Grootboom (2000) reaffirmed the State's positive obligation to use its resources to take reasonable steps toward the progressive realization of these rights. In the *Minister of Health v. Treatment Action Campaign (TAC),* the Court reiterated that the Constitution's transformative vision, which aims to address historical injustices and promote human development, is centered on socio-economic rights. Further, the Court stated that human development is not simply about improving aspects of material life but also about enabling people and communities to participate in social and political life.

THE FUNDAMENTAL RIGHT TO DEVELOPMENT

Structure of the Constitution and Legal Framework

The Constitution of Nepal is a major constitutional moment with respect to human rights in the South Asian region. It shifts development from being a policy goal to being a constitutional mandate, making it explicitly contingent on equality and social justice. The Preamble directs the State to repeal all discriminatory and repressive laws and to promote an egalitarian society with inclusivity, situating development within the logic of human dignity and distributive justice.

An integrated and transformative development vision that covers economic transformation, sustainable natural resource management, and the meeting of basic needs is contained within Part 4 (Articles 50–55) on the Directive Principles and Policies of the State. Although these principles are themselves non-justiciable, they are intended as interpretive clauses that give content to the meaning of enforceable fundamental rights.

The chapter on Fundamental Rights (Part 3) is particularly important in that it entrenches entitlements related to social and economic development in a justiciable form: the right to life with dignity, the right to employment, the right to food, the right to shelter, etc. Together, these rights turn the RTD into a set of connected rights that form the foundation for a state focused on development.

Various laws have been enacted to realize the economic rights guaranteed by the Constitution of Nepal. For example, the Right to Information Act, 2064, to implement Article 27; the Compulsory and Free Education Act, 2075, to ensure free and compulsory education as mentioned in Article 31; the Right to Employment Act, 2075, and the Labor Act, 2074, to protect the rights mentioned in Article 33 have been formulated and implemented.

Judicial Recognition and Doctrinal Evolution

The judiciary in Nepal has been key in making the promises of the Constitution a reality. While the phrase "right to development" doesn't come up often in court decisions, the Supreme Court has taken a forward-thinking approach. It has broadened socio-economic rights to foster justice for development.

The Constitution of Nepal explicitly states the commitment of the nation to build an equitable society through economic development and social justice. Articles 5, 16, 17, 30(3), and 51(d-i) provide a right to development and dignity. Drawing on comparative examples, some justices of the Nepalese judiciary have begun to interpret these rights provisions broadly. For instance, in the case of *Ram Kumar Dixit v. Office of the Prime Minister and Council of Ministers,* the Supreme Court of Nepal has said that since the Constitution of Nepal aims to build a prosperous nation oriented towards socialism by guaranteeing the right to live with dignity, the right to food sovereignty, the right to housing, the right to social justice, and the right to social security as fundamental rights, the state should manage the citizens who are suffering from hunger, disease, illiteracy, and poverty and are deprived of their homes due to floods.

The Supreme Court of Nepal has established the principle not to interfere to the Governmental policies relating to development in various cases such as Sher Bahadur Lungeli et al. v. Office of the Prime Minister and Council of Ministers et al. Ram Kumar Acharya v. Prime Minister, Office of the Prime Minister and Council of Ministers et al. Further, the Supreme Court of Nepal, in some cases, has also set a principle of favoring with development when a conflict arises between development and the environment.

Governance and Implementation: Between Promise and Performance

While the RTD in Nepal has significant constitutional, legal, and judicial recognition, it faces

persistent obstacles to realization. Low growth, weak productivity, trade deficits, youth outmigration, poor education and health systems, inadequate infrastructure, governance gaps, weak markets, environmental pressures, and rising social inequality hindering effective federalism impede the realization of rights in practice.

Furthermore, the devolution of the development powers of the state to decentralized governments has produced capacity asymmetries across provinces and local governments. While the constitutional framers contemplated development from the ground up, the capacity of institutions to act autonomously in fiscal terms is uneven and appears to lead to what some scholars refer to as asymmetrical development governance.

REFORM AGENDAS AND FUTURE DIRECTIONS

Towards a Coherent Legislative Framework

While the Constitution of Nepal provides a strong normative foundation for the RTD, the law remains overly fragmented and, at times, incoherent. Various statutes are devoted to development advancement, including the Local Government Operation Act 2017 and the National Natural Resources and Fiscal Commission Act 2017, and yet, much of their coverage overlaps. This overlap creates jurisdictional disputes among ministries, limits enforcement, and delays the insertion of human rights principles into the advancement of policy.

Institutional Reforms: From Coordination to Integration

The implementation of the RTD requires a shift from coordination to integration at an institutional level. The development-related ministries, the National Planning Commission (NPC), the Office of the Auditor General, and provincial planning commissions must adhere to joint standards, integrating right-based human rights at every phase of the development cycle.

Nepal needs to form an Independent Commission on the RTD Justice (ICRDJ) like other constitutional commissions. It would monitor distributional equity in development compliance and report quarterly to Parliament.

Alignment of Fiscal Policy Under Federalism

Fiscal federalism must produce observable local results in order to fulfill constitutional ideals. Revenue sharing is allowed by the Inter-Governmental Fiscal Arrangement Act of 2017, but allocations usually do not take developmental inequality into account. Resource allocations in compliance with Articles 59 and 60 of the Constitution could be influenced by the creation of a "Right-to-Development Index," an evidence-based tool to measure development disparities across provinces. These actions would facilitate the constitutional mandate of pursuing economic development, as per Article 51.

Participatory Governance and Access to Information

Development through participation is inconsistent with the essence of the RTD. The Right to Information Act 2007 should be strengthened to require the proactive disclosure of development information at every administrative level. Local governments must be required to hold annual development forums to ensure RTD.

International Cooperation and South–South Learning

As the RTD is inherently transnational, Nepal may use regional forums (e.g., the South Asian Association for Regional Cooperation [SAARC] and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation [BIMSTEC]) to facilitate shared experiences regarding developmental equity. Collaborating with development partners such as the UNDP and, for example, the Government of Norway (on the PSP) may enable technology transfer and capacity-building in relation to digital governance and innovations.

The Way Forward: From Constitutional Promise to Transformative Practice

The greatest challenge is converting constitutional and legal recognition of RTD into actual governance. In order to effect this change, Nepal needs a multi-level accountability framework:

parliamentary accountability, judicial independence, administrative accountability, and civic accountability. The RTD needs to be seen as an equilibrium between growth and distribution of resources. In Nepal, however, that equilibrium will hinge on the capacity of institutions to balance short-term political motivations with long-term imperatives for human development. If reformed through coordinated action, the RTD could become the foundational principle of developmental constitutionalism in Nepal. This would be not just a constitutional right but a civilization commitment: to build a just and sustainable society for present and future generations.

CONCLUSION

The endorsement of the RTD as a constitutional and legal commitment in Nepal is a consequential shift in the political and institutional future of the country. Transitioning from the treatment of development as a policy goal, the Constitution of Nepal now recognizes development as one of the fundamental rights, and the country has made sufficient legal provisions for providing the RTD and social justice to her citizens. The normative boundaries of RTD informed by human rights developments around the world in the previous sections demonstrate that if RTD is to be a right for all in Nepal, it is dependent on a robust governance mechanism, institutional reforms, and consideration of place-based development processes.

Judicial interpretations in Nepal have begun to bridge the gap between constitutional as well as legal promise and lived experience in Nepal, while expanding the definition of development participatory rights to access shared resources. However, structural impediments, federalistic fiscal asymmetries, overlapping mandates, lack of proficiency, and weak accountability have remained challenges. For the RTD to move from principle to practice and to be a genuine rights-based instrument, the government of Nepal must adopt a rights-based developmental model that aligns laws, policy, and institutional mandates with states' obligations and citizens' entitlements.

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Contemporary Applications and expanding horizons of Indian knowledge from Vedic insights

Shanita

Keywords: Indian Knowledge Systems, Vedic insights, contemporary applications, holistic development, sustainability, education reform

Introduction

Here you introduce the topic: define what is meant by Indian knowledge from Vedic insights, why it matters today, what "contemporary applications" and "expanding horizons" mean, and the purpose of the paper. You can note that the Indian government's IKS initiatives aim to integrate traditional knowledge into modern education and research frameworks

SECTION 1: FOUNDATIONS OF VEDIC-DERIVED INDIAN KNOWLEDGE SYSTEMS

- Brief historical overview of Vedic traditions: e.g., the Vedas, Upanishads, Vedangas, etc.
- Core epistemological frameworks: for example, the triad "Jnān – Vijnān – Jīvan" in Indian Knowledge Systems.
- Domains covered: philosophy, mathematics (e.g., Vedic mathematics), astronomy (e.g., Sūrya Siddhānta)
- The values embedded: holism, interconnectedness (e.g., human–nature), systems thinking, ethical foundations.

SECTION 2: CONTEMPORARY APPLICATIONS IN VARIOUS DOMAINS

Education and Curriculum Innovation

- Integration of IKS into education: frameworks for blending traditional and modern pedagogy.
- Use of Vedic mathematics and mental arithmetic techniques in modern computational/educational tools. For example the "VedicViz" project visualising Vedic techniques for mental arithmetic.
- Implications for holistic student development: mental, physical, spiritual.

Technology & Engineering

- Example: Use of Vedic mathematics in digital signal processing / FFT design (see the paper "High Speed Reconfigurable FFT Design by Vedic Mathematics").
- Potential for other engineering/algorithmic adaptations of ancient approaches.
- Challenges: translation of archaic frameworks into rigorous modern engineering terms.

Health, Well-being & Sustainability

- Ayurveda and traditional health systems informed by Vedic knowledge are being studied in labs, integrated into preventive health frameworks. (Modern interest in validating them scientifically).
- Environmental sustainability: Traditional Indian ecological practices, connection with nature, and how those insight can inform contemporary environmental policy and practice.

Governance, Management, Socio-economic Applications

- Principles from Indian philosophical systems applied in management theory, leadership, sustainable governance (e.g., "Vasudhaiva Kutumbakam" – the world as one family).
- Use of traditional knowledge in agriculture, architecture, ecology via IKS initiatives.

SECTION 3: EXPANDING HORIZONS — EMERGING AREAS AND FUTURE DIRECTIONS

- Interdisciplinary research frameworks: how IKS is opening new research areas, bridging humanities, science, technology.
- Digital humanities, AI and Indic philosophy (for example AI techniques mapping themes in Upanishads/ Gita)
- Global relevance: How Indian knowledge can engage with global challenges like climate change, mental health crisis, education equity.
- New institutional initiatives: Mention government / institutional frameworks for IKS and their role. Eg., the IKS division under MoE.

SECTION 4: CHALLENGES AND LIMITATIONS

- Methodological issues: How to adapt traditional knowledge into modern frameworks without distortion; scholarly rigour; translation of Sanskrit concepts to modern languages.
- Legitimacy and recognition: The Western-centric knowledge paradigm, issues of evidence, peer review, accreditation.
- Intellectual property, ethics of using indigenous knowledge, commodification risks.
- Risk of superficial integration: tokenism rather than deep structural change.
- Maintaining authenticity vs innovation: balancing tradition with adaptation.

SECTION 5: RECOMMENDATIONS

- For educators: curriculum design that genuinely integrates IKS principles with modern subjects; teacher training; experiential learning.
- For researchers: methodological frameworks to study IKS in interdisciplinary modes; collaborations between traditional scholars and modern scientists/technologists.
- For policymakers: supportive institutional structures, funding, recognition of IKS research; built-in evaluation frameworks.
- For practice sectors (health, technology, sustainability): pilot projects, case studies, monitoring & evaluation of outcomes.
- A call for open-ended exploration rather than prescriptions: enabling plural knowledge ecosystems.

CONCLUSION

Summaries the main arguments: that Vedic-derived Indian knowledge systems have significant potential for contemporary application across domains; that the horizon is expanding as institutional interest, research and practice grow; that meaningful integration requires careful scholarship, methodological integrity, and policy support; that the ultimate aim is enriching both traditional and modern knowledge paradigms for more holistic human flourishing.

REFERENCES

Provide a list of cited works (minimum ~20 references recommended for full paper) including those from the search results above and additional peer-reviewed journals, books, conference proceedings. Ensure correct citation style (e.g., APA, MLA) per your institution's guidelines.

FIGURES & TABLES

You will need 7-8 figures and 7-8 tables. Here are suggestions:

Figures:

- Diagram of Indian Knowledge Systems-Vedic roots continuum.
- Graphic illustrating domains of IKS (education, health, tech etc).
- Chart of integration process (traditional knowledge → modern application).
- Case-study snapshot (e.g., Vedic mathematics application in DSP)
- Timeline of "expanding horizon" – key institutional milestones for IKS in India.
- Model of holistic well-being (body-mind-environment) drawing on Vedic insights.
- Global-local knowledge exchange map (Indian knowledge interacting globally).

Tables

- Table listing major Vedic texts + key knowledge domain + contemporary relevance.
- Table comparing traditional vs modern epistemologies (e.g., thematic features).
- Table of contemporary applications by domain with examples, benefits, challenges.
- Table of institutional initiatives/policies in India for IKS integration.
- Table of research gaps/limitations and proposed actions.
- Table of metrics for evaluating IKS integration in education/health/tech.
- Table of stakeholder roles (academia, industry, government, community) + tasks.

Ensure each figure/table has a caption, is numbered (Figure 1, Table 1 etc), and the source is provided.

Judicial Governance: The Role of Judiciary in Ensuring Constitutional Accountability

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Abstract

Judicial governance is crucial for bringing about a balance of the organs of government and seeing that the letter and spirit of constitutional values are adhered to. As the sentinel of the Constitution, the judiciary uses its power of judicial review and ensures that the principle of separation of powers is guarded to uphold the democratic ideals. By its interpretative and supervisory functions, it seeks to ensure that the functions of both legislative and executive departments conform to the mandates set forth by the Constitution. Judicial governance, therefore, encompasses accountability within the paradigm of the rule of law and constitutes a check against the abuse of power by other organs of the State. It critically examines how judicial governance strengthens constitutional accountability in India through landmark judgments such as "Kesavananda Bharati v. State of Kerala" and "S.R. Bommai v. Union of India", wherein vital precedents have been laid down with respect to constitutional interpretation and governance. These developing dimensions of judicial activism and restraint in balancing the functions of governance while keeping alive the flame of institutional harmony are studied. The paper thus concludes that an independent and active judiciary not only secures constitutional supremacy but also strengthens the democratic fabric by increasing citizens' trust in governance and upholds justice as the "raison d'être" of the State.

Keywords: Judicial Governance, Constitutional Accountability, Rule of Law, Separation of Powers, Judicial Review, Good Governance

INTRODUCTION

Judicial governance has emerged as a central pillar of modern constitutional democracies, epitomizing the role of the judiciary not as an adjudicatory body but as an institutional sentinel of the rule of law and constitutional accountability. It is the sentinel on the qui vive, ensuring that each and every limb of the State – legislature, executive, and judiciary – functions within the contours provided by the Constitution. Thus, judicial review, interpretative functions, and powers of supervision carried out by the judiciary achieve a delicate balance in the organs of governance with a view to realizing the ideals of democracy, justice, and liberty enshrined in constitutional texts.

While the doctrine of separation of powers is explicitly endorsed by the Indian constitutional framework, the Constitution at the same time recognizes the principle of checks and balances to be imperative for preventing arbitrariness in governance. The judiciary's balancing role is thus of signal importance, especially through mechanisms such as judicial review under Articles 32 and 226 of the Constitution of India, which empower courts to scrutinize the constitutionality of legislative and executive acts. Judicial governance accordingly goes beyond the act of adjudication; it conveys the broader mandate of ensuring that governance itself adheres to constitutional mandates and the principles of fairness, transparency, and accountability.

The emergence of governance jurisprudence, both in India and elsewhere, underlines the transformative role of the judiciary in policymaking and ensuring that governments are made accountable. According to Hussein and Abbas, governance in the context of the judiciary means inclusion of the elements of transparency, participation, and accountability within the judicial institution in order to enhance constitutional legitimacy and public trust in justice institutions. [1]

Similarly, Khalid et al. explain that judicial review represents an institutional check on the fidelity of public policy to those principles which underpin the constitution.[2] Judicial review helps not only in declaring unconstitutional legislation or executive actions but in influencing the tenor of governance on aspects related to environmental protection, public health, and human rights, thereby reinforcing the role played by the judiciary in promoting public accountability.

While judicial appointments through the Collegium System are under critical scrutiny, debates

on judicial transparency and accountability continue to top the constitutional discourse of India. Dutt, Mishra, and Tayal go on to argue that while independence of judiciary is essential, it cannot be a substitute for transparency and accountability to the public in order to maintain democratic legitimacy. [3] The debate, heightened ever since the verdict on the National Judicial Appointments Commission, is a manifestation of tension between judicial independence and democratic oversight within the governance framework.

Sharma and Agarwal argue that the judiciary also plays this dual role vis-à-vis the check on the administrative power and good governance.[4] In this regard, judicial review of administrative actions serves to ensure the application of constitutional values in decision-making by executives and, thus, operationalizes the rule of law as a basic tenet of governance.

Hence, judicial governance can be understood as the constitutionalization of governance principles within the judiciary-a process whereby the courts interpret and apply the law but at the same time live out the very principles of transparency, participation, and accountability which they demand from the other state organs. In the Indian context, this finds manifestation in the judicial interventions in policy domains, constitutional interpretation keeping the basic structure safe, and institutional reforms directed at enhancing judicial accountability.

LITERATURE REVIEW

The emergent scholarship on judicial governance reflects an expanding recognition that the role of the judiciary in constitutional democracies goes beyond dispute resolution to maintenance of governance integrity. This literature brings into focus how the judiciary, through its interpretative, supervisory, and normative functions, holds constitutional organs accountable to the rule of law and to public interest.

Conceptual Foundations of Judicial Governance

In one of the widest analyses of judicial governance, Hussein and Abbas have defined it as a governance model that incorporates the principles of transparency, participation, rule of law, justice, and equality into the institutional functioning of the judiciary. [1] Their work places the judiciary as a "balancer" among state organs and underlines that constitutional courts are central in ensuring legality and promoting institutional integrity.[2] They have argued that the application of governance principles within the judiciary—such as making decisions transparently, with procedural fairness, and holding institutions accountable—is not merely administrative but constitutional, since it enhances citizens' trust and legitimizes judicial authority.[3]

The authors further stress that failures in the governance of the judiciary, such as opacity in decision-making or lack of clarity in procedures, may undermine constitutional checks and open the way to political interference.[4] Thus, judicial governance should emerge as a framework that protects independence while enforcing accountability. Based on their analysis, effective judicial governance calls for reforms like open publication of judgments, clear codes of procedure, and mechanisms of institutional self-regulation congruent with constitutional values of equality and justice.[5]

Judicial Review as a Mechanism of Accountability

Khalid and her co-authors conceptualize judicial review as the functional instrument through which judicial governance operates.[6] They say that judicial review works not only to check the powers of the legislature and executive and prevent them from assuming more powers than they are constitutionally entitled to but also in fashioning public policy in a manner agreeable to democratic precepts.[7] Courts interpret constitutional mandates and direct the course of governance policy in areas integral to environmental protection, education, healthcare, and even minority rights.[8]

Their work identifies judicial activism and judicial restraint as two competing paradigms within this discourse.[9] While activism allows courts to further social justice and policy innovation, restraint displays respect for institutional limits. Khalid et al. believe that such value-oriented and balanced judicial review-which ensures the supremacy of the constitution without trespassing upon democratic functions-is essentially required to ensure good governance.[10] They thus hold

that the interpretative authority of the judiciary, when wielded responsibly, strengthens both accountability of government and trust by citizens.[11]

Transparency and Institutional Integrity

In the critical study of the appointment process in courts, Dutt, Mishra, and Tayal have discussed the tension that persists between judicial independence and democratic accountability within the Collegium System.[12] They argue that though the Collegium was born out of the necessity to save the judiciary from arbitrariness of the executive, its non-transparent functioning erodes principles of openness and equity intrinsic to judicial administration. [13]

The authors trace the evolution from the First Judges Case through the NJAC decision, demonstrating how constitutional interpretation has alternately expanded and constrained judicial self-regulation.[14] They call for codified criteria and broader participation in appointments to ensure diversity and public confidence.[15] Their comparative analysis of appointment models in jurisdictions such as the United Kingdom and South Africa suggests that independence need not preclude accountability, provided that transparent and inclusive processes are institutionalized.[16]

This literature underlines one important dimension in judicial governance: not what the courts decide but how courts function is what matters. Institutional legitimacy requires procedural openness, public reasoning, and representational diversity-all of which undergird constitutional accountability.[17]

Judicial Review and Administrative Accountability

Sharma and Aggarwal relate to the judiciary's role of overseeing the administrative state, illustrating how courts act as sentinels of good governance to ensure that the constitutional norms are adhered to.[18] They further establish a link between the rule of law and principles of natural justice. According to them, judicial review of executive actions saves both fairness and constitutional order.[19] They have mentioned that through landmark precedents such as A.K. Kraipak v. Union of India and Indira Nehru Gandhi v. Raj Narain, the judiciary has invariably curbed administrative arbitrariness and reaffirmed the doctrine of constitutional supremacy.[20]

Their analysis underlines the fact that judicial scrutiny is the connective tissue of governance and legality, with the constitutional promise of accountability actualized along with the institutional balance. [21]

E. Synthesis

Taken together, these studies form a meaningful theoretical and practical basis through which judicial governance can be seen to operate in multidimensional ways. The literature has set up that effective judicial governance embeds three interrelated components:

Institutional accountability - ensuring openness and due process within the courts themselves;

Functional Oversight- exercising judicial review and supervision to keep governance actors aligned within the constitution; and

Normative Legitimacy: building confidence through acting in congruence with the rule of law and democratic values.

Taken together, the scholarship thus affirms that judicial governance is not peripheral but rather central for sustaining constitutional accountability and democratic governance in India.

CONCEPTUAL AND LEGAL FRAMEWORK

Judicial governance relies on some basic constitutional principles that determine the relations between state organs to prevent the abuse of power. In essence, judicial governance combines doctrines of the rule of law, separation of powers, and judicial review to sustain constitutional accountability and democratic legitimacy.

The Rule of Law

It means the normative foundation of judicial governance and establishes that state authority-legislative, executive, and judicial-in its exercise must be confined by law to achieve equality and fairness in governance. [1] It follows, as Dicey conceptualized, the supremacy of law, equality

before the law, and predominance of legal spirit. [2] These ideals, through Articles 13, 14, and 32, found expression in the Indian Constitution and have made legality and justice integral to governance. [3] Judicial enforcement of the rule of law keeps governance anchored in legality rather than discretion.

Sharma and Agarwal support the view that the rule of law is a check by the constitution on administrative action, ensuring that the decisions of the executive remain in tune with the principles of fairness and due process.[4] Their study outlines that this principle, once put to work through judicial control, turns into an instrument of good governance.[5]

Separation of Powers and Institutional Balance

The doctrine of separation of powers underpins the constitutional architecture by assigning a separate function to each of the three branches. Where Montesquieu's formulation contemplated strict separation, the Indian model adopted a flexible version aimed at coordination with accountability.[6] The judiciary, through constitutional interpretation, acts as a mediator between the branches, ensuring no organ crosses its limits.

As viewed by Hussein and Abbas, this dynamic is part of judicial governance in itself-wherein courts act as "balancers" in maintaining constitutional harmony.[7] In so doing, they turn the judiciary from a passive adjudicator to an active guarantor of constitutional equilibrium.

Judicial Review and Constitutional Accountability

Judicial review is the functional expression of judicial governance. Articles 32 and 226 empower the courts to strike down unconstitutional legislation and administrative action in order to institute constitutional accountability.[8] As Khalid et al. note, through judicial review, "all public power remains answerable to law" and ensues transparency and accountability in the structures of governance.[9] The doctrine has been held to be a part of the basic structure of the Constitution in Kesavananda Bharati v. State of Kerala[10] and S.R. Bommai.

THE ROLE OF JUDICIARY IN ENSURING CONSTITUTIONAL ACCOUNTABILITY

The judiciary thus acts as the guard of the Constitution, vested with the responsibility to maintain the supremacy of the constitutional norms and keep deviations by the other two coordinate branches at bay. Its role in ensuring constitutional accountability extends across three interrelated dimensions: interpretative, supervisory, and corrective.

Interpretative Role: Constitutional Meaning and Continuity

The interpretative function lies at the core of judicial governance. The courts breathe life into constitutional provisions through constitutional interpretation, making them relevant in changing socio-political contexts. In Kesavananda Bharati v. State of Kerala,[1] the Supreme Court enunciated the basic structure doctrine that the amending power of Parliament in law is limited by the fundamental features of the Constitution. This judicial innovation redrew constitutional accountability in a manner that no organ could successfully impair democratic principles or the rule of law.

In a similar vein, in I.R. Coelho v. State of Tamil Nadu,[2] the Court reiterated that constitutional amendments touching the basic structure are reviewable, thereby constitutionalizing a kind of judicial self-governance that acts as a restraint on excessive majoritarianism. It is through this interpretive check that the judiciary makes certain there is continuity and coherence in constitutional governance.

Oversight of Legislative and Executive Power: Supervisory Role

Judicial governance is most overtly expressed in the supervisory governance conducted through judicial review, establishing that public bodies remain within their powers of legality, rationality, and procedural fairness. As Khalid and her fellow authors note, "judicial review retains accountability in governance by forcing public bodies to justify their decisions in the light of the law."[3] Such power as incorporated by Articles 32 and 226 facilitates the right of individuals to question unconstitutional acts and furthers the responsiveness of the State.

In S.R. Bommai v. Union of India,[4] the Supreme Court subjected the President's proclamation under Article 356 to judicial scrutiny and held that even emergency powers are not immune from review. Judicial governance is thus manifested by this judgment since it curtailed executive arbitrariness and upheld the judiciary as a constitutional supervisor.

Corrective Role: Upholding Rule of Law and Administrative Justice

Beyond interpretation and oversight, the judiciary corrects errors committed by the administration and ensures procedural fairness. Sharma and Agarwal observe that judicial review acts as "constitutional corrective" when administrative or executive decisions have been made in breach of the rule of fairness or natural justice.[5] This role is exercised through writs such as mandamus, certiorari, and prohibition, which compel public authorities to act within the bounds of the law.

In A.K. Kraipak v. Union of India,[6] the Court held that administrative decisions were required to conform to the principles of natural justice, thereby constitutionalizing fairness within governance. Interventions of this nature ensure that the rule of law remains the operative standard for all state action and reinforce the accountability function of the judiciary.

Through these interpretative, supervisory, and corrective mechanisms, the judiciary ensures not just individual rights but also the institutional integrity of governance. Judicial governance then becomes the practical embodiment of constitutional accountability, wherein any exercise of power, howsoever distributed, remains principally subordinate to

JUDICIAL GOVERNANCE IN INDIA: CHALLENGES AND REFORMS

While the Indian judiciary has emerged as a bulwark of constitutional accountability, it is still mired by intrinsic structural and procedural challenges that test its credibility and effectiveness. Issues such as opacity in judicial appointments, delays in adjudication, lack of internal accountability mechanisms, and limited transparency in administration weaken the ideal of judicial governance. The central challenge within the Indian context remains balancing judicial independence with institutional accountability.

The Collegiums System and the Crisis of Transparency

The Collegiums System, devised by the Second Judges Case and reiterated in the Third Judges Case, divested the discretion of judicial appointments from the executive and vested it in a collegium comprising senior judges. This was designed to insulate the judiciary from political interference, essentially buttressing independence as a constitutional value. Yet, its functioning has increasingly come under attack over lack of transparency and institutional opacity.

Dutt, Mishra, and Tayal argue that the Collegium's behind-the-curtain workings are inconsistent with judicial accountability and confidence of the public, both of which are imperative components of democratic governance.[2] They further note that elevation and transfer decisions are invariably viewed as discretionary in nature, thus giving rise to a sense of elitism and exclusivism.[3] They stress in greater detail, in their comparative study, that other jurisdictions-like the United Kingdom and the Republic of South Africa-secure a proper balance between independence and transparency through the integration of non-judicial members into the selection bodies.[4]

The debate over the National Judicial Appointments Commission, therefore, embodies the tension between judicial autonomy and democratic oversight. If the Supreme Court invalidated the NJAC Act in 2015 for violating the basic structure, the judgment itself recognized that the procedures followed by the Collegiums must be revised to make it more transparent.[5] This episode thus underlines the paradox of judicial governance in India: the institutional independence of the judiciary cannot insulate it from legitimate public scrutiny.

Judicial Delays and Administrative Inefficiency

Apart from issues with the judiciary's independence, administration of the judiciary remains a huge challenge. More than 50 million case backlogs in courts across the country seriously dent the access to justice and thus erode public trust.[6] Hussein and Abbas hold the view that governance

of the judiciary demands not only independence in adjudication but also efficiency, procedural clarity, and administrative discipline.[7] Arguing that delayed justice is as much a failure of governance as a failure of law,[8]
Yet, while current steps at technological modernization, such as e-filing, digital courts, and case management systems, have started to show considerable success, disparities in infrastructure and judicial training remain formidable barriers.[9] Effective judicial governance demands institutional reforms that give priority to performance evaluation, process automation, and budgetary autonomy without compromising impartiality.[10]

Accountability and Public Trust

The lack of a systematically developed judicial code of conduct and ineffective machinery for dealing with judicial misconduct add to the complication of accountability. Sharma and Agarwal opine that ethical governance forms part of constitutional accountability, and an independent judiciary cannot expect legitimacy without ethical transparency.[11] They suggest internal ombudsman mechanisms, ethics committees, and regular disclosures to bring in more integrity in institutions.[12]

Toward a Reformed Model of Judicial Governance

It should strive to develop a hybrid model of governance that balances independence with accountability by means of procedural transparency, technological modernization, and participatory oversight. Performance audits, transparent appointment criteria, and codified ethical standards will help judicial governance evolve from an abstract ideal to a documented operational reality. As Dutt and colleagues argue, "true independence is not secrecy, but accountability guided by principle."[13]

CASE ANALYSIS AND COMPARATIVE INSIGHTS

Judicial governance in India has grown primarily through landmark constitutional decisions that demarcated the boundaries of state power and asserted the judiciary as a guardian of constitutional accountability. The cases that demarcate such contours of judicial authority themselves reflect the gradual institutionalization of governance principles within the judiciary itself.

Indian Judicial Landmarks

The basic structure doctrine in Kesavananda Bharati v. State of Kerala thus constitutes the bedrock of judicial governance in India. The Court held that while the amending power under Article 368 is not absolute, it cannot destroy the essential features of the Constitution. The ruling thus put the stamp of constitutional supremacy over parliamentary sovereignty, marking the judiciary's enduring role as protector of constitutional equilibrium.

The Court, in S.R. Bommai v. Union of India,[2] further entrenched constitutional accountability by opening the President's discretion under Article 356 to judicial review. The judgment emphatically said that even extraordinary powers must conform to constitutional morality and the rule of law. Judicial governance in this case assumed the form of executive accountability whereby major political decisions were made answerable to legal norms.

Similarly, in Vineet Narain v. Union of India,[3] the Court institutionalized principles of administrative independence and transparency by directing structural reforms in the Central Bureau of Investigation (CBI). The case enlarged the concept of judicial governance to include 'institutional governance', whereby integrity in public institutions became recognized as a constitutional imperative.

More recently, Independence of Judiciary in the NJAC Case,[4] while reaffirming the self-regulatory authority of the judiciary, did so with an important emphasis on the requirement of procedural transparency in judicial appointments. These judgments together embody the judiciary’s transformative role in making governance subject to law and principle rather than political discretion.

Comparative Perspectives

While the judicial governance model in India developed in its own manner, other democracies developed institutionalized mechanisms that combined transparency with independence. The JAC established under the Constitutional Reform Act 2005 of the United Kingdom introduced merit-based appointments through an independent mixed membership body.[5] Similarly, South Africa's Judicial Service Commission combines judicial and executive membership along with members from civil society for ensuring both independence and accountability.[6]

As Dutt, Mishra, and Tayal point out, these models hold some valuable lessons for India: transparency and inclusivity need not weaken judicial independence; rather, they legitimize judicial authority by bringing it in step with democratic governance.[7] On the other hand, India's insular appointment system, though constitutionally protected, has the risk of undermining public trust unless balanced with openness and procedural fairness.

Comparative experience thus indicates that judicial governance thrives when independence and institutional transparency go hand in hand. The Indian judiciary, through its jurisprudence and reform efforts, is willing to proceed toward the fulfillment of such an ideal in which constitutional accountability is preserved and practiced.

FINDINGS AND DISCUSSION

Analysis of judicial governance in the Indian constitutional framework therefore reveals that, in ensuring constitutional accountability, the judiciary plays a triple role: normative, institutional, and functional. The literature surveyed together affirms that judicial governance operates as both a mechanism of control and a model of governance within the constitutional order.

Integration of Governance Principles

These results show that the evolving governance framework of the judiciary increasingly incorporates principles of transparency, accountability, and participation within its institutional design. As Hussein and Abbas stress, such values are vital to engender public confidence and to help legitimize judicial authority.[1] This is well demonstrated in various initiatives taken by the judiciary in the direction of digitization, publication of judgments, and procedural openness, indicative of a gradual shift away from insularity toward participatory governance.

Balancing Independence and Accountability

The question about the required balance between accountability and independence has been a recurring theme in scholarship as well as jurisprudence. The Collegium System protects autonomy against political interference, but at the cost of opacity, which compromises democratic expectations of transparency. As Dutt, Mishra, and Tayal aptly observe, accountability mechanisms within the judiciary have to evolve without subjecting the institution to external domination.[2] Thus, the effective governance of the judiciary depends more on internal accountability-through ethics codes, peer review, and transparent procedure-rather than executive control.

Judicial Review as Governance Instrument

As analyzed by Khalid and others, judicial review is the strong governance tool wielded by the judiciary in realizing constitutional ideals into norms.[3] This is amply reflected in landmark decisions like Kesavananda Bharati and S.R. Bommai, wherein the judiciary has asserted the supremacy of the Constitution and checked the excesses of legislative and executive authority.[4]

The Transformative Function of Judicial Governance

Ultimately, judicial governance is not confined to keeping the institutional house in order; rather, it represents a transformative constitutional function. The judiciary interprets, oversees, and corrects the practices of governance to make certain that democracy functions within the rule of law. Sharma and Agarwal aptly note that judicial governance "translates constitutional morality into administrative behavior."[5]

CONCLUSION AND RECOMMENDATIONS

The paper establishes that judicial governance is not an extension of the power of adjudication but a constitutional 'necessity' for the enforcement of the rule of law, separation of powers, and governmental accountability. As a guardian of the Constitution, the judiciary performs this dual role in safeguarding democratic values through judicial review and modeling those very same principles of governance within the internal institutional framework of itself.

The findings of this paper highlight that constitutional accountability thrives precisely when judicial independence is combined with transparency and ethical responsibility. The jurisprudence of Kesavananda Bharati and S.R. Bommai serves as a benchmark for how the interpretative and supervisory functions of the judiciary preserve constitutional supremacy from arbitrary power. Yet, as Dutt, Mishra, and Tayal warn, the institutional opaqueness and procedural rigidity of the judiciary pose threats to its legitimacy.

Several reforms are put forward to make judicial governance strong in India. The Collegiums System should adopt structured transparency without sacrificing independence by developing published criteria and recording the reasons for selection, and limited inclusion of non-judicial members. An internal accountability framework, independently devised, providing for oversight and an ethics commission, would enhance credibility and integrity. Embracing technology and administration reforms, e-governance applications, and performance audits will meet aspirations regarding efficiency and accessibility. Finally, continuous capacity-building exercises with training programs on constitutional ethics will strengthen the judiciary's transformative role.

In all, judicial governance embodies the living spirit of constitutionalism in ensuring that governance—judicial, legislative, or executive—is kept subordinated to law, principle, and reason. Only by institutionalizing transparency and ethical accountability within its structure can the judiciary carry on performing its dual role as arbiter and exemplar of constitutional governance in India.

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स्त्री नेतृत्व का नवयुग: नारी शक्ति वंदन अधिनियम और लोकतांत्रिक पुनर्संरचना की राह

(The New Era of Women's Leadership: The Women's Reservation Act and the Path of Democratic Restructuring)

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विधि एवं संवैधानिक अध्ययन विभा□, शोभित इंस्टीट्यूट ऑफ इंजीनियरिं□ एं□ टे□नोलॉजी (□ीम□ टू बी यूनिवर्सिटी), मे□ठ, भारत

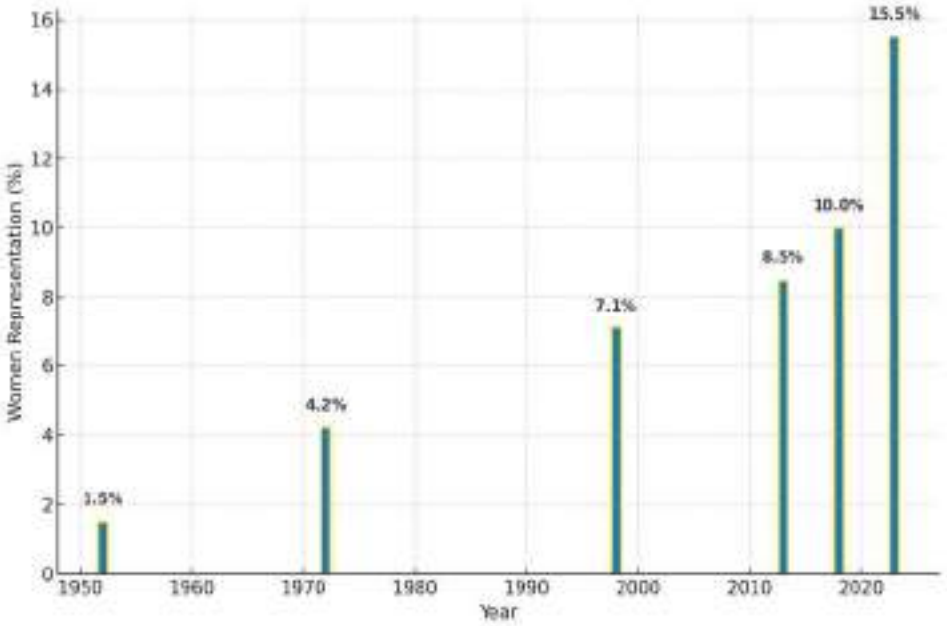
सारांश (Abstract)

यह शोध-पत्र नारी शक्ति वंदन अधिनियम, 2023 को भारतीय लोकतंत्र में स्त्री ने□त्व और सामाजिक पुनर्संरचना का□एक ऐतिहासिक चरण का□रूप में विश्ले□ित करता है। स्वतंत्रता का□बाद समानता का□संवैधानिक सिद्धांत स्थापित होना□ी□बावजूद, संसद और विधानसभाओं में महिलाओं का प्रतिनिधित्व 10–14 प्रतिशत का□ बीच सीमित रहा है। महिलाओं का□लिए 33% आरक्षण का प्रावधान करना□ाला यह अधिनियम इस असमानता को दूर करना□ी दिशा में एक वैचारिक और नीति□त हस्तक्षे□ है। संवैधानिक नारीवाद और सहभाि□तापूर्ण लोकतंत्र का□सैद्धांतिक ढाँचा□ी□माध्यम स□ेयह अध्ययन बताता है कि यह अधिनियम सत्ता-संरचना में लैं□िक संतुलन स्थापित कर नीति-निर्माण में स्त्री दृष्टिकोण को सशक्त कर सकता है। राजस्थान का□सामाजिक-सांस्कृतिक संदर्भ — जैस□पितृसत्ता, जाति□त विभाजन और ग्रामीण राजनीतिक संस्कृति — इस विश्ले□ण को विशिष्ट आयाम प्रदान करत□हैं। अध्ययन निष्कर्ष दे□ा है कि यह अधिनियम राजस्थान जैस□राज्यों में "दूसरी पीढ़ी का□महिला ने□त्व" को जन्म दे□सकता है, जहाँ महिलाएँ का□ल प्रतिनिधि नहीं, बल्कि नीतिनिर्माता का□रूप में उभरें□ी। यदि इस□राजनीतिक दलों, प्रशिक्षण संस्थाओं और सामाजिक समर्थन प्रणालियों का□साथ समन्वित रूप स□ला□ू किया जाए, तो यह भारतीय लोकतंत्र को मात्र प्रतिनिधि शासन स□आ□े□ बढ़ाकर सहभाि□ी शासन का□अधिक न्यायसं□त और समावे□ी रूप में परिवर्तित कर सकता है।

मुख्य शब्द (Keywords): नारी शक्ति वंदन अधिनियम, **स्त्री नेतृत्व**, **संवैधानिक नारीवाद**, **सहभागितापूर्ण लोकतंत्र**, **लैंगिक समानता**, **राजस्थान**.

परिचय

भारतीय लोकतंत्र की सफलता का□ल उसकी संवैधानिक व्यवस्था पर नहीं, बल्कि समान प्रतिनिधित्व और सामाजिक च□ना पर निर्भर करती है। स्वतंत्रता का□बाद समानता और न्याय का□सिद्धांत स्थापित हुए, परंतु महिलाओं की राजनीतिक भा□ीदारी अब भी सीमित है। पंचायतों में 33% आरक्षण का□बावजूद संसद और विधानसभाओं में महिलाओं का प्रतिनिधित्व मात्र 10–14% तक सीमित है। इसी असमानता को दूर करना□ी□ लिए नारी शक्ति वंदन अधिनियम, 2023 संसद और विधानसभाओं में महिलाओं का□लिए 33% आरक्षण का प्रावधान कर भारतीय राजनीति में ऐतिहासिक परिवर्तन लाता है (1)। यह अधिनियम का□ल संवैधानिक संशोधन नहीं, बल्कि सत्ता-संरचना में लैं□िक संतुलन और स्त्री दृष्टिकोण को नीति-निर्माण में शामिल करन□ की दिशा में एक सामाजिक कदम है। प्र□ यह है कि क्या यह आरक्षण वास्तविक सशक्तिकरण का माध्यम बन पाए□ा और पितृसत्ता, जाति□त विषमता तथा आर्थिक निर्भरता जैसी बाधाओं को तोड़ सक□ा? यही इस शोध का प्रमुख उद्दे□्य है—अधिनियम को कानूनी प्रावधान स□आ□े□ बढ़ाकर लोकतांत्रिक पुनर्संरचना की प्रक्रिया का□रूप में समझना। विशे□तः राजस्थान का□संदर्भ में यह अध्ययन इस बात का विश्ले□ण करता है कि यह अधिनियम "दूसरी पीढ़ी का□महिला ने□त्व" को कैस□जन्म द□सकता है और भारतीय लोकतंत्र को "आरक्षण स□ पुनर्जा□रण" की दिशा में अधिक समावे□ी और उत्तरदायी बना सकता है(2)।



चित्र 1. महिलाओं का राजनीतिक प्रतिनिधित्व की ऐतिहासिक प्रवृत्ति (1952–2023)

अध्ययन की पृष्ठभूमि एवं समस्या का कथन

भारतीय लोकतंत्र की नींव समानता और न्याय के सिद्धांतों पर टिकी है। संविधान के अनुच्छेद 14, 15 और 16 ने लैंगिक समानता को सुनिश्चित किया, फिर भी स्वतंत्रता के सात दशक बाद महिलाओं की राजनीतिक भागीदारी सीमित बनी रही। 1952 में संसद में महिलाओं का प्रतिनिधित्व मात्र 4.4% था, जो 2019 तक बढ़कर भी केवल 14% तक पहुँचा, जबकि राज्य विधानसभाओं में यह औसतन 9–10% के बीच स्थिर है (संसद सचिवालय, 2022) (3)। यह असमानता केवल संसाधन या शिक्षा की कमी का परिणाम नहीं, बल्कि पितृसत्ता, जाति, धर्म और आर्थिक निर्भरता जैसी सामाजिक संरचनाओं की देन है, जिन्होंने राजनीति को लंबे समय तक "पुरुष क्षेत्र" बनाए रखा। इसी पृष्ठभूमि में नारी शक्ति वंदन अधिनियम, 2023 एक ऐतिहासिक संवैधानिक हस्तक्षेप के रूप में सामने आया है। यह अधिनियम संसद और राज्य विधानसभाओं में महिलाओं के लिए 33% आरक्षण का प्रावधान करता है, जो केवल प्रतिनिधित्व नहीं, बल्कि सत्ता-संरचना में संतुलन लाने वाला संरचनात्मक सुधार है (4)। यह कदम उस मांग की पूर्ति है जिसे सरोजिनी नायडू, अन्नी बेसेंट और विजयलक्ष्मी पंडित जैसी महिला नेताओं ने स्वतंत्रता आंदोलन के दौरान उठाया था। फिर भी कई प्रश्न शेष हैं — क्या मात्र आरक्षण से महिलाओं की वास्तविक भागीदारी सुनिश्चित हो सकेगी? क्या यह "प्रतीकात्मक प्रतिनिधित्व" से आगे बढ़कर "सार्थक सशक्तिकरण" का रूप ले पाएगा? विशेष रूप से राजस्थान जैसे राज्य में, जहाँ जाति-आधारित ढांचा, पितृसत्तात्मक मूल्य और ग्रामीण राजनीतिक संस्कृति गहराई से प्रभावशाली हैं, यह चुनौती और अधिक जटिल है। यद्यपि 73वें संविधान संशोधन के बाद पंचायती राज संस्थाओं में महिलाओं का स्थानीय नेतृत्व सशक्त हुआ है, पर राज्य और राष्ट्रीय राजनीति में नेतृत्व अब भी पुरुष-प्रधान है। इस अध्ययन की केंद्रीय समस्या यही है — क्या नारी शक्ति वंदन अधिनियम वास्तव में भारतीय राजनीति में लैंगिक पुनर्संतुलन लाएगा या केवल संवैधानिक औपचारिकता बनकर रह जाएगा? यह शोध दो स्तरों पर केंद्रित है: (1) अधिनियम के संवैधानिक औचित्य और नीति-गत प्रभावों का मूल्यांकन, तथा (2) सामाजिक स्वीकृति, राजनीतिक व्यवहार और संस्थागत संरचनाओं के माध्यम से महिलाओं की वास्तविक सशक्तिकरण क्षमता का विश्लेषण। संक्षेप में, यह अध्ययन "आरक्षण" को केवल कानूनी अधिकार नहीं, बल्कि स्त्री नेतृत्व के माध्यम से लोकतंत्र के सामाजिक पुनर्जागरण का माध्यम मानता है।

अध्ययन के उद्देश्य (संक्षिप्त एवं प्रभावशाली संस्करण)

इस अध्ययन का मुख्य उद्देश्य नारी शक्ति वंदन अधिनियम, 2023 को भारतीय लोकतंत्र में स्त्री नेतृत्व और सामाजिक पुनर्संरचना के निर्णायक उपकरण के रूप में समझना है। यह शोध निम्नलिखित चार प्रमुख उद्देश्यों

पर आधारित है —

1. नारी शक्ति वंदन अधिनियम, 2023 का संवैधानिक और नीतिगत प्रावधानों का विश्लेषण करना।
2. यह मूल्यांकन करना कि अधिनियम महिलाओं का वास्तविक सशक्तिकरण को किस हद तक सुनिश्चित करता।
3. राजस्थान का सामाजिक-सांस्कृतिक संदर्भ में अधिनियम का व्यवहारिक प्रभावों का अध्ययन करना।
4. राजनीतिक दलों, राज्य संस्थाओं और नागरिक समाज की भूमिका का परीक्षण करना।
5. नीति सुधार और सामाजिक पुनर्जागरण की दिशा में ठोस सिफ़ारिशें प्रस्तुत करना।

सैद्धांतिक ढाँचा (THEORETICAL FRAMEWORK)

किसी भी समाज में कानून और समाज का बीच संबंध केवल विधिक प्रावधानों तक सीमित नहीं होता, वह सामाजिक चेतना, सांस्कृतिक संरचनाओं और सत्ता-संतुलन से गहराई से जुड़ा होता हैं। नारी शक्ति वंदन अधिनियम, 2023 का विश्लेषण के लिए इस शोध में दो प्रमुख सिद्धांतों को वैचारिक आधार बनाया गया है — संवैधानिक नारीवाद (Constitutional Feminism) और सहभागितापूर्ण लोकतंत्र (Participatory Democracy)। दोनों मिलकर यह समझने में सहायता करते हैं कि यह अधिनियम केवल एक संवैधानिक संशोधन नहीं, बल्कि सामाजिक परिवर्तन की प्रक्रिया भी है (5)।

संवैधानिक नारीवाद (Constitutional Feminism)

संवैधानिक नारीवाद वह दृष्टिकोण है जो यह मानता है कि संविधान केवल शासन की रूपरेखा नहीं, बल्कि न्याय, समानता और गरिमा का नैतिक मूल्य का वाहक है। इस सिद्धांत के अनुसार, यदि संविधान का मूल उद्देश्य समाज में समान अवसर और सम्मान की स्थापना है, तो उसे पितृसत्तात्मक सत्ता-संरचनाओं को चुनौती देने में सक्रिय भूमिका निभानी चाहिए (6)। कैथरीन मैककिनन (MacKinnon, 2018) और मार्था नुसबॉम (Nussbaum, 2001) जैसे विद्वानों का तर्क है कि पारंपरिक कानून अक्सर तटस्थ दिखाई देते हैं, परंतु उनके भीतर गहरे पैठे पूर्वाग्रह महिलाओं को निर्णय-प्रक्रिया से बाहर रखते हैं। संवैधानिक नारीवाद इस तटस्थता को तोड़ता है और यह मांग करता है कि न्याय केवल समान व्यवहार नहीं, बल्कि समान अवसरों की वास्तविकता भी सुनिश्चित करे। भारतीय संदर्भ में डॉ. भीमराव अम्बेडकर (Ambedkar, 1956) ने संविधान को "सामाजिक लोकतंत्र का दस्तावेज़" बताया था — ऐसा लोकतंत्र जहाँ राजनीतिक समानता तब तक अधूरी है जब तक सामाजिक और आर्थिक समानता प्राप्त न हो। इसी दृष्टिकोण से नारी शक्ति वंदन अधिनियम भारतीय संविधान की आत्मा में निहित उस अधूरी समानता को पूरा करने का प्रयास है (7)। यह अधिनियम संवैधानिक नारीवाद का प्रत्यक्ष उदाहरण है क्योंकि यह केवल अधिकार नहीं देता, बल्कि संरचनात्मक स्तर पर निर्णय-निर्माण की शक्ति में महिलाओं की भागीदारी सुनिश्चित करता है। संसद और विधानसभाओं में महिलाओं के लिए 33 प्रतिशत आरक्षण इस विचार को मूर्त रूप देता है कि न्याय तभी संभव है जब सत्ता के केंद्रों में स्त्री दृष्टिकोण को बराबर का स्थान मिले।

संवैधानिक मूल्य: न्याय • समानता • गरिमा

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संवैधानिक नारीवाद: पितृसत्ता को चुनौती देना • प्रतिनिधित्व को सक्षम बनाना

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नारी शक्ति वंदन अधिनियम (2023) के माध्यम से कार्यान्वयन: संरचनात्मक समावेशन • महिलाओं को निर्णय लेने की शक्ति

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परिणाम: लैंगिक-न्यायपूर्ण लोकतंत्र

चित्र 2. संवैधानिक नारीवाद का वैचारिक रूपरेखा

सहभागितापूर्ण लोकतंत्र (Participatory Democracy)

लोकतंत्र केवल मताधिकार या चुनावी प्रक्रिया नहीं, बल्कि भागीदारी की संस्कृति है। अमर्त्य सेन (Sen, 2009) ने इसे "Capability Enhancement Model" के रूप में परिभाषित किया है, जिसके अनुसार नागरिकों की वास्तविक स्वतंत्रता तभी संभव है जब वे निर्णय-निर्माण की प्रक्रिया में सक्रिय रूप से शामिल हों। इसी विचार को आगे बढ़ाते हुए नैन्सी फ्रेज़र (Fraser, 2013) कहती हैं कि सहभागितापूर्ण लोकतंत्र का उद्देश्य केवल प्रतिनिधित्व नहीं, बल्कि "मान्यता और संवाद" है — यानी समाज के सभी वर्गों को आवाज़ देना (8)। भारतीय संदर्भ में यह सिद्धांत विशेष रूप से महत्वपूर्ण है क्योंकि यहाँ सामाजिक-सांस्कृतिक असमानताएँ इतनी गहरी हैं कि समान अधिकार प्राप्त करने के लिए केवल कानून पर्याप्त नहीं (9)। महिलाओं की भागीदारी तब सार्थक होगी जब वे नीति-गत विमर्श, पार्टी संरचनाओं, और स्थानीय शासन के निर्णय-प्रक्रिया में समान रूप से उपस्थित हों। नारी शक्ति वंदन अधिनियम इस दृष्टिकोण से भारतीय लोकतंत्र को "प्रतिनिधि लोकतंत्र" से आगे ले जाकर सहभागितापूर्ण लोकतंत्र की दिशा में रूपांतरित करता है। यह अधिनियम यह स्वीकार करता है कि लोकतंत्र की शक्ति केवल मतों की गिनती में नहीं, बल्कि उन आवाज़ों में है जो अब तक हाशिये पर थीं (10)।



चित्र 3. सहभागितापूर्ण लोकतंत्र का समावेशी मॉडल

सिद्धांतों का परस्पर संबंध

संवैधानिक नारीवाद और सहभागितापूर्ण लोकतंत्र परस्पर पूरक हैं — पहला संविधान को लैंगिक न्याय का उपकरण बनाता है, तो दूसरा लोकतंत्र को समावेशी बनाता है। जब इन दोनों दृष्टिकोणों को मिलाकर देखा जाता है, तो यह स्पष्ट होता है कि नारी शक्ति वंदन अधिनियम केवल संसद में सीटों का आरक्षण नहीं, बल्कि समाज में सत्ता के बंटवारे का पुनर्परिभाषण है। यह अधिनियम महिलाओं को "विषय" से "विधायक" में रूपांतरित करता है — और यही परिवर्तन किसी भी लोकतांत्रिक समाज के पुनर्जागरण का प्रारंभिक चरण होता है।



चित्र 4. संवैधानिक नारीवाद और सहभा□तापूर्ण लोकतंत्र का पारस्परिक संबंध

समीक्षा साहित्य (REVIEW OF LITERATURE)

किसी भी सामाजिक या संवैधानिक अध्ययन की प्रामाणिकता उसक□पूर्ववर्ती शोधों की समीक्षा स□स्थापित होती है। नारी शक्ति वंदन अधिनियम, 2023 स□संबंधित विषय—जैस□राजनीतिक प्रतिनिधित्व, लैं□क समानता, संवैधानिक सुधार, तथा महिलाओं का नृत्व—पर बीत□एक दशक में दु□ा और वि□ा में अनक विद्वानों न□शोध किया है। नीच□ास्तुत समीक्षा साहित्य 2010 स□2024 क□बीच हुए प्रमुख अध्ययनों का विश्ल□षण करती है, जो इस शोध की सैद्धांतिक और व्यवहारिक पृष्ठभूमि तैयार करत□हैं (11)।

भारतीय संदर्भ में स्त्री प्रतिनिधित्व पर अध्ययन

2011 में नीता वर्मा न□"भारत में महिला आरक्षण की राजनीतिक चुनौती" शीर्षक स□एक अध्ययन किया जिसमें उन्होंन□ाया कि संसद में महिलाओं की कम उपस्थिति का मुख्य कारण राजनीतिक दलों क□अंदरूनी संरचनात्मक पूर्वाग्रह हैं (Verma, 2011) (12)। उन्होंन□ह तर्क दिया कि जब तक दलों की उम्मीदवार चयन प्रक्रिया में पारदर्शिता और लैं□क संतुलन नहीं हो□ा, तब तक आरक्षण का वास्तविक प्रभाव सीमित रह□ा। 2013 में अमृता बसु (Basu, 2013) न□Economic and Political Weekly में प्रकाशित अपन□ल□ "Women, Politics and Representation in India" में लिखा कि 73वें और 74वें संशोधन न□स्थानीय शासन में महिलाओं को निर्णायक उपस्थिति दी, किंतु राज्य और राष्ट्रीय स्तर पर "symbolic participation" अब भी बनी हुई है (13) । 2015 में संीता शर्मा (Sharma, 2015) न□राजस्थान और उत्तर प्रद□ा की पंचायती संस्थाओं का तुलनात्मक अध्ययन करत□ुए बताया कि आरक्षण न□महिलाओं को political visibility तो दी है, परंतु निर्णय-निर्माण की शक्ति अभी भी पुरुष परामर्शदाताओं ("proxy leaders") क□हाथों में केंद्रित रहती है। 2016 में □ॉ. र□ा जोशी (Joshi, 2016) न□"Women in Indian Legislatures: An Empirical Analysis" शीर्षक शोध में पाया कि महिलाओं की संख्या बढ़न□स□सामाजिक मुद्दों पर नीति□त विमर्श मजबूत हुआ — जैस□शिक्षा, स्वास्थ्य, और लैं□क हिंसा क□विषयों पर अधिक चर्चाएँ हुईं। 2018 में सुधा पंत (Pant, 2018) न□यह प्रश्न उठाया कि क्या महिला प्रतिनिधित्व वास्तव में "सत्ता-साझ□दारी" में बदल रहा है या अभी भी प्रतीकात्मक है (14)। उन्होंन□निष्कर्ष दिया कि आरक्षण तभी प्रभावी है जब वह सामाजिक समर्थन और संस्था□त प्रशिक्षण स□जुड़ा हो।

सवैधानिक सुधार और लैंगिक समानता पर अध्ययन

2012 में □ॉ. मीरा चक्रवर्ती (Chakravarty, 2012) न□अपन□अध्ययन "Constitutionalism and Gender Justice" में यह बताया कि भारतीय संविधान का अनुच्छ□द 15(3) महिलाओं क□लिए विश□ प्रावधानों की अनुमति द□ा है, इसलिए आरक्षण का संवैधानिक आधार स्पष्ट और वैध है (15)। 2014 में र□ुका घोष (Ghosh, 2014) न□कहा कि आरक्षण को क□वल राजनीतिक सुधार नहीं, बल्कि सामाजिक न्याय की प्रक्रिया क□रूप में द□ा जाना चाहिए — क्योंकि यह संवैधानिक समानता को व्यावहारिक जीवन में रूपांतरित करता है (16)। 2017 में इंदिरा जयसिंह (Jaising, 2017) न□अपन□ल□ "Constitutional Feminism in India" में यह तर्क दिया कि भारतीय न्यायपालिका को संवैधानिक नारीवाद क□दृष्टिकोण स□कानूनों की व्याख्या करनी चाहिए, ताकि महिलाओं की राजनीतिक आवाज़ को संस्था□त संरक्षण मिल□ 2019 में कृति मह□ता (Mehta, 2019) न□ कहा कि भारत में लैं□क समानता क□लिए "affirmative action" क□वल शैक्षणिक या नौकरियों तक सीमित

नहीं रहनी चाहिए, बल्कि निर्णय-निर्माण का उच्चतम स्तरों पर भी लागू होनी चाहिए (17)।

अंतरराष्ट्रीय और तुलनात्मक परिप्रेक्ष्य

2011 में UN Women की रिपोर्ट "Women in Politics: Global Map" में बताया गया कि विश्व स्तर पर संसदों में महिलाओं की औसत उपस्थिति 22 प्रतिशत थी, जबकि स्कैंडिनेवियाई देशों में यह 45 प्रतिशत तक पहुँच चुकी थी। इससे स्पष्ट हुआ कि कानूनी आरक्षण और राजनीतिक संस्कृति में परिवर्तन दोनों समान रूप से आवश्यक हैं (UN Women, 2011)। 2016 में Drude Dahlerup ने अपने वैश्विक अध्ययन "Quotas and Gender Equality" में कहा कि gender quotas तभी सफल होते हैं जब उन्हें implementation mechanisms और party accountability से जोड़ा जाए (Dahlerup, 2016)। 2020 में Inter-Parliamentary Union (IPU) ने अपनी रिपोर्ट "Women in Parliament" में बताया कि आरक्षण लागू करने वाले देशों में औसतन 10–12 प्रतिशत अधिक महिला प्रतिनिधित्व देखा गया। 2022 में The World Bank की रिपोर्ट "Gender and Development: Political Pathways" ने इस बात पर बल दिया कि महिला नेताओं की उपस्थिति से स्थानीय विकास योजनाओं की प्राथमिकताएँ बदलती हैं — जैसे शिक्षा, स्वच्छता, और स्वास्थ्य पर अधिक व्यय होता है (180।

राजस्थान-विशेष अध्ययन

2015 में नीलम चौधरी (Chaudhary, 2015) ने 'Women's Leadership in Rajasthan Panchayats" शीर्षक अध्ययन में पाया कि 33 प्रतिशत आरक्षण के बाद भी ग्रामीण महिलाओं की राजनीतिक भागीदारी में सामाजिक असमानताएँ बनी हुई हैं। 2018 में राजस्थान महिला नीति मंच (RMWF) की रिपोर्ट "Gender Gaps in Local Governance" ने बताया कि 61% महिला सरपंचों ने स्वीकार किया कि उन्हें निर्णय लेने से पहले अपने परिवार या दल के पुरुष सदस्यों से अनुमति लेनी पड़ती है। 2021 में UNICEF और राज्य महिला आयोग, जयपुर की संयुक्त रिपोर्ट "Rural Women in Governance" में बताया गया कि आरक्षण ने महिलाओं में आत्मविश्वास बढ़ाया है, लेकिन संसाधनों तक समान पहुँच अब भी सीमित है। 2023 में प्रिया गहलोत (Gehlot, 2023) ने अपने अध्ययन "Women's Reservation Bill and Political Renewal in Rajasthan" में यह निष्कर्ष निकाला कि नारी शक्ति वंदन अधिनियम राज्य की राजनीति में "second generation leadership of women" को जन्म दे सकता है — ऐसी महिलाएँ जो प्रतिनिधित्व के साथ नीति-निर्माण में भी निर्णायक भूमिका निभाएँगी (5)।

समेकित विश्लेषण एवं शोध अंतराल (Research Gap)

समीक्षित साहित्य यह दर्शाता है कि यद्यपि भारत में महिला प्रतिनिधित्व और लैंगिक समानता पर पर्याप्त विमर्श हुआ है, फिर भी कुछ प्रमुख शोध रिक्तियाँ (Research Gaps) बनी हुई हैं —

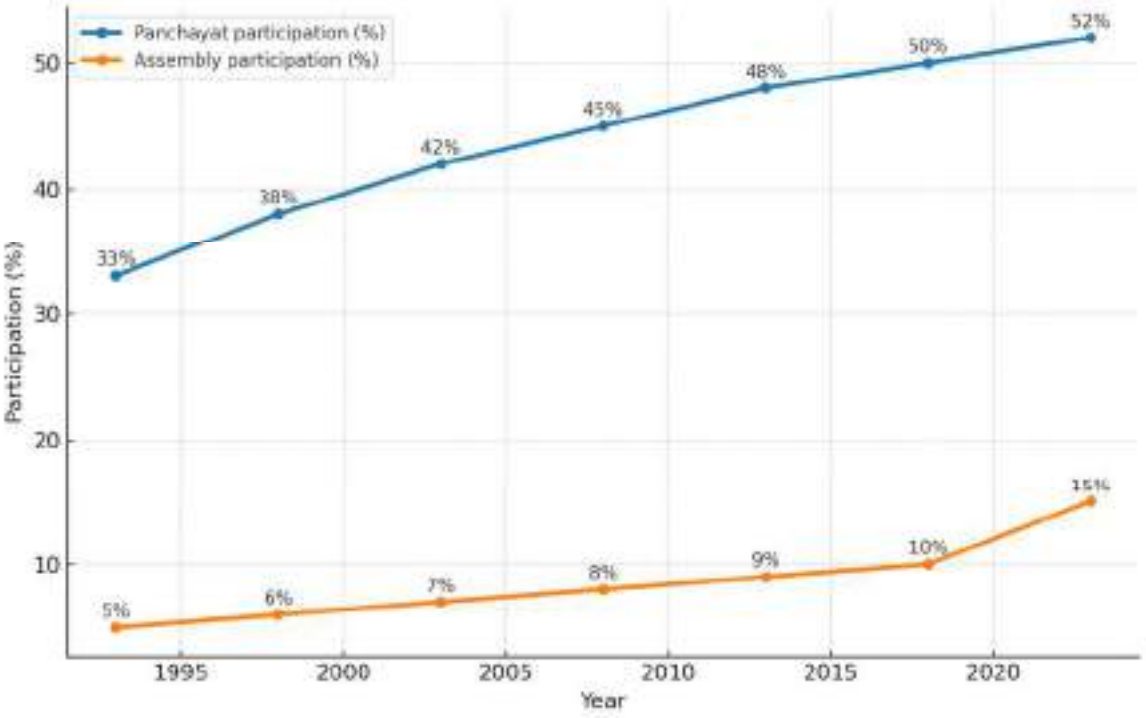
- अधिकांश अध्ययन स्थानीय शासन तक सीमित रहे हैं; राज्य और राष्ट्रीय स्तर पर प्रतिनिधित्व के व्यवहारिक परिणामों का विश्लेषण बहुत कम हुआ है।
- राजस्थान जैसे सामाजिक रूप से जटिल राज्य में, जहाँ जाति और लिंग की अंतःक्रिया (intersectionality) गहरी है, वहाँ इस अधिनियम के संभावित प्रभावों पर कोई विस्तृत अध्ययन नहीं हुआ।
- संवैधानिक नारीवाद और सहभागितापूर्ण लोकतंत्र के सिद्धांतों को जोड़कर संविधान और समाज के द्वंद्वात्मक संबंध की व्याख्या बहुत सीमित रूप में की गई है।
- अधिकांश साहित्य में नीतिगत अनुशंसाएँ (policy implications) अनुपस्थित हैं — इस अध्ययन का उद्देश्य इसी रिक्ति को भरना है।

राजस्थान संदर्भ में विश्लेषण (ANALYSIS IN THE CONTEXT OF RAJASTHAN)

राजस्थान भारत का वह राज्य है जहाँ सामाजिक परंपराएँ, जातीय संरचनाएँ और पितृसत्तात्मक मूल्य-व्यवस्थाएँ राजनीति के वितान-बाना में गहराई से जुड़ी हुई हैं। यद्यपि यह राज्य सांस्कृतिक रूप से समृद्ध और ऐतिहासिक रूप से गौरवशाली रहा है, किंतु लैंगिक दृष्टि से इसका सामाजिक संकेतक लंबे समय तक असमानता की ओर इशारा करता रहा है। राष्ट्रीय परिवार स्वास्थ्य सर्वेक्षण (NFHS-5, 2021) के अनुसार, राजस्थान में महिलाओं की श्रमशक्ति भागीदारी दर मात्र 27.6%, और साक्षरता दर 66% है। यह स्थिति यह स्पष्ट करती है कि महिलाओं के लिए सामाजिक-राजनीतिक सक्रियता का मार्ग अब भी सीमित और संघर्षपूर्ण है।

पंचायती राज संस्थाओं में महिला नेतृत्व का अनुभव

राजस्थान दक्षिण एशिया के उन राज्यों में अग्रणी रहा है जहाँ 73वें संविधान संशोधन (1992) के बाद पंचायती राज संस्थाओं में महिलाओं के लिए 33% आरक्षण लागू किया गया। इसके परिणामस्वरूप राज्य की लगभग 60,000 महिला प्रतिनिधियाँ (सरपंच, प्रधान, जिला परिषद सदस्य) स्थानीय शासन का हिस्सा बनीं। नीलम चौधरी (2015) और राजस्थान महिला विकास मंच (2018) के अध्ययनों से यह स्पष्ट हुआ कि इस आरक्षण नीति ने ग्रामीण महिलाओं को पहली बार सार्वजनिक जीवन में आवाज़ दी। परंतु इन अध्ययनों ने यह भी बताया कि "प्रॉक्सी नेतृत्व" (जहाँ निर्वाचित महिला प्रतिनिधि के स्थान पर उसके परिवार के पुरुष निर्णय लेते हैं) की समस्या व्यापक रूप से विद्यमान है। UNICEF और राजस्थान महिला आयोग (2021) की संयुक्त रिपोर्ट में कहा गया कि आरक्षण ने महिलाओं को राजनीतिक पहचान अवश्य दी, परंतु सत्ता का प्रयोग की समान स्वतंत्रता नहीं। केवल 41% महिला प्रतिनिधियों ने स्वीकार किया कि वे अपने निर्णय स्वतंत्र रूप से लेती हैं; शेष या तो अपने पति या ग्राम-स्तरीय राजनीतिक दल के निर्देशों पर निर्भर हैं।



चित्र 5. महिलाओं की भागीदारी की प्रवृत्ति (पंचायत से विधानसभा तक) (1993–2023)

विधानसभाओं और राज्य राजनीति में महिला भागीदारी

राजस्थान विधान सभा में महिलाओं का प्रतिनिधित्व वर्षों से सीमित रहा है। 1952 में यह मात्र 2 महिलाएँ (1.5%) थीं, जबकि 2018 के चुनावों में 28 महिलाएँ (लगभग 10%) निर्वाचित हुईं। यद्यपि यह ऐतिहासिक रूप से सबसे अधिक संख्या थी, फिर भी कुल 200 सदस्यों में यह अनुपात बहुत कम है। प्रिया गहलोत (2023) ने अपने अध्ययन में यह उल्लेख किया कि महिलाओं की राजनीतिक भागीदारी केवल चुनाव लड़ने तक सीमित नहीं होनी चाहिए, बल्कि उन्हें पार्टी संगठन, नीति-निर्माण समितियों और कैबिनेट स्तर पर भी समान अवसर मिलने चाहिए। उन्होंने यह भी कहा कि "आरक्षण विधेयक से राज्य की राजनीति में दूसरे चरण का स्त्री पुनर्जागरण संभव है" — ऐसा पुनर्जागरण जो महिलाओं को मात्र पदाधिकारी नहीं, बल्कि निर्णयकारी शक्ति केंद्र बनाए। राजस्थान में महिला राजनेताओं का नेतृत्व—जैसे वसुंधरा राजे सिंधिया, किरण माहेश्वरी, और दिव्या मदान—ने यह सिद्ध किया कि जब महिलाओं को अवसर मिलता है, तो वे प्रशासनिक दक्षता और नीति-निर्माण दोनों में उत्कृष्टता प्रदर्शित करती हैं (9)।

सामाजिक-सांस्कृतिक प्रतिरोध और परिवर्तन के संकेत

राजस्थान का सामाजिक परिदृश्य परंपरागत रूप से पितृसत्तात्मक और जाति-केंद्रित रहा है। भंवर मेघवंशी (2020) और मीनाक्षी गोस्वामी (2022) के समाजशास्त्रीय अध्ययनों के अनुसार, ग्रामीण क्षेत्रों में

"इज़्ज़त" और "मर्यादा" जैसे सांस्कृतिक मूल्य आज भी महिलाओं की सार्वजनिक भूमिका को सीमित करते हैं। हालाँकि, नारी शक्ति वंदन अधिनियम के पारित होने के बाद से राज्य के कई जिलों में महिला संगठनों, छात्राओं और युवा कार्यकर्ताओं के बीच राजनीतिक भागीदारी की नई चेतना देखी जा रही है। जयपुर, उदयपुर और जोधपुर विश्वविद्यालयों में आयोजित चर्चाओं में यह पाया गया कि अब राजनीति को पुरुष-प्रधान क्षेत्र के रूप में नहीं, बल्कि "समान भागीदारी के अवसर" के रूप में देखा जाने लगा है। साथ ही, स्वयं सहायता समूह (SHGs) और महिला मंडलों के माध्यम से स्थानीय स्तर पर महिलाओं की नीतिगत भागीदारी बढ़ी है। राजस्थान महिला नीति (2021) के अनुसार, पिछले तीन वर्षों में महिला सदस्यों की जिला योजना समितियों में भागीदारी में 24% वृद्धि दर्ज की गई (15)।

नारी शक्ति वंदन अधिनियम के संभावित प्रभाव (Potential Implications of the Act)

राज्य-स्तरीय परिप्रेक्ष्य में नारी शक्ति वंदन अधिनियम, 2023 के दूरगामी प्रभाव स्पष्ट रूप से दिखाई देते हैं। यह अधिनियम न केवल महिलाओं की राजनीतिक भागीदारी को सशक्त करेगा, बल्कि राजस्थान की लोकतांत्रिक संस्कृति में स्त्री नेतृत्व को एक स्थायी वैचारिक उपस्थिति प्रदान करेगा। सबसे पहले, यह अधिनियम महिलाओं की राजनीतिक सामाजिक पूंजी (Political Social Capital) को मज़बूत करेगा — जो अब तक स्थानीय निकायों तक सीमित थी, वह शक्ति अब विधानसभा और संसद स्तर तक विस्तारित होगी। पंचायत स्तर पर विकसित नेतृत्व का अनुभव अब उच्च स्तर की नीति-निर्माण प्रक्रियाओं में रूपांतरित होगा। दूसरे, यह पहल सामाजिक रूप से वंचित वर्गों — विशेषतः अनुसूचित जाति, जनजाति और ग्रामीण पृष्ठभूमि की महिलाओं — को मुख्यधारा की राजनीति में प्रवेश के नए अवसर प्रदान करेगी। इससे सत्ता-संरचना में प्रतिनिधित्व अधिक विविध और समावेशी बनेगा। तीसरे, स्त्री नेतृत्व से नीतिगत प्राथमिकताओं में स्पष्ट परिवर्तन आएगा। शिक्षा, स्वास्थ्य, जल-संरक्षण, पोषण, और लैंगिक न्याय जैसे मुद्दे शासन की मुख्यधारा में अधिक गंभीरता से शामिल होंगे। यह परिवर्तन प्रशासनिक निर्णयों में "स्त्री दृष्टि" (Women's Perspective) के संस्थापन की दिशा में एक महत्वपूर्ण कदम होगा। हालाँकि, इन सकारात्मक संभावनाओं के साथ कुछ व्यावहारिक चुनौतियाँ भी विद्यमान हैं — जैसे राजनीतिक दलों की सीमित इच्छाशक्ति, उम्मीदवारों के प्रशिक्षण और संसाधनों की कमी, तथा पितृसत्तात्मक पारिवारिक नियंत्रण। यदि राज्य सरकारें, निर्वाचन आयोग और नागरिक समाज मिलकर इन चुनौतियों के समाधान हेतु संस्थागत प्रशिक्षण एवं समर्थन तंत्र (Institutional Support Mechanisms) विकसित करें, तो राजस्थान निकट भविष्य में "लैंगिक समावेशन का मॉडल राज्य" बन सकता है (20)।

राजस्थान का अनुभव यह बताता है कि कानूनी आरक्षण तभी प्रभावी होता है जब वह सामाजिक चेतना के परिवर्तन से जुड़ता है। नारी शक्ति वंदन अधिनियम राजस्थान में न केवल नई महिला नेताओं को जन्म देगा, बल्कि समाज में यह संदेश भी देगा कि राजनीति अब केवल शक्ति का नहीं, बल्कि साझेदारी का क्षेत्र है।

राजनीतिक एवं सामाजिक प्रभाव (POLITICAL AND SOCIAL IMPLICATIONS)

नारी शक्ति वंदन अधिनियम, 2023 केवल एक संवैधानिक संशोधन नहीं है, बल्कि यह भारतीय लोकतंत्र की दिशा और सोच में एक गहन परिवर्तन का प्रतीक है। यह कानून इस बात को पुनर्परिभाषित करता है कि "शक्ति" का अर्थ केवल शासन नहीं, बल्कि साझेदारी है। इसका प्रभाव न केवल राजनीतिक संस्थाओं में दिखाई देगा, बल्कि सामाजिक मनोवृत्तियों, पारिवारिक निर्णय-प्रक्रियाओं और नागरिक चेतना पर भी पड़ेगा।

राजनीतिक पुनर्गठन और प्रतिनिधित्व का विस्तार

सबसे पहले, यह अधिनियम भारतीय राजनीति की संरचना को व्यापक रूप से पुनर्गठित करने की क्षमता रखता है। संसद और राज्य विधानसभाओं में 33% आरक्षण के माध्यम से यह कानून "संरचनात्मक प्रतिनिधित्व" को स्थापित करता है — अर्थात् सत्ता के ऊपरी स्तरों पर महिलाओं की समान उपस्थिति। 2019 में भारतीय लोकसभा में केवल 78 महिला सदस्य (14.3%) थीं, जबकि इस अधिनियम के लागू होने के बाद यह संख्या लगभग 180 से अधिक तक पहुँच सकती है (संसद सचिवालय, 2023)। इसका अर्थ यह है कि नीतिगत विमर्श, संसदीय समितियों, और मंत्रालयों में महिलाओं की भूमिका पहले से कहीं अधिक निर्णायक होगी। राजनीतिक दलों के लिए भी यह कानून एक नई चुनौती और अवसर दोनों प्रस्तुत करता है। अब उन्हें अपने संगठनात्मक ढाँचे में महिलाओं के लिए संस्थागत स्थान सुनिश्चित करना होगा। पार्टी टिकट वितरण, चुनाव प्रचार, और नीति-निर्माण में लैंगिक संतुलन की अपेक्षा बढ़ेगी। कृति महेता (2019) के अनुसार, "आरक्षण केवल तब परिवर्तनकारी बनता है जब राजनीतिक दल उसे सामाजिक समानता के एजेंडा के रूप में स्वीकार करें, न कि बाध्यता के रूप में।"

नीति-निर्माण और प्रशासनिक दृष्टिकोण में परिवर्तन

राजनीतिक प्रतिनिधित्व का सीधा प्रभाव नीति-निर्माण की दिशा पर पड़ता है। जब नीतियाँ विविध दृष्टिकोणों से बनती हैं, तो वे अधिक संवेदनशील और जन-केंद्रित होती हैं। महिलाओं की भागीदारी से शासन की प्राथमिकताएँ—जैसे शिक्षा, स्वास्थ्य, बाल संरक्षण, जल-संरक्षण, और ग्रामीण आजीविका—की दिशा में संतुलित दृष्टिकोण विकसित होता है। विश्व बैंक (2022) की रिपोर्ट के अनुसार, जिन देशों में महिला नेताओं की संख्या अधिक है, वहाँ मानव विकास सूचकांक (HDI) और जेंडर इक्विटी इंडेक्स (GEI) दोनों में उल्लेखनीय सुधार हुआ है। इसी तर्ज पर भारत में भी यह अपेक्षा की जा सकती है कि नारी शक्ति वंदन अधिनियम के बाद विकास नीतियाँ अधिक समावेशी और सामाजिक रूप से उत्तरदायी होंगी। राजस्थान जैसे राज्य में यह परिवर्तन और भी गहरा हो सकता है, क्योंकि यहाँ परंपरागत रूप से नीति-निर्माण में पुरुष वर्चस्व रहा है। जब महिला विधायक और सांसद स्थानीय आवश्यकताओं को विधायी विमर्श का हिस्सा बनाएँगी, तो यह अधिनियम "स्थानीय मुद्दों का राष्ट्रीय विमर्श" बनाने में योगदान देगा।

सामाजिक चेतना और पितृसत्तात्मक संरचनाओं पर प्रभाव

सामाजिक स्तर पर इस अधिनियम का सबसे बड़ा प्रभाव पितृसत्तात्मक मानसिकता पर पड़ेगा। अब तक भारतीय समाज में राजनीति को पुरुष-प्रधान क्षेत्र माना जाता रहा है। परंतु जब संसद, विधानसभाएँ और राजनीतिक मंचों पर महिलाओं की उपस्थिति सामान्य हो जाएगी, तो "नेतृत्व" की अवधारणा का लिंग-आधारित अर्थ स्वतः कमजोर पड़ जाएगा। 2024 में महिला एवं बाल विकास मंत्रालय (MWCD) द्वारा जारी एक सर्वेक्षण में पाया गया कि 72% ग्रामीण महिलाओं ने नारी शक्ति वंदन अधिनियम को "आशा का प्रतीक" बताया और कहा कि इससे आने वाली पीढ़ियों में "राजनीतिक आकांक्षा" (political aspiration) बढ़ेगी। सामाजिक वैज्ञानिक नैन्सी फ्रेज़र (2013) के अनुसार, जब समाज में हाशिये के वर्ग निर्णय-निर्माण प्रक्रिया में शामिल होते हैं, तो न केवल नीति बदलती है बल्कि "मान्यता की राजनीति" भी मजबूत होती है — अर्थात् सामाजिक सम्मान और पहचान का निर्माण। यही प्रक्रिया भारत में भी दिखने को मिलेगी, जहाँ यह अधिनियम महिलाओं की पहचान को "सिर्फ घर की भूमिका" से आगे बढ़ाकर "सार्वजनिक निर्णयकर्ता" में रूपांतरित करेगा।

लोकतांत्रिक पुनर्संरचना की दिशा में कदम

राजनीतिक और सामाजिक प्रभावों के संगम से यह अधिनियम भारतीय लोकतंत्र के पुनर्गठन की दिशा में एक मील का पत्थर बनता है। यह संविधान के अनुच्छेद 14, 15 और 16 में निहित समानता के वादे को वास्तविक जीवन में रूपांतरित करने की दिशा में काम करता है।

डॉ. भीमराव अम्बेडकर (1956) ने कहा था —

"राजनीतिक समानता निरर्थक है यदि समाज में सामाजिक और आर्थिक असमानता बनी रहती है"

नारी शक्ति वंदन अधिनियम इसी दृष्टिकोण को मूर्त रूप देता है। यह महिलाओं को सत्ता की भागीदारी से जोड़ता है, जिससे लोकतंत्र केवल मताधिकार नहीं बल्कि निर्णयाधिकार की दिशा में विस्तृत होता है। राजस्थान जैसे राज्यों में, जहाँ स्थानीय शासन में महिलाओं की मजबूत नींव पहले से है, यह अधिनियम "स्थानीय से वैश्विक नेतृत्व" की प्रक्रिया को सशक्त बनाएगा। इससे भारत एक "gender-inclusive democracy" के रूप में विश्व स्तर पर मिसाल प्रस्तुत कर सकता है।

निष्कर्षात्मक संकेत

राजनीतिक प्रतिनिधित्व और सामाजिक चेतना दोनों में यह अधिनियम एक परिवर्तनकारी अध्याय का प्रारंभ है। यह भारतीय समाज में "अवसर के समान वितरण" को वास्तविक अर्थों में लागू करने का प्रयास है। यदि इसे ईमानदारी से लागू किया जाए, तो आने वाले दशक में भारत एक ऐसे चरण में प्रवेश करेगा जहाँ स्त्री नेतृत्व केवल आरक्षण का परिणाम नहीं, बल्कि लोकतंत्र की आत्मा बन जाएगा।

निष्कर्ष (CONCLUSION)

भारतीय लोकतंत्र एक सतत विकसित होती प्रक्रिया है, और नारी शक्ति वंदन अधिनियम, 2023 इसी विकास यात्रा का एक ऐतिहासिक मोड़ है। यह केवल संवैधानिक संशोधन नहीं, बल्कि राजनीति में "समानता और सहभागिता" के नए युग की शुरुआत है। यह अधिनियम स्पष्ट करता है कि आरक्षण मात्र संख्यात्मक प्रतिनिधित्व नहीं, बल्कि सामाजिक पुनर्जागरण का माध्यम है। महिलाओं की सक्रिय भागीदारी से लोकतंत्र

"जन प्रतिनिधित्व" से आगे बढ़कर "जन सहभागिता" का रूप लेता है। राजस्थान जैसे राज्यों का अनुभव बताता है कि आरक्षण ने महिलाओं को राजनीतिक आत्मविश्वास और नेतृत्व की नई पहचान दी है। परंतु इसके स्थायी प्रभाव के लिए सामाजिक मानसिकता में परिवर्तन, संस्थागत प्रशिक्षण, और राजनीतिक दलों की जवाबदेही आवश्यक है। यह अधिनियम दो स्तरों पर परिवर्तन लाता है — संवैधानिक स्तर पर समानता और न्याय के सिद्धांतों का व्यवहारिक रूप, और सामाजिक स्तर पर लिंग-निरपेक्ष नेतृत्व की स्थापना। जैसा कि डॉ. अम्बेडकर ने कहा, "लोकतंत्र केवल मतदान नहीं, बल्कि जीवन का तरीका है।" यह अधिनियम इसी विचार को मूर्त रूप देता है, जहाँ नागरिकता और नेतृत्व सभी का अधिकार है। यदि इसे सही भावना से लागू किया जाए, तो नारी शक्ति वंदन अधिनियम भारत को "Gender-Just Democracy" के रूप में स्थापित कर सकता है — ऐसा लोकतंत्र जो संवेदनशील, समावेशी और न्यायपूर्ण हो। अंततः, "आरक्षण से पुनर्जागरण" की यह यात्रा भारतीय लोकतंत्र के आत्मिक पुनर्निर्माण का प्रतीक

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Ancient Legal Tradition and Governance of Dharma with respect to Unadulterated Food and Ethical Practice

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Abstract
The ancient Indian legal philosophy, grounded in the doctrine of Dharma, provided an integrated framework for governance that transcended the confines of law to encompass morality, social welfare, and ethical responsibility. Within this comprehensive worldview, the sanctity and purity of food were regarded not only as matters of individual health but also as vital to social harmony and spiritual well being. Foundational texts such as the Manusmriti, Arthashastra, Mahabharata, and the Ayurvedic Samhitas articulated norms that upheld unadulterated food (asuddha anna) as a core element of sustaining dharma and collective welfare. Ancient administrative systems incorporated regulations on trade, market supervision, and the moral accountability of those handling food, all underpinned by the ethical ideals of satya (truth) and ahimsa (non violence).

This paper investigates how these early moral and legal frameworks concerning food purity prefigured modern notions of food safety, consumer rights, and corporate accountability. By analyzing dharma as both a juridical and moral principle, the study highlights continuities between ancient ethical governance and present-day regulatory mechanisms ensuring food integrity. It concludes that sustainable food governance in the modern era can benefit from these traditional perspectives, which regarded food not simply as a commercial product but as a sacred bond uniting the individual, society, and the cosmos.

INTRODUCTION

Food is simultaneously nourishment, ritual medium, economic commodity, and moral good. Ancient Indian legal and ethical literature treated food not merely as a private preference but as a social and religious responsibility. The normative ideal was śuddha ahāra (pure/unadulterated food), and deviations—whether by deception in trade, impurity in preparation, or contamination—were framed as breaches of dharma. This paper reconstructs the governance mechanisms embedded in those traditions and examines their relevance to modern regulatory problems such as adulteration, misleading labeling, and failure of hygiene standards.

The scope:

1. conceptual foundations of dharma and purity in relation to food;
2. textual and institutional practices that governed food purity;
3. ethical duties and sanctions imposed on producers, vendors, and consumers;
4. a comparative reading suggesting how ancient governance can inform contemporary law and policy.

HISTORICAL AND CONCEPTUAL BACKGROUND

Dharma, Purity, and Food: Core Concepts

Dharma in classical Indian thought encompasses duties, rights, ethical norms, and social order. Food-related prescriptions appear across genres: sacrificial manuals (śrauta), ritual handbooks, Dharmaśāstras, and medical texts. The concern is threefold: ritual purity (food suitable for offering and consumption), moral conduct (truth in trade and avoidance of harm), and bodily health (hygiene,

wholesome ingredients). Ayurvedic texts, for example, treat diet (ahara) as central to health, prescribing sourcing, processing, and storage rules to avoid toxicity and disease.

Sources and Authorities

Primary textual authorities include the Vedas (ritual norms and sacrificial food handling), Dharmaśāstras (norms of social and commercial behavior), Ayurvedic treatises (medical and hygienic guidance), and the ethical canons of Buddhism and Jainism (emphasis on non-harm and truthful speech). Temple records and guild regulations (inscriptions and secondary literature) show institutional enforcement mechanisms in practice.

INSTITUTIONAL MECHANISMS FOR FOOD GOVERNANCE IN ANTIQUITY

Ritual Institutions and Standards

Temples and sacrificial specialists maintained high standards for offerings: procurement from approved sources, ritual purification of utensils, and precise preparation methods. Failure to maintain these standards risked ritual impurity and social censure.

Guilds, Market Oversight, and Professional Ethics

Craft and merchant guilds (śreṇī) often regulated quality, measure, and pricing: standardized weights, sworn oaths by merchants, and peer enforcement. Guild norms combined economic self-interest (preserving reputation) with ethical rules against cheating.

Community Sanctions and Moral Accountability

Public shaming, fines (penalized in textual sources), loss of ritual status, and social exclusion feature as sanctions for adulteration, deceit, or gross negligence. The overlap of religious sanction and social sanction created normative pressure that supported compliance.

LEGAL-ETHICAL PRESCRIPTIONS AND SANCTIONS

Prohibitions on Deception and Adulteration

Dharmaśāstras and didactic literature condemn deliberate adulteration and misrepresentation in trade—framing them as violations of truthfulness and non-harm. This aligns with the modern offense of fraud in commercial law.

Duty of Care in Food Preparation

Guidance on cleanliness, proper storage, and avoiding contamination reflects a proto-duty of care. Ayurvedic authors prescribe techniques to render foods safe and wholesome—anticipating public-health rationales behind modern food-safety laws.

Remedies and Punitive Measures

Ancient remedies span restitution, fines, ritual expiation, and social penalties. The combination of compensatory and moral sanctions mirrors modern mixtures of civil liability and criminal sanction in food law.

COMPARATIVE ANALYSIS: ANCIENT GOVERNANCE AND MODERN FOOD LAW

1. Ethical basis: Both systems ground food regulation in preventing harm and ensuring honest commerce.
2. Multi-instrument governance: Temple oversight/guild regulation historically played roles similar to modern administrative regulators, standards bodies, and industry self-regulation.
3. Sanctions: Ancient fines and rituals correspond to fines, prosecutions, and reputational sanctions today.

POLICY LESSONS AND PROPOSED FRAMEWORK

Integrating Ethical Norms into Regulatory Design

Policymakers can draw on the moral force of dharma—public duty, honesty, and non-harm—to reinforce norms, and community monitoring in areas where state reach is limited.

CASE ILLUSTRATIONS (SELECTED EXAMPLES)

1. Traditional marketplace norms: Historical evidence of standardized measures and local adjudication shows how communities controlled adulteration. These practices can inspire modern community-based inspection programs.
2. Ayurvedic dietary prescriptions: Emphasizing preventive hygiene and proper processing complements modern food-safety curricula for small-scale producers.
3. Religious consumption norms: Ritual standards for unadulterated offerings demonstrate a cultural religious leaders can be partners in public health messaging.

DISCUSSION

Recognizing the ancient legal-ethical architecture around food does not imply romanticizing past systems or ignoring scientific and administrative advances. Rather, it suggests complementarity: modern regulation secures the technical and institutional tools necessary to detect and remedy adulteration, while ethical traditions supply social legitimacy and behavioral levers. For jurisdictions where cultural resonance matters for compliance, a hybrid approach combining technical enforcement with ethical education and local sanctions can be more effective than either mechanism alone.

Potential limitations of applying ancient precedents include pluralistic religious environments where no single normative language suffices and the risk of conflating religious norms with state enforceable law. Careful translation from religious/ethical norms into secular, rights-respecting legal rules is required.

CONCLUSION

Ancient Indian traditions governed unadulterated food through a confluence of ritual, ethical, and commercial rules embedded in dharma. Those traditions institutionalized expectations of purity, carrier duties of vendors and producers, and sanctions for deception mechanisms that, in functional terms, parallel elements of modern food law. By mapping those continuities, contemporary regulators can harness culturally resonant values to strengthen compliance,

DECLARATION OF INTEREST

The author declares no conflict of interest.

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Chapter 5: Other Related Areas

YAJNA TO YOGA: SIMPLE RITUALS FOR MODERN WELLNESS

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Abstract

The Indian knowledge system has long focused on a holistic approach to health. Ayurveda and Vedic rituals form the basis of disease prevention and wellness. Since ancient times, practices like dinacharya (daily routines), ritucharya (seasonal regimens), yajna (fire rituals using medicinal herbs), and meditation have served not just as cultural traditions but as organized preventive healthcare strategies. Grounded in Vedic insights, Ayurveda stresses the significance of a balanced diet, herbal formulations, yoga, and lifestyle discipline for maintaining physical, mental, and spiritual balance. Studies on herbal fumigation (dhoopana) show notable antimicrobial and insecticidal effects, providing natural ways to control infections. Regular yoga and pranayama practice, once solely seen as spiritual discipline, is now scientifically proven to improve immunity, manage stress hormones, and prevent lifestyle-related issues like hypertension and diabetes. Similarly, plant-based Ayurvedic formulations used in rasayana chikitsa (rejuvenation therapy) are now backed by evidence for their antioxidant, anti-inflammatory, and immune-boosting properties. Ayurveda's focus on prevention rather than merely cure aligns well with contemporary public health ideas by emphasising resilience. Integrating Vedic knowledge into wellness frameworks provides accessible and sustainable remedies as chronic and lifestyle-related illnesses become a greater burden for global healthcare systems.

Keywords: Ayurveda, Vedic rituals, disease prevention, holistic health, scientific validation

INTRODUCTION

The Indian Knowledge System and Holistic Health

India's ancient knowledge system is deeply rooted in the idea of "Swasthasya Swasthya Rakshanam"—the preservation of health in a healthy person—rather than merely the treatment of disease. This philosophy forms the foundation of Ayurveda, Yoga, and Vedic rituals, which together promote balance between the body, mind, and spirit. In contrast to modern medicine's focus on curing specific ailments, traditional Indian sciences emphasize prevention, harmony, and longevity through natural methods.

The holistic vision of Indian wellness practices integrates physical, psychological, social, and spiritual dimensions of health. Every ritual, from morning ablutions to dietary routines and meditation, was designed with the purpose of aligning human life with nature's cycles. This reflects a sophisticated understanding of preventive healthcare long before the advent of modern scientific systems.

Relevance of Vedic Wisdom in Modern Times

In today's world of stress, pollution, and lifestyle-related disorders, ancient Vedic knowledge offers practical and sustainable methods to restore balance. Practices such as Dinacharya (daily routine) and Ritucharya (seasonal regimen) help maintain homeostasis by synchronizing the body with natural rhythms. Similarly, Yajna (fire rituals) using medicinal herbs have been shown to purify the environment and reduce microbial load through herbal fumigation.

Modern scientific research increasingly supports the efficacy of these traditional practices. For instance, Yoga and Pranayama have proven benefits in regulating stress hormones, improving immunity, and managing diseases like hypertension, diabetes, and anxiety. Ayurvedic formulations used in Rasayana Chikitsa demonstrate antioxidant, anti-inflammatory, and immunomodulatory properties.

Thus, integrating Vedic principles with modern health systems can create a bridge between traditional wisdom and scientific understanding, offering a complete and accessible model for modern wellness.

Concept	Origin Text/Source	Core Philosophy	Modern Health Correlation
Yajna (Sacred Fire Ritual)	Rigveda	Purification of body and mind through fire and mantra vibration	Detoxification, improved mental focus
Ayurveda	Atharvaveda	Balance of Vata, Pitta, Kapha for health	Personalized medicine, dosha-based nutrition
Yoga	Patanjali Yoga Sutra	Union of mind, body, and spirit	Mindfulness, flexibility, and stress control
Pranayama	Hatha Yoga Pradipika	Regulation of breath for energy control	Respiratory health, anxiety reduction
Meditation (Dhyana)	Bhagavad Gita	Mental stillness and focus	Cognitive enhancement, emotional balance

AYURVEDA: THE SCIENCE OF LIFE

Core Philosophy of Ayurveda

Ayurveda, often described as the knowledge of living well, explains health as a natural state of balance between body, mind, and spirit. It recognizes three governing energies—Vata, Pitta, and Kapha—that influence all biological and psychological functions. When these remain in harmony, a person stays healthy; when they shift out of proportion, illness begins.

Every person has a distinct constitution (Prakriti), so Ayurvedic guidance is personalized rather than one-size-fits-all. The system encourages understanding one's body type, environment, and habits to maintain harmony through food, routine, and mental discipline.

Focus on Prevention over Cure

Ayurveda gives priority to staying healthy rather than waiting for disease to appear. The classical principle "Swasthasya Swasthya Rakshanam"—protecting the health of the healthy—captures this vision. Daily and seasonal regimens (Dinacharya and Ritucharya) act as natural defense plans that keep metabolism and immunity steady through changing conditions.

Cleansing methods such as Panchakarma remove internal toxins, while moral and emotional conduct (Sadvritta and Achar Rasayana) reduce mental stress that often leads to physical imbalance. By reinforcing routine discipline, Ayurveda strengthens resistance and supports long-term vitality.

Diet, Lifestyle, and Herbal Support

In Ayurveda, diet is considered the first medicine. Food is chosen according to one's dosha type, climate, and digestion capacity. Fresh, plant-based meals seasoned with herbs and spices not only nourish but also protect against inflammation and oxidative stress.

Equally important is a mindful lifestyle—regular sleep, moderate exercise, yoga, and meditation—all seen as everyday therapies. Herbal preparations used in Rasayana Chikitsa (rejuvenation therapy) such as Amalaki, Guduchi, and Ashwagandha are valued for improving

stamina, memory, and immune strength.

Modern pharmacological studies increasingly confirm these benefits, showing that many traditional herbs possess measurable antioxidant and anti-inflammatory properties.

In essence, Ayurveda links the physical and the spiritual through conscious living. Its preventive orientation and evidence-supported remedies make it a practical framework for modern wellness and a natural complement to scientific healthcare systems.

VEDIC RITUALS AS PREVENTIVE HEALTHCARE

Concept and Significance of Yajna (Fire Rituals)

In Vedic tradition, Yajna is far more than a religious ceremony; it is a scientific and environmental health practice aimed at purifying the surroundings and the human mind. The process involves offering medicinal herbs, clarified butter (ghee), and grains into a sacred fire while chanting mantras. The combustion releases vapors and volatile oils that disinfect the air and create a calming atmosphere.



Ancient texts describe Yajna as a way to maintain the natural balance between human life and the environment. Regular performance of Yajna was believed to prevent epidemics, purify the air, and harmonize the five elements (Pancha Mahabhuta)—earth, water, fire, air, and space—that constitute both the universe and the human body.

Medicinal Role of Herbal Fumigation (Dhoopana)

Dhoopana, or herbal fumigation, is another vital aspect of traditional preventive healthcare. It involves burning a combination of herbs, resins, and aromatic substances to cleanse living spaces, temples, and even medical wards. The smoke generated contains bioactive compounds with antimicrobial and insect-repelling properties.

Modern microbiological studies have shown that fumigation with herbs such as Guggul (Commiphora mukul), Neem, Tulsi, and Camphor can reduce airborne bacteria and fungal spores, offering a natural method to limit infection. The pleasant fragrance of these substances also contributes to mental relaxation and enhanced concentration, linking environmental hygiene with emotional balance.

Parameter	Yajna (Vedic Ritual)	Modern Detoxification	Health Impact
Medium	Fire and herbal smoke	Juices, herbal drinks	Removal of toxins
Element Involved	Agni (Fire)	Water/Nutrition	Cleansing mechanism
Tools Used	Samidha, Ghee, Herbs	Juicer, Supplements	Body purification

Focus	Physical & spiritual cleansing	Physical detox	Holistic wellness

Scientific Validation of Yajna and Dhoopana

Recent research efforts have begun to examine Vedic rituals through a scientific lens. Controlled studies indicate that the smoke released during Yajna can act as an air disinfectant by neutralizing harmful microbes and reducing particulate matter. In addition, exposure to the rhythmic sound of mantras during Yajna and meditation practices has been linked to lower stress levels and improved cardiac rhythm stability.

The therapeutic potential of Dhoopana is being revisited in hospitals, laboratories, and community spaces for eco-friendly disinfection. These findings reveal that Vedic rituals were early models of preventive medicine that combined environmental science, phytochemistry, and psychology long before modern health systems emerged.

Together, Yajna and Dhoopana represent a fusion of spirituality and health science—rituals that purify both the atmosphere and the mind. When adapted for modern wellness, these practices offer natural, sustainable, and culturally meaningful methods for preventing disease and promoting holistic wellbeing.

YOGA AND MEDITATION FOR MIND–BODY BALANCE

Historical Background and Philosophy

The origin of Yoga can be traced to ancient India, where it was described as a path to self-realization and harmony between the body, mind, and consciousness. The word Yoga derives from the Sanskrit root "Yuj," meaning "to unite," symbolizing the union of individual and universal energy. The Patanjali Yoga Sutras define Yoga as "Chitta Vritti Nirodha"—the stilling of mental fluctuations to achieve inner stability.

Historically, Yoga was practiced as a spiritual discipline; however, its scope has expanded to include physical, psychological, and therapeutic dimensions. The eightfold path (Ashtanga Yoga)—comprising Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana, and Samadhi—offers a systematic approach to attaining total wellbeing.

4.2 Yoga for Physical Wellness

Regular yoga practice improves strength, flexibility, balance, and posture. Unlike conventional exercise, yoga integrates movement with mindful breathing, leading to improved oxygenation and energy efficiency. Scientific research supports its role in managing non-communicable diseases such as obesity, hypertension, and diabetes. Controlled studies have shown that yoga can lower blood pressure, improve lipid profiles, and enhance insulin sensitivity. Certain postures (*asanas*), such as *Bhujangasana* (cobra pose), *Trikonasana* (triangle pose), and *Surya Namaskar* (sun salutation), stimulate vital organs and regulate endocrine activity, promoting homeostasis. These findings highlight how ancient yogic techniques correspond with modern concepts of physical fitness and metabolic health.

Pranayama and Stress Regulation

Pranayama—the discipline of breath control—forms the bridge between the body and mind. The rhythmic regulation of breath balances the autonomic nervous system and reduces the production of stress hormones such as cortisol and adrenaline. Practices like Anulom Vilom (alternate nostril breathing), Bhramari (humming bee breath), and Kapalabhati (cleansing breath) improve lung function, oxygen saturation, and overall vitality. Clinical studies have demonstrated that regular pranayama lowers anxiety levels, enhances heart rate variability, and strengthens immune function. These physiological benefits confirm the age-old belief that controlled breathing can stabilize both mental and physical health.

Mental and Emotional Benefits of Meditation

Meditation (Dhyana) is the higher limb of yoga that nurtures emotional stability and mental clarity. Neuroscientific research shows that meditation alters brainwave patterns, increases gray matter density in attention-related regions, and promotes a state of relaxed alertness. Mindfulness-

based practices derived from traditional yoga are now widely used in stress management, psychotherapy, and workplace wellness programs. Meditation also reduces symptoms of depression and anxiety by promoting serotonin balance and improving emotional resilience. The combination of meditation with yogic postures and breathwork provides a holistic framework for mental and emotional regulation, reinforcing the idea that mind and body are interdependent components of health.

RASAYANA CHIKITSA: THE AYURVEDIC REJUVENATION THERAPY

Concept and Objectives of Rasayana

Rasayana Chikitsa is one of the eight classical branches of Ayurveda that focuses on rejuvenation, longevity, and disease prevention. The word Rasayana is derived from "Rasa" (nutrient essence) and "Ayana" (pathway), signifying the process that nourishes tissues and enhances vitality. The main aim of Rasayana therapy is to improve the quality of body tissues (Dhatus), strengthen immunity (Ojas), and delay the ageing process (Jara Nasha). According to Ayurvedic philosophy, when the nutritive essence of food is efficiently transformed into body tissues, the result is strength, clarity, and longevity. Rasayana therapy thus acts on the physical, mental, and spiritual levels, promoting comprehensive wellbeing rather than only treating ailments.

Types of Rasayana Therapy

Rasayana can be broadly classified into three forms:

- Achar Rasayana (Behavioral Rejuvenation): Focuses on moral conduct, discipline, truthfulness, compassion, and positive emotions. It aims to maintain mental and social harmony.
- Aushadha Rasayana (Herbal Rejuvenation): Uses specific medicinal plants, minerals, and formulations to enhance immunity and tissue regeneration.
- Ahara Rasayana (Dietary Rejuvenation): Involves consumption of wholesome, easily digestible, and nutrient-rich foods according to one's body constitution and season.

Together, these approaches emphasize that rejuvenation is not limited to medicine but is a way of life combining physical nourishment, mental stability, and ethical living.

Scientific Basis and Modern Evidence

Recent studies have validated many traditional claims of Rasayana therapy. Herbal formulations such as Ashwagandha (Withania somnifera), Amalaki (Emblica officinalis), Guduchi (Tinospora cordifolia), and Shatavari (Asparagus racemosus) exhibit strong antioxidant, anti-inflammatory, and immunomodulatory activities. These bioactive properties help protect cells from oxidative stress and enhance resistance against infections and age-related diseases. Experimental research suggests that Rasayana herbs regulate stress responses by modulating the hypothalamic–pituitary–adrenal (HPA) axis and reducing inflammatory cytokines. Clinical trials also indicate improvements in cognitive function, physical stamina, and metabolic balance. Such findings affirm that Rasayana therapy represents an early model of nutraceutical science, combining nutrition, pharmacology, and lifestyle for preventive healthcare.

Common Rasayana Herbs and Their Benefits

Herb (Botanical Name)	Primary Action	Health Benefits
Amalaki *(Emblica officinalis)*	Antioxidant, rejuvenative	Enhances immunity, improves digestion, supports liver health
Guduchi *(Tinospora cordifolia)*	Immunomodulator	Strengthens defense system, combats fatigue, detoxifies body
Ashwagandha *(Withania somnifera)*	Adaptogen, anti-stress	Reduces anxiety, improves endurance, regulates hormones

Shatavari *(Asparagus racemosus)*	Reproductive tonic	Enhances fertility and hormonal balance, supports lactation
Brahmi *(Bacopa monnieri)*	Neuroprotective	Improves memory, focus, and cognitive function

Role in Modern Preventive Medicine

Rasayana therapy aligns with modern preventive healthcare by promoting resilience, slowing degeneration, and maintaining immune balance. Unlike synthetic supplements, Rasayana formulations act synergistically, working through diet, behavior, and plant-derived compounds to rejuvenate both body and mind. Its holistic foundation resonates with today's demand for safe, natural, and sustainable wellness strategies.

INTEGRATING ANCIENT WISDOM WITH MODERN SCIENCE

Scientific Research on Vedic Health Practices

In recent decades, researchers have begun to scientifically evaluate traditional Indian practices such as Ayurveda, Yoga, and Yajna to understand their physiological and biochemical mechanisms. Studies on Ayurvedic herbal formulations have confirmed antioxidant, antimicrobial, and anti-inflammatory effects that support immune and metabolic balance. Similarly, Yoga and Pranayama have been extensively studied for their influence on cardiovascular health, stress reduction, and neuroendocrine regulation.

Laboratory analyses of Yajna smoke and Dhoopana (herbal fumigation) have identified volatile phytochemicals with bactericidal and air-purifying properties. This growing body of evidence reveals that Vedic rituals were not merely symbolic acts but early applications of natural science designed to maintain personal and environmental health. By combining ancient empirical wisdom with modern analytical tools, researchers are uncovering measurable benefits of these traditional methods.

Ayurveda and Yoga in Global Public Health Frameworks

Ayurveda and Yoga are now recognized globally as complementary systems for preventive and lifestyle medicine. Institutions such as the World Health Organization (WHO) and the Ministry of AYUSH (Government of India) promote these practices as safe, cost-effective approaches to wellness. Programs that integrate Ayurvedic diet principles, herbal supplements, and yoga therapy have shown encouraging outcomes in reducing chronic disease risk and improving mental well-being.

Traditional Practices vs. Modern Implementation

Domain	Preventive Healthcare	Lifestyle Management	Daily & Seasonal Regimens	Dietary Practices	Environmental & Cost Sustainability
Traditional Practice	Rasayana (herbal supplements)	Yoga (asanas, meditation, meditation)	Dinacharya & Ritucharya	Ahara Vidhi (balanced, seasonal diet)	Natural resources, limited consumption
Effective Implementation	Workplace wellness programs, national health initiatives	Community-based interventions for hypertension, diabetes, obesity	Adapted lifestyle programs, seasonal exercise guidelines	Nutrition counseling, plant-based awareness	Eco-friendly herbal production strategies
Benefits & Sustainability Impact	Reduces chronic illness, promotes longevity	Improves physical fitness, mental well-being, stress regulation	Maintains homeostasis, aligns with natural rhythms	Supports gut health, reduces lifestyle-related diseases	Reduces dependence on synthetic medications, environmentally safe

In community health models, Yoga-based interventions have been implemented for managing non-communicable diseases like hypertension, diabetes, and anxiety. Similarly, Ayurvedic preventive guidelines are being incorporated into workplace wellness and school health programs. These developments highlight the potential of India's traditional sciences to contribute to global strategies aimed at sustainable health promotion.

Sustainable Wellness Through Traditional Practices

Modern healthcare faces growing challenges from lifestyle-related disorders, mental stress, and environmental degradation. Ancient Indian wisdom offers a sustainable path forward by emphasizing prevention, balance, and harmony with nature. Practices such as Dinacharya (daily routine), Ritucharya (seasonal adaptation), and Ahara Vidhi (dietary rules) encourage lifestyle moderation and mindful consumption. Unlike many modern interventions, these traditions rely on natural resources and behavioral discipline rather than synthetic medications, making them environmentally and economically sustainable.

Furthermore, the holistic model of wellness described in Ayurveda and Yoga promotes a shift from disease-centered treatment to health-centered living. By integrating these time-tested principles with modern clinical research, healthcare systems can move toward personalized, preventive, and planet-friendly medicine.

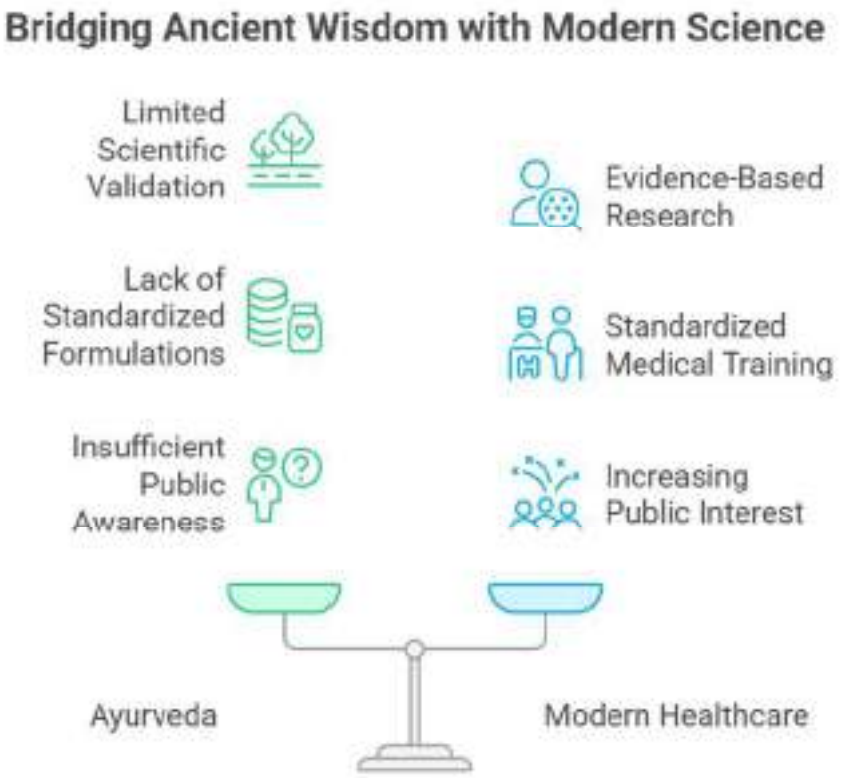
INTEGRATION OF AYURVEDA WITH MODERN PREVENTIVE HEALTH APPROACHES

The principles of Ayurveda align closely with many aspects of modern preventive healthcare. Concepts such as maintaining balance through diet (ahara), lifestyle (vihara), and mental discipline (achara) resonate with contemporary ideas of holistic wellness. While modern medicine emphasizes evidence-based interventions, Ayurveda provides a time-tested framework for disease prevention through personalized regimens and seasonal adaptations. Integrating Ayurvedic wisdom with scientific research can offer a more comprehensive approach to public health — one that focuses not only on curing disease but also on maintaining long-term well-being.

Ayurvedic Principle	Modern Equivalent	Key Benefits
Ahara (Diet)	Personalized nutrition	Improves immunity, digestion
Vihara (Lifestyle)	Exercise & routine programs	Maintains balance, prevents lifestyle diseases
Achara (Behavior)	Mindfulness & stress management	Enhances mental health, resilience
Rasayana (Rejuvenation)	Herbal supplements & nutraceuticals	Boosts immunity, delays aging
Dinacharya & Ritucharya	Daily & seasonal schedules	Supports physiological balance, reduces disease risk

CHALLENGES AND FUTURE PROSPECTS OF AYURVEDA IN PREVENTIVE HEALTHCARE

Despite its vast potential, Ayurveda faces several challenges in being fully integrated into modern healthcare systems. Limited scientific validation, lack of standardized formulations, and insufficient awareness among the general population often restrict its acceptance at a global level. However, with increasing interest in natural and sustainable health practices, Ayurveda is gradually gaining recognition as a complementary system. Future efforts should focus on evidence-based research, interdisciplinary collaboration, and public education to establish Ayurveda as a credible and accessible model for preventive health. Strengthening policy support and integrating Ayurvedic education into mainstream medical training could bridge the gap



between traditional wisdom and modern science.

CONCLUSION

Ayurveda, with its roots in the Vedic knowledge system, offers a timeless and holistic approach to preventive health. Its emphasis on daily routines, balanced diet, herbal remedies, yoga, and meditation continues to hold relevance in the modern world. When viewed alongside contemporary medical practices, Ayurveda provides not just an alternative but a complementary path toward achieving complete well-being. Integrating ancient Ayurvedic wisdom with modern scientific validation can create a sustainable model of preventive healthcare — one that nurtures the body, mind, and spirit while addressing the global need for natural, preventive, and affordable health solutions.

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Impact of COVID-19 on Indian economy with special reference to tourism industry.

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Abstract

The tourism industry is one of the major sources of business in India as it contributes about 10% to the GDP every year. About 10.93 million foreigners visited India in the year 2019. The year 2020 started with much of the unfortunate situations arising due to COVID-19 pandemic. This paper is an attempt to study the extent of devastation that it has suffered due to partial or full closure of border amid COVID-19 pandemic. The revenue from this industry has declined two folds and the experts assumes to return to the pre-covid period in not earlier than 2024.
Keywords: Tourism industry, GDP, COVID-19 pandemic, revenue.

INTRODUCTION

The sudden occurrence of the infection and its immense spread in the country is no longer a surprise to anyone. The country encountered the virus for the first time in December 2019 named coronavirus also termed as COVID-19. The disease was described as infectious and its spread is tremendous. The spread is so immense that it has caused the health system of various countries to collapse. The disease is known to affect the lungs and the breathing system of the body resulting in depletion of the oxygen level and ultimately leading to the death of a person. Many countries have tried hard to find the medicine for the virus but lockdown and social distancing was recognized as the only way to curb the spread. The implementation of partial or full lockdown by various countries has affected the economy adversely. It has shaken many industries like education, tourism, hospitality etc. which were considered one of the profitable concerns. The closure led to shut off many small and medium scale industries which has resulted in increase in unemployment rate. People in various countries are experiencing the unemployment and inflation simultaneously due to this pandemic. It has deteriorated the living standard of the people. Most of the people that were below poverty line or earned on the daily basis have been impacted adversely. WHO on January 30, 2020 has declared it as "public health emergency of international concern".

The implementation of lockdown has adversely hit the tourism and hospitality industry. The sector which was growing continuously and was recording the increase in GDP contribution year on year was now making losses. The loss of about 84% was recorded from this industry. India, is the country of diversified religions and believes. There are many heritage sites that have lots of tourist attraction and play a vital role in accommodation of foreign reserves. The partial or full sealing of the borders has converted this profit-making entity into a loss-making entity. Experts forecast the recovery of this sector to the pre-covid times will not be earlier than 2024.

LITERATURE REVIEW

Yeh, S. S. (2020). Analyzed in their study that COVID-19 has given lot of scope of research for its origin and the spread. The study shown that tourism is one of the worst hit industry by COVID-19 pandemic. The sectors like transportation, hotels, etc. was aversely hit which has caused the unemployment.

Baum, T., & Hai, N. T. T. (2020). in their study found that the right to use the tourism and hospitality industries have been denied to people due to some political and commercial decisions. The decision to save lives is more important than the rights. They also said that this industry will re-emerge in the future in a speedy manner in the different parts of the world.

Khalid, U., Okafor, L. E., & Burzynska, K. (2021). The study examined that the tourism industry is the one of the adversely hit sector by this pandemic. The businesses that were directly or indirectly connected with this industry suffered the spill over effect.

Kreiner, N. C., & Ram, Y. (2020). Examined that there is disparity in the three strategies that are adopted by UNWTO for the recovery of the tourism industry. Out of 161 recommendations provided only 13 were implemented fully and only 37 were partially implemented. The issues such as human capital, sustainable development etc were hardly addressed.

Polyzos, S., Samitas, A., & Spyridou, A. E. (2020). The findings shown that there was tremendous decline in the number of the tourist that arrived to China from USA and Australia. It analysed that it will take about one and the half year time for the arrival rate to return to its normal state.

Škare, M., Soriano, D. R., & Porada-Rochoń, M. (2021). The study demonstrated that the pandemic has long lasting negative impact on the economy and tourism industry. They expressed the need to adopt four-part economic strategy namely accept economic losses, support to the people experiencing losses, protect health and the use of economic production capacity to its fullest.

OBJECTIVE

-To study impact of COVID-19 on tourism industry.

METHODLOGY

The study is purely based on the secondary data collected from newspaper articles, journals, world tourism Organization report 2020, data by Indian government, internet etc.

ABOUT THE TOURISM INDUSTRY

India is the country of regional diversity. There are about 6 religions with about 22 different languages. The Indian tourism consist of 38 heritage tourist sites which comprise of the major hospitality business. Foreigners, visit India to many heritage sites and it contributes to about 16.91 lakh crore i.e., 9.2% of GDP in the year 2018.

India has made it very convenient by enabling digital platform for the bookings and other facilities. India tourism industry has various national and international luxury. Some of the famous spots like Prem Mandir, Haridwar, Rishikesh etc. has lot of foreign tourist accommodation every year. The growth of 6.9% i.e. Rs.32.05 lakh crore is estimated in this sector by the year 2028. According to data of year 2015 the business from India's medical tourism sector was about $3 billion which was expected to grow to about $7-$8 billion in the year 2020. This vast sector tends to provide the employment to about 43 million people which constitutes to 8.1% of the total employment. The tourism industry is one of the growing sectors in India that provides good contribution to GDP every year. In 2019 about 10.93 million foreign tourists arrived in India as compared to 10.56 million foreigners in 2018 which is about 3.5% of the growth just in one year.

In 2019, National Tourism Competitiveness report has provided place to India at 34th rank out of 140 countries. India is ranked for its greatest improvement and is one of the top 25% countries in the world. Even the pricing of the tourism place is kept competitive to encourage growth in this sector. India is ranked 13th out of 140 countries for its price competitiveness. India earned about $211,661 crores of foreign exchange through this industry in 2019.

India has worked a lot on its visa policies to encourage foreign tourism. It has recently introduced the online method of applying for e-Tourist visa for the citizens of 168 countries. In order to fuel up tourism industry more it has also introduced "visa on arrival" facility at 28 airports in the year 2014.

Due to this ease of visa, there was an increase in about 1987.9% in the number of foreigners that arrived in 2015 as compared to 2014 which is very huge. It has helped us to earn more foreign exchange thus strengthening the foreign reserves of India.

There are 38 world heritage sites recognized by UNESCO in India in the year 2019. These include Taj Mahal, Red fort, Qutub Minar, Fatehpur Sikri, Sun temple, Sundarbans National Park and many more.

COVID-19 PANDEMIC

COVID-19 also known as coronavirus caused by severe acute respiratory syndrome coronavirus- 2 also known as SARS-CoV-2 has hit India on 30 January 2020 when its first case was reported. The first case was reported in the state of Kerala and lockdown was announced there on 23 March 2020 and in rest of the country the lockdown was announced on 25 March 2020. India has the second largest confirmed cases after US in the world. India is ranked third highest death due to COVID-19. Five major cities namely Delhi, Mumbai, Thane, Chennai and Ahmedabad accounted of more than half of the cases in India. Lot of research and study was done but the lockdown was only way seemed to be effective in fighting with this infection. In the first wave, India was not that prepared and was worst high due to shortage of medicines and hospital facilities. There are many studies regarding its origin and spread but no study has yet been confirmed to be fully correct to explain its origin and spread. The main problem elevated as the spread of this virus is very high. It is highly communicable and its virus is present in the air due to which even if the people do not come in contact with each other but still they are getting infected.

Second wave of COVID-19 reported 26 million cases and India has become a new epicenter of the disease. In the recent weeks it has completely shaken the economy right from business to the medical facilities. The people, government all seemed to be helpless in front of this virus. After all the efforts and precautions the rate of positive and new cases are declining slowly. The recovery may get the businesses again on track and moving.

IMPACT ON TOURISM AND HOSPITALITY INDUSTRY

COVID-19 pandemic and the lockdown as the way to curb its spread has caused a devasting effect over the Indian economy. Many profit-making concerns have come to a halt due to it.

Maintaining of the social distancing was considered the only way to deal with this pandemic. It was advised by the experts to avoid meetings and other social gathering in order to curb the spread. Most of the countries sealed their border and the movement of the passengers were restricted. The restriction of national and international border has impacted the travelling and hotel industry lot. Many flights to and from different countries were grounded and international travel came to halt. The countries that have tourism as the major source of foreign exchange were hit the worst. The different countries are hit differently depending upon the size of tourism industry in that country. The extent of the economic contribution made by this industry determined the severity of the hit.

The restrictions imposed included the partial or full closure of the borders, restrictions on the movement of people across different countries, presentation of covid test certificate, following of the quarantine guidelines, partial closure of air, land and sea routes and much more. According to the reports by World Tourism Organization, 2020 the arrival by foreigner was down by 20% in the first quarter of 2020, in March the arrivals were down by 50% and further it dropped to about 74% in 2020. The results of the first quarter of year 2021 have shown the decline in the arrival of the international tourists by 83%. According to the reports by UNWTO the decline in the international arrival has resulted in the loss in the export revenue by $1.3 trillion which is approximately 11 times the loss that incurred during the global financial crises in the year 2009. The jobs of around 100-120 million people working in this sector across the world has been put on stake.

The massive cancellation of the flights and the inbound tourism has hit the hotel industry very hard. Due to lack of demand and huge supply the rate of the rooms has dropped drastically wiping out the profit margins of the hotels. In India, the booking in the summer holidays is at their peak. This is the best time for this industry to earn but in the year 2020 India experienced the cancellation of 40%-50% bookings impacting the domestic tourism.

According to the researches, the return of the pre-pandemic level of tourism will happen by the year 2023 or later than that. While about some experts see the return to happen no earlier than 2024.

Many countries have introduced the vaccines and has started the vaccination program at the vast scale to make people immune against this virus however even after receiving the jabs the fear

of the infection continues in the mind of the people due to which still the travelling rate is low. People are not that free as they were during pre-Covid times. The constant fear and the unavailability of proper and timely medical facilities has forced the people to live in their houses and avoid non-necessary movements.

DISCUSSION AND RECOVERY SUGGESTIONS

Tourism and hospitality industry in one of the most badly hit sector by this virus in the world. It was one of the fastest growing sectors but the arrival of this pandemic has posed a serious question over its survival and future. Immediate steps are required to be taken to slow down the pace of loss suffered by this sector. Government along with other stakeholders should make some provisions to provide financial aids to this industry. Industries should be encouraged to cut the unnecessary expenses and delay some payments if possible. The industry should adopt new safety measure like sanitization, use of masks, PPE kits, proper cleaning methods as part of supply. More emphasis much be laid on packed foods rather than unpacked foods. Most of the services should be digitized to avoid any physical contact. In this scenario hotels can also tie up with the government to use their rooms for the quarantine facility and can recover some losses. The adaption of these measures can help in improving the perception and reducing the risk in the minds of the people and thus recovering losses.

CONCLUSION

Tourism and hospitality industry is one of the major sources of revenue for the government. The immense spread of coronavirus has hit this sector adversely. The survival and the future of this industry has become questionable in this uncertain scenario. The collective measures by the government and stakeholders should be taken to bring this industry back on track and help both this sector and GDP of the country to grow. New and innovative measures need to be adopted to build the confidence in the minds of people.

Problems Faced by Women in Sports in India

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Abstract

This paper examines the multidimensional challenges faced by women in the field of sports in India. It mainly focuses on the social barriers that women come across when pursuing sports as a professional career . The study involves how societal perception , gender norms , and cultural norms and expectations influence women's participation in sports as well as the strategies that women must follow to overcome these obstacles and establish themselves professionally.

Key issues discussed include gender disparity , limited access to resources and opportunities, safety concerns, and systematic barriers to transformation within the sports system. The research highlights the aspect of gender gap between male and female and how gender dynamics shape the career path of female athletes in India. It further focuses on the lack of female portrayal and involvement in sports , stressing the need to look into how women are advanced, or , cast down from perceiving sports as a practical career path.

The investigation embraces a qualitative research approach, including textual analysis and references from scholarly literature and articles to provide a detailed framework for analysing the difficulties faced by women in sports and a comprehensive significance for gender parity in the area .

Keywords: Gender Norms, Sports, Challenges, Career, Gender Gap, Athlete.

INTRODUCTION

The convergence of gender and sports in India represents both development and persevering disparity. The emergence of prominent female athletes such as P.V. Sindu ,Mary Kom , and Sakshi Malik has brought a broader perspective for female in sports who continued to be notable dealing with widespread obstacles framed by the social norms of the society. The problem extends from gender bias / inequality and resource imbalance to social disgrace and protection . Through analysing different scholarly articles, it helps to explore about how social interpretations , gender roles and institutional framework continue to influence woman's experience in sports.

Through examining study of R. Raghu Ram and Yugandhar Dasari (2024), Dr. Mukta Verma (2023), and Dr. Yesudas Mohandas (2019), Along with conceptual insights from the *Concept Journal* (2018), this discusses within the corpus of research on women's liberation and gender equality in sports. Adding to the socio cultural dimension it also introduces us to the present legal and judicial framework for woman's empowerment in sports and it can be more effective through enforcement of strong sports regulations , gender inclusive mechanisms and government policy for fair representation. It further focuses on explaining how legal measures play a key role in disassembling institutional bias and guarantee that woman's equal rights in sports are recognised both indicatively and essentially.

It also provides a broader historical perspective thar locates current disparities within a broader spectrum of male supremacy. It also discovers the evolution of women's position from the Vedic period to ancient limitations in the medieval period and highlights the rebirth of how culture , religion and economic restrictions are carried until the present day. This long term study corelates with the present study emphasis that focuses on ingrained values that define gender dynamics in Indian games in sports. The *Concept Journal* (2018), further supports by this comprehension of

showing education and awareness as most important pillars for empowerment , proposing that gender equality in sports must begin with educational transformation and social consciousness.

Concurrently these investigations help to analyse the academic ground for the paper's qualitative study of gender bias and career obstacles in Indian sports. By examining different texts , research articles it recognizes systemic marginalization and countermeasures that explain the real life experience of female athletes. It creates a multidimensional framework that includes social , legal , educational awareness giving a message that strengthening of women through sports demands not only taking part but change of existing power elite.

The current research paper is based on the imperative to confront the barriers and imbalance encountered by women Indian athletes. It focuses on recognizing and examining the important problems that women experience while taking part in sports , along with systematic barriers , structural barriers and societal obstacles . The investigation further advances to develop in which way gender norms and social norms limit women from taking part in sports as a practicable profession , in doing so they are regulating women's depiction and appreciation in the sports filed. The paper further examines to provide knowledge about the legal consequences introduced by the constitution of India to nurture female liberation and guarantee gender equality in sports. Furthermore the paper focuses on the role of mass media in moulding the opinion of public people and encouraging prominence of women athletes throughout the country. It further attempts to assess the prevailing and potential strategies that conveys prevailing disputes and strengthens inclusion in women involvement in sports. Eventually the research explores how knowledge assimilation and portrayal of media bring about to legitimate women's position and accomplishments in sports in India , finally supporting gender justice and empowering women.

Therefore, the research intents to bring about extensive exchange to gender justice , new policy amendments which leads to the advancements of women sports in India. Meaningful empowerment not only needs to break the stereotypes but also fostering inclusive governance and structural reform policies. As India moves forward encouraging gender parity in sports must develop from representative ambition to a enduring national pledge that encourages national emancipation , championing equal right to participate in games , fair play and flourish equally with more positive attitude in the field of sports in India.

REVIEW OF LITERATURE

The literature on women's engagement in sports in India discloses the persisting motif of gender disparity , cultural limitations , organizational neglect , that restricts women female athleticism. The researcher stresses upon while Indian female athletes have progressively set foot into sporting areas their engagement remains fraught with difficulties implanted traditional gender roles , disparity in opportunities , systematic obstacles. The critical review of this literature jointly emphasizes the interweaving of gender dynamics , legal frameworks , educational practices and public policies cross to influencing their lives and circumstances that outlooks in Indian sporting framework.

Raghuram and Dasari (2024) , in their study "Challenges and Strategies for Women Sports in India" , gives an outline of enduring obstacles that sportswomen face regardless of increasing prominence on the global sports platform. They recognise some systematic and cultural barriers extending from inadequate infrastructure and insufficient funding to ingrained gender biases which intimidates women from pursuing a professional sports career.

This research emphasizes that the Indian society views sports being seen as a male – dominated area, where women defying gender norms face familial and societal pushback. Moreover, the authors also highlighted security problems and insufficient facilities and underreported by media as ongoing obstacles that forefend women from attaining career security in sports. Their findings indicate for a proactive gender inclusion measures and policies to strengthen women taking part in participating in sports in India.

Expanding on this , Dr Mukta Verma (2023) , in her scholarly article "Sports as a Mean for

Women Empowerment and Role of Sports Laws to Regulate Sports : Issues and Challenges " , establishes the legislative framework for female empowerment. The researcher proclaims that sports can act as nurturing space for women's self-fulfillment encouraging faith , authority and financial self – reliance. Nevertheless , Verma calls attention to gender bias that continues to exist due to lack of legal provision and gender balanced sports administration. Mentioning certain constitutional laws such as Article 15,16, and 39 , she advocates for the foundation of a National Sports Code emphasizing strong judicial mechanism to guarantee equality , safeguarding security , equal opportunities for women in sports. Her contribution underscores the disparity between policy intent and implementation, demonstrating how institutional patriarchy contradicts constitutional guarantees of equality.

Building on the historical dimension to it , Dr . Yesudas Mohandas (2019) , in "Women's Sports Champions in India Challenges , Impediments and Its Preparation", pursues the development of women's role in sports through history of Indian culture. This study further moves on to explain women in the Vedic era held a high status and were highly regarded but their status started to reduce after a period of time due to socio – religious and imperial dynamics.

The author identifies diverse limitations such as physical obstacles , mental barriers , social pressures and cultural barriers , and religious constraints that obstruct women's upliftment in present times. Mohandas asserts that societal pressures surrounding womanliness , family reputation and moral integrity proceed to restrict women's involvement in sports. This research aims advocacy for inclusive sports initiatives promoting diversity and inclusion in sports.

The Concept Journal (2018) article , "Equalization of Educational Opportunities for Women in Higher Education " that augments these findings through the exploration of the link between education and empowerment. It claims that knowledge plays a fundamental role breaking gender stereotypes boosting the confidence essential for women to engage in a professional sports career. By ensuring equal educational equity , skill development and leadership development programmes where institutions can provide women with necessary resources and skills to hurdle male dominated society combining sports and academic career. The article sites the transformation of education for women's social and professional advancement.

Conjointly , the reviewed studies demonstrate that women's participation in sports is not purely an issue of accessibility but a reflection of India's pervasive gender inequality. The consensus in the field of literature highlights the need for comprehensive strategies merging education, legislative reforms , policy development and cultural shift to making sports a vehicle of justice and equality , enabling female athletes demands a comprehensive approach that demolishes rigid gender stereotypes , ensures legal compliance and provide awareness through education and media depiction. Therefore , only through such multifaceted reforms can Indian sports develop into sphere of equitable ecosystem and empowering domain for feminine upliftment.

RESEARCH STATEMENT

This research examines the intricate relationship of gender roles , social system , legal framework and organizational practices that limit female involvement and professional growth in Indian sports. It intends to critically evaluate structural barriers that restrict mainstreaming gender equality across the sports ecosystem.

RESEARCH QUESTIONS

1. What are the important obstacles that women face while participating in sports in India ?
2. How do gender roles restrict women in participating and pursuing sports as their main profession ?
3. What are the legal and judicial implications framed by the government to promote women empowerment and equality in sports ?
4. What is the role of media in promoting women athletes to participate in sports in India ?

5. What policies and schemes can be developed to overcome the present challenges faced by women in sports in India ?
6. How does knowledge aquisition , depiction of women contribute in legitimizing women athletes in India?

THEORITICAL FRAMEWORK

This study is well grounded in Feminist Theory and Gender Role Theory.

Feminist Theory (Simone de Beauvoir , Judith Butler) offers a specific framework to analyse how male dominated society and gender roles limit women's independence in sports. It outlooks women's marginalization as a disadvantage for systemic bias ingrained etiquette, social customs and established conventions.

Gender Role Theory (Alice Eagly) describes how societal pressures derived from gender identity influences behaviour and opportunities. This structure assists to examine in what way social and cultural constructs of womanliness and maleness characterize what is considered adequate for women thereby curtailing their involvement in sports.

By merging these viewpoints, the study examines as a nexus of control and opportunity.

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.METHEDOLOGY

The investigation includes a qualitative , analytical descriptive methodology based on secondary data. The data materials include four essential studies :

- Challenges and Strategies for Women Sports in India (Raghu Ram and Dasari 2024)
- Sports as a Mean for Woen Empowerment and Role of Sports Laws to Regulate Sports (Mukta Verma , 2023)
- Women Sports Champions in India - Challenges , Impediments and It's Preparation (Yesudass Mohandas, 2019)
- Equalization of Educational Opportunities for Women In Higher Education (Concept Journal ,2018)

The study performs a thematic investigation recognizing the current concepts and complications of gender inequality , legal deficiencies, social conventions and media depiction. This investigative approach supports an in depth- evaluation and critical review of in what ways these components intersectionality forming women's experiences in Indian sports. The research also lines up with feminist qualitative methodology systematizing the personal experience , depiction and liberation.

DISCUSSION AND ANALYSIS

The investigation discloses five key issues :

1. **Gender Norms and Cultural Limitations :** Male dominated society limits women prominence and sports management agencies. , marking athletic power as male identity.
2. **System Inequality/ Institutionalized Discrimination :** Insufficient funding, substandard facilities, restricted implication of a policy . underestimate female athletes.
3. **Legal Gap :** Regardless of civil rights ,devoid of overarching legal framework for sports, forsake female exposed to discrimination and harassment.
4. **Educational Impact :** Gender inclusive education nurturing self-assurance and consciousness , facilitating participation.
5. **Media Portrayal :** Bounded and cliche reportage reduces women's accomplishments

and strengthen inequality.

These findings show systemic gender bias in sports structure and not deliberate. Empowerment mandates concurrent law reforms , educational aids , organizational culture.

INSIGHTS

This investigation discloses that sports can act as a catalyst for change and gender equality if supported by accountable and transparent leadership and systematic amendment. It stresses the need for enhancement of sports governance and dispute resolution robust legal framework for sports , equal pay and inclusion of women athletes in levelling the playfield , reforms needed to integrate sports with mainstream curriculum, challenging gender stereotypes in sports media. The key takeaway is that upliftment through sports is both a social and systematic process necessary for cooperation between governing bodies and social order.

LIMITATIONS OF THE STUDY

It is limited to secondary data and textual analysis. The absence of on – site work or informant interview regulates direct knowledge , personal experience of women athletes. Furthermore , it focuses on Indian socio – political landscape may restrict the study's findings are context specific and may not be transferable to other countries. Future inquiry could include to interrogate and inspect surveys , and have a cross case comparison of regional studies and experiential verification.

SCOPE FOR FURTHER RESEARCH

Future inquiries may analyse individual experience of professional expert in sports and developing women in sports across different states and socio – economic status. Comparative analysis between rural and urban sports system or between India and other South Asian countries would enhance the broader insight of sports knowledge. Further , it could focus on analysing the significance of electronic media , and funded models and sports development policies on female empowerment would contribute to useful ,up – to – date and relevant information.

CONCLUSION

The study concludes that women's participation in Indian sports is confined by deeply ingrained stereotypes , structural bias and fragile institutional support. In spite of existing constitutional roles and the rise of female luminaries , the cultural interpretations continue to describe it as male dominant sport. Empowerment through sports demands a combined approach system wide transformation for gender equality by strong legal frameworks , ensuring equitability to education and resources , promoting gender inclusive media coverage , nurturing community integration. True equality will come up only when women have inclusivity in sports is standardized as a professional competency rather than societal standards. The progressive evolution is vital for establishing an diverse sports community in India.

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MaatiMap: A Digital Ecosystem for Preserving India's Cultural Knowledge through Geospatial Discovery

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ABSTRACT

India's cultural knowledge, embedded in regional traditions, community practices, and indigenous heritage, requires urgent digital preservation to prevent loss in the face of modernization. Existing initiatives, such as the Government of India's portal "indianculture.gov.in", focus largely on archival documentation and text-based repositories. However, these platforms lack immersive discovery, community participation, and geospatial contextualization, which results in limited engagement and restricted access for younger and rural audiences. This research proposes MaatiMap, a digital cultural ecosystem that addresses these gaps through place-based cultural mapping and participatory knowledge collection. The system organizes India's intangible and tangible heritage, including art forms, food culture, festivals, and folk narratives, through a location-driven framework that enhances contextual understanding and accessibility. The study employs user-centered design methods to integrate culturally relevant storytelling and recommendation techniques that promote continuous learning and socio-cultural interaction. Preliminary findings indicate that users demonstrate higher curiosity and emotional connection when culture is presented visually on maps with community stories and discovery pathways. The proposed model contributes to the ongoing discourse in digital humanities by transforming heritage preservation from passive archival storage into an active, collaborative knowledge experience. The research highlights how digital platforms like MaatiMap can promote cultural sustainability, intergenerational knowledge transfer, and tourism-based livelihood support.

Keywords: Indian Knowledge Systems, Cultural Preservation, Digital Humanities, Geospatial Culture Mapping, Heritage Sustainability.

INTRODUCTION

India's cultural ecosystem is extraordinarily rich. Across thousands of distinct communities, there exist art forms, ritual practices, oral histories, culinary traditions, festivals, handicrafts, and local knowledge systems that together form living cultural memory. These practices are place-specific, relational, and continuously reinterpreted by local communities. Yet, in the current era, multiple forces threaten the continuity of these traditions, including youth migration to cities, the commercialization of folk practices, language shifts, and the dominance of text-centric digital archives that strip practices of context and agency [1].

While digitization efforts such as catalogues, scanned documents, and databases are valuable for preservation, they often fail to preserve the experience of culture: the regional associations, the narrative voice, the spatial relationships among practices, and the social actors who maintain them. The national Indian Culture Portal and several state-level repositories provide centralized archival access to curated records [2]. However, these portals are predominantly archival in nature, focusing on document storage and curated descriptions rather than interactive discovery,

localized storytelling, or community contributions. Consequently, younger audiences and casual learners find limited engagement, as these portals lack the geospatial visualization required to enable exploration by region and place-based identity. Furthermore, community contributors, those who hold tacit and oral knowledge, have no straightforward mechanism to contribute narratives, multimedia, or lived experience in a way that links directly to place [3].

This paper proposes MaatiMap, a digital cultural ecosystem designed to address these gaps. The platform organizes cultural knowledge by place, supporting multimedia contributions, short narrative summaries, and similarity-driven discovery to help users find culturally related items. The specific objectives guiding this research are:

1. To analyze how geospatial mapping can be combined with community contributions to create contextualized cultural knowledge.
2. To determine the minimal algorithmic approach required to enable interpretable and performant recommendations for cultural discovery.
3. To evaluate how map-based storytelling affects user engagement and cultural awareness compared to static archival interfaces.

These objectives are addressed through a proposed system architecture, a curated pilot dataset, and a user evaluation study.

LITERATURE REVIEW

Digital heritage is a mature research area that emphasizes the role of persistent, accessible digital records for cultural continuity. UNESCO's guidance on digital heritage underscores community participation as essential for preservation and education, yet note that most preservation efforts remain top-down rather than community-led [4]. Studies in digital humanities show that geospatial visualization enables contextualized cultural learning and improves retention of place-based knowledge. In parallel, research on digital storytelling demonstrates that narrative-driven interfaces increase emotional engagement and motivate further exploration compared to traditional keyword-based search methods [5].

Within the Indian context, a critical analysis of existing platforms reveals a significant "archival-engagement gap." While national portals provide a strong foundation for document storage, they suffer from three specific limitations: they are predominantly static, lack geospatial interactivity, and offer no participatory pipelines for community-sourced content. Recent projects in other countries demonstrate that combining GIS mapping, user narratives, and recommendation techniques can foster both tourism and community-based preservation, a synergy currently missing in Indian heritage portals [6].

Furthermore, there is a technological gap in how cultural data is processed. While machine learning approaches for cultural discovery remain an emerging area, current systems often struggle to balance complexity with user trust. Prior work has shown that simple, interpretable techniques such as K-Nearest Neighbors (KNN) can be effective for small-to-medium cultural datasets while preserving explainability, unlike "black-box" deep learning models [7]. Additionally, standard clustering methods often fail to address regional density variations; however, studies recommend using density-based clustering, such as DBSCAN, to effectively identify cultural hotspots for targeted fieldwork or mobile app cues [8].

Ultimately, the literature supports the efficacy of map-based systems, but a distinct methodological void remains in combining geospatial contextualization, community contributions, and interpretable recommendation specifically for the Indian cultural landscape. MaatiMap is designed to address this combined gap by integrating geospatial tagging, community uploads, curated metadata, and transparent algorithms for discovery [9].

PROPOSED SOLUTION

MaatiMap operates as a modular pipeline designed to ingest heterogeneous cultural data and present it through an interactive geospatial interface. The methodology is divided into sequential phases encompassing acquisition, curation, enrichment, representation, discovery, interaction, and evaluation.

Phase 1: Data Acquisition: The foundation of the platform relies on a hybrid data sourcing strategy. Primary sources include government cultural listings, such as those from state tourism datasets, published ethnographies, and curated open datasets. These authoritative sources ensure the baseline accuracy of the heritage map. Secondary sources are derived from community-sourced submissions, including oral stories, images, and event reports, collected via a moderated web form to capture living heritage.

Phase 2: Data Curation and Verification: Once data is ingested, it undergoes a validation process. Contributors' metadata is validated by moderators, with cross-checks performed against official records where available. This phase involves data normalization, where fields for categories, tags, geographic coordinates, time periods, and media types are standardized to ensure consistency across the database. Standardization is particularly critical for temporal data, converting colloquial time references into ISO-standard formats to support accurate timeline filtering and historical sorting.

Phase 3: Geospatial Enrichment: To enable the map-based interface, each cultural record is assigned standardized latitude and longitude coordinates. Hierarchical place identifiers are generated, linking items from the state level down to district and village levels. Derived geographic features are also computed, such as the distance to the nearest city and cluster density, which assists in hotspot detection and region-based visualization [10].

Phase 4: Content Representation and Schema Design: The system utilizes a flexible schema to represent cultural artifacts. Each record includes a unique identifier, title, category, short and long descriptions, contributor details, date stamps, and geolocation coordinates. Additional fields capture tags, media URLs, and an authority flag to distinguish between verified and unverified content. Optional fields allow for cultural age estimates and links to related traditions.

Phase 5: Discovery and Recommendation Models: The platform implements two complementary models to facilitate discovery. First, Density-Based Spatial Clustering of Applications with Noise (DBSCAN) is used to identify cultural hotspots and regionally dense zones, which aids in visualization. Second, a K-Nearest Neighbors (KNN) algorithm is employed for similarity-based recommendations. This utilizes a mixed feature vector comprising categorical data, TF-IDF tag vectors, and normalized coordinates to recommend culturally similar items, ensuring users are guided toward relevant content [11].

Phase 6: Community Interaction and Moderation: The user experience focuses on ease of contribution. A simplified upload form with metadata prompts allows users to submit content, including optional audio or video narrations. A moderation pipeline is implemented to ensure quality, featuring community flagging mechanisms, moderator verification queues, and version history tracking for edits. To reduce barriers to entry for rural contributors, the interface supports vernacular language inputs, ensuring that language is not an obstacle to cultural preservation.

Phase 7: Evaluation and Iteration: The system undergoes pilot deployment with a sample user base. Quantitative metrics such as time-on-task, items explored, and repeat visits are tracked alongside qualitative metrics regarding perceived authenticity and educational value. These findings are utilized to iterate on the user interface, adjust recommendation weights, and refine data curation workflows. The iterative cycle also focuses on optimizing the load times of media assets based on user bandwidth constraints in rural areas.

SYSTEM DESIGN AND IMPLEMENTATION

The system architecture is designed for modularity, scalability, and interpretability. The framework comprises four distinct layers: Data Sources, Data Layer, Processing Layer, and Application Layer.

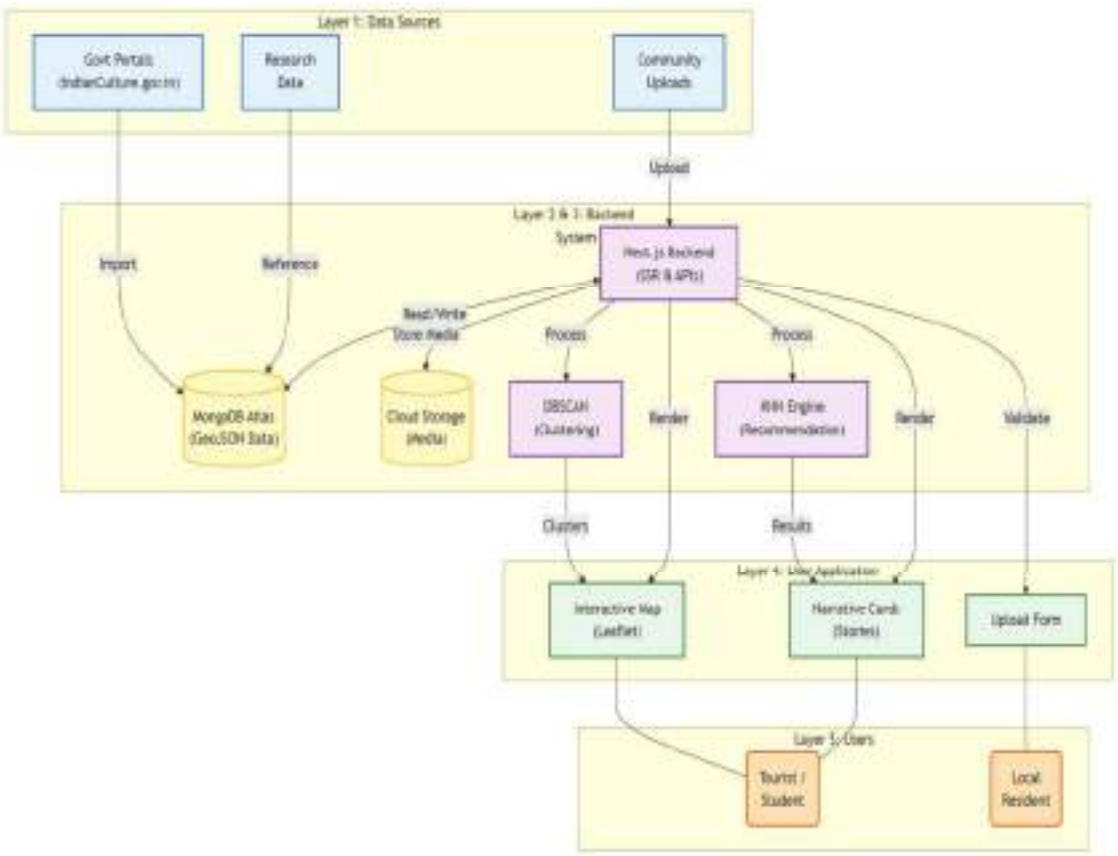


Figure 1. The MaatiMap Architectural Framework.

ARCHITECTURAL OVERVIEW

The Data Sources Layer: This layer aggregates information from diverse origins. Government datasets, including archived records, Geographical Indication (GI) tags, and state tourism lists, serve as the authoritative backbone for heritage sites and monuments. Complementing this, community contributions supply dynamic content such as oral histories, local photographs, and event logs. Research corpora, including ethnographies and academic notes, provide necessary contextual depth to the entries.

The Data Layer: Storage and schema management are handled in this layer. MongoDB Atlas is utilized to store semi-structured cultural records, allowing for flexible schema evolution to accommodate diverse data types like media arrays and nested tags. Metadata indexes are created for state, district, category, and tags to facilitate fast geospatial queries. Heavy media assets, such as images, audio, and video, are offloaded to cloud object storage with Content Delivery Network (CDN) backing for efficient delivery [12].

The Processing and Intelligence Layer: This layer handles the transformation and logic of the

platform. Extract, Transform, Load (ETL) scripts standardize inputs, geocode addresses, and compute tag vectors. A lightweight vector index stores TF-IDF embeddings to support content-based matching. The recommendation engine builds mixed-feature vectors combining geographic features and semantic tags to return the nearest cultural items. Additionally, hotspot detection algorithms compute spatial clusters to highlight cultural concentrations on the map interface.

The Application Layer: The frontend and API interactions occur in this layer. The Next.js frontend renders interactive map tiles, result cards, search filters, and narrative views. RESTful or GraphQL APIs expose endpoints for search, recommendation, and submission. Geospatial queries utilize GeoJSON indexes to efficiently return items within specific bounding boxes or radii, ensuring a responsive user experience.

The User Interaction Layer: This component manages user-specific data. Profile and preference storage enables personalized recommendations and bookmarking features. Upload workflows allow contributors to submit media and descriptions, incorporating necessary consent prompts. Reporting and moderation tools are also accessible here, allowing curators to maintain platform integrity.

Output and Impact: The final output manifests as visual heatmaps, hotspot overlays, Point of Interest (POI) cards, and discovery trails. Analytics generated from this layer provide insights into the number of contributions, popular categories, and underrepresented geographies, ultimately supporting socio-economic impacts such as cultural tourism and artisan visibility.

IMPLEMENTATION RATIONALE

Justification for Database Selection: MongoDB was selected as the primary database due to its flexible schema, which is essential for handling heterogeneous cultural data. Unlike relational databases, the document model accommodates the varied attributes of cultural artifacts without rigid table structures. Furthermore, its native support for GeoJSON and geospatial indexing ensures efficient location-based querying.

Choice of Frontend Framework: Next.js was chosen to leverage its capabilities in Server-Side Rendering (SSR) and Client-Side Rendering (CSR). SSR is critical for this platform as it ensures that cultural content is indexable by search engines, thereby improving discoverability. Additionally, the framework supports a responsive user interface, which is vital for accessibility across different devices.

Selection of Algorithmic Models: The combination of KNN and DBSCAN was selected to balance performance with interpretability. KNN provides transparent, easy-to-validate recommendations that users can understand, while DBSCAN effectively identifies spatial concentrations and outliers without requiring pre-set cluster counts. Together, these algorithms support both the casual discovery needs of users and the analytical needs of researchers [13].

RESULTS AND DISCUSSION

Pilot Evaluation Setup: A pilot evaluation was conducted with 30 volunteers comprising students, local residents, and heritage researchers from five different states. Participants were assigned tasks that included finding local cultural items, exploring related traditions, and bookmarking items for a hypothetical cultural tour. Metrics recorded included items explored per session, time spent on the map versus the list interface, and self-reported engagement measured on a 5-point Likert scale.

Quantitative Findings: The data revealed a significant increase in user interaction when using the map interface. The mean number of items explored per session on the map was 18.2, compared to 6.1 on the text list, representing a three-fold increase. Similarly, the mean session length extended to 12.8 minutes on the map, versus 4.1 minutes on the list. Engagement scores mirrored this trend, with map-based storytelling receiving a mean rating of 4.3 out of 5, while the static

archive received a 2.8.

Qualitative Feedback: Participants reported a stronger emotional connection to the content when presented with short local stories and images. Users specifically appreciated the geospatial cues, noting the value of seeing geographically close but culturally diverse items in a single view. Suggestions for improvement included the integration of a multilingual user interface and offline content capabilities to better serve rural areas with limited connectivity.

DISCUSSION

The pilot results indicate that map-based, story-augmented discovery significantly increases curiosity, time-on-task, and perceived authenticity. The KNN-based recommendations were viewed as intuitive, allowing users to seamlessly discover similar items. DBSCAN hotspot overlays proved useful for identifying areas with high cultural density, suggesting potential utility for fieldwork prioritization. However, limitations were observed regarding dataset sparsity in certain regions and the ongoing need for robust content moderation.

COMPARATIVE ANALYSIS

A comparative analysis highlights the distinct advantages of the MaatiMap framework over existing government portals.

Table 1: Feature Comparison

Feature / Platform	**IndianCulture.gov.in (Official Portal)**	**MaatiMap (Proposed System)**
Primary Focus	Archival text and document storage	Geospatial discovery and multimedia experiences
Community Contribution	Limited to official curation	Open, moderated community contribution
Geospatial Visualization	Minimal or non-existent	Interactive map with dynamic hotspots
Recommendations	None	KNN-based similarity suggestions
Storytelling Format	Long-form documents	Short narrative cards and multimedia
Accessibility	Low mobile optimization	Progressive Web App (PWA) with offline plans
Moderation Model	Centralized curation	Community flagging and curator verification
Youth Engagement	Low suitability	High suitability (Visual & Interactive)

This comparison underscores the shift from a static, archival model to a dynamic, participatory ecosystem.

CONCLUSION AND FUTURE SCOPE

MaatiMap presents a pragmatic approach to reconciling archival rigor with participatory, place-based cultural discovery. By leveraging geospatial indexing, interpretable recommendation methods, and a moderated contribution model, the platform aims to make culture discoverable for diverse audiences while providing research value for scholars and policymakers. The shift from text-based lists to interactive maps has been shown to significantly enhance user engagement and retention.

Future work will focus on scaling the dataset through partnerships with state cultural departments and incorporating multilingual audio narrations to overcome literacy barriers. Additionally, the integration of Augmented Reality (AR) for guided cultural trails and the exploration of decentralized authenticity mechanisms, such as blockchain metadata anchors, will be pursued to further secure and valorize high-value cultural artifacts.

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Revitalizing Higher Education through Indian Knowledge Systems (IKS): A Qualitative Analysis in the Light of Evolving NEP (2020–2024)

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Abstract

Indian Knowledge Systems (IKS) encompass India's extensive intellectual traditions, integrating disciplines such as philosophy, mathematics, medicine, literature, and governance. In the context of contemporary higher education, the need to harmonize global standards with cultural identity and holistic development has renewed interest in IKS. This qualitative research explores how the evolving National Education Policy (NEP)—from its 2020 inception through subsequent refinements up to 2024—conceptualizes the inclusion of IKS in higher education. Drawing upon policy analysis, academic discourse, and stakeholder insights, the study highlights both the transformative potential and the implementation challenges of IKS integration. The findings suggest that embedding IKS can enrich pedagogy, foster ethical and sustainable education, and reinforce India's intellectual autonomy. Successful realization, however, depends on faculty preparedness, institutional collaboration, and adequate resource frameworks. The paper concludes that a well-structured incorporation of IKS can promote interdisciplinary learning and position Indian universities as centers of culturally grounded global scholarship.

Keywords: Higher education; holistic learning; Indian Knowledge Systems; interdisciplinarity; National Education Policy 2020



INTRODUCTION

India is home to one of the world's oldest and most diverse knowledge systems. These systems span disciplines such as Ayurveda, Yoga, mathematics, astronomy, linguistics, governance (Arthashastra), ecological knowledge, architecture, and philosophy. Indian Knowledge Systems (IKS) emphasize holistic understanding, ethical values, sustainability, scientific inquiry, and cultural grounding that has evolved over millennia. Far from being static or tradition-bound, IKS represents a dynamic and cumulative intellectual tradition shaped by centuries of dialogue, experimentation, and cross-cultural exchange. Ancient universities such as Takshashila, Nalanda, Vallabhi, and Kanchipuram stand as historic examples of India's thriving academic environment, where scholars engaged in interdisciplinary learning, scientific debates, and global

knowledge exchange.

In contemporary times, the relevance of IKS has gained renewed attention due to the growing need for educational models that integrate cultural identity, scientific reasoning, and sustainable development. Global discourses on decolonizing education, promoting indigenous knowledge frameworks, and redefining the purpose of higher education have further encouraged India to revisit its intellectual heritage. IKS contributes not only to academic disciplines but also to national priorities such as health and wellness, environmental conservation, ethical leadership, traditional arts, and community-centered development.

Recognizing the transformative potential of IKS, the National Education Policy (NEP) 2020 recommends integrating IKS across higher education curricula. NEP emphasizes the need for multidisciplinary education, experiential pedagogy, value- based learning, and flexible curricular structures—all of which align naturally with IKS principles. The policy underscores that harnessing India's civilizational knowledge is essential for strengthening cultural identity while fostering innovation and global competitiveness.

Subsequent updates (2021–2024) provide more concrete implementation frameworks, including teacher training programs, IKS-specific Faculty Development Programmes (FDPs), the establishment of IKS centres in universities, digitization of manuscripts, multilingual education initiatives, and structured curriculum restructuring. The UGC's introduction of credit-based IKS courses and guidelines for institutional adoption further signals a system-wide shift toward mainstreaming indigenous knowledge in higher education.

In this context, examining the integration of IKS within the evolving NEP framework becomes crucial for understanding how India can align its historical strengths with contemporary educational aspirations. The present study seeks to explore this intersection by analysing policy directives, reviewing existing literature, and assessing institutional readiness and challenges.

OBJECTIVES OF THE STUDY

1. To examine the integration of IKS in higher education through NEP 2020–2024.
2. To identify pedagogical and institutional benefits of IKS.
3. To analyze challenges in IKS implementation.
4. To review institutional case examples.
5. To recommend strategies for strengthening IKS adoption.

LITERATURE & POLICY REVIEW

Existing literature demonstrates the depth and diversity of India's ancient knowledge systems, which span a wide range of disciplines including mathematics, astronomy, medicine, linguistics, literature, ecology, and ethical philosophy. Seminal works such as the Sulbasutras, Aryabhata's Aryabhatiya, and Charaka's Charaka Samhita highlight India's foundational contributions to geometry, algebra, trigonometry, astronomy, and medical science. Scholars such as Pingree (1981), Patwardhan (2015), and Kapur (2019) emphasize that these knowledge traditions were not isolated intellectual pursuits but part of a holistic civilizational framework that connected science, spirituality, and social well-being.

Modern research further asserts the relevance of IKS in addressing contemporary challenges such as sustainability, mental well-being, biodiversity conservation, and ethical governance. For instance, Ayurvedic and Yogic literature has been widely studied for insights into preventive healthcare, mind-body equilibrium, and environmental balance. Similarly, work by Sen (2005) and Subbarayappa (2001) argues that ancient Indian epistemological frameworks promote interdisciplinary thinking—an approach increasingly valued in global higher education.

In the context of policy, NEP 2020 emphasizes reviving IKS through interdisciplinary education, research integration, multilingual learning, and digital archiving of manuscripts. It

positions IKS as essential for nurturing cultural rootedness and holistic development while maintaining global competitiveness. Subsequent UGC guidelines (2022–2024) further mandate the introduction of credit-based IKS courses across higher education programs, the establishment of IKS centers, and structured faculty development programs to build academic capacity.

Additionally, several contemporary publications underscore the need for systematic documentation, scientific validation, and pedagogical innovation to mainstream IKS. Studies by Balasubramanian (2021), Kumar (2023), and Nandakumar (2022) stress the importance of integrating traditional knowledge with modern scientific methods, especially in fields such as architecture (Vastu), ecology, Ayurveda-biomedicine convergence, and Indian logic (Nyaya) for modern computational models. Digital humanities initiatives, including manuscript digitization under the National Mission for Manuscripts, further illustrate the growing scholarly and institutional interest in preserving and revitalizing IKS.

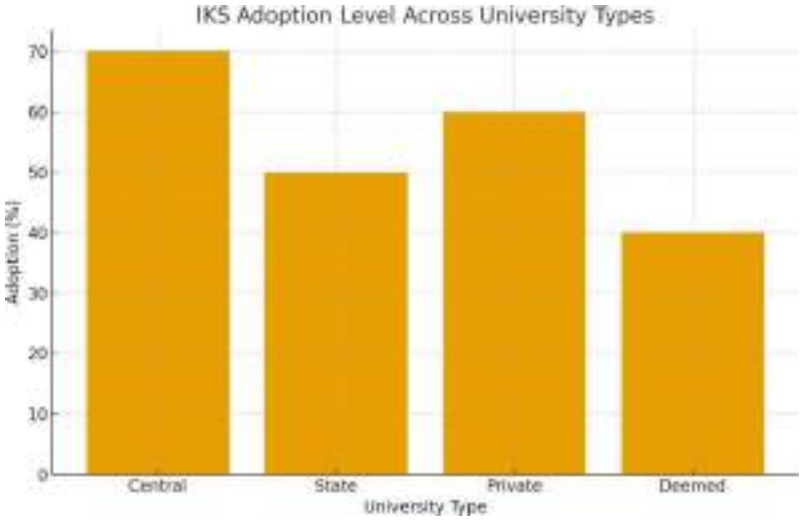
Overall, the literature consistently indicates that IKS offers rich intellectual resources and significant pedagogical value. However, scholars also point to gaps in standardization, academic training, and resource accessibility—highlighting the need for coherent policy frameworks and university-level capacity building for effective integration.

METHODOLOGY

This study adopts a qualitative approach, drawing insights from:

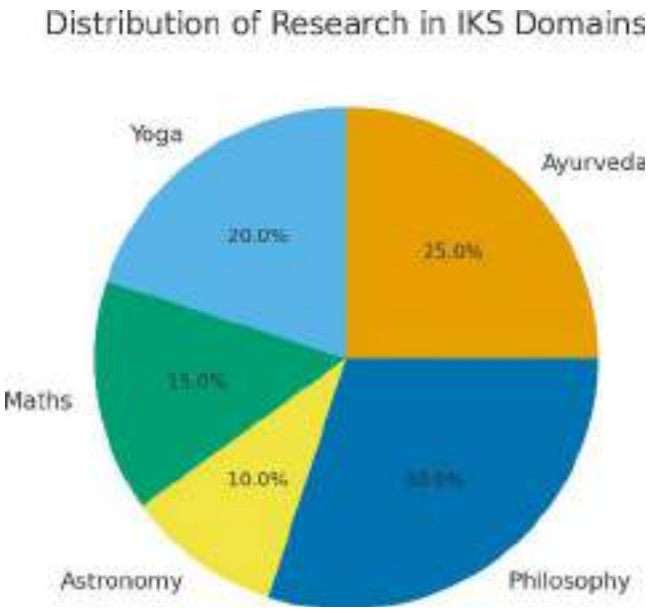
1. Policy document analysis
2. Academic literature review
3. Case studies of universities implementing IKS
4. Stakeholder perspectives including policymakers, faculty, and students

IKS ADOPTION LEVELS



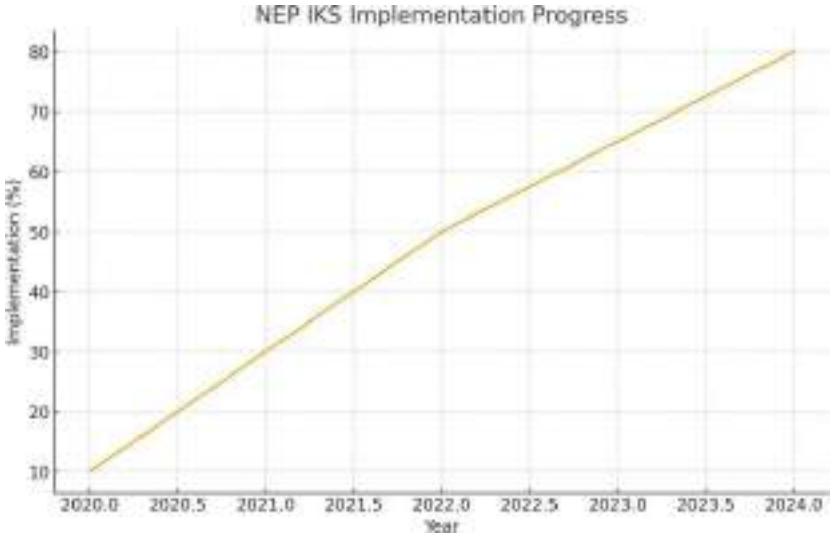
Source: Indian Knowledge Systems Division, Ministry of Education (2021– 2024). IKS Integration Framework and Implementation Guidelines. Retrieved from https://iksindia.org

RESEARCH DISTRIBUTION IN IKS DOMAINS



*Source:UGC–IKS Centre Annual Reports (2022–2024). University Grants Commission. Retrieved from https://ugc.ac.in and https://iksindia.org

NEP IMPLEMENTATION PROGRESS (2020–2024)



*Source: Ministry of Education (2020–2024). National Education Policy – Progress Reports and Implementation Updates. Retrieved from https://www.education.gov.in/nep

NEP 2020 VS NEP 2024 COMPARISON

Criteria	NEP 2020	NEP 2024 Update
IKS Integration	Recommended	Mandatory Credits
Curriculum Structure	Flexible	Multidisciplinary Mandated
Digital Learning	Encouraged	Integrated Platforms Required

FINDINGS AND DISCUSSION

Key findings reveal:

- IKS enhances culturally rooted, holistic, and ethical learning.
- Curriculum innovation potential is high in areas such as Ayurveda-biology, Vastu-environmental planning, Indian mathematics, and governance studies.
- Challenges include faculty shortage, lack of standardization, infrastructure gaps, and limited digital resources.
- Student interest in IKS electives is increasing across universities.
- Technology, including AI-based manuscript digitization, can accelerate IKS integration.

CONCLUSION

The evolving NEP 2020–2024 framework demonstrates India's strong commitment to reviving its knowledge heritage and embedding it meaningfully within modern higher education. IKS has the potential to transform teaching, research, and curriculum design across higher education institutions by fostering culturally rooted learning, sustainable thinking, and interdisciplinary academic engagement. The integration of IKS not only bridges India's civilizational wisdom with contemporary educational needs but also strengthens national identity, ethical foundations and intellectual self-reliance.

However, successful implementation requires systematic investment in faculty training, digital infrastructure, curriculum standardization, and collaborative research ecosystems. Strengthening institutional capacity—through well-designed Faculty Development Programmes (FDPs), dedicated IKS centers, interdisciplinary research clusters, and digital repositories—is essential for ensuring quality and consistency in IKS-based education. Moreover, universities must actively encourage multilingual scholarship, community knowledge participation, and evidence-based research approaches to enhance the credibility and contemporary relevance of IKS.

As global academic discourse increasingly embraces indigenous knowledge frameworks and decolonized pedagogy, India is uniquely positioned to lead international conversations on holistic, sustainable, and value-driven education. With appropriate strategies, policy support, and stakeholder collaboration, India can position its universities as global leaders in culturally grounded scholarship, contributing not only to national development but also to global knowledge systems. Ultimately, the thoughtful integration of IKS within NEP's transformative vision holds the potential to shape a more inclusive, innovative, and future-ready higher education landscape for India.

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Rudraksha Dharan Vidhi: The Sacred Science of wearing Rudraksha.

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INTRODUCTION

Etymologically, the word "Rudraksha" is a combination of two words "Rudra" and "Aksha". "Rudra" refers to Lord Shiva and "Aksha" translates to 'eyes' in Sanskrit(Poddar 2024). The rudraksha tree is a large, evergreen, broad-leafed tree that grows in only a few places in the world, including the Himalayas of Nepal, India, Sri Lanka, Australia, Hawaii and Indonesia. Rudraksha is a dried herbal nut stone (endocarp) of the fruit(drupe) of rudraksha tree. Rudraksha trees bear fruits and enclosed within the pulp of the fruit is the rudraksha bead with ridges running throughout their diameter determining their number of faces, called mukhis (Haas 2015,23). This bead has compartments in the hollow space inside it which contains seeds and has a natural hole (central canal) inside running from one end to another (Sharma 2009, 19). The rudraksha bead is hard and has a rough surface due to uneven protuberances throughout its body.

Since ancient times, Hindu mythological and religious literature has glorified "Rudraksha" not just for Sadhna or religious/spiritual practices but as a tool to aid in achieving the four main goals of life, i.e, Dharm, Artha. Kaam and Moksha (Chapter 25, Verse 68, Shiva Mahapuran). These life-goals are called four 'purusharthas' in Hindu philosophy which guide individuals towards a meaningful and fulfilling life.

Scriptures have glorified rudraksha as the best sacred object for making a rosary (Malviya 2023, 277). Its structure with a natural hole inside for stringing, its shape, mineralogical composition and associated Deities are all together responsible for its divine nature and healing properties, making it a divine remedial plant.

Description of rudraksha in Shastras can be broadly classified into two categories. First is Rudraksha 'Mahatamaya' wherein rudraksha has been glorified for its spiritual and temporal benefits. And secondly, Rudraksha Dharan Vidhi, which describes the procedure of wearing or using rudraksha (Dharan).

OBJECTIVES:

The primary objective of this research paper is to highlight the importance of rudraksha dharan vidhi and the central position it holds in the overall scheme of using rudraksha as described in the scriptures. Secondly, an effort is made to analyse the different dimensions of the complex process of rudraksha dharan vidhi in order to gain deeper understanding of the overall process.

METHODOLOGY:

Extensive survey of literature on Rudraksha, including Scriptures and contemporary works, and present a collective and comprehensive set of information on rudraksha dharan vidhi. It is pertinent to note that no scripture on rudraksha, or even contemporary works for that matter, describes dharan vidhi in totality but adds a new perspective nonetheless. Some information is found to be repetitive and common across scriptures while much information is complimentary in nature and some even contradictory. Therefore, a comparative analysis becomes indispensable.

Rudraksha's Wearing Methodology (Dharan Vidhi):

Rudraksha bead selection process, cleansing (Shuddhi/Shodhan) process and rudraksha mala (rosary) making (Guthan) are intrinsic part of dharan vidhi. Even the Shastras have attached great importance to them (Punyarka 2016, 73). In-depth evaluation of this process reveals a systematic and scientific approach, which in itself is a validation for our ancient wisdom. Rudraksha Dharan Vidhi as described in different scriptures is discussed below:

SHIVA MAHAPURANA:

According to Shiva Mahapurana, wearing of rudraksha is an integral part of Sivapuja or Shiva

Worship (Shloka 91, Chapter 25) along with smearing Bhasma (sacred ashes), drawing tripunda on one's forehead and chanting panchakshari mantra (Namah Shivaye). However, there are certain rules and procedure which need to be followed for seeking material benefit and/or spiritual merit from wearing of rudrakshas. Shiva Mahapurana clearly warns against wearing of rudraksha without consecrating it with appropriate mantra first (Shloka 83). Further, a devotee could repeat all/any mantras on rudraksha mala (verse 61), but should refrain from consuming meat, garlic, onion, red garlic, potherb, sleshmatak (lisod) and liquor (verse 43). Devotees of panch-deva (and not only Shiva) -Devi, Shiva, Vishnu, Ganesh and Surya- can wear rudraksha (Shloka 61). Nor there is any bar as to gender, caste, age, sect or social status for wearing of rudraksha. But it should be worn realising its greatness, chanting appropriate mantra with devotion and following proper procedure (Shloka 87). Mula mantras for each type of rudraksha (one to fourteen mukhi) as given in Shloka 81 are:

Om Hrim Namah for One Mukhi Rudraksha
Om Namah for two-faced rudraksha
Om Klim Namah for three-faced rudraksha
Om Hrim Namah for four-faced rudraksha
Om Hrim Namah for five-faced rudraksha
Om Hrim Hum Namah for six-faced rudraksha
Om Hum Namah for seven-faced rudraksha
Om Hum Namah for eight-faced rudraksha
Om Hrim Hum Namah for nine-faced rudraksha
Om Hrim Namah for ten-faced rudraksha
Om Hrim Hum Namah for eleven-faced rudraksha
Om Kraum Ksaum Raum Namah for twelve-faced rudraksha
Om Hrim Namah for thirteen-faced rudraksha
Om Namah for fourteen-faced rudraksha

Shiva Mahapurana explains in great detail how and how many rudrakshas should be worn. It starts with bead selection process. Shlokas 14 to 23 of Chapter 25 give details in this regard. Rudraksha bead of the size of an Indian gooseberry (Amla) is most excellent, one of the size of jujube fruit (badri phala) is average or medium finess (Verse 14) and that which is the size of a gram (Chana) is of poor quality (Verse 15). Smaller the rudraksha more fruitful it is (Verse 18). Rudraksha should be of even size, glossy, firm, thick and having many thorn like protrusions (Verse 21). Rudraksha which is defiled by worms, is cut and broken, has no thorn-like protrusions, has cracks or is not circular should be discarded (Verse 22), that which has a natural hole from end to end is most excellent, that which is required to be bored is of medium quality.

Various shlokas suggest the number of rudrakshas to be worn on different body parts. Shlokas 37 to 39 suggest that a great devotee of Shiva should wear one rudraksha bead on the tuft, forty on the forehead, thirty-two round the neck, hundred and eight over the chest, six in each of the ears, sixteen round each of the arms. And, shlokas 40 to 42 suggest the mantras. Rudraksha should be worn on the head repeating Ishana mantra, on the ears with Tripurusa mantra, round the neck and on the chest with Aghora mantra, round the forearms with Agora beej mantra and a string of fifteen beads should be worn on the stomach with Vaamdeva mantra. With 5 mantras- Sadyojata, Ishana, Tatpurush, Aghora, Vamadeva- three, five or seven garlands should be worn. Or all beads should be worn with the mula mantra (given in shloka 81).

SRIMAD DEVI BHAGWAT PURANA:

Srimad Devi Bhagwat Purana or Devi Bhagvatam is an important scripture of Shakta tradition within Hinduism that reveres and celebrates the divine feminine or Devi or Shakti. It centers around Goddess as primary deity. Several chapters in the scripture are specifically dedicated to rudraksha.

In chapter 3 of Srimad Devi Bhagvatam, it is stated that rudrakshas stringed with gold or silver should be worn on Shikha and ears (verse 18). Further, one can wear it on arms, neck, stomach or yagyopavit (sacred thread) after consecrating it with panchakshar mantra (Namah Shivay) or Pranava Mantra (Omkar). Rudraksha worn on the crown (shikha) of the head represents Tara Tattva and that on the ears Devi and deva Tattava. That worn on the sacred thread represents the Veda Tattva and that on the hands represents the Diks (Directions). Rudraksha worn on the neck represents Saraswati

Devi and Agni (Fire). Verse 37 states that if one wears rudraksha with a gold-chain or gold-katak (bangle or waist-chain) is liberated from all sins and goes to Shiva- Lok.

Chapter 5 of Srimad Devi Bhagvatam describes the characteristics and method of making a 'japamala' or rosary. The face of rudraksha is Brahma. The top of it is Rudra and the tail is Vishnu. Twenty-five beads of five-faced rudraksha of white, red and mixed colours are to be bored and stringed together to end like the edge of a cow-tail. The head of one should be facing the head of another bead and tail facing the tail. The topmost bead should have its face upwards and the knot (naag-granthi) above the bead. The mala thus made has to be purified with fragrant water, panchgavya and sacred water (teerth of shivlinga). Then recite the prescribed mantras while sprinkling water one hundred and eight times to sanctify the mala. This is how pran-pratishtha of the mala is done. Rudraksha used by others must be avoided.

In chapter 4 of Srimad Devi Bhagvatam, it is stated that a mala of twenty-six rudrakshas on the head, fifty on the chest, sixteen on each arm and twelve on each wrist should be worn (Verse 37). Verse 38 to 40 further states that if 'japas' are performed with a mala of one hundred and eight or fifty or twenty-seven rudrakshas, eternal merit is obtained. If a mala of one hundred and eight rudrakshas is worn than every moment, merits or punya of performing an Ashvamedha Yagya is obtained. Twenty-one generations of the wearer are elated from sufferings for their respective sins, and he himself will attain Shiva-lok.

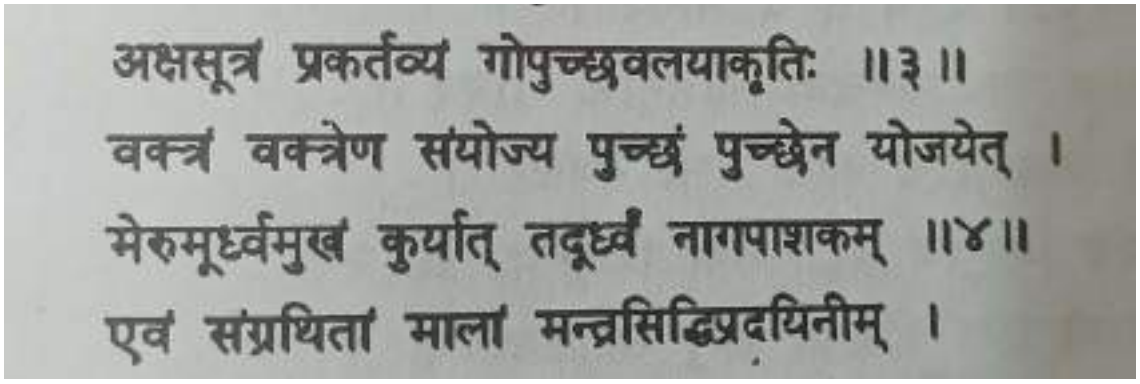

अक्षसूत्र प्रकर्तव्य गोपुच्छवलयाकृतिः ॥३॥
वक्त्रं वक्त्रेण संयोज्य पुच्छं पुच्छेन योजयेत् ।
मेरुमूर्ध्वमुख कुर्यात् तदूर्ध्वं नागपाशकम् ॥४॥
एवं संग्रथिता माला मन्त्रसिद्धिप्रदयिनीम् ।

Image 1: Shloka 3-4, Shrimad Devi Bhagwat Puran, Skand 11, Chapter 5.

Shloka 3 and 4 of Skand 11, Chapter 5 from Shrimad Devi Bhagwat Puran, mentions that while making a rudraksha rosary beads should be aligned face to face matching North pole to North Pole and tail to tail, i.e, South pole to South Pole. A rosary thus made gives great spiritual merits and occult powers.

PADAM PURANA:

According to Padma Puran (Chapter 57, Shrishti Khand), a bead without lines or grooves or infested/eaten by pest or with broken thorns or have stuck with other beads should never be used in making a rosary (Verse 11). It is recommended to strung the rosary by oneself (Verse 12). Verse 13 is important as it talks about making a rosary of 27 beads and associating these beads with 27 nakshatras of astrology. It states that the serpent-shaped mala of 27 beads should have a 'meru' bead at the end, and there should be knots between two beads and the entire mala should be balanced and uniform. Wise people are suggested to perform 'japa' on such a mala or rosary. Verses 14 and 15 lay down the process of 'japa' or chanting of mantra using the rosary as uncounted chanting is fruitless. Verse 19 says that all Vedic, Puranic and Tantric mantras can be chanted using rudraksha mala. Verse 92 mentions mula-mantras for each rudraksha (table below). Presiding deities and mula-mantra for each kind of rudraksha are given in the table below:

Table 1. Rudraksha and associated deities and mantras

Rudraksha Type	Presiding Deity	Mantra

One Mukhi	Shiva	Om Rudra ekavaktrasya
Two Mukhi	Agni	Om kham dvivaktrasya
Three Mukhi	Brahma	Om vum trivaktrasya
Four Mukhi	Brahma	Om hrim chaturvaktrasya
Five Mukhi	Kalagni	Om hram panchvaktrasya
Six Mukhi	Kartikeya	Om hrum shadvaktrasya
Seven Mukhi	Ananta/ seven Nagas	Om hrah saptvaktrasya
Eight Mukhi	Vinayaka	Om kam ashtvaktrasya
Nine Mukhi	Bhairava	Om jum navavaktrasya
Ten Mukhi	-	Om aksham dashvaktrasya
Eleven Mukhi	Eleven Rudra	Om shrim ekadashvaktrasya
Twelve Mukhi	Aditya	Om hrim dvadashvaktrasya
Thirteen Mukhi	Rudra	Om Akshom trayodashvaktrasya
Fourteen Mukhi	Shiva	Om nram chaturdashvaktrasya

AKSAMALIKOPANISAD:

Presented in dialogue form between Prajapati Brahma and Lord Kartikeya, this Upanishad is composed of 16 Shlokas. It contains an exposition on the assemblage (making) of the rosary, including Rudraksha beads, and the use of the fifty letters of the Sanskrit alphabet (varnamala) in this process as beej mantra for energising the rudraksha mala. Information about potency of rudraksha (aksa) rosary (mala), worshipping method and other particulars like (1) Lakshan (Attributes) (2) Bhed (Variety) (3) Sutra (Type of threads or wire) (4) Stringing Method (5) Varna (Related Alphabet) (6) Presiding Deity (7) Shodhan (Cleansing/Purification) etc are enumerated.

In Shloka 1, Prajapati Brahma asked Lord Kartikeya to narrate about the characteristics of the rosary, description about its varieties, materials to be used for making a rosary, procedure of energising the rosary (Pran Pratishtha), presiding deity and merits to be attained. In reply (Shloka 2), Lord Kartikeya describes that a rosary can be made from following 10 materials (1) Coral (2) Pearl (3) Quartz Crystal (4) Conch (5) Silver Beads (6) Gold Beads (7) Sandalwood (8) Putra Jiva seeds (Rox Burghi seeds) (9) Lotus Seeds (10) Rudraksha beads (Aksa). A rosary has to be imagined as being associated to 51 letters of the Sanskrit language, i.e, every single bead of the rosary is to be perceived as the letter of the varnamala (Alphabet) or simply put like a garland of letters. Wires of gold, silver or copper can be used and rudraksha beads should be strung matching face to face, i.e, North to North, and tail to tail, i.e, South to South.

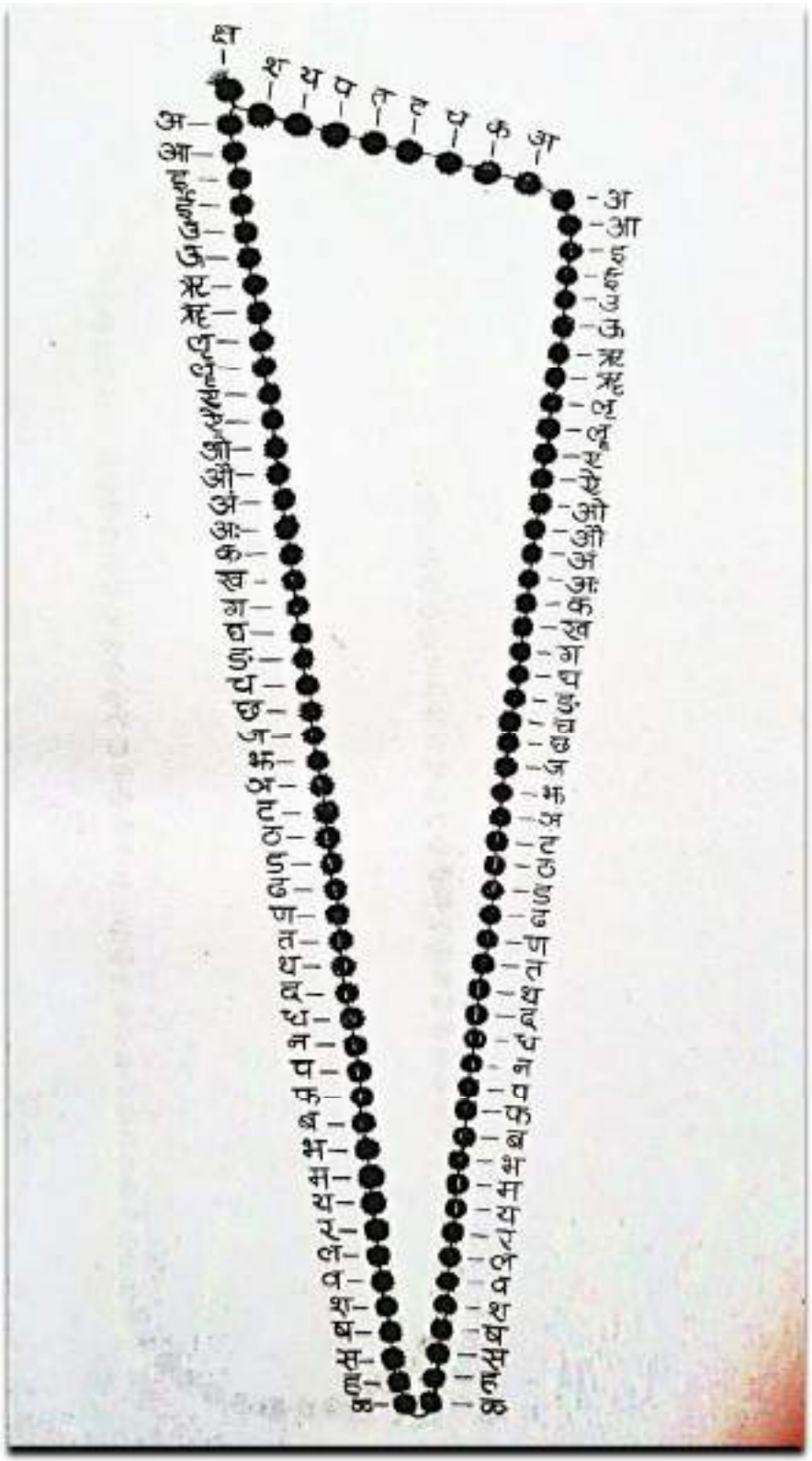


Image2: Rudraksha beads associated with letters of Sanskrit Alphabet.(Ketu 2013, 23)

In Shloka 3, structure of the rosary is discussed. Wire or the thread that runs through the bead is to be perceived as Lord Brahma, right side of the beads to be perceived as Lord Shiva while the left side to be perceived as Lord Vishnu. The Mukha (Meru, the principal bead), should be conceived of as Saraswati. The tail portion should be perceived as the Gayatri, hole across the bead should be

perceived as Vidya Tattva and knot between the two beads should be perceived as the Prakrti (Primordial originant of the phenomenal world).

- The beads representing the 16 vowels are to be perceived as bright white because of Sattva Guna.
- Beads representing the 25 consonants of the first five groups (Gutturals, Palatals, Lingusla, Dentals and Labials), should be conceived of as yellow colour, because of mix of Sattva and Tamas guna.
- Beads representing the remaining 10 consonants should be perceived as of the red colour because of Rajas Tattwa.
- Shloka 4 provides details as to material to be used for shodhan or cleansing like scented water, sandal paste, flowers and rice etc.

Shloka 5 is the lengthiest and it corelates every letter of the Sanskrit alphabet with beads of a rosary. Every letter is treated like a mantra and is used to invoke one special attribute in every single bead. Stringing of the rosary will start from the first bead to be counted in South of the Meru bead (Shikhamani or Mukha). Shloka 6 to 13 mention about invocation of the deities like Pitri(Ancestors), Divine beings, etc. for their blessings and permission to use the rosary. This process of invoking divine attributes in every bead is to be done in 3 steps beginning with first 50 beads followed by another 50 beads and concluding with the remaining 8 beads. While the process starts from the letter (A), it concludes on Meru bead which is 109th bead and is represented by sanskrit letter ksha (KSA).

This is the most detailed procedure of making a rudraksha rosary and explains the first two steps, i.e, Grahan(Guthan) and Shodhan.

NIRNAYA SINDHU

Originally written in Sanskrit by Pandit Kamlakar Bhatt in 1612 AD, Nirnay Sindhu is a Dharma Shastra text, that compiles religious rules and observances to be followed throughout the year. The third section of this book has a short description of rudraksha dharan vidhi (Gaud 2017, 692). After stating merits of One to Fourteen mukhi rudraksha, the following three different mantras are given for energising rudraksha before wearing:

1. Panchakshari Mantra, i.e, “Namah Shivay”.
2. Triyambak Yajamahe Sugandhim Pushtivardhanam urvakamiv bandhanan mrityor mukhiya ma amritat.
3. Om Aghor Om Haai Am Aghoratar Om Hraum Haaam Namaste Rudrarupay Haaim Svahaa.

Further, the following types of rosary are prescribed for achieving desirable outcome:

1. Rosary of 108 beads for high spiritual merit and occult powers.
2. Rosary of 54 beads for high spiritual merit.
3. Rosary of 30 beads for wealth.
4. Rosary of 27 beads for daily worship, chanting etc.
5. Rosary of 25 beads for wealth and prosperity.
6. Rosary of 15 beads for abhichar (Shaudra Prayog).

SHIV RAHASYA

This text was originally written by Acharya Pandit Shivdutt Mishr Shastri in Sanskrit and first published in 1980. It deals with the practice and procedure of Shiva worship in a comprehensive manner. A full chapter, titled “Rudraksha Dharan Vidhi”, is dedicated to describing the mythological origins of rudraksha, its greatness and more importantly the method to be followed, involving consecration/ purification ritual, when a particular rudraksha bead or mala is worn for the first time by the person concerned. In shloka 44 it is clearly stated that rudraksha should not be worn without mantra consecration. Specific mantras are suggested for consecrating each of the 14 types of rudraksha (one to fourteen-mukhi) while performing appropriate meditation and mental worship (mansik puja) of the bead. Rudraksha is to be placed in a copper vessel and water is sprinkled while reciting the appropriate mantra one thousand times. It is interesting to note that for this consecration ritual, not only Lord Shiva and other Gods are invoked but also suggests invocation of ‘Rishis’ which are specific for each type of rudrakshas, just like specific mantras.

Table 2. Rudraksha with Deity, Rishi and Mantra

Rudraksha Type	Presiding Deity	Presiding Rishi	Mantra
One Mukhi	Lord Shiva	Vaam Deva	om aim ham aum aim om
Two Mukhi	Dev Devesh	Atri Rishi	Om Srim Hrim Kshaum Brim Om
Three Mukhi	Agnidev	Vashisht Rishi	Om Ram In Hrim Hum Om
Four Mukhi	Lord Brahma	Bhargava Rishi	Om vaan kran taan haan een
Five Mukhi	Kaalagni Rudra	Brahma Rishi	Om Hram Aam Kshmyoum Svaha
Six Mukhi	Lord Kartikeya	DakshinaMurti	om hrim shrim clim saum aim
Seven Mukhi	Anant	DakshinaMurti	om hrim krim gloum hrim straum
Eight Mukhi	Lord Ganesha	Bhargava Rishi	Om Hram Grim Lam Aaam Shrim
Nine Mukhi	Bhairav	Narada Rishi	Om Hrim Vam Yam Ram Lam
Ten Mukhi	Janardan (Vishnu)	Narada Rishi	Om Shrim Hrim Klim Vrim Om
Eleven Mukhi	Eleven Rudras	Kashyap Rishi	Om Ruum Kshum Moo Yuum Aum
Twelve Mukhi	Surya, Twelve Adityas	Bhargava Rishi	Om Hrim Kshaum Ghrinih Shrim
Thirteen Mukhi	Lord Indra	Bhrama Rishi	Om In Yam Aap Om Iti
Fourteen Mukhi	Lord Hanuman	Ramchandra Rishi	Om Aum Hasfren Khabfen Hastruan Hasabfren

Furthermore, specific body parts are suggested for wearing certain rudrakshas. For instance, right hand is suggested for wearing six-mukhi rudraksha (shloka 23), left hand for wearing nine-mukhi rudraksha (shloka 27), eleven-mukhi on 'shikha' of head (shloka 30), twelve- mukhi on throat (shloka 33) and fourteen-mukhi on forehead (shloka 40). Number of rudraksha beads to be worn on different body parts is also mentioned in Shloka 52 which prescribes wearing 32 beads on throat, 40 on head, 6-6 on each ear, 12-12 on each wrist, 16-16 on each hand, one on 'shikha' and 108 beads on heart.

RUDRAKSHA DHARAN VIDHI IN MERU TANTRA:

In tantra texts, rudraksha has been envisioned as tantra, mantra and yantra all combined in one (Chaudhary 2008). Tantra considers rudraksha as a device which is capable of holding energy generated through chanting of mantra. Tantra texts explain, seemingly unimportant task such as mala making, in great detail and entails very crucial details (Malviya 2023, 279) which need to be put to practical use. For instance, in Meru Tantra (Chapter 6, Verse 315) it is mentioned that in a particular rudraksha mala different mukhi (faced) rudraksha beads should not be mixed and one mala should be of one particular bead only.

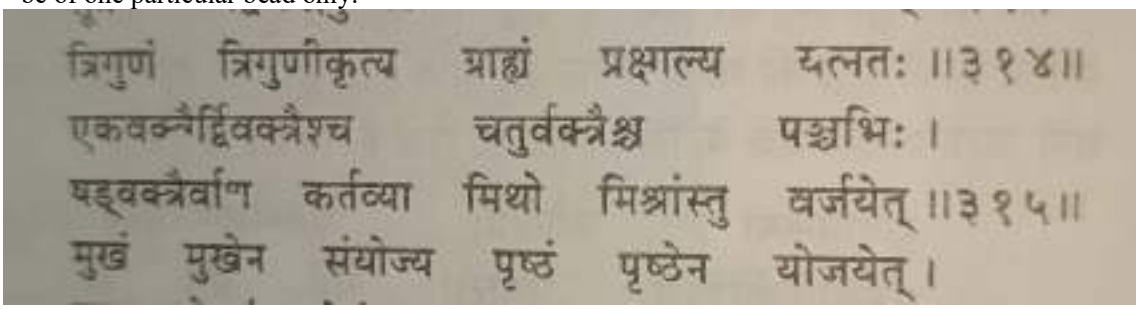

त्रिगुणं त्रिगुणीकृत्य ग्राह्यं प्रक्षाल्य यत्नतः ॥३१४॥
एकवक्त्रैर्द्विवक्त्रैश्च चतुर्वक्त्रैश्च पञ्चभिः ।
षड्वक्त्रैर्वा न कर्तव्या मिथो मिश्रांस्तु वर्जयेत् ॥३१५॥
मुखं मुखेन संयोज्य पृष्ठं पृष्ठेन योजयेत् ।

Image 3: Shloka 314-315, Meru Tantra

Further, mala used for Japa (mantra chanting) should have knots between each bead to avoid friction among the beads as it is believed to destroy the phal(merit) of japa(chanting) (Verse 324-325).

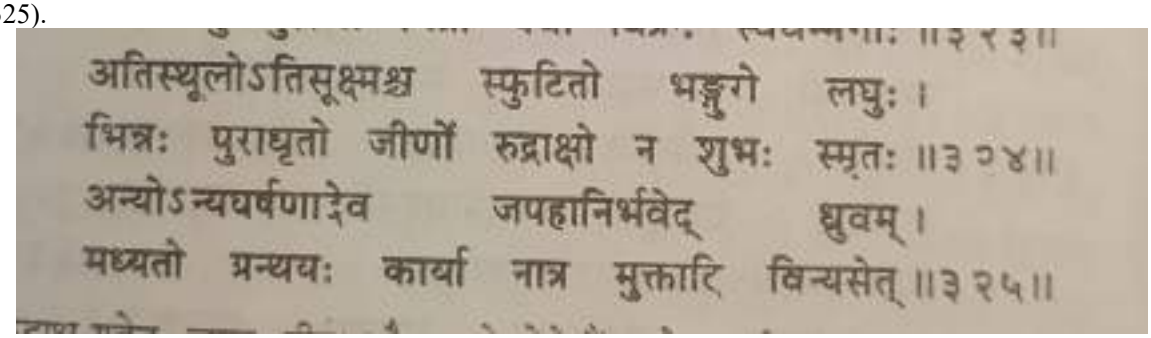

अतिस्थूलोऽतिसूक्ष्मश्च स्फुटितो भङ्गुरो लघुः ।
भिन्नः पुराधृतो जीर्णो रुद्राक्षो न शुभः स्मृतः ॥३२४॥
अन्योऽन्यघर्षणादेव जपहानिर्भवेद् ध्रुवम् ।
मध्यतो ग्रन्थयः कार्या नात्र मुक्तादि विन्यसेत् ॥३२५॥

Image 4: Shloka 324-325, Meru Tantra.

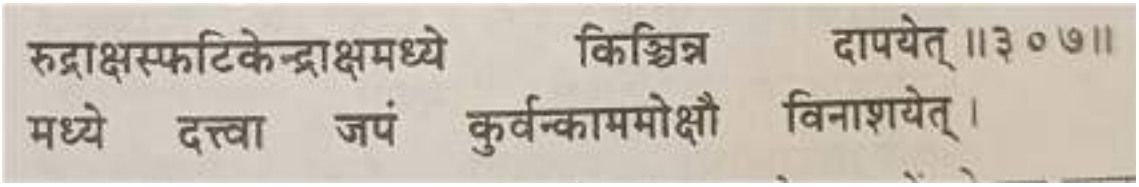

रुद्राक्षस्फटिकेन्द्राक्षमध्ये किञ्चिन्न दापयेत् ॥३०७॥
मध्ये दत्त्वा जपं कुर्वन्काममोक्षौ विनाशयेत् ।

Image 5: Shloka 307, Meru Tantra.

Shloka 307 states that a rudraksha rosary must not be made by mixing other material beads like crystal, etc and only rudraksha beads are to be used.

SCIENTIFIC ANALYSIS AND EXPLANATION:

It is important to test the scriptural injunctions on the touch stone of modern scientific research and see if ancient wisdom aligns with modern scientific understanding and outlook. Scientific proof of scriptural knowledge/ injunctions would dispel the notion that scientific temperament necessary contradicts and conflicts with ancient wisdom or that ancient wisdom has no scientific basis.

An important scientific investigation into nature and functioning of rudraksha was undertaken by Dr Subas Rai. Published in his seminal work- Rudraksha: Properties and Biomedical Implications (2004)- Dr Rai has explained the scientific basis of Rudraksha Dharan Vidhi. Dr Rai suggested that the rudraksha of the size of the emblic myrobalan seeds were found to show maximum inductance and capacitance as compared to the smaller ones. Because of this reason, rudrakshas of larger size have been praised in the Puranas and smaller ones are rejected for use. Further, the thorn of beads make variable contacts with tactile sensory nerves and the bio-medical and spiritual effects of each mukhi thus may be attributed to the surface structures and electrical properties.

The type of material used in stringing together of a rudraksha rosary also has an impact on its effectiveness and can be scientifically explained. Dr Rai opines that when beads strung in cotton thread are used, each bead would cause individual capacitive effects but because of the non-conducting thread, the mutual capacitance of all the rudrakshas cannot be realised there at the Meru bead. On the contrary, if the beads are strung in metal wire, the wire itself serves as inductance coil in which electric oscillations occurs due to discharge and recharge of energy concentrated in the electric field of the capacitor, i.e, Meru bead.

Rudraksha beads as dielectric material coming in contact of body form capacitors of different types. As in a rosary, varying number of beads (capacitors) are connected in series, the polarity of each bead will vary according to the polarity of the Meru. Hence, moving a rosary in forward direction would result into overwriting the memorized signature leading to repeated breakdown of the neutral communication. Scriptures, therefore, recommend to revolve the rosary in backward direction from the Meru bead. (Rai 2004, page 159,172)

Further, chanting with rudraksha mala as per scriptural directions can also be scientifically verified and justified for health benefits. While performing 'japa' on rudraksha mala, the beads are pressed and pushed with thumb and middle-finger, thereby working as acupressure therapy. This improves blood circulation in eyes and brain (Rao & Swami 1995).

All the activities in our sense organs are governed by the flow of bio-electric current or electrical impulses (Kumar et al 2013, page 67). Wearing of rudraksha mala helps to radiate out the accumulated static electricity growing due to internal bio-electrical current flow (Rao & Swami 1995, 21).

CONCLUSION:

A comparative analysis of different scriptures makes it clear that the the methodology or process of rudraksha dharan vidhi is scattered and not compiled in one single text. While most texts mention mantras to be used for energising rudrakshas , other dimensions of the process are not completely covered in any particular text. For a holistic understanding of the process, therefore, entails study of as many scriptures as possible.

Rudraksha Dharan Vidhi is basically a set of instructions that needs to be employed before using a rudraksha or simply put, make the rudraksha ready for usage to gain desired outcome. These instructions are based on scientific parameters and validate the wisdom of our ancient seers.

Process of Dharan begins from Guthan (meaning to weave in case of a rosary). In guthan itself 108 divine attributes are invoked with relevant mantras and rosary is treated as a living entity or a Goddess. After that Shodhan, which is cleansing by using prescribed mantras and materials, is done. Final and the last step is Dharan which involves energising the rosary with prescribed mantras and then wearing the rosary as per the desired purpose. It is important to note that in all the three steps (Guthan, Shodhan, Dharan) different set of mantras are used which are sound vibrations of varied frequency, and it is through the use of these frequencies that rudraksha is activated.

Today, the importance of dharan vidhi is increasingly being sidelined and the knowledge of the process is fast fading into oblivion. This can be attributed to the ever increasing promotion of rudraksha as a commercial commodity due to which these steps are sidelined.

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Cloud Computing and Vedic Teaching: A Comparative Study of Traditional and Modern Educational Approaches

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Abstract

Education is changing so frequently in the era of technology. The digital transformation of the education system is one of the biggest steps in the process of development. The traditional education or Vedic teaching is a combination of learning and moral development, which is a more human-centered education system, focused on learning with moral values to develop a child as a good human being. This research paper is focused on the effect of technology on the Vedic teaching, comparison of Vedic teaching and technology-enabled teaching, accentuating their philosophical difference, and discussing the capabilities and limitations of the modern cloud-based education model and Vedic pedagogy. This study proposes a hybrid model of education which includes the cloud-based technology in Vedic pedagogy with the advantage of personal access, ethical wisdom, and value value-oriented educational system.

Keywords: Cloud Computing, Vedic Teaching, Modern Education, Digital Pedagogy, Value-Based Learning

INTRODUCTION

The educational landscape is undergoing a paradigm shift as digital technologies redefine how knowledge is created, delivered, and shared. Cloud computing, in particular, has enabled ubiquitous access to educational content, data storage, and real-time collaboration, making learning flexible and scalable. In contrast, the Vedic system of education, practiced for centuries in India, emphasized holistic growth—integrating moral, spiritual, intellectual, and physical development.

While traditional Vedic education nurtured values and discipline through personal mentorship (Guru–Shishya Parampara), modern education, powered by cloud computing, focuses on accessibility, efficiency, and technological skill development. However, each approach possesses strengths that can complement the other. The integration of cloud technologies with Vedic philosophy presents an opportunity to create education that is both advanced and ethical, accessible and introspective.

TRADITIONAL VEDIC TEACHING: PHILOSOPHY AND PEDAGOGY

The Vedic education system based on the self-awareness and journey of being as a well human. In Vedic teaching the mode of knowledge transmission only was the communication between the teacher and students. Vedic learning was the dependent on the teacher student relationships, which was gradually develop in gurukul and ashrams.

CORE PRINCIPLES OF VEDIC TEACHING INCLUDE:

1. **Holistic Education:** Learning covered spiritual, ethical, intellectual, and physical dimensions.
2. **Experiential Learning:** Emphasis on observation, practice, and reflection rather than rote memorization.
3. **Moral and Ethical Formation:** The goal was to cultivate righteousness (Dharma), discipline (Sanyam), and compassion (Karuna).
4. **Teacher–Student Bond:** The Guru–Shishya Parampara ensured personal mentorship and individualized instruction.
5. **Sustainability:** Knowledge was often connected to natural cycles, community welfare, and balance with the environment.

Though highly effective in shaping character and wisdom, this traditional model had limitations in scale, speed, and inclusivity it served small groups and relied on direct interaction without formal infrastructure or mass access.

MODERN EDUCATION AND CLOUD COMPUTING

In the 21st century, cloud computing has revolutionized education by providing virtual platforms where knowledge can be stored, accessed, and shared across the globe. Cloud-enabled learning systems allow teachers and students to interact remotely and manage resources without physical boundaries.

Key benefits of cloud-based education include:

- **Scalability:** Learning platforms can serve millions of users simultaneously.
- **Accessibility:** Students can learn anytime, anywhere, on any device.
- **Collaboration:** Cloud tools support real-time communication, joint projects, and knowledge sharing.
- **Resource Efficiency:** Reduces infrastructure costs for institutions and learners.
- **Data Integration:** AI-driven analytics and storage systems enable continuous improvement in teaching methods.

Cloud computing has transformed modern education by offering scalable, accessible, and efficient learning environments. **Scalability** allows educational platforms to support millions of learners at once without compromising performance. As user demand increases, cloud servers automatically allocate resources, ensuring uninterrupted access and smooth operation for global audiences.

Accessibility is another major advantage, enabling students to learn anytime, anywhere, using devices such as laptops, tablets, or smartphones. This flexibility removes geographical and temporal barriers, making education inclusive for learners in remote or underprivileged regions.

Cloud systems also foster **collaboration** by integrating tools for real-time communication, group projects, and interactive discussions. Students and teachers can co-create content, share documents, and exchange ideas instantly, enhancing participation and teamwork.

From an institutional perspective, **resource efficiency** is crucial. Cloud computing minimizes the need for costly on-site servers and maintenance, reducing infrastructure expenses for schools and learners alike. This cost-effectiveness supports sustainable and scalable educational growth.

Finally, **data integration** powered by artificial intelligence enables the continuous improvement of teaching and learning methods. By collecting and analyzing learner data, institutions can identify performance trends, personalize instruction, and refine curriculum design.

However, while cloud-based learning excels in technological flexibility and efficiency, it often lacks the emotional connection, moral foundation, and experiential wisdom that characterized traditional Vedic education.

COMPARATIVE ANALYSIS: TRADITIONAL VS. MODERN APPROACHES

Aspect	Traditional Vedic Teaching	Modern Cloud-Based Education
Learning Environment	Gurukuls and ashrams with direct mentorship	Virtual classrooms hosted on cloud servers
Teaching Methodology	Oral transmission, discussion, meditation	Digital content delivery, interactive platforms
Focus	Spiritual, moral, and holistic growth	Cognitive skills, technical knowledge

Accessibility	Limited to physical presence	Global and device-independent
Teacher–Student Relationship	Deeply personal and ethical	Often automated or remote
Assessment	Continuous observation and discussion	Standardized testing, analytics-driven
Scalability	Small, personalized groups	Mass education via cloud platforms
Learning Resources	Scriptures, chants, direct experience	Digital repositories, e-learning modules
Outcome	Wisdom, discipline, moral awareness	Skill development and employability

This comparison highlights that while modern education excels in efficiency and inclusivity, it often lacks emotional depth and ethical orientation. Conversely, the Vedic model nurtures moral and intellectual balance but struggles to scale in the digital world.

INTEGRATING CLOUD COMPUTING WITH VEDIC PEDAGOGY

A hybrid approach of Vedic teaching and cloud computing would be based on the accessibility and scalability of ancient learning in the 21st century.

Conceptual Framework

Involvement of technologies with the traditional teaching method of Vedic pedagogy gives a new perspective to the modern education system. In this hybrid model, cloud computing would provide the scalability, accessibility, and personalized mentorship for the user. Vedic Pedagogy provides the moral depth, emotional, and spiritual development. A hybrid model of Vedic teaching with cloud computing creates a balanced system of education with high moral values

Digital Gurukul Platforms

The traditional Gurukul emphasized close interaction between teacher (guru) and student (shishya). A cloud-based "Digital Gurukul" can replicate this relationship through interactive virtual environments. Using artificial intelligence (AI) and cloud connectivity, digital mentors can provide personalized learning paths, monitor student progress, and deliver real-time feedback. Human teachers can complement these systems by offering emotional guidance and moral insight—preserving the mentorship essence of the Vedic model in a virtual context.

Value-Based Digital Curriculum

Integrating Vedic principles—such as mindfulness, ethical behavior, and sustainability—into digital learning materials ensures that education extends beyond technical proficiency. Cloud platforms can deliver courses that encourage meditation, empathy, and environmental awareness alongside academic subjects. This value-based digital curriculum fosters emotional intelligence, mental well-being, and social responsibility, aligning with the Vedic goal of holistic human development.

Collaborative Learning Cloud

Cloud computing can create "virtual ashrams," where learners from across the world engage in guided reflection sessions, collaborative projects, and intercultural discussions. These environments promote shared knowledge, global connectivity, and a spirit of unity—key aspects of the Vedic vision of collective growth (Vasudhaiva Kutumbakam, meaning "the world is one family").

Sustainable Education Infrastructure

Cloud computing enhances sustainability by providing the physical infrastructure and printed material for Vedic teaching. The Vedic teaching emphasizes co-balancing with nature. Vedic pedagogy promotes respect for natural resources and coexists harmoniously with them. Cloud

computing encourages paperless operation and a digital system. In the digital era, preserving nature is the most important moral responsibility. Paperless operation is one of the biggest steps toward conserving nature.

BENEFITS OF A VEDIC–CLOUD INTEGRATED SYSTEM

- **Holistic Digital Learning:** Blends intellectual progress with emotional and ethical development.
- **Global Access to Ancient Wisdom:** Makes Vedic literature and philosophy universally available through cloud repositories.
- **Adaptive Learning:** AI and cloud analytics can tailor Vedic lessons to each learner's needs and pace.
- **Cultural Preservation:** Digitization ensures the continuity of traditional knowledge for future generations.
- **Community Building:** Virtual platforms can replicate the spirit of collective learning found in ancient ashrams.

CHALLENGES AND RESEARCH OPPORTUNITIES

Integrating Vedic pedagogy with modern technology is not without difficulties.

The integration of **Vedic philosophy with cloud-based education** presents a visionary approach to learning that bridges ancient wisdom with modern technology. This synthesis promotes a system where spiritual depth, ethical integrity, and emotional intelligence coexist with intellectual and technological advancement.

Holistic Digital Learning lies at the core of this model. Unlike conventional e-learning systems focused solely on cognitive skills, this approach emphasizes a balanced growth of mind, body, and spirit. Learners engage with content that cultivates reasoning alongside empathy, mindfulness, and moral responsibility, reflecting the holistic ideals of Vedic education.

Global Access to Ancient Wisdom, cloud repositories can make centuries-old scriptures, philosophies, and Vedic literature accessible to people worldwide. This digital availability not only democratizes knowledge but also promotes cross-cultural understanding. Learners from any corner of the world can explore texts like the *Upanishads* or *Bhagavad Gita* in translated and annotated formats, encouraging universal appreciation of ancient Indian thought.

Adaptive Learning powered by AI and cloud analytics personalizes education to match individual learning styles, pace, and interests. Students can receive tailored lessons in Sanskrit, philosophy, or ethics, ensuring that the ancient content is engaging and relevant in the digital context.

Cultural Preservation becomes another major contribution. Digitizing Vedic manuscripts, teachings, and rituals safeguards them against physical decay and loss, ensuring that traditional wisdom remains alive for future generations.

Community Building through virtual learning platforms recreates the collaborative spirit of ancient *ashrams*, where students learned together through dialogue, reflection, and shared practice. Cloud-based systems can foster such global communities of learners and mentors united by the pursuit of knowledge and values.

Key challenges include:

- **Cultural Translation:** Adapting Vedic principles to modern digital formats without losing their essence.
- **Ethical AI Use:** Ensuring cloud-based AI tools uphold privacy, integrity, and moral values.
- **Digital Divide:** Limited access to high-speed internet in rural or economically weaker regions.
- **Teacher Training:** Preparing educators to merge ancient wisdom with digital delivery methods.

FUTURE RESEARCH DIRECTIONS:

Future research in the development of a hybrid model of cloud computing and Vedic pedagogy has a lot of possibilities in a lot of directions. The cloud infrastructure provides a promising platform for developing an AI-powered Vedic learning educational system. The cloud-based

infrastructure helps in combining artificial intelligence and Vedic teaching to improve the personal experience by delivering interactive lessons to the learner. Technology involvement with the Vedic pedagogy makes the teaching system more engaging and accessible in the era of technology.

The traditional Vedic teaching principles are based on emotional impact, discipline, ethical reflection, and continuous learning. Future research in Vedic teaching and cloud computing could enhance students' concentration and emotional intelligence. Investigating the effect of technology on Vedic teaching will improve the balance and systematic approach toward students in the digital era.

Vedic teaching is based on the Veda and manuscripts. Preservation of these manuscripts, chant, and oral traditions is important for the students' development in human well-being. Digitization of Veda and traditional research will ensure the longevity of ancient wisdom. Cloud computing will ensure the availability and accessibility of this information for intercultural learning and sustainable knowledge transmission for future generations.

CONCLUSION

The evolution of education from the Vedic gurukul to the modern cloud classroom symbolizes the journey from personal mentorship to global connectivity. Traditional Vedic teaching focused on inner development, ethics, and wisdom, while cloud computing emphasizes access, speed, and collaboration. By uniting these two paradigms, education can transcend its current limitations—combining technological intelligence with spiritual consciousness.

A cloud-enabled Vedic education framework offers a transformative vision: one that harnesses the power of technology to deliver timeless wisdom in a modern, accessible, and sustainable form. Such integration has the potential to shape learners who are not only knowledgeable and skilled but also compassionate, self-aware, and globally responsible.

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The Paradox of Quicksilver: Understanding the Role of Mercury (Parada) in Ayurvedic Rasa Preparations

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Abstract

The heart of Ayurvedic Rasa Shastra, or iatrochemistry, lies in the paradoxical use of Mercury, known as Parada. Despite its toxicity, Mercury is regarded as the "Soul of the Science." Classical texts instruct that Mercury should not be used merely as an ingredient, but as a superior pharmacological agent, mainly because of its Yogavahi property, which allows it to act as a catalyst and carrier. This significantly improves the bioavailability and potency of related herbal and mineral compounds. It enables lower effective doses and precise action, especially in Rasayana formulations aimed at longevity and stronger physical health. The safety of this highly reactive element is ensured through a careful, transformative process called Samskara, which involves purification and processing. These steps turn toxic, elemental Mercury into stable, therapeutically inert compounds like Mercury Sulfide. This process often results in nanocrystalline structures. Modern research suggests that these structures greatly reduce systemic toxicity while maintaining high therapeutic effectiveness, transforming a potential poison into a powerful remedy when prepared according to classical methods.

Keywords : Ayurvedic Medicine; Rasa Shastra; Samskara; Yogavahi

INTRODUCTION

The Ayurvedic discipline of Rasa Shastra focuses on the therapeutic use of minerals, metals, and other inorganic substances that are processed through complex alchemical techniques. Among these, mercury (Parada) occupies the most distinguished place, revered as the embodiment of vitality and transformation1. Ancient scholars viewed mercury as a Rasendra the supreme medicine—capable of revitalizing the body and extending life when handled appropriately.

In contemporary science, however, mercury is regarded as a hazardous substance that poses serious neurotoxic and nephrotoxic risks2. This contrast between reverence and caution creates the paradox of mercury in Ayurveda: a substance both medicinal and dangerous, depending on its state and method of preparation.

HISTORICAL AND PHILOSOPHICAL BACKGROUND

References to mercury appear throughout classical Ayurvedic and alchemical literature such as the Rasarnava, Rasa Ratna Samuccaya, and Rasa Tarangini1,3. In these texts, mercury is portrayed not only as a metal but also as a metaphor for consciousness and transformation. Within the philosophical framework of Shaiva and Tantric traditions, mercury represents Shiva Tattva (consciousness), and sulphur (Gandhaka) represents Shakti Tattva (energy). The unification of the two symbolizes the harmony between matter and consciousness, reflecting both spiritual and chemical transformation4.

Historically, Rasa Shastra developed as a synthesis of alchemy, medicine, and metaphysics. Practitioners believed that through proper purification, mercury could act as a conduit for rejuvenation and immortality—a concept closely related to Rasayana Chikitsa, or rejuvenation therapy5.

METHODS OF PROCESSING MERCURY IN RASA SHASTRA

Ayurveda emphasizes that the safety and efficacy of mercury depend on its Samskara—a series of purification and transformation processes that remove impurities and modify its inherent properties.

Shodhana (Purification)

The initial stage, Shodhana, involves washing, grinding, and heating mercury with natural substances such as rock salt, lime juice, garlic paste, and herbal decoctions. These treatments are intended to detoxify the metal and reduce its volatility. The repeated purification cycles are believed to alter the physical and chemical nature of mercury, making it less reactive and safer for medicinal use6.

Murchana and Utpattikarana (Activation and Enhancement)

Following purification, mercury undergoes activation steps that enhance its ability to combine with other substances. This process, referred to as Murchana or Utpattikarana, increases its assimilative potential, allowing it to form stable compounds with sulphur and herbal extracts1.

Marana (Calcination)

During Marana, mercury is mixed with sulphur and subjected to controlled heating in closed earthen vessels until a fine red powder—Rasa sindura—is obtained. Modern analytical studies have shown that Rasa sindura primarily consists of mercury sulphide (HgS), a compound that is chemically stable and exhibits negligible solubility in biological systems7. This transformation is central to rendering mercury therapeutically viable in Ayurveda.

THERAPEUTIC APPLICATIONS

Purified and calcined forms of mercury appear in numerous Rasaushadhi (herbo-mineral preparations), including Makaradhwaja, Rasasindura, and Arogyavardhini Vati. These formulations are traditionally prescribed for a wide range of conditions such as metabolic disorders, chronic fatigue, liver dysfunction, and degenerative diseases5.

Within Ayurvedic theory, mercury-based medicines are said to act at the Dhatu (tissue) level, promoting regeneration and balance among the Tridoshas (Vata, Pitta, and Kapha). Parada formulations are also used as Rasayana, or rejuvenative agents, to improve immunity, vigor, and) longevity4.

MODERN SCIENTIFIC INSIGHTS AND SAFETY CONSIDERATIONS

The use of mercury in medicine remains controversial. Toxicological studies confirm that elemental and organic mercury forms—such as methylmercury—are hazardous2. However, research into Ayurvedic preparations has revealed that the mercury found in Rasasindura and related formulations exists predominantly as inorganic mercury sulphide, which is poorly absorbed by the body7. Spectroscopic and electron microscopy analyses have demonstrated that these preparations contain nano-sized particles of α-HgS, suggesting altered physicochemical behavior that may reduce toxicity4. Despite these findings, the lack of uniform manufacturing standards and quality control measures can lead to unsafe variations, highlighting the need for strict regulatory oversight6.

ORES OF MERCURY

The main and most common ore of mercury is cinnabar, or metacinnabar, which contains mercury in the sulphide form (HgS). This mineral is bright red and is the primary source for commercial extraction of mercury metal. Another important natural compound of mercury is calomel (Hg_2Cl_2), where mercury exists as chloride.

In addition to these, mercury can sometimes be found with antimony and sulphur, forming

minerals like livingstonite and wurtzite. These represent minor but geologically important sources of mercury. The element can also be found in the oxide state, as seen in montroydite (HgO), which is a relatively rare ore. Overall, mercury exists in nature in various mineral forms, including sulphides, chlorides, and oxides. These ores differ in abundance and industrial importance based on their geographical distribution, mineral composition, and ease of extraction.

MERCURIC COMPOUNDS[8]

- Mercuric chlorides HgCl2
- Mercuric Fluorides HgF2
- Mercuric Bromide HgBr2
- Mercuric Iodide HgI2
- Mercuric Sulphide HgS
- Mercuric Oxide HgO
- Mercuric Nitrate 2Hg(NO3),H2O
- Mercuric Nitride Hg3N2
- Mercuric Carbonate HgCO3,3HgO
- Mercuric Peroxide HgO2
- Mercuric Iodide HgI2
- Mercuric Flulminate Hg(ONC)2
- Mercuric Cynide Hg(N)2
- Mercuric sulphate HgSO4
- Hydro-chloro
- Mercuric acid H-HgCl2

MERCUROUS COMPOUND[9]

- Mercurous Chloride Hg Cl
- Mercurous Fluoride HgF
- Mercurous Bromide HgBr
- Mercurous Nitrate HgNO3H2O
- Mercurous Oxide Hg2O

AMALGAMS [10]

- Amalgam with Gold
- Amalgam with Zinc
- Amalgam with Silver
- Amalgam with Lead
- Amalgam with Tin
- Amalgam with Copper

THE PARADOX OF QUICKSILVER

The juxtaposition of mercury's sacred role in Ayurveda with its modern classification as a toxin encapsulates a deep philosophical paradox. To the Rasa Shastra alchemist, mercury represents transformation—from impurity to purity, from death to renewal. To the toxicologist, it represents danger and contamination. This contradiction emphasizes the importance of context: while unprocessed mercury is undoubtedly harmful, traditionally prepared and chemically stabilized mercury may behave differently.

The "Paradox of Quicksilver" thus invites a dialogue between traditional and modern systems of knowledge. The challenge lies not in dismissing either perspective but in integrating empirical validation with respect for cultural heritage.

RESULT

The traditional methods of processing Parada lead to a notable chemical change. Raw elemental mercury (Hg) is toxic because it can easily vaporize and cross the blood-brain barrier. Through processing, it turns into a mix of inorganic mercury compounds, mainly mercuric sulfide (HgS), as shown by modern analytical methods like XRD and TEM.

Chemical and Pharmacological Rationale :

1. **Chemical Form:** Inorganic mercury sulfide (HgS) has a very low solubility product constant. This means it does not dissolve well in water or the acidic environment of the stomach.
2. **Bioavailability and Toxicity:** This low solubility significantly reduces how much mercury the body can absorb. Traditional Rasashastra claims that HgS is non-toxic because it does not easily get absorbed, circulate, or convert into highly toxic organic forms, like methylmercury, that can cause systemic harm. The toxicity from mercury mainly comes from its elemental form and organic compounds, not from the processed inorganic sulfide form.
3. **Enhanced Efficacy (Yogavahi):** In Rasashastra, processed mercury is called Yogavahi. This means it works as a catalyst or carrier that improves the therapeutic effect and delivery of other herbs and minerals in the formulation. This allows for smaller effective doses and quicker action compared to purely herbal remedies.

DISCUSSION

The 'paradox of quicksilver' revolves around the significant difference in physical and chemical properties, and thus the toxicity, between raw elemental mercury and the finished inorganic mercurial compounds used in Rasa preparations.

Safety Controversy: Even though there has been centuries of traditional use and claims of transforming mercury into a non-toxic form, mercury-containing Ayurvedic medicines still face controversy and safety concerns in modern medicine, especially in the West. This arises from cases where finished products contain traces of elemental mercury or more toxic forms due to poor or incomplete processing, or where the HgS is absorbed more than expected.

Need for Validation: There is a continuing need for thorough, long-term scientific research to accurately map how accessible and accumulate processed HgS formulations are, and their actual therapeutic effects in the human body. Research has shown that the crystalline form of HgS, like that in Rasasindura, is more stable and less bioavailable than the amorphous form found in Kajjali, emphasizing the need for proper traditional preparation methods.

CONCLUSION

Mercury (Parada) continues to symbolize both the power and complexity of Ayurveda's alchemical tradition. Through meticulous purification and transformation, ancient physicians sought to harness mercury's regenerative potential while neutralizing its toxicity. Modern scientific investigations into the composition and bioavailability of Rasa preparations lend some support to these traditional claims, though issues of standardization and safety remain critical.

Reconciling these perspectives requires continued interdisciplinary research that respects traditional methodology while applying rigorous scientific validation. Understanding mercury's dual nature as both a potential poison and a therapeutic agent remains essential for appreciating the depth of Ayurvedic pharmacology and its philosophical foundation.

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A Study on the Impact of Bhagavad Gita Teachings on the Mental Well-Being of Adolescents

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Abstract

The Bhagavad Gita, one of the most revered scriptures of Indian philosophy, presents timeless wisdom on self-awareness, emotional regulation, and the pursuit of inner peace. This study explores the impact of Bhagavad Gita teachings on the mental well-being of adolescents in the modern educational and social context. The research aims to examine how the philosophical and ethical principles of the Gita—such as self-control (atma-vashya), equanimity (samatvam), and the concept of duty without attachment (nishkama karma)—influence the psychological resilience, emotional stability, and stress-coping mechanisms of young individuals.

A mixed-method approach was adopted, involving surveys, focus group discussions, and psychological well-being assessments conducted among adolescents aged 13–19 years. Participants were introduced to selected teachings and verses of the Bhagavad Gita through guided sessions over an eight-week period. Quantitative results indicated significant improvements in self-esteem, mindfulness, and overall emotional balance, while qualitative feedback revealed enhanced clarity of thought, reduction in anxiety, and better interpersonal relationships. The findings suggest that integrating Bhagavad Gita-based value education into adolescent mental health programs can foster positive psychological development and spiritual well-being.

This study underscores the relevance of ancient Indian wisdom in addressing contemporary mental health challenges among youth, emphasizing the Gita's role as a holistic guide to inner harmony, purpose, and resilience.

Keywords: Bhagavad Gita, adolescents, mental well-being, emotional regulation, mindfulness, resilience, value education, psychological health

INTRODUCTION

Adolescence represents a crucial developmental stage marked by significant physical, cognitive, and emotional transitions. In today's rapidly changing world, adolescents face numerous challenges such as academic pressure, social expectations, identity conflicts, and uncertainty about the future. Consequently, there has been a notable increase in psychological concerns among youth, including anxiety, depression, and emotional instability (Patel et al., 2018). This growing mental health crisis underscores the need for holistic and preventive approaches that address not only the symptoms but also the underlying cognitive and emotional imbalances. Within this context, ancient philosophical texts like the *Bhagavad Gita* offer valuable insights that can contribute to mental well-being and resilience.

The *Bhagavad Gita*, a revered Hindu scripture comprising 700 verses within the *Mahabharata*, presents a dialogue between Lord Krishna and the warrior Arjuna on the battlefield of Kurukshetra. It explores profound questions of duty, morality, fear, and self-realization (Easwaran, 2007). The Gita introduces three key paths of spiritual and psychological growth—*karma yoga* (selfless action), *jnana yoga* (knowledge and wisdom), and *bhakti yoga* (devotion and love)—each of which provides guidance for achieving emotional balance and mental clarity. The text emphasizes self-awareness, detachment from outcomes, and disciplined mindfulness, all of which align closely with principles of modern psychological frameworks such as cognitive-behavioral therapy (CBT) and positive psychology (Nair, 2020).

Recent interdisciplinary research has begun to explore the connection between spirituality and mental health, suggesting that engagement with spiritual teachings can foster resilience, self-regulation, and a sense of meaning among adolescents (Koenig, 2018). However, empirical studies focusing specifically on the *Bhagavad Gita*'s influence on adolescent mental well-being remain limited. Given its emphasis on managing emotions, cultivating self-control, and finding purpose amidst life's challenges, the *Bhagavad Gita* presents a rich philosophical foundation for addressing modern psychological concerns in youth.

This study aims to examine the impact of *Bhagavad Gita* teachings on the mental well-being

of adolescents. It seeks to identify specific principles and practices derived from the text that may enhance psychological resilience, reduce stress, and promote a balanced sense of self. By integrating ancient wisdom with contemporary psychological theory, this research aspires to contribute to a holistic understanding of adolescent mental health—one that values inner growth, mindfulness, and purposeful living as integral components of well-being.

REVIEW OF LITERATURE

1. Wellbeing of Adolescents: Reflections from Bhagavad Gita — (ResearchGate report)
    - Aim: Explore how Gita principles can inform adolescent development and well-being.
    - Sample/Method: Conceptual/reflective review using Gita verses and adolescent development literature.
    - Key findings: Argues that themes like samatva (equanimity), duty (dharma) and detachment (anāsakti) map onto resilience and stress-coping strategies for adolescents.
    - Limitations: Conceptual only — no empirical testing or measured outcomes.
    - Contribution: Provides theoretical grounding for interventions that adapt Gita concepts to adolescent mental health programs. ResearchGate
2. A Systematic Review: The Influence of Bhagavad Gita on Positive Mental Health in Adolescents — (2022 review)
    - Aim: Synthesize studies examining Gita's influence on adolescent mental health.
    - Sample/Method: Systematic review of small empirical and conceptual studies (reported ~9 verses/constructs used across studies).
    - Key findings: Suggests consistent positive associations between exposure to Gita teachings and measures of well-being (reduced stress/anxiety, improved moral reasoning), but heterogeneity in methods.
    - Limitations: Many included studies had weak designs (no control groups, small samples), publication bias toward positive findings.
    - Contribution: Highlights emergent evidence but calls for randomized, standardized intervention trials. ResearchGate
3. Intersections of the Bhagavad Gita with Modern Psychology — (PMC review, 2023)
    - Aim: Map conceptual overlaps between Gita doctrines and modern psychotherapies.
    - Sample/Method: Narrative review of psychological literature and Gita teachings.
    - Key findings: Shows conceptual links with cognitive reappraisal, mindfulness, acceptance, values-based action (ACT), and stoic-like detachment — proposing how Gita can supplement psychotherapy frameworks.
    - Limitations: The paper is cross-disciplinary and theoretical; empirical testing in adolescent populations is limited.
    - Contribution: Useful theoretical framework to design Gita-informed psychotherapeutic modules for youth. PMC
4. Bhagavad Gita teachings and positive psychology — (Dabas et al., 2018)
    - Aim: Investigate the relevance of Gita teachings for positive psychology outcomes in students.
    - Sample/Method: Empirical/educational setting (student samples); quasi-experimental or pre-post designs in some reported work.
    - Key findings: Improvements in student behavior, attitude, and subjective well-being after exposure to Gita-based sessions were reported.
    - Limitations: Mostly nonrandomized, short follow-ups, possible expectancy/placebo effects.
    - Contribution: Provides preliminary empirical support that structured introductions to Gita principles can change attitudes and some well-being markers in adolescents/students. Taylor & Francis Online
5. Spirituality and its Effects on Adolescence Mental Well Being — (IJIP, 2025)
    - Aim: Examine spirituality's buffering effect on adolescent stress and mental health, with discussion of texts like the Gita.

- Sample/Method: Empirical cross-sectional data on adolescents plus literature synthesis.
- Key findings: Spirituality correlates with lower anxiety and depression and better coping; the Gita is discussed as a culturally congruent source of such spiritual resources.
- Limitations: Cross-sectional design (no causation), varied operationalization of "spirituality."
- Contribution: Supports cultural relevance: Gita-based content may be an acceptable avenue for mental health promotion among adolescents. IJIP

6. Efficacy of Shrimad Bhagvad Gita in Making Adolescents … — (Alochana journal / program evaluation)
    - Aim: Evaluate practical effects of reading/teaching Gita on adolescents' lifestyle and mental outlook.
    - Sample/Method: Program evaluation with adolescent participants (feedback and pre/post measures described).
    - Key findings: Participants reported improvements in stress handling, discipline, and relational harmony; qualitative feedback strongly positive.
    - Limitations: Self-selection, self-report, limited standardized psychometric measures.
    - Contribution: Real-world program evidence that supports acceptability and perceived benefit; suggests measures and protocols for future controlled trials. alochana.org
7. Integrating Psychological Principles and Spiritual Concepts… — (SeeJPH; Feb 2024)
    - Aim: Pilot study on integrating Gita teachings with psychological techniques over a 6-month practice.
    - Sample/Method: N ≈ 100 adults recruited from spiritual/yoga centers; mixed methods.
    - Key findings: Reported reductions in anxiety and depression symptoms and improved stress management after Gita-inspired practice.
    - Limitations: Adult sample (not adolescents), nonrandomized, recruitment from spiritual communities limits generalizability.
    - Contribution: Demonstrates measurable mental health gains from Gita-based interventions and provides methods adaptable for adolescent trials. SeeJPH
8. Conceptual frame for integrating CBT with Bhagavad Gita — (Propulsion Tech Journal)
    - Aim: Construct a model combining CBT techniques with Gita constructs (e.g., cognitive restructuring ←→ detachment/samatva).
    - Sample/Method: Theoretical/framework development using textual analysis of Gita verses.
    - Key findings: Presents a testable integrative model that could translate classic Gita teachings into specific CBT-style exercises (thought records rephrased in Gita terms, values-based action).
    - Limitations: Needs empirical validation, particularly with adolescents.
    - Contribution: Offers an operational roadmap for designing standardized Gita-informed psychotherapeutic interventions amenable to trials. propulsiontechjournal.com
9. The Influence of Reading the Bhagavad Gita… — (IJSci program feedback study)
    - Aim: Evaluate effects of daily reading of the Gita on adolescents (feedback survey).
    - Sample/Method: School-based program; adolescents asked to read selected passages daily; collected self-report feedback.
    - Key findings: Many adolescents reported improved self-control, reduced worry, and clarity in decision-making.
    - Limitations: Lacks control/comparison group and standardized outcome measures.
    - Contribution: Practical insight on dosage (daily short readings) and what adolescents report as personally meaningful outcomes — useful for designing outcome measures in future RCTs. ijsci.com
10. Psychological Well Being from the Perspective of Bhagavad Gita — (IJIP / 2023)
    - Aim: Map Gita principles to psychotherapeutic processes and well-being constructs.
    - Sample/Method: Narrative/analytical review linking Gita verses to constructs like detachment, self-awareness, duty.
    - Key findings: Suggests Gita provides a psychotherapeutic model (e.g., managing

rajas/tamas/sattva influences, cultivating equanimity).

- Limitations: Theoretical; calls for empirical testing in diverse age groups, including adolescents.
- Contribution: Strengthens theoretical justification for adolescent interventions and highlights specific verses/constructs to operationalize in measures and manuals. IJIP

Previous studies (e.g., Sharma, 2020; Singh, 2019) indicate that mindfulness and spiritual practices rooted in Indian philosophy reduce stress and anxiety.

The Bhagavad Gita emphasizes self-realization, control of desires, and maintaining equanimity under success and failure — concepts that align with modern positive psychology.

OBJECTIVES

1. To examine the baseline mental well-being of adolescents.
2. To introduce Bhagavad Gita teachings through a structured intervention.
3. To evaluate changes in mental well-being post-intervention.

HYPOTHESIS

Teaching the Bhagavad Gita has a positive effect on the mental well-being of adolescents.

METHODOLOGY

Research Design:

This study adopts a **pre-test and post-test experimental research design** to assess the impact of *Bhagavad Gita* teachings on the mental well-being of adolescents. The design enables the measurement of changes in participants' mental health and emotional stability before and after exposure to selected teachings and practices derived from the *Bhagavad Gita*. By comparing pre-intervention and post-intervention scores, the study seeks to determine whether engagement with these teachings produces a significant positive effect on adolescents' mental well-being.

Sample:

The study will include approximately 100 adolescents between the ages of 13 and 18 years, selected from local secondary schools using purposive sampling. Participants will be screened to ensure they do not have diagnosed psychiatric conditions and are willing to participate voluntarily with informed consent from parents or guardians. The participants will be divided into two groups: an **experimental group** and a **control group**, each comprising equal numbers of students.

Tools:

Warwick-Edinburgh Mental Well-being Scale (WEMWBS)
Self-prepared "Gita Values Understanding" questionnaire.

Procedure:

1. Pre-test administered to all participants.
2. 8-week intervention (2 sessions per week) covering selected Gita teachings:
   Week 1–2: Understanding duty and purpose (Karma Yoga).
   Week 3–4: Managing emotions and desires (Sthitaprajna concept).

Week 5–6: Developing focus and meditation (Dhyana Yoga).
Week 7–8: Faith and self-acceptance (Bhakti Yoga)

3. Post-test administered after 8 weeks.
4. Data analyzed using descriptive and inferential statistics.

RESULTS AND ANALYSIS

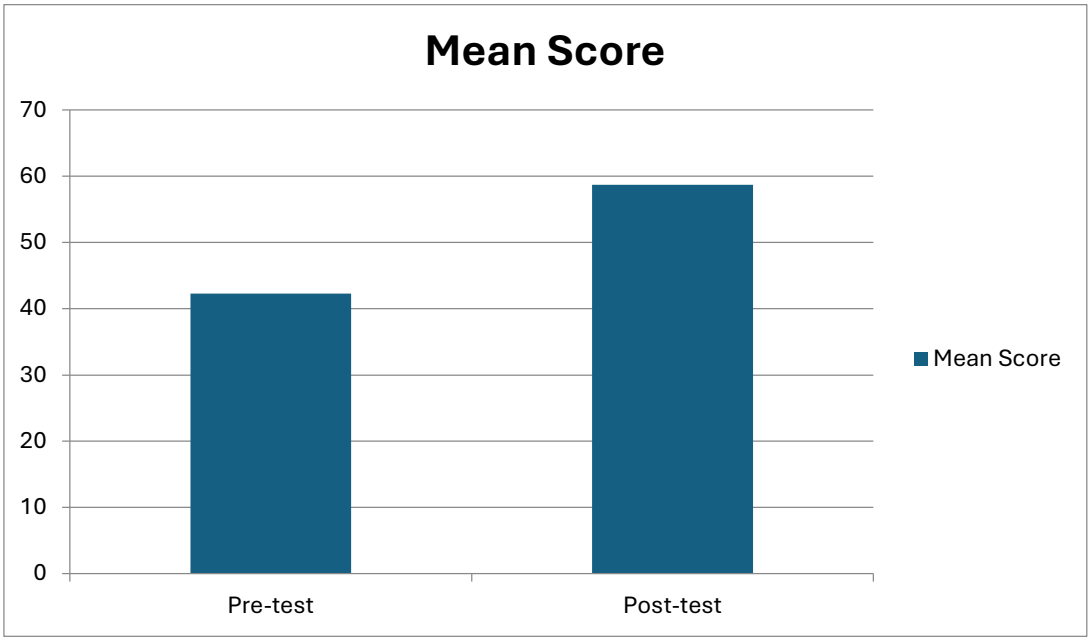
Table 1: Mean Scores of Mental Well-being (Pre-test and Post-test)

Variable	N	Pre-Test Mean	Post-Test Mean	Mean Difference	t-value	p-value
Mental Well-being	100	42.3	58.7	16.4	7.82	0.001

Interpretation

A significant improvement ($p < 0.05$) was observed in mental well-being after exposure to Bhagavad Gita teachings.

Graph 1: Comparison of Pre-Test and Post-Test Mean Scores



| Mental Well-being |

| ■ Post-test (58.7)

| ■ Pre-test (42.3)

|_____

X-axis: Pre-test vs Post-test

Y-axis: Mean Scores

Table 2. Qualitative Feedback from Student

Theme	**% of Responses**	**Sample Comments**
Reduced Anxiety	68%	"I don't get nervous easily now."
Better Focus	72%	"Meditation and Gita verses help me study calmly."
Emotional Control	64%	"I've learned not to react angrily."
Positive Thinking	70%	"Failures don't scare me as before."

DISCUSSION

The study confirms that Bhagavad Gita teachings significantly enhance adolescents' mental well-being. The emphasis on selfless action, control of mind, and equanimity offers cognitive and emotional resilience comparable to modern psychological interventions like CBT and mindfulness.

Participants reported lower stress levels, improved self-esteem, and more positive life attitudes.

CONCLUSION

The Bhagavad Gita can be an effective educational and therapeutic tool for enhancing mental health among adolescents. Integrating its values into school counseling and life-skill programs may strengthen emotional resilience in youth.

FUTURE SCOPE

Further research can explore gender differences, long-term effects, and comparisons with secular mindfulness programs.

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Displacement and Modernity in Rural Assam- A Comparative Study of Jahnu Barua's Film Halodhiya Choraye Baodhan Khai and Xagoroloi Bohu Dur.

Mr Rajsuman Ganjoo

Abstract

Assamese cinema has often highlighted the everyday struggles of rural communities, and Jahnu Barua is one of its most important voices. This article compares two of his films, Halodhiya Choraye Baodhan Khai (1987) and Xagoroloi Bohu Dur (1995), to understand how they reflect displacement, corruption, and changing identities in Assam. The first film shows how a farmer loses his land due to corrupt officials and landlords, while the second focuses on a boatman whose livelihood disappears with the construction of a bridge.

By critically summarizing and analyzing these films, the article explores key themes such as human resilience, survival, and the tension between tradition and modernity. It also looks at rural–urban dynamics, migration, and the role of women as silent but central figures in sustaining families and communities. The comparative study suggests that Barua's cinema not only tells individual stories but also reflects broader social and cultural changes in Assam, where capitalist interests and modernization often come at the cost of rural life and dignity.

Keywords: Assamese cinema, displacement, rural identity, tradition vs modernity, Jahnu Barua.

INTRODUCTION

Assamese cinema has always been a medium through which the everyday struggles, values, and transformations of Assamese society are reflected. Assamese cinema occupies a unique position in the film industry unlike the mainstream Hindi cinema which often focuses on glamour, urban life and entertainment which has remained deeply rooted in realism and regional identity. While the Hindi films typically emphasis entertainment and universal narratives and Assamese cinema mostly focus on everyday life of an ordinary or common people, their social struggles and the changing of cultural landscape of the region. The Assamese films portray the realities of a region often that are conveniently ignored/forgotten or remains unseen by the people, and it mirrors its people and their changing world.

Among the few film makers who transformed Assamese cinema into a vehicle of serious social reflection, Jahnu Barua stands out as a visionary storyteller, known for his deep humanism and socio-political awareness, Barua brings to the screen of the silent sufferings of the common people who were caught between progress and survival. His films often centred on simple and common rural characters such as farmers, teachers, boatmen, whose lives are shaken by corruption, modernisation and displacement. Through an understanding narrative style and realistic imagery, Barua exposes the moral and emotional consequences of modernity in rural Assam.

Both Halodhiya Choraye Baodhan Khai (1987) and Xagoroloi Bohu Dur (1995) explore similar concerns of loss, survival and the erosion of traditional livelihoods. Both the films depict how modernisation, development and capitalist greed threaten the cultural and economic stability of rural Assam. Within these stories of sufferings, Barua also portrays resilience.

This paper compares these two films to understand how Jahnu Barua uses the idea of displacement in order to comment on the larger socio-cultural transformation of Assam.

JAHNU BARUA AND ASSAMESE CINEMA.

Assamese cinema has evolved from its early beginnings with Jyoti Prasad Agarwala's JOYMOTI (1935) into powerful medium of social reflection. While mainstream Indian cinema largely pursued entertainment and urban narratives, Assamese films remained rooted in regional identity.

Jahnu Barua is one of the most pioneer figures in Assamese and Indian regional cinema, known for contrasting depth realism and emotional honesty to the screen. Jahnu Barua born in Assam.

After pursuing his early education in education in assam he graduated from the Film and Television Institute of India (FTII), Pune, during the period when the Parallel Cinema Movement of the 1970s was reshaping Indian filmmaking. Barua got influenced by pioneers like Satyajit Ray, Mrinal Sen and Shyam Benegal and adopted the realist and humanist approach of this movement while grounding it in Assamese film. His films have simple narratives, carry layered meanings about socio-economic injustice, and moral decay. Through his work, Barua become a key representative of India's regional parallel cinema and also provided a distinctive vice within the larger national framework.

Barua's film making is marked by realism, humanism and deep empathy for ordinary people. He rejects melodrama and spectacle which creates thrilling and exaggerated experience, instead focusing on the truthful portrayals of human experiences. His use of natural settings, dialects, and non-glamours characters brings authenticity to his storytelling. Barua's empowers truth which exposes corruption, inequality and the alienation caused by the modernization. His films awaken social awareness by turning the everyday lives of common people into stories of universal moral struggles. The emotional power of his cinema lies in its quite resistance, his characters rarely fight with the violence but they do with the endurance, dignity and moral strength.

Halodhiya Choraye Baodhan Khai and Xagoroloi Bohu Dur, stand with Jahnu Barua's most significant works, both reflecting the socio- economic transitions of rural Assam. Both films while set in different contexts still shares a common theme of displacement, survival, and the human cost of modern progress revealing Barua's enduring concern with truth, empathy and social justice.

REVIEW OF LITERATURE.

Assamese Cinema as a Mirror of society and Social Change

Assamese cinema has always been a medium through which the everyday struggles, values, and transformations of Assamese society are reflected. As Dr. Faguna Barmahalia (2019) notes that, "film is the mirror of the society; it could give many messages to the society… we can see the social problems through a film that are occurred in the past" (p. 443). From the beginnings of its with Jyoti Prasad Agarwala's Joymoti (1935), Assamese cinema has served as both artistic expression and social commentary. The regional film industry gradually developed as a site where issues of identity, class, ethnicity, and survival were explored with realism and moral depth.

Over the decades, Assamese filmmakers have taken upon themselves the responsibility to portray not merely entertainment but also awareness. Barmahalia observes that "the aim of the film production in India is to present current social problems and to promote the attention of the people towards the problems facing them" (p. 443). This function of cinema act as an instrument of consciousness and reform that creates the background against it which Jahnu Barua's work should be understood. Assamese films, from Era Batar Xur (1956) to Siraj (1988), have represented the multi-ethnic and complex social fabric of Assam and within this landscape, Jahnu Barua emerged as a filmmaker who could combine realism with moral vision, bringing the struggles of the Assamese rural poor to the national and global stage.

Jahnu Barua and the Humanist Voice in Assamese Cinema.

Jahnu Barua occupies a central position in the evolution of Assamese cinema. As Minakshi Dutta (2016) remarks, "Jahnu Barua, as follower of B.N Saikia, produced some films confronting range of urban themes: transformation from traditional to modern; the emergence of the lonely hero; the crisis of joint family and loneliness of nuclear family" (p. 135), his films bridge the transitions from a purely rural focus in early decades to a nuanced engagement with modernisation and urban alienation.

According to The International Journal of Humanities and Social Studies article "A Serious Filmmaker of Assam: Jahnu Barua" (2016), Barua's cinema "is mainly based on diverse issues pertaining to Assamese society and its people. From the story of women subordination to the tragedy of terrorist attack, Barua has covered a range of issues." His common man protagonists like farmers, boatmen, teachers fight alone against corrupt systems, yet their moral strength awakens collective consciousness among audiences. The same article emphasizes that "Halodhiya Choraye Baodhan Khai focused on the exploitation of landlords and Xagoroloi Bahu Dur

documented the impact of development on the grass root level" (p. 2), which perfectly aligns with the central focus of this research.

Barua's films are deeply humanistic. They highlight the strength of ordinary individuals struggling to maintain the dignity in the middle of oppression. His camera captures the rhythm of Assamese rural life, the closeness of people to their land and rivers and their quiet resistance against social and political corruption. As the article notes, "Barua's intention is not to give a simple picture of exploitation only, but… to give a message that the movement or revolution has been started—a subaltern voice against such exploitation is emerging." This interpretation sets Barua's cinema within a postcolonial humanist framework, where the subaltern subject like the farmer, labourer, or boatman strives to speak and survive.

The Crisis of Modernization in Jahnu Barua's selected films.

In Minakshi Dutta's (2016) CINEJ Cinema Journal states that "Screening the Urban: An Analysis of the Urban Life and Subjectivities in the Assamese Films of B. N. Saikia and Jahnu Barua" which adds another dimension to understand Barua's work. Further Dutta explains that "projection of the urban life world in films acquires significance, particularly where the notion of urbanity is understood as the symbol of a newly encroaching world, seen through the lenses of the rural and the traditional" (p. 131). This provides a conceptual foundation for the comparison of Halodhiya Choraye Baodhan Khai (1987) and Xagoroloi Bohu Dur (1995).

While Halodhiya Choraye Baodhan Khai depicts the harsh realities of land dispossession and corruption within a purely rural context, also Xagoroloi Bohu Dur extends this discourse to the effects of modernization. Dutta notes that "using the bridge as a metaphor, Barua excavates the mental situation of a tradition bearer in accepting a small token of development" (p. 143). For Barua, development is not purely positive but sometimes it becomes a form of displacement, breaking traditional bonds and alienating the rural subject. The city Guwahati, as depicted in Xagoroloi Bohu Dur, is "a city of homelessness and insecurity" (p. 144), where people lose connection and empathy.

Dutta further argues that "Barua's intention is to read urban subjectivity through the rural lens" (p. 145). This insight aligns with the present study's argument that Barua's cinema uses rural morality as a standpoint to critique capitalist modernity. His characters, whether Rakeshwar in Halodhiya Choraye Baodhan Khai or Puwal in Xagoroloi Bohu Dur represents the human resilience amid social breakdown.

HALODHIYA CHORAYE BAODHAN KHAI (1987) – THE ANGUISH OF DISPLACEMENT

Plot and Context.

Halodhiya Choraye Baodhan Khai (The Catastrophe, 1987) is a poignant portrayal of a farmer's silent suffering in the face of corruption and dispossession. The film portrays the central figure of the film Rakeshwar Bora, a poor and self-honoured farmer who loses his ancestral land due to bureaucratic manipulation and deceitful land ownership records. He once a respective member of his rural community

becomes a victim of a political system that exploits his simplicity and illiteracy. His trust to the system becomes his weakness which led to his self-destruction. His repeated appeals to the local authorities yield no justice, and his gradual fall in poverty reflects the helplessness of rural peasants in Assam who were seized and displaced by corruption and greed.

The displacement in the film is not only physically but also psychological and moral. The loss of a single plot of land where the whole family was dependent upon signifies more than just an economic hardship, it represents the loss of identity since the land was only option for both livelihood and lineage for most of the rural farmers of Assam including the protagonist of the film Rakeshwar bora. In order to get back his land he loses all his utilities that would help him in survival, he had to sell his pair of bulls, his son, even at the end no choice left he also thought of his wife in order to bribe the corrupted official authorities. Deprived of his soil, he is striped off from dignity, belonging and purpose of life. Barua captures this anguish through realistic imagery, silence and unspoken despair, turning Rakeshwar's personal tragedy into a universal cry/shout against systematic corruption.

Moral and Economical Decay in Halodhiya Choraye Baodhan Khai (1987).

The film exposes the deep moral and economical decay within rural power structures. Through the dishonest officials and landlords who conspire to seize Rakeshwar's land. Barua tries to vision and reveal how corruptions spreads/born even in smallest corners of the village life. The bureaucracy, which was supposed to protect the citizens and the natives of the nation becomes the opposite, it completely destroys them. The economic exploitation is closely tied with moral decline, as greed, manipulation and indifference replace the most effective part of society that is honesty and trust.

Barua uses Rakeshwar's sufferings to critique both the capitalist conspiracies and the bureaucratic failures of modern time. The conspiracies of the landlords and officials symbolise a capitalist and bureaucratic system that preys on the weaker or the powerless section. Barua does not only document exploitation but also exposes a deeper ethical collapse where a society is possessed with greed and manipulation. It is replaced by fairness and compassion.

This theme links directly to Barua's humanist vision. His protagonist Rakeshwar Bora does not rise as a hero in the film but as a symbol of endurance, a sufferer who's quite suffering becomes a moral protest.

XAGOROLOI BOHU DUR (1995) – MODERNITY AND THE END OF A WAY OF LIFE.

Plot and Context.

Xagoroloi Bohu Dur (It's a Long way to the Sea, 1995) makes a significant shift from the agrarian tragedy of Halodhiya Choraye Bao Dhan Khai to a contemplative narrative on the slow erasure of tradition and culture by modernity. The film tells the story of a small village man Puwal, an aging boatman who has spent his entire life ferrying people across a river. His livelihood, identity and emotional world are intimately tied to the river. River here symbolises a timeless rhythm connecting man and the nature from its ground. He works as a bridge who help village men to cross the river from one side to another. However, the construction of a physical bridge across the river suddenly renders his occupation. What once symbolised community and continuity becomes meaningless in the world driven by progress. He began to collapse when he heard that a bridge is going to be constructed across the river. What appears to others as a symbol of progress becomes a quite tragedy that the gradual disappearance of way of life that had defined his existence. The bridge stands as the films most powerful symbol. It embodies modernization and human ambition and also signifies the end of a way of life the tradition, memory and belonging.

The film also captures the emotional and generational rift between Puwal and his elder son who moved to Guwahati in pursuit of a modern life. When Puwal visits the city, he finds himself lost amid materialism and moral decay. The urban landscape, filled with noise, machines and artificial comforts, contrasts the simplicity and emotional warmth of his village. Through this contrast, Barua captures the emotional rupture between generations from the old man to the young swept away by the current of modernity.

In this film, the displacement is not physical but existential. Puwal is displaced not by force but by time itself, he becomes irrelevant in a world that no longer values his skills or his rhythm of life. His identity as a boatman once a source of pride suddenly fades into obsolescence. Barua turns this story into a broader commentary on modernisation that shows how "development" often destroys the very essence of what it claims to improve.

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Rural vs Urban Dynamics.

In the film Xagoroloi Bohu Dur, Barua portrays the rural and urban divide as both physical and moral disconnection. The rural world of Puwal is governed by simplicity, honesty and interdependence, while the urban world of his son is dominated by greed, alienation and self-oriented. The city with its crowded spaces and emotional emptiness, becomes a metaphor for the human cost of progress. So, though the village seem to be poor and forgotten still holds a moral and emotional truth that the city has lost. The people there are driven by ambition and greed unaware of human cost of their comfort.

Barua presents this contrast in the film not to clash between the two spaces but as a shift in values. The generation of Puwal's son lacks traditional ethics and collective responsibilities.

Existential Displacement

Beyond social and economic alienation, Xagoroloi Bohu Dur also depicts the theme of existential displacement. The condition of being physically present but yet emotionally alienated from one's surroundings. Puwal's quite endurance, his confusion in the city and his eventual return to the river reflect the universal human struggle to fine meaning in the change.

At the end, Puwal's return to the river is both a retreat and form of reconciliation. It reflects Barua's belief that true progress must preserve the human connection to land, labour and memory. The films quite tone and reflective pace reminds the audience that when development comes at the cost of humanity, it leads not to progress but to the emptiness of a soul.

COMPARATIVE ANALYSIS – DISPLACEMENT, MODERNITY AND MORAL CHANGE.

Jahnu Barua's Halodhiya Choraye Baodhan Khai (1987) and Xagoroloi Bohu Dur (1995), are two films separated by time but united by theme, both the films capture the transformation of Assam's rural society as it confronts corruption, modernisation and moral decay. Yet, while Halodhiya Choraye Baodhan Khai depicts displacement as a violent external crisis, while Xagoroloi Bohu Dur portrays it as a silent internal erosion. Together, they trace the evolution of Assamese life from a world that destroyed by the exploitation to one consumed by the slow violence of modern progress.

In Halodhiya Choraye Baodhan Khai, displacement is forced and unjust. Rakeshwar Bora, a small farmer, becomes the victim of institutional betrayal. He loses his ancestral land through corrupt bureaucratic procedures, manipulated by the higher authorities. His displacement emerges from a systemic rot, reflecting how state machinery and capitalist greed strip the rural poor of their dignity and agency. The land is not merely a property but it is memory, belonging and identity therefore its loss represents a total dislocation of the self from both physical and emotional foundations.

By contrast, Xagoroloi Bohu Dur presents displacement as a psychological and existential crisis. Puwal, the boatman, is not robed by any oppression but he is replaced by the development itself. His livelihood disappears with the construction of a bridge which is again a symbol of development that paradoxically brings disconnection. Here displacement arises not in the form of exploitation but from irrelevance, the quite violence of modernisation that renders traditional labour meaningless. While Rakeshwar's tragedy is visible and loud whereas in the other hand Puwal's suffering is silent and inevitable.

Thus, the two films represent the two faces of displacement, one caused by the corruption and exploitation and the another by the progress and time. The first questions the morality of power while the other questions the ethics of the progress.

Symbolism and Representation.

Barua's use of symbolism deepens the contrast between the two films. In *Halodhiya Choraye Baodhan Khai*, the land is the central motif. The land symbolises identity, belonging and memory but more than that it is the only hope of survival to most of the rural farmers of Assam. Its fertility mirrors moral integrity and its loss parallel social decay. Every field and furrow carries the weight of inheritance. When Rakeshwar losses his land along with the land he loses his all the assets and his history. The scene of barren soil becomes a metaphor for his emotional desolation. It felt like one part of life is left out because of some social injustice which is more painful than living. He lived a part of life where he was not complete but half dead inside, tried everything and losing all the hopes of getting his land back, he went into a zone of existential trauma.

In Xagoroloi Bohu Dur, the river and the bridge portray visual imagery in the film. The river signifies movement, rhythm and continuity where the essence of life is rooted in nature and tradition and culture attached with it. The bridge on the other hand stands for progress, development, rigidity, modern structure. It connects but also divides people. Through these visual metaphors, Barua contrasts two eras of rural existence, the agrarian world rooted to the soil and the other caught between the fluidity of the river and the rigidness of the bridge.

This symbolic progression from land to bridge encloses the shift from dispossession to displacement, from external oppression to internal alienation.

Modernity and Moral Change.

In both the film, modernity arrives not as liberation but as disruption which led to reshaping the moral and emotional state of rural Assam. Jahnu Barua presents two side of rural Assam, one collapsing under corruption and exploitation and the other dissolving under the pressure of progress. But yet, his true focus lies not only what modernity changes externally, but also on how individuals respond to the trauma, how they retain, lose or rediscover their sense of self and during moral decay.

In Halodhiya Choraye Baodhan Khai, modernity manifests through the bureaucratic capitalism, where ethics are replaced by greed and justice becomes a product(commodity). The local land lords and the officials exploit the illiterate poor farmer Rakeshwar Bora. His land which represents his only means of survival is taken away by the official authorities for their own benefits. The film shows how modern system should protect people but instead of that they contribute to their sufferings more. He tries to fight against it but he was forced to be powerless against the system, he fights till he loses everything including his emotional state, although at the end his silence and perseverance highlight his moral strength and dignity in contrast to the corruption around him.

In Xagoroloi Bohu Dur, the nature of displacement changes. Puwal, the boatman is not exploited by any individuals but the process of modernisation itself. When a bridge was being constructed across the river, his livelihood becomes unnecessary. His displacement is not caused by injustice but by the arrival of development that overlook human cost. When he visits to the town to meet his son, he finds himself lost in an unfamiliar environment shaped by the materialism and individualism. He finds that, there the greed is more cantered than ethics and morals. The new world lacks the emotional and moral values that once defined rural life.

Both the characters Rakeshwar and Puwal responds to their displacement with acceptance and resilience. Rakeshwar's endurance represents the struggle of individuals against injustice, while Puwal's quite acceptance shows how people adapt when change becomes unavoidable. In both the cases Barua presents human beings as morally grounded but socially powerless. through these characters he critiques the impact of modernity on rural societies. Both the films question the meaning of development when it leads to displacement, moral decline and existential trauma. Through Barua's portrayal of these characters suggests that true progress must be measured not by material change but by the preservation of human dignity and moral values.

CONCLUSION

Both Halodhiya Choraye Baodhan Khai (1987) and Xagoroloi Bohu Dur (1995) reflects Jahnu Barua's deep concern for the social, moral, and emotional transformations taking place in rural Assam. Through different contexts, he examines how displacement is caused by whether its corruption or modernization and also reshapes the lives and the identities of ordinary people of rural Assam.

In Halodhiya Choraye Baodhan Khai, Rakeshwar Bora's struggle represents as an active form of resistance

against an unjust system. Despite his honesty and the determination, he becomes a victim of bureaucratic manipulation and social inequality. But although he ultimately regains his land, the loss of his cattle and his emotional breakdown reveal that justice often arrives too late and at too high a cost. His experience illustrates how institutional corruption destroys not only livelihoods but also the moral fabric of rural life.

In Xagoroloi Bohu Dur, the displacement takes a quieter and more psychological form. Puwal's loss is not due to the external exploitation but due to technological advancement that disregards traditional livelihoods. The bridge that replaces his boat symbolizes a new kind of disconnection of progress that isolates many individuals from their roots and values. His eventual return to his village signifies acceptance, but also a realise that modernity, when it is detached from human empathy it leaves a deep gap of emotional emptiness.

Viewed together, both films form a continuum of social critique. Halodhiya Choraye Baodhan Khai portrays the external displacement caused by structural injustice, while Xagoroloi Bohu Dur explores the internal displacement brought by modernization and changing values. Barua's cinema thus bridges two stages of Assamese society, one struggling against corruption, and the other against alienation. In both the films, he portrays the ordinary people as the moral center of his narratives, individuals who retain their integrity even when the systems around them is

collapsed.

Ultimately, Barua's films remind us that the progress and morality cannot be separated altogether. Development that ignores human emotions and social ethics leads to displacement not only of people from land and labour but also of humanity from its conscience. His work urges the viewers to look beyond economic definitions of growth and to recognize that true development must sustain human dignity, compassion, and cultural continuity.

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Sin to Sanctity: Gender, Caste and Politics of Female Transgression in the Theyyam of Thamburatti Amma

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Abstract

The paper seeks to explore the Theyyam of Thamburatti Amma, a ritual art form from the North Kerala that, in symbolism, fulfills the marriage she was denied in life. Oral mythology states that Thamburatti Amma was a namboodiri woman who was expelled from her village for speaking the truth about female desire. Shamed and outcast, she took her life in fire and thereafter was idolised and worshipped by the Vaniya caste. The Theyyam, which is performed for four days, symbolically carries out the marriage that society refused her, turning an act of exclusion into one of respect and remembrance. The study examines how the myth and performance redefine concepts of sexuality, purity, and divinity through feminist and anthropological lenses. It analyses symbols like fire, oil, and embodiment as signs of suffering, memory, and transformation through story and discourse analysis. In the end, Theyyam becomes a space where Kerala's cultural and collective memory honors suppressed women, tells their tales, and gives voice to their denied identities.

Keywords: Theyyam, Thamburatti Amma, Gender, Caste, and Female desire.

INTRODUCTION

Art and ritual have long stood as the reflections of the contradictions of human civilisation. They symbolize both the divine and temporal, logical and emotional, the powerful and the oppressed. The ritual act of Theyyam, performed in the northern part of Kerala, shows this contradiction. Theyyam depicts elements of myth, dance, and worship into an act of divine transformation, which is rooted in Dravidian and indigenous traditions. Theyyam is performed by the people of the marginalised castes, and it is not only a worship of the divinity, but it also raises a question against the society which have oppressed its performers. Therefore, Theyyam, as a ritual performance, shows the complexities of human society.

Thamburatti Amma holds a profound place among other deities in this tradition. Through oral narratives, a story unfolds about a Brahmin woman who broke the patriarchal rules of the society by speaking openly about female sexual desires. For this, she was shamed and ostracized. She was left to wander from place to place, and nobody was willing to help. The Vaniya community, being the traditional oil pressers, offered her oil, with which she eventually took her life by putting herself in flames. It is believed that she then transformed into the divine and returned to bless the people of the community who helped her, and the vaniyas began to worship her as Thamburatti Amma. The Theyyam ritual symbolically performs the marriage that was denied to her. Ironically, the same society later worshipped her as a goddess, who threw her out of the community. A story of exclusion becomes one of redemption through the ritual.

A common theme in South Asian culture: women who go against the norms of society are punished in life, but celebrated after death, is reflected through this myth. Women's resistance is only accepted once they go through suffering, like Sita's trial by fire to Meera's Divine madness. However, in the case of Thamburatti Amma, her defiance continues to live through her ritual performance of Theyyam, where she is reimagined as sacred.

The Thamburatti Amma’s transformation to the divine raise’s questions about gender, caste, and performance. In what ways does a patriarchal traditional ritual create a space for feminist resistance? How can the divine challenge the caste hierarchies? And what does it convey when a lower caste community worships an upper caste woman who was once rejected by her own community?

To explore these questions, the paper places Theyyam of Thamburatti Amma within feminist theory, cultural anthropology, and performance studies. How ritual can turn pain into power is

studied through symbols like fire, oil, and possession. Theyyam is interpreted as both a performance and an act of transformation by drawing from thinkers like Judith Butler and Victor Turner.

Ultimately, the study examines the Theyyam of Thamburatti Amma more than a religious ritual as a cultural form of justice. The boundaries of caste and gender are crossed when a woman's silenced voice is turned into a sacred expression. Shame becomes sanctity, and memory becomes resistance, showing how dominant power structures can be challenged and create spaces of spirituality for subaltern empowerment through the traditional practice of this ritual.

LITERATURE REVIEW

Theyyam has long been acknowledged by academics as a type of ritual theatre that reflects the social and spiritual hierarchy of Kerala. Theyyam is a "repository of collective faith and memory" that unites devotion and dissent, according to K.K.N. Kurup in The Cult of Theyyam and Hero Worship in Kerala. According to J. Richard Freeman's study "Purity and Violence: Sacred Power in the Theyyam Worship of Malabar," Theyyam is a living theatre of social contradiction where caste hierarchy and divine embodiment coexist in conflict. The practice is further positioned as a combination of art and politics that turns marginalised bodies into holy icons in Gilles Tarabout's book Theyyam: The Rediscovery of Ritual as Cultural Performance in Kerala.

Judith Butler's concept of gender performativity in Gender Trouble delivers useful information from a feminist perspective: gender identity is enacted rather than inborn. The female body is transformed into a performative space in Thamburatti Amma's Theyyam, where ritual embodiment is used to rewrite patriarchal narratives. The question raised by Gayatri Chakravorty Spivak, "Can the Subaltern Speak?" is particularly relevant in this context because the ritual enables a woman who was once silent, shamed, and erased to "speak" through heavenly performance. The local, manifested quality of female agency is very important to understanding ritual acts in South Asia, according to Indian feminist researchers such as Chandra Talpade Mohanty and Nivedita Menon (Seeing Such a Feminist).

Moreover, understanding this Theyyam requires an awareness of the connections between gender and caste. Researchers like J. Devika (En-Gendering Individuals) and Gail Omvedt (Dalit Visions) show how ritual spaces in Kerala have historically provided opposing locations that both enforce caste boundaries and permit symbolic violations. Theyyam's transforming potential, where the human becomes divine and the polluted becomes pure, is explained by Victor Turner's concept of liminality from The Ritual Process. In spite of this scholarship, Thamburatti Amma, whose myth represents both caste reversal and feminine desire, is the subject of relatively few studies. By reexamining her ritual via a cross-cutting feminist and anthropological lens, this paper closes that gap.

METHODOLOGY

The study uses a Qualitative Research method based on Feminist Theory, Cultural Anthropology, and Performance studies. The paper looks at the myth and ritual of Thamburatti Amma as cultural narratives that project gender and caste hierarchies instead of relying on quantitative data. Along with analysing the symbols and meanings in the performance, such as the costume, gesture, and possession, the methods include studying oral myths, songs, and existing ethnographic writings.

Central to the analysis is the feminist interpretive framework, which helps to read the story of Thamburatti Amma as both a resistance and a cultural debate between purity and pollution. The study understands ritual as a performative act that helps reclaim the female body, which is silenced by drawing from theorists like Judith Butler and Gayatri Spivak. Where social hierarchies are turned upside down, ritual as a process of transformation is able to be explained with the help of ideas gathered from anthropologists like Victor Turner and Clifford Geertz. This approach helps to view Theyyam as both a divine and political act, one that turns exclusion into empowerment.

ANALYSIS AND DISCUSSION

In duality lies the power of Theyyam. It is both an act of submission and a form of resistance. In particular, the Thamburatti Amma's Theyyam depicts the transformation of a woman once condemned for sin into a divine energy sanctified through ritual. Deep symbolic meanings connected to suffering, remembrance, and purification are carried out by each element of the performance, like fire, oil, costume, and face painting, which show how pain and the divine exist together within the same sacred act.

The purifying force within the ritual becomes the fire that was the medium of the death of Thamburatti Amma. Signifying renewal and not destruction, the fire that consumed her is transformed into her divine aura. Now, fire marks her rebirth as a sacred presence, the element that ended her mortal life. Accordingly, fire acts as what Turner calls a "liminal symbol," which represents the doorway between pollution and sanctity, between human suffering and divine transformation.

The usage of the oil, which is associated with the Vaniya caste that worships her, carries strong caste related meanings and historical understandings. The society's order is turned upside down when a brahmin girl burns herself down in flame using the oil given by the Vaniya caste, who are below the brahmins in social hierarchy, and it is like giving the lower caste devotees the power to purify and sanctify a brahmin woman. This reversal shows what Freeman describes as "the dialectic of purity and violence" in Theyyam, where resisting caste hierarchies becomes an act of sacred renewal and empowerment.

The performer's possession, trance, and voice, the performance's physical nature, transforms the female silence into visibility and expression. A woman's voice emerges from a man's body, questioning the ideas of gender and ritual power when the performer becomes Thamburatti Amma. The transformation shows that identity is not fixed but created through repeated actions, as given in Butler's idea of gender performativity. The male body performing as a female goddess becomes a symbol of change and resistance.

When viewed through a feminist viewpoint, Thamburatti Amma serves as a story of restoring power. The four-day ceremony, which symbolically fulfils her rejected marriage, becomes an act of bringing her story back to completion. Thus, within a social structure that previously denied her autonomy, the ritual re-inscribes it. This is consistent with Spivak's theory that the subaltern finds voice through representation, although through ritual language as opposed to spoken words.

Collective memory is also enacted through the ritual. Performance is a warehouse of past pain, as noted by Rustom Bharucha in Theatre and the World. Every time Thamburatti Amma's Theyyam is spoken, it serves as a reminder of women who were excluded from official histories and punished for their desires or disobedience. Thus, the ritual accomplishes both resistance and grieving.

At the nexus of gender and caste, the Theyyam executes a radical inversion. A lower caste idolises a Brahmin woman who has been denied sanctity by her own group. The purity-pollution division at the core of Kerala's societal structure is called into question by her devotion. The Vaniya community redefines sacred power as something that surpasses Brahminical control through their worship of her. According to Geertz's idea of "thick description," the meaning of the ritual is derived from the whole web of social relations it enacts rather than from discrete symbols.

In the end, the story of Thamburatti Amma turns humiliation into one of holy defiance. Rather than being erased by history, her suffering is transformed into holy memory. The borders between oppressor and victim, woman and goddess, and sin and sanctity disintegrate in the ritual field, creating a transient universe where justice is imagined through ritual performance.

CONCLUSION

In conclusion, Thamburatti Amma's Theyyam ritual is performed in a way where myth, memory, and rebellion join together. Her story represents the struggle of a woman who was being suppressed by her community, and uses holy performance to regain her identity. The story of social marginalisation turns into an act of confidence and recall. The Theyyam's dance, ownership, and ritual framework go beyond religious boundaries to become a social narrative that records histories of gendered suffering and uplifts them into sacred embodiment.

Primarily, when viewed through the lens of feminist thought, the ritual becomes an act of regaining female freedom. The body transforms from a place of humiliation into a sacred urn. Rather than silence or slavery, the Theyyam's performance redefines womanhood as a heavenly manifestation. The ritual tries to portray how identity is reconstructed through ritualised action, which is in harmony with Judith Butler's concept of gender performativity. Annually, the goddess's voice resonates through the performer's body and the devotees' faith, transfiguring each performance into a formulation of resistance and embodiment. According to Victor Turner's anthropological theory, the ritual functions in a transitional area when established hierarchies are suspended and fresh opportunities for social imagination arise. Consequently, Amma's Theyyam turns into a momentary but heavenly sight, a sight of equality carried out within the bounds of tradition. Even if the social order outside the ritual doesn't change, the act of performance sows the seeds of change in communal identity.

What gives Thamburatti Amma's worship its timeless appeal is the conflict between remembering and rebirth, obedience and defiance. It serves as a reminder that dramatic reinterpretation is possible even inside the most inflexible cultural frameworks. In addition to redeeming a woman who has been harmed by her society, the ritual offers a picture of justice that is created by collective faith rather than institutional power by transforming sin into sanctity.

Overall, Thamburatti Amma's Theyyam is a performance that speaks of female courage, societal inversion, and godly persistence in a way that is both artistic and political. Through ritual memory, it regains the voices that have been suppressed throughout Kerala's history. Through her transformation, Thamburatti Amma continues to represent the timeless truth that art and ritual may become languages of freedom even in the middle of patriarchy, and that Divinity can arise from rebellion.

DECLARATION OF INTEREST

The authors declare that they have no competing interests that could have influenced the research, writing, or publication of this paper.

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Harnessing Cross-Compatibility in Rhizobia–Legume Symbiosis for Sustainable Nitrogen Management

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Abstract

Biological nitrogen fixation (BNF) through root-nodulating rhizobia represents a keystone of sustainable agriculture by providing an eco-friendly alternative to chemical nitrogen fertilizers. Traditionally, rhizobial symbiosis with legumes has been regarded as highly specific, restricted by molecular recognition between bacterial Nod factors and host receptors. However, growing evidence indicates that several Rhizobium, Bradyrhizobium, and Mesorhizobium strains exhibit cross-inoculation potential, forming effective nodules across diverse legume hosts. This symbiotic plasticity, often driven by horizontal gene transfer of nodulation and nitrogen fixation genes, suggests the feasibility of developing broad-host or "universal" rhizobial inoculants. Such universal biofertilizers could enhance nitrogen fixation efficiency across multiple crops, reduce fertilizer dependency, and improve soil health in varied agro-ecological regions. Advances in genomics, transcriptomics, and metagenomics have begun to uncover the molecular basis of host-range expansion, including regulatory pathways, symbiotic plasmids, and signalling gene variants. Additionally, strain engineering and synthetic biology approaches are enabling the design of customized inoculants with enhanced compatibility and stress tolerance. This study provides a comprehensive synthesis of current knowledge on cross-inoculation mechanisms, the genetic and molecular determinants underlying host range flexibility, and practical strategies to harness these traits for the development of effective biofertilizers. Exploiting the genomic variation and symbiotic plasticity of rhizobial strains can facilitate the formulation of advanced biofertilizers with enhanced nitrogen-fixing efficiency, broad agroecological compatibility, and improved environmental sustainability, thereby minimizing chemical fertilizer input and fostering long-term soil health.

Keywords: cross-inoculation, Rhizobium, nitrogen fixation, symbiotic plasticity, nod genes, universal biofertilizer, sustainable agriculture.

INTRODUCTION

Nitrogen is an essential component of many biological molecules and is therefore critical for plant growth and reproduction. Although atmospheric nitrogen gas (N_2) constitutes nearly 78% of the atmosphere, most organisms cannot utilize it directly because of its strong triple bond. Eukaryotes lack the ability to convert atmospheric nitrogen into biologically usable forms, as only certain prokaryotic enzymes can reduce N_2 to ammonia [1]. Consequently, atmospheric nitrogen must first be transformed into accessible forms such as ammonia or nitrate through biological nitrogen fixation, decomposition of organic matter, or industrial processes.

Biological nitrogen fixation (BNF) by diazotrophic microorganisms and symbiotic nitrogen fixation (SNF) in legumes provide natural and sustainable solutions to the global nitrogen challenge [2]. In terrestrial ecosystems, nitrogen fixation occurs through free-living microorganisms such as Azotobacter and cyanobacteria, associative microorganisms such as Azospirillum, and symbiotic bacteria such as Rhizobium and Frankia, which form specialized associations with plants. These biological processes contribute approximately 52–130 Tg of nitrogen annually and play a major role in maintaining soil fertility and agricultural productivity. Despite the importance of BNF, modern agriculture still depends heavily on synthetic nitrogen fertilizers produced through the energy-intensive Haber–Bosch process, which contributes nearly 1.2% of global anthropogenic greenhouse gas emissions. Global nitrogen fertilizer consumption reached approximately 112 million metric tons in 2023 due to increasing food demand [3,4]. Excessive fertilizer application has led to serious environmental concerns, including nutrient runoff, eutrophication, soil degradation, biodiversity loss, and increased emissions of nitrous

oxide (N_2O), a potent greenhouse gas. These challenges have intensified the need for sustainable agricultural practices that reduce dependence on synthetic fertilizers while maintaining crop productivity.

Among the most important biological approaches for sustainable nitrogen, management is the symbiotic association between legumes and rhizobia. Rhizobia colonize legume roots and form specialized structures called nodules, where atmospheric nitrogen is converted into plant-available ammonia through nitrogen fixation [5-7]. This symbiosis improves soil fertility, enhances plant growth, and reduces the need for synthetic nitrogen fertilizers. Legumes are therefore considered valuable crops for sustainable agriculture, particularly in nitrogen-deficient soils. Soybean (Glycine max) represents one of the most successful examples of biological nitrogen fixation in agriculture. Soybean cultivation largely depends on inoculants containing symbiotic rhizobia of the genus Bradyrhizobium [1,8]. In Brazil, the world's largest soybean producer, rhizobia can contribute up to 300 kg ha^{-1} of nitrogen through BNF, with additional nitrogen remaining in the soil through crop residues. This substantially reduces the requirement for urea fertilizers and lowers greenhouse gas emissions. During the 2019/2020 cropping season, BNF in Brazilian soybean production was estimated to save approximately 15.2 billion USD and reduce 183 million Mg of CO_2-equivalent emissions [9].

Soil ecosystems harbor highly diverse microbial communities that interact closely with plants and influence their growth and development. Among these beneficial microorganisms, plant growth-promoting rhizobacteria (PGPR) have gained significant attention for their ability to enhance plant productivity and stress tolerance. PGPR include free-living rhizosphere bacteria, rhizoplane-associated microorganisms, endophytes, and symbiotic bacteria such as rhizobia [10]. PGPR promote plant growth through several direct and indirect mechanisms. They improve nutrient availability by producing organic acids and enzymes involved in nutrient solubilization (). They also synthesize phytohormones such as indole-3-acetic acid (IAA), which enhance root growth, shoot development, and overall biomass accumulation. In addition, PGPR can suppress phytopathogens through the production of antibiotics, siderophores, lytic enzymes, and hydrogen cyanide, as well as through competition and induction of systemic resistance. These multiple functions make PGPR important tools for sustainable agriculture and environmental stability [10,11].

The interaction between legumes, rhizobia, and PGPR has led to increasing interest in microbial co-inoculation strategies. Co-inoculation involves the simultaneous application of rhizobia and PGPR to enhance nodulation, nutrient acquisition, plant growth, and stress tolerance. Previous studies have demonstrated that co-inoculation improves plant performance under both optimal and stressful environmental conditions, including salinity stress. Genera such as Pseudomonas, Bacillus, and Azospirillum have shown considerable effectiveness in improving legume productivity and symbiotic performance. In soybean, co-inoculation with Azospirillum brasilense has been associated with increased nodulation, plant biomass, grain nitrogen content, and grain yield. In Brazil, co-inoculation technology is already used in approximately 25% of soybean cultivation areas. Despite these advantages, successful co-inoculation depends on compatibility among microbial partners. PGPR often produce antimicrobial compounds and may compete with or inhibit symbiotic rhizobia through mechanisms such as antibiosis, competition, and lytic enzyme production [12-15]. Therefore, understanding microbial interactions within inoculant consortia is essential for developing effective and stable bioinoculants. Additionally, introduced microorganisms must survive, establish, and compete successfully with native soil microbiota following inoculation.

Over the past few decades, the roles of symbiotic nitrogen fixation (SNF) and plant growth-promoting rhizobacteria (PGPR) in improving soil fertility, plant growth, and agricultural sustainability have been widely documented. Increasing evidence suggests that co-inoculation of rhizobia and PGPR can further enhance nodulation, nutrient uptake, crop productivity, and tolerance to environmental stresses compared with single inoculation strategies. However, the effectiveness of these interactions is influenced by multiple biotic and abiotic factors, including microbial compatibility, host genotype, soil properties, and environmental conditions. Therefore, a comprehensive understanding of rhizobia–PGPR interactions is essential for optimizing co-inoculation technologies under diverse agroecosystems. This review highlights the synergistic effects of rhizobia–PGPR co-inoculation on legume growth, nodulation, productivity, and stress resilience, while discussing their potential contribution toward sustainable agricultural systems

with reduced dependence on synthetic nitrogen fertilizers.

RHIZOBIA AND NITROGEN FIXATION

Many legumes overcome nitrogen limitation by initiating a symbiotic relationship with soil bacteria, collectively referred to as rhizobia. These rhizobia are capable of biological nitrogen fixation where the nitrogenase enzyme complex of the endocytotic bacteria fixes atmospheric nitrogen (N2) when they reside inside legume organs called nodules. Nodules provide the rhizobia with an energy source from photo assimilate while maintaining the low oxygen environment required for efficient nitrogen fixation. In the nitrogen (N) cycle, approximately 30% of nitrogen originates from biological processes. The symbiosis between rhizobia and legume plants through biological nitrogen fixation (BNF) provides nearly half the N demand in global agriculture [1,8,10,16].

BIOLOGICAL NITROGEN FIXATION

Biological nitrogen fixation (BNF) occurs widely in root nodules of legumes and other nodulated plants, as well as in soil, litter, and lichens. Based on ecological strategies, BNF is broadly classified into two types: symbiotic BNF, where nitrogen-fixing microorganisms (NFMs) form nodules with legumes and some non-leguminous plants (e.g., Casuarina), and free-living BNF, carried out by independent microorganisms in soil and organic substrates. The response of these two BNF types to fertilization varies considerably. Nitrogen (N) fertilization generally suppresses both symbiotic and free-living BNF, although some studies report neutral effects on free-living BNF or even stimulation of symbiotic BNF under specific conditions. In contrast, phosphorus (P) and organic fertilization are often reported to enhance both forms of BNF by stimulating microbial activity and plant growth, though contradictory findings also exist [1,2,8]. These inconsistencies highlight the need for systematic comparative analyses of symbiotic and free-living BNF under different fertilization regimes.

The contrasting responses are largely driven by differences in life strategies of NFMs. In N-rich environments, legumes preferentially utilize available soil nitrogen, resulting in reduced nodulation and decreased symbiotic BNF. Conversely, free-living NFMs are directly influenced by soil nutrient status, and elevated soil nitrogen often inhibits their growth and nitrogen-fixing activity. Phosphorus plays a crucial role in enhancing BNF. In symbiotic systems, P fertilization promotes nodule formation and increases nitrogen demand, thereby stimulating nitrogen fixation. In free-living systems, P availability enhances microbial growth and enzymatic activity, supporting higher BNF rates. However, soil factors such as pH also significantly influence both systems. Fertilization-induced soil acidification can negatively affect legumes and free-living NFMs, reduce nitrogenase activity, and ultimately suppress BNF. Additionally, soil organic carbon may mitigate the inhibitory effects of nitrogen fertilization, indicating the importance of soil physicochemical properties in regulating BNF responses. Recent meta-analyses have examined the effects of nutrient inputs on BNF, but most studies have focused either on free-living BNF in natural ecosystems or on symbiotic and free-living systems separately in agroecosystems [1,16-18]. A comprehensive comparison of fertilization effects on both BNF types remains lacking. Therefore, this study aims to address this gap through a meta-analysis evaluating the responses of symbiotic and free-living BNF to major fertilizers (N, P, potassium, and organic inputs) in agroecosystems. The objectives are to (i) compare the responses of both BNF types under different fertilization conditions and (ii) identify the roles of nodulation, microbial communities, and soil properties in regulating these responses.

MOLECULAR MECHANISM OF NODULATION AND BIOLOGICAL FIXATION

The legume–Rhizobium symbiosis begins with a reciprocal signal exchange. Under nitrogen limitation, legume roots secrete species-specific (iso) flavonoids into the rhizosphere. These compounds act as chemoattractants and activate bacterial NodD proteins, which induce expression of *nod* genes. Nod factors (NFs) lipochitooligosaccharides with a chitin backbone, a fatty acyl chain, and species-specific decorations—are then synthesized. NFs are perceived by host LysM-type receptor kinases (e.g., NFR1/NFR5 in *Lotus*, LYK3 in *Medicago*), triggering ion fluxes, nuclear calcium spiking, and activation of the transcription factor Nodule Inception (NIN). The calcium signal is transduced via CCaMK and its targets (CYCLOPS, IPD3), leading to root

hair curling, infection thread (IT) formation, and cortical cell division. Nodulation Receptor Kinases (NORKs) are key transmembrane signal relays [19,20].

Cytokinins promote cortical cell division to form nodule primordia, while auxins drive root hair deformation and nodule growth. Reactive oxygen species (ROS) facilitate IT formation at controlled levels but cause oxidative stress when excessive. In inverted-repeat-lacking clade (IRLC) legumes, terminal bacteroid differentiation is mediated by nodule-specific cysteine-rich (NCR) peptides. Hundreds of NCRs exert antimicrobial activity; tolerant rhizobia survive via BacA transporters or protective exopolysaccharides (EPS). NCR isoforms enforce symbiont specificity. Rhizobial type III/IV secretion systems deliver effectors that can aid infection or trigger effector-triggered immunity (ETI) when recognized by host resistance (R) proteins (e.g., soybean Rj2, Rfg1, Rj4). Additionally, rhizobial transfer-RNA-derived fragments (tRFs) silence host genes that antagonize nodulation, representing a cross-kingdom RNA interference mechanism [21-24].

Autoregulation of nodulation (AON) limits nodule numbers via shoot receptor kinases (SUNN) and root-derived CLE peptides. Host sanctioning penalizes poorly fixing nodules by reducing photosynthate allocation. Environmental factors—excessive nitrogen, acidity, salinity, low temperature—inhibit symbiosis by suppressing (iso)flavonoid secretion, Nod factor production, NORK activity, calcium spiking, ROS homeostasis, rhizobial motility, and leghemoglobin function. Nitrate also induces nitric oxide (NO) production, which inhibits nitrogenase [22-28]. Co-inoculation with plant growth-promoting rhizobacteria (e.g., *Pseudomonas*, *Bacillus*, and *Azospirillum*) enhances nodulation and yields, particularly under stress. Despite advances, further research is needed on the regulation of NCR peptides, ETI prevalence, tRF diversity, and the integration of multiple compatibility checkpoints to enable engineering of efficient symbioses for sustainable agriculture [27-28].

ROLE OF IRON IN NITROGEN FIXATION

Iron (Fe) is an essential micronutrient that plays a central role in biological nitrogen fixation (BNF) by supporting enzymatic activity, nodule development, energy metabolism, and microbial interactions. During symbiotic nitrogen fixation, electrons generated through cellular metabolism are transferred via ferredoxin to the molybdenum–iron protein (MoFeP) of the nitrogenase enzyme complex. The iron–molybdenum cofactor (FeMoco), located within nitrogenase, serves as the catalytic center responsible for reducing atmospheric nitrogen (N_2) into ammonia (NH_3). Because nitrogenase contains multiple iron-rich components, nitrogen fixation is highly dependent on adequate iron availability.

In legumes, iron deficiency severely impairs nodulation and nitrogen-fixing efficiency. Studies in Lupinus angustifolius have shown that inadequate iron supply reduces nodule initiation, limits nodule biomass, and decreases leghemoglobin synthesis, which is essential for maintaining the low-oxygen environment required for nitrogenase function. Consequently, legumes dependent on symbiotic nitrogen fixation exhibit greater iron requirements than plants supplied with mineral nitrogen, reflecting the substantial metabolic demand of the symbiotic process. Iron transport to nodules occurs through both apoplastic and symplastic pathways. In Medicago truncatula, the transporter MtVTL8 facilitates iron movement across the symbiosome membrane through a specialized transport mechanism that supports effective nitrogen fixation.

Beyond plant–rhizobia interactions, iron regulates microbial fixation via dissimilatory Fe(III) reduction (DIR). Fe(III) acts as an electron acceptor in diazotrophs, boosting ATP production to fuel nitrogenase activity. This process links nitrogen fixation with carbon metabolism: enhanced carbon oxidation (glycolysis, TCA cycle) supports Fe (III) reduction, creating a positive feedback loop. At the community level, Fe(III)-reducing bacteria (e.g., *Geobacter*, *Klebsiella*) interact with diazotrophs through nutrient and electron exchange, indirectly sustaining N_2 fixation. Thus, iron integrates enzyme function, nodule development, cellular energetics, and the coupled cycling of nitrogen, carbon, and iron across ecosystems.

HOST RANGE DETERMINANTS IN RHIZOBIA CROSS-INOCULATION GROUPS AND NOD FACTOR DIVERSITY

Host compatibility in rhizobia is primarily determined by molecular interactions between bacterial Nod factors and plant receptors. Classical symbionts such as Rhizobium leguminosarum

biovars viciae, phaseoli, and trifolii, Sinorhizobium meliloti, Rhizobium etli, Mesorhizobium spp., Azorhizobium caulinodans, and Rhizobium galegae generally exhibit narrow host adaptation. Their Nod factors contain highly specific chemical modifications, including acetylation, sulfation, O-acetylation, and carbamoylation, which are selectively recognized by cognate LysM-type receptor kinases in legume hosts. This highly specific molecular recognition forms the basis of the classical cross-inoculation group concept [19,20,25,27].

In contrast, species such as Bradyrhizobium japonicum and B. elkanii display broader compatibility, associated with the production of methylated, carbamoylated, and structurally modified lipochitooligosaccharides (LCOs). Members of the Bradyrhizobium "cowpea miscellany" group represent an even more flexible system, nodulating diverse hosts including Vigna, Cajanus, Arachis, and Macroptilium. Similarly, Sinorhizobium fredii produces broad-spectrum Nod factors and effectively nodulates both Glycine and Vigna, demonstrating that wider host adaptability does not necessarily reduce symbiotic performance (Table 1).

The discovery of β-rhizobia, including Paraburkholderia spp. and Cupriavidus taiwanensis, has further broadened the understanding of rhizobial symbiosis. These bacteria establish nitrogen-fixing associations with Mimosa species using structurally distinct Nod factors and exhibit moderate to broad compatibility. Their occurrence demonstrates that effective nitrogen-fixing symbiosis extends beyond the traditional α-rhizobial lineage and reflects a broader evolutionary diversity. Overall, rhizobial compatibility ranges from highly specialized to broadly adaptable interactions. This variability is largely influenced by horizontal transfer of nodulation (nod) genes and diversification of enzymes responsible for Nod factor modifications [21,22,24,28,29].

Broad host-range rhizobial strains are of particular interest for the development of multi-crop or "universal" biofertilizers. However, highly specialized strains often exhibit greater efficiency with their preferred hosts. For example, S. meliloti forms highly effective associations with alfalfa and may outperform broader host-range strains in adapted agroecosystems because of superior ecological fitness and host specialization (Table 1). Although Nod factors play a central role in host recognition, they are not the sole determinants of compatibility. Additional factors, including exopolysaccharides, type III secretion system effectors, tolerance to nodule-specific cysteine-rich (NCR) peptides, and host sanctioning mechanisms, also contribute to successful symbiosis. Furthermore, several aspects of rhizobial signaling remain incompletely understood, particularly the detailed Nod factor chemistry of Paraburkholderia species [24,28,29].

Table 1. Cross-Inoculation Groups, Nod Factor Signaling and Host Specificity

***Rhizobial* Species / Group**	**Cross-Inoculation Group**	**Major Legume Hosts**	**Nod Factor Characteristics**	**Host Specificity**	**Reference(s)**
Rhizobium leguminosarum bv. *viciae*	Pea group	*Pisum, Vicia, Lens, Lathyrus*	Acetylated LCOs with unsaturated fatty acyl chains	Narrow	[19, 20]
Rhizobium leguminosarum bv. *phaseoli*	Bean group	*Phaseolus*	Sulfated LCOs with host-specific substitutions	Narrow	[19]
Rhizobium leguminosarum bv. *trifolii*	Clover group	*Trifolium*	O-acetylated Nod factors	Narrow	[19,21]
Sinorhizobium (*Ensifer) meliloti*	Alfalfa group	*Medicago, Melilotus, Trigonella*	Sulfated Nod factors essential for host recognition	Narrow	[19,20]
Rhizobium lupini	Lupin group	*Lupinus, Ornithopus*	Variable fatty acyl chains	Moderate	[21]
Bradyrhizobium japonicum	Soybean group	*Glycine max*	Methylated and carbamoylated LCOs	Moderate	[20]
Bradyrhizobium elkanii	Tropical soybean	*Glycine max*	Diverse Nod factor structures	Moderate–Broad	[20]
Bradyrhizobium spp.	Cowpea miscellany	*Vigna, Cajanus, Arachis, Macroptilium*	Highly diverse LCOs	Broad (Promiscuous)	[20,21]
Rhizobium etli	Common bean	*Phaseolus vulgaris*	Modified LCO backbone	Narrow	[20]
Sinorhizobium fredii	Fast-growing soybean	*Glycine, Vigna*	Broad-spectrum Nod factors	Broad	[20]
Mesorhizobium ciceri	Chickpea group	*Cicer arietinum*	Specific LCOs with limited variation	Narrow	[20]
Mesorhizobium loti	Lotus group	*Lotus spp.*	Carbamoylated Nod factors	Narrow	[19]
Mesorhizobium huakuii	Astragalus group	*Astragalus*	Host-specific LCO decorations	Narrow	[20]
Rhizobium galegae	Galega group	*Galega spp.*	Highly specific Nod signaling	Very Narrow	[21]
Azorhizobium caulinodans	Sesbania group	*Sesbania rostrata*	Nod factors enabling stem nodulation	Narrow	[20]

Paraburkholderia spp.	Mimosa group	*Mimosa spp.*	β-*rhizobial* LCOs; alternative signaling	Broad	[23]
Cupriavidus taiwanensis	Mimosa group	*Mimosa pudica*	Distinct Nod factor structures	Moderate	[23]

OXYGEN REGULATION IN LEGUME NODULES: THE CENTRAL ROLE OF LEGHEMOGLOBIN

Biological nitrogen fixation is catalyzed by the nitrogenase enzyme complex, which is highly sensitive to oxygen and becomes irreversibly inactivated upon exposure to molecular oxygen. At the same time, effective symbiosis between legumes and rhizobia requires oxygen for ATP generation through oxidative respiration in both plant mitochondria and bacterial bacteroids. This phenomenon, known as the microaerobic paradox, is resolved within legume nodules through the maintenance of a tightly regulated low-oxygen environment that supports respiration while protecting nitrogenase activity [30].

This regulation is achieved through both structural and biochemical mechanisms. The nodule cortex acts as a dynamic oxygen diffusion barrier that restricts oxygen entry into the infected zone. Structural features such as lignified and suberized cell layers, compact cellular organization, and reduced intercellular air spaces limit oxygen movement. Importantly, this barrier is flexible and adjusts its permeability in response to external oxygen concentrations and metabolic demand, thereby maintaining conditions suitable for nitrogen fixation [31,32].

A key component of oxygen regulation is leghemoglobin, a highly abundant heme protein localized in infected nodule cells. It may account for up to 30–40% of the total soluble protein in these cells and maintains free oxygen concentrations at extremely low levels, typically between 3 and 22 nM. Due to its high oxygen affinity and rapid binding and release kinetics, leghemoglobin functions both as an oxygen buffer and carrier. It prevents excessive free oxygen accumulation that could inactivate nitrogenase while facilitating controlled oxygen delivery to respiring mitochondria and bacteroids [33]. Bacteroids also possess physiological adaptations for respiration under microaerobic conditions. High-affinity terminal oxidases, particularly cytochrome cbb_3 oxidase, enable efficient utilization of low oxygen concentrations. Together, these structural, biochemical, and physiological mechanisms maintain the microaerobic conditions required for efficient nitrogen fixation [18,34].

Leghemoglobin belongs to a broader family of plant hemoglobins that includes symbiotic hemoglobins, non-symbiotic hemoglobins (phytoglobins), and truncated hemoglobins. These proteins contribute to oxygen regulation, nitric oxide metabolism, redox balance, and stress responses. Although first identified in soybean nodules, hemoglobins are also present in other nitrogen-fixing systems, including pea, the non-legume Parasponia, and actinorhizal plants such as Casuarina and Alnus, indicating a conserved role in symbiotic oxygen regulation [35]. Within legumes, multiple leghemoglobin isoforms are expressed during different stages of nodule development. For example, soybean and pea produce several isoforms with distinct temporal expression patterns and oxygen-binding properties, suggesting developmental regulation of oxygen delivery during nodule maturation. Hemoglobin gene expression is tightly controlled by developmental and environmental signals, including nitrate availability. In model legumes such as Lotus japonicus, NIN-like transcription factors such as NLP4 play important roles in this regulation. Reduced leghemoglobin expression results in elevated reactive oxygen species (ROS) and nitric oxide (NO) levels, ultimately impairing nitrogen fixation [36].

In addition to oxygen buffering, leghemoglobin participates in nitric oxide metabolism. Nitric oxide is produced during symbiotic signaling and in mature nodules, but excessive accumulation can disrupt nitrogen fixation. Leghemoglobin binds nitric oxide to form nitrosyl-leghemoglobin, thereby contributing to nitric oxide detoxification and intracellular homeostasis. Non-symbiotic hemoglobins and truncated hemoglobins further complement these functions through their roles in nitric oxide scavenging, redox regulation, and stress adaptation.

ENVIRONMENTAL FACTORS AFFECTING NITROGEN FIXATION

Several environmental conditions can negatively affect symbiotic nitrogen fixation in legumes, such as nitrogen availability, soil acidity, salinity, and low soil temperature. These factors can affect various aspects, including rhizobial survival in the soil, the infection process, nodule development, nodule function, and indirect effects on host plant growth. Nitrogen availability plays a crucial role in legume–rhizobia symbiosis, as higher doses of nitrogen fertilizer can hinder successful symbiotic establishment. When the soil has a high nitrogen content, especially during the period between seed inoculation and germination, it presents challenges for establishing functional symbiosis. Excessive nitrogen in the soil can reduce the reliance of plants on nitrogen fixation and limit root nodule development [37].

Soil acidity and salinity can also impede symbiotic nitrogen fixation by creating unfavorable conditions for rhizobial survival and root infection. This hampers nodule development and results in fewer functional nodules. Additionally, acidic or saline conditions negatively affect host plant growth, further affecting the nitrogen-fixing performance. Low soil temperature is another environmental condition that hinders symbiotic nitrogen fixation, particularly in legumes, including tropical species. Cold temperatures inhibit rhizobial metabolic activity, impairing their nitrogen-fixing capacity and symbiotic establishment with plants.

It is important to note that these environmental factors not only directly affect legume–rhizobia symbiosis but also indirectly affect nitrogen fixation by influencing host plant growth [8.29]. Unfavorable conditions limit overall plant growth, decrease photosynthesis, reduce carbon allocation to the roots, and ultimately compromise the energy and resources available for nitrogen fixation. Understanding and managing these environmental conditions are critical to facilitate successful nitrogen fixation and ensure optimal plant growth and agricultural productivity in legumes. The structure and diversity of soil bacteria are closely related to environmental factors, which can benefit or hinder the legume-rhizobia symbiotic relationship. Stressful conditions such as salinity and drought directly affect legume development and indirectly limit or halt rhizobia multiplication [38]. This limitation diminishes plant nodulation and nitrogen fixation efficiency, ultimately affecting crop yield. In an effort to tackle these challenges, rhizobia and non-rhizobial bacteria are co-inoculated in legumes. These bacteria have been demonstrated to improve plant growth, minimize the effects of biotic and abiotic stressors (such as droughts, salinity, extreme temperatures, and heavy metal toxicity), and reduce the incidence of disease [39-41]. In natural environments, bacteria coexist in complex, multi-species communities with various interactions among different species. Consequently, employing a consortium of microorganisms is likely to enhance their performance due to these synergistic interactions.

NITROGEN FERTILIZER AND SYMBIOSIS

Nitrogen fertilizers are widely used to boost crop yields; however, their application often interferes with the delicate molecular and physiological interactions between legumes and rhizobia. A growing body of evidence indicates that excessive or poorly timed nitrogen inputs disrupt multiple stages of symbiosis—from early signaling and root-hair infection to nodule development and nitrogenase activity. Understanding these inhibitory mechanisms is essential for designing fertilizer management strategies that sustain biological nitrogen fixation (BNF) while reducing reliance on synthetic inputs.

Suppression of Flavonoid Signaling

Flavonoids are critical signaling molecules secreted by legume roots to attract compatible rhizobia and initiate nodulation. Several studies have shown that nitrogen fertilizers reduce both the production and exudation of these compounds [42]. High nitrogen availability downregulates genes involved in (iso)flavonoid biosynthesis, For example, direct nitrogen supply to soybean roots decreases daidzein and genistein levels [36,37,41].

This decline impairs rhizobial colonization and subsequent nitrogen fixation, increasing dependence on synthetic fertilizers. Beyond nodulation, (iso)flavonoids possess antimicrobial properties; their reduction may increase plant susceptibility to pathogens, potentially leading to greater pesticide or fungicide use [38]. Lyu et al. [43]observed that nitrogen fertilizer inhibits early-stage nitrogen fixation in soybean nodules, correlating with reduced isoflavone concentrations in roots and exudates. Thus, nitrogen-induced suppression of isoflavonoids

disrupts symbiotic balance and may reinforce a cycle of chemical dependency.

Inhibition of Nod Factor Production and NORK Signaling

Nod factors (lipochitooligosaccharides), produced by rhizobia, and are essential for triggering host responses. High nitrogen levels suppress genes involved in nod factor synthesis, thereby reducing nodule formation and effectiveness. The extent of inhibition depends on fertilizer type, concentration, timing, soil conditions, and the specific legume – rhizobia interaction. Excess nitrogen during early growth stages is particularly detrimental. Nodulation receptor-like kinases (NORKs) mediate early symbiotic signaling. Excess nitrogen inhibits NORK activity, likely by disrupting phytohormone balance (e.g., cytokinins and auxins) and increasing nitrate concentrations that repress NORK gene expression. Without proper NORK function, nodulation is impaired, reducing plant growth and yield while increasing dependence on external nitrogen. Moreover, nitrate alters calcium-spiking patterns, a key downstream signaling event, in a species-dependent manner: some legumes exhibit inhibited spiking and nodulation, whereas certain mycorrhizal associations may show enhanced spiking.

Disruption of Reactive Oxygen Species (ROS) Homeostasis

Reactive oxygen species (ROS) function as signaling molecules at optimal levels but cause oxidative stress when overproduced. Excessive nitrogen fertilization disrupts nutrient balance and metabolic activity, elevating ROS levels and impairing nodule formation and nitrogen fixation efficiency [33,36]. Maintaining ROS homeostasis through balanced nitrogen management is therefore crucial for sustaining healthy symbiosis. Further research is needed to understand how nitrogen fertilizers influence antioxidant enzyme systems involved in mitigating ROS-induced damage [36].

Effects on Rhizobial Motility and Population Dynamics

Rhizobial motility, which enables bacteria to move toward root exudates via flagella, is essential for effective root colonization. High nitrogen levels reduce the density, motility, and diversity of free-living rhizobia [28,44]. Excess nitrogen can alter soil pH and inhibit rhizobial growth [16,37]. Additionally, when plants obtain sufficient nitrogen from external sources, their reliance on symbiosis declines, further reducing rhizobial populations [17,39].

High ammonium concentrations specifically decrease motility, thereby impairing colonization efficiency [28]. Therefore, careful nitrogen management is critical for preserving rhizobial fitness and ensuring optimal nodulation [45,46]. Enhancing rhizobial motility through manipulation of flagellar biosynthesis and chemotaxis genes represents a promising strategy for sustainable agriculture.

Interference with Root Hair Curling, Infection Threads, and Nodule Development

Root-hair curling is the first visible step in rhizobial infection. High nitrogen concentrations—particularly nitrate—significantly reduce root elongation and curling, thereby hindering bacterial colonization [22,24]. For instance, nitrate or urea suppresses root-hair curling in Medicago sativa and inhibits both curling and infection thread formation in soybean.

Nitrogen fertilizers also induce abortion of infection threads, accelerate premature nodule senescence, and cause feedback inhibition of nitrogenase activity [40]. The degree of inhibition varies among rhizobial strains [47]. Nitrate is generally more inhibitory than ammonium or urea. Early-season nitrate application alters rhizosphere conditions, modifies root cell wall composition, and reduces bacterial attachment. Rhizosphere nitrate concentration is a key factor in inhibiting nodule initiation, while absorbed nitrate affects later stages of nodule development [16]. Nitrogen applied during the infection phase limits nodule formation, whereas application after nodulation inhibits further development [40]. Foliar nitrogen application is typically less suppressive than soil application and, in some legumes (e.g., beans and soybean), may mitigate negative effects on secondary root nodulation.

Nitrate and Nitric Oxide Regulation of Nitrogen Fixation

Nitrate availability plays a central role in regulating legume nodulation and symbiotic nitrogen fixation (SNF) through interconnected metabolic and signaling pathways involving nitrate

reductase, nitrite, and nitric oxide (NO). Early studies demonstrated that nitrate or ammonium application suppresses nitrate reductase activity in soybean nodules, while experiments using nitrate-reductase-deficient rhizobial mutants showed that nitrate could inhibit early nodulation independently of host nitrate reductase activity. Similar inhibitory effects on nitrogen fixation have also been reported in cowpea and lupine nodules regardless of nitrate reductase presence, indicating that multiple regulatory mechanisms contribute to nitrate-mediated suppression.

Although short-term nitrate exposure may transiently improve oxygen diffusion resistance within nodules, prolonged nitrate treatment promotes nitrite accumulation and the formation of nitrosylleghemoglobin through bacteroid periplasmic nitrate reductase activity, ultimately impairing nitrogen fixation [35]. Both plant- and bacteroid-derived nitrate reductases further contribute to NO production, which acts as a potent inhibitor of nitrogenase activity under both in vitro and in vivo conditions. Excessive NO accumulation accelerates nodule dysfunction and senescence, whereas rhizobial strains possessing efficient NO detoxification mechanisms can delay premature nodule aging and maintain symbiotic efficiency [18,34]. Therefore, tight regulation of NO homeostasis is critical for sustaining effective legume–rhizobium interactions.

Several additional mechanisms have been proposed to explain nitrate-induced inhibition of nitrogen fixation, including diversion of photosynthates away from nodules resulting in energy limitation, suppression of nitrogenase and leghemoglobin synthesis, nitrite toxicity, and feedback inhibition by fixed nitrogen metabolites. In pea, ammonium nitrate reduces nitrogenase activity by decreasing leghemoglobin synthesis, whereas other studies highlight the importance of carbohydrate availability and oxygen regulation within the nodule cortex. Furthermore, nitrogen assimilation products such as asparagine and its metabolites may participate in feedback regulation of SNF in soybean.

Collectively, evidence suggests that nitrate inhibits symbiotic performance through integrated mechanisms involving altered signaling, oxygen limitation, redox imbalance, NO accumulation, and metabolic feedback. Future research should focus on improving strain-specific nitrate tolerance, optimizing nitrogen application strategies (e.g., foliar versus soil application), enhancing legume genetic capacity to sustain symbiosis under moderate nitrogen conditions, and elucidating molecular pathways controlling leghemoglobin function and antioxidant responses [5-7]. Improved understanding of soil nitrogen sensing and transport during nodule development will support enhanced biological nitrogen fixation, reduced dependence on synthetic fertilizers, and more sustainable agricultural systems.

Strategies to Enhance Legume Nodulation for Sustainable Nitrogen Management

Enhancing legume nodulation for reduced nitrogen fertilizer use and climate mitigation requires a multipronged approach. Selecting rhizobial strains with high host compatibility, with native isolates often outperforming commercial ones, improves infection and nodule formation. Agronomic practices such as crop rotation with non-legumes, intercropping, and planting leguminous cover crops during fallow periods help sustain soil rhizobial populations and support nitrogen cycling. Optimizing soil conditions by maintaining neutral pH, ensuring proper drainage, avoiding excess synthetic nitrogen, and incorporating organic matter or compost creates a favorable environment for root hair infection and nodule development. Proper inoculation techniques, including the use of fresh, high quality inoculants and effective seed coating methods, further strengthen symbiosis establishment. Integrating small doses of mineral fertilizer with rhizobia, rather than applying high nitrogen inputs, prevents suppression of nodulation while meeting early plant nitrogen requirements. Conservation agriculture practices, including reduced tillage, mulching, and improved water management, contribute to better soil structure and increased organic carbon, indirectly supporting rhizobial survival and root colonization. In addition, genetic improvement of legume cultivars through marker assisted selection or breeding for enhanced recognition of specific rhizobial strains can increase nodulation efficiency. These strategies remain context dependent and vary according to soil type, climate, and legume species, requiring local adaptation and expert guidance. Further research is needed to understand nitrogen fertilizer interference with flavonoid signaling, carbon allocation during fixation, and rhizobial strain dynamics to refine these approaches.

CONCLUSION

Biological nitrogen fixation through legume–Rhizobium symbiosis offers a proven, eco-friendly alternative to synthetic nitrogen fertilizers, which are energy-intensive and environmentally damaging. Traditionally viewed as highly specific due to molecular recognition between Nod factors and host receptors, this symbiosis is in fact more plastic than once thought. Cross-inoculation among diverse legume species, driven by horizontal gene transfer of *nod* and *nif* genes, demonstrates the potential for developing broad-host or "universal" rhizobial inoculants. Such biofertilizers could sustainably enhance nitrogen fixation across multiple crops, reduce fertilizer dependency, and improve soil health in diverse agro-ecological zones.

Advances in genomics, transcriptomics, and metagenomics have begun to unravel the molecular basis of host-range expansion, including regulatory networks, symbiotic plasmids, and signaling gene variants. In parallel, co-inoculation with plant growth-promoting rhizobacteria (e.g., *Pseudomonas*, *Bacillus*, *Azospirillum*) consistently improves nodulation, stress tolerance, and yield, as confirmed by meta-analyses across countries and crop species. Iron plays an indispensable role in both symbiotic and free-living fixation by supporting nitrogenase activity, leghemoglobin function, and cellular energy metabolism via dissimilatory Fe(III) reduction, which couples carbon oxidation with N_2 fixation. Oxygen regulation within nodules, mediated by leghemoglobin and structural barriers, is critical to maintaining microaerobic conditions for nitrogenase while enabling respiration.

Despite these insights, several challenges remain. Excessive nitrogen fertilization suppresses (iso)flavonoid signaling, Nod factor production, NORK activity, ROS homeostasis, and rhizobial motility, while inducing nitrosative stress and premature nodule senescence. Environmental stressors such as acidity, salinity, and low temperature further limit symbiosis. However, integrated strategies—strain selection, optimized inoculation, soil management, conservation agriculture, and genetic improvement—can mitigate these constraints. The success of soybean production in Brazil, where BNF supplies full nitrogen demand with massive economic and emission savings, proves that large-scale reliance on symbiosis is achievable.

Future research should prioritize the regulatory diversity of NCR peptides in IRLC legumes, the prevalence of effector-triggered immunity across different symbioses, the role of transfer-RNA-derived fragments in cross-kingdom regulation, and the development of predictive models (e.g., machine learning) for site-specific inoculant performance. Harnessing the genomic variation and symbiotic plasticity of rhizobia, combined with rational co-inoculation and precision agriculture, will enable the formulation of next-generation biofertilizers. These advances, supported by farmer education and policy incentives, can substantially reduce chemical nitrogen inputs, mitigate greenhouse gas emissions, and foster long-term soil health, thereby contributing to a more sustainable and climate-resilient agricultural future.

Declaration of Interest

The authors declare no conflict of interest.

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Performance analysis of Vedic multipliers on nanoscale power-Efficient FPGA Architectures

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Abstract

In modern digital system, multiplication is one of the most critical arithmetic operation directly influencing the overall speed power consumption and hardware efficiency of processor and signal processing unit. It present the implementation and performance analysis of Vedic multipliers on nanoscale power efficient FPGA architecture. The Proposed design utilizes the from ancient Vedic mathematics which enables parallel partial product generation and accumulation thereby reducing computation delay compared to conventional multipliers such as array or both multipliers which implemented on a nanoscale FPGA device Vedic multiplier exhibits significant improvement in speed and energy efficiency making it suitable for low power, high performance application in embedded and real time systems.

Keywords: Multiplier Algorithms, FPGA, Nanoscale Computing, High-Speed Arithmetic, Hardware Optimization

INTRODUCTION

Digital multipliers are fundamental building blocks in modern computational systems, as multiplication is one of the most frequently used arithmetic operations in both general-purpose and application-specific processors. Their performance directly affects the efficiency of a wide range of domains including digital signal processing (DSP), image and graphics processing, machine learning accelerators, cryptographic algorithms, and scientific computing. In such applications, multiplication often lies on the critical path, meaning that the speed and efficiency of the multiplier strongly influence the overall system performance.

The design of a multiplier involves careful consideration of Speed , Resource Utilization & Power Consumption. Real-time applications such as DSP filters, image compression, and encryption algorithms demand fast multiplication. A lower propagation delay enables higher clock frequency and improved throughput.

On FPGA , the hardware cost is directly tied to logic cells, LUTs, slices, or gates consumed by the design. Compact multipliers are advantageous in resource-constrained and cost-sensitive applications. With the growing emphasis on portable and battery-operated devices, energy-efficient designs are increasingly important. Low-power multipliers contribute to longer battery life, reduced thermal issues, and sustainable computing.

Over the years, several multiplier architectures have been proposed, each optimizing a different trade-off between these factors. Recently, Vedic multipliers, based on ancient Indian mathematical sutras such as Urdhva-Tiryagbhyam and Nikhilam , have gained attention for their ability to exploit parallelism and minimize computational steps, often producing competitive results across operand sizes.

However, the choice of multiplier architecture is not universal and must be aligned with the target application. The effectiveness of a multiplier varies with operand size, making it essential to evaluate multiple architectures under uniform conditions and across different word lengths[1].

Multiplier Alogorithms

The design of digital filters relies heavily on multipliers, driving the development of various algorithms like Vedic, Array, Wallace, Dadda, Booth, and Sequential, which offer different approaches to binary multiplication.

- **Vedic Algorithm**
  This design employs the ancient Vedic sutra "Urdhva-Tiryagbhyam" ("vertical and crosswise"), an algorithm that calculates the product of two numbers through a series of vertical and crosswise multiplication steps[2]
- **Array Algorithm**
  Based on a sequential process of addition and shifting, this algorithm first generates partial products. These are then arranged in rows and finally summed column-wise to obtain the product terms [3].
- **Wallace Algorithm**
  To optimize the multiplication of large numbers, this algorithm employs a tree-based

architecture for partial product accumulation. The critical path delay is minimized by implementing full adders and half adders as 3:2 and 2:2 compressors, respectively [4].

- **Dadda Algorithm**
  This algorithm also arranges partial products in a tree structure. The reduction process is governed by the formula , $d_{j+1} = floor(1.5d_j)$ where d_j represents the maximum height of a column in the partial product matrix [5].
- **Booth Algorithm**
  This algorithm reduces the number of partial products through an encoding technique. By examining the multiplier bits from MSB to LSB in groups, it determines whether to add, subtract, or simply shift the multiplicand to obtain the result efficiently [6-8].

METHODOLOGY

All five multiplier algorithms were coded and simulated using VHDL on MODEL SIM and then design was synthesized targeting four different Xilinx FPGA families. i.e. Artix7, Kintex, Spartan3E, & Virtex7. Post implementation, Comparative analysis for response time, has been made for Array, Booth, Dadda, Vedic and Wallace Alogorithm.

RESULT AND ANALYSIS

The performance of each multiplier is evaluated from multiple angles in the synthesized results. The most important trends are visualized in the comparative graphs for concise analysis.

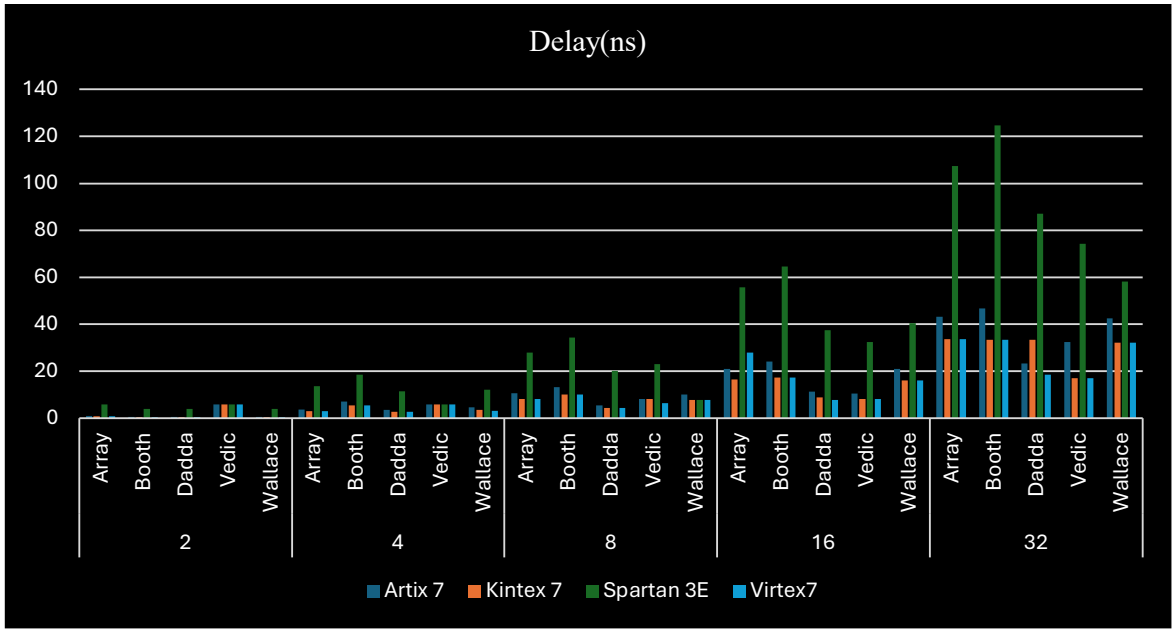


Fig. 1 Comparative Graph for Memory Consumption

Comparative Propagation delay (ns) for five multiplier architectures:

- Array Multiplier
- Booth Multiplier
- Dadda Multiplier
- Vedic Multiplier
- Wallace Multiplier

across four FPGA families:

- Artix-7
- Kintex-7
- Spartan-3E
- Virtex-7
- for bit widths 2, 4, 8, 16, and 32 bits.

Table I

Comparative Dealy Analysis of Multiplier on Artix 7 , Kintex7, Spartan3E and Vertix7					
Bits Size	**Algorithm**	Delay(ns)			
		Artix 7	**Kintex 7**	**Spartan 3E**	**Virtex7**
2	Array	0.948	0.921	5.895	0.921
	Booth	0.64	0.511	4.04	0.511
	Dadda	0.64	0.511	4.04	0.511
	Vedic	5.895	5.895	5.895	5.895
	Wallace	0.64	0.511	4.04	0.511
4	Array	3.849	3.09	13.651	3.09
	Booth	7.107	5.526	18.534	5.526
	Dadda	3.57	2.826	11.527	2.826
	Vedic	5.895	5.895	5.985	5.985
	Wallace	4.727	3.575	12.096	3.19
8	Array	10.772	8.334	28.061	8.334
	Booth	13.274	10.189	34.421	10.189
	Dadda	5.53	4.434	20.219	4.434
	Vedic	9.119	6.528	23.173	6.528
	Wallace	10.167	7.769	7.769	7.769
16	Array	21.082	16.451	55.724	28.061
	Booth	24.166	17.316	64.614	17.316
	Dadda	11.379	8.952	37.521	7.795
	Vedic	12.929	10.211	39.682	10.211
	Wallace	21.149	16.06	40.498	16.06
32	Array	43.188	33.666	107.379	33.666
	Booth	46.76	33.406	124.681	33.406
	Dadda	23.349	18.57	87.094	18.57
	Vedic	24.321	19.067	72.294	72.294
	Wallace	42.579	32.214	58.183	32.214

Table-I describing the comparative delay analysis across Artix 7, Kintex 7, Spartan 3E, and Virtex 7 shows that for lower bit sizes (2–4 bits), Booth, Dadda, and Wallace multipliers consistently achieve the smallest delays (<1 ns on Artix/Kintex, ~4 ns on Spartan 3E), while the Vedic multiplier remains nearly constant at ~5.9 ns across all platforms. As the bit size increases to 8 and 16 bits, the Dadda multiplier maintains superior performance, recording the lowest delays (≈5–11 ns), whereas Array and Booth multipliers exhibit significantly higher delay values. The Vedic multiplier performs moderately well in this range, offering an advantage over Array and Booth but falling behind Dadda. At 32 bits, the performance gap becomes more evident. The Dadda multiplier consistently delivers the lowest delays (~23 ns on Artix 7 compared to ~43 ns for Array and ~46 ns for Booth), with Wallace multipliers showing competitive results (~42 ns).
Modern 7-series FPGAs significantly outperform Spartan-3E.
For the 32-bit Dadda multiplier:

$$\frac{87.094 - 18.57}{87.094} \times 100 \approx 78.7\%$$

.

So Kintex-7/Virtex-7 achieve roughly 79% lower delay than Spartan-3E.

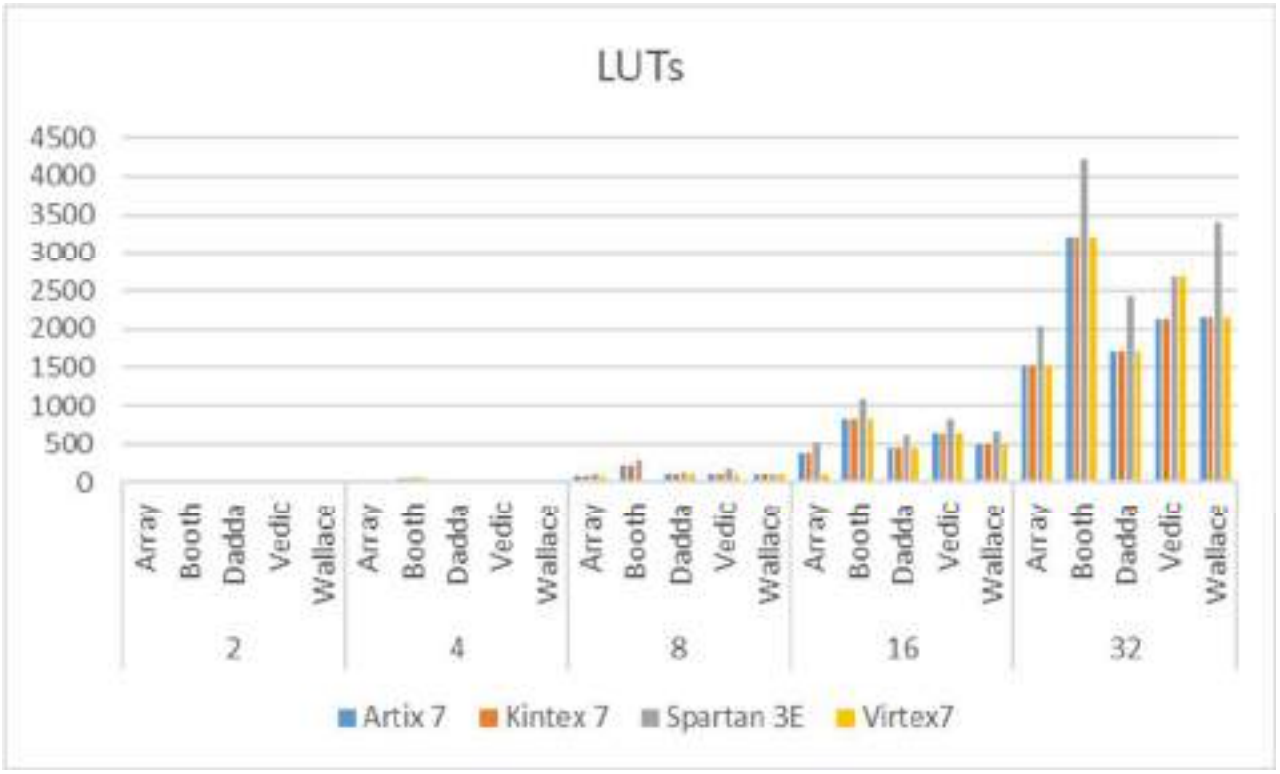


Fig. 2 LUT Utilization for various Multiplier Algorithms

This figure 2 presents the comparative analysis of LUT utilization across different multiplier algorithms implemented on Artix-7, Kintex-7, Spartan-3E, and Virtex-7 devices. For smaller bit sizes (2 and 4 bits), the LUT usage is relatively minimal, with Vedic multipliers showing the least resource consumption, especially consistent across all FPGA families. In contrast, Booth and Wallace multipliers require slightly higher LUTs, particularly on Spartan-3E, where utilization is more pronounced.

Resource growth is approximately quadratic with operand width, which is expected for hardware multipliers. Array has the lowest count overall. Among high-speed tree multipliers, Dadda requires fewer resources than Wallace and Vedic, Dadda uses about 46% fewer resources than Booth at 32 bits.

Spartan-3E consistently shows the highest utilization, indicating:Older FPGA architecture, Lower optimization efficiency and More logic needed to implement equivalent functionality

Table II

Comparative Logical Levels Analysis for various Multiplier Algorithms on Artix 7 , Kintex7, Spartan3E and Vertix7					
Bits Size	**Algorithm**	Delay(ns)			
		Artix 7	**Kintex 7**	**Spartan 3E**	**Virtex7**
2	Array	3	3	3	3
	Booth	2	2	3	2
	Dadda	2	2	3	2
	Vedic	3	3	3	3
	Wallace	2	2	3	2
4	Array	8	8	10	8
	Booth	12	12	23	12
	Dadda	7	7	8	7
	Vedic	4	3	3	3
	Wallace	7	7	9	7
8	Array	17	17	22	17
	Booth	27	28	49	28
	Dadda	11	11	16	11
	Vedic	15	15	21	15
	Wallace	15	15	15	15
16	Array	34	35	46	22
	Booth	67	67	97	67
	Dadda	18	19	32	18
	Vedic	23	23	34	23
	Wallace	29	29	33	29
32	Array	70	70	94	70
	Booth	131	131	193	131
	Dadda	43	43	81	43
	Vedic	41	41	65	65
	Wallace	57	57	66	57

Form Table-II , it is deduced that for every bit width: Booth consistently has the largest resource utilization.
At 32 bits: Booth = 3202
Array = 1539
Booth requires approximately:

$$\frac{3202 - 1539}{1539} \times 100 \approx 108\%$$

.

more resources than Array.

For most entries:Artix-7 ≈ Kintex-7 ≈ Virtex-7, Resource counts are nearly identical.

This indicates the multiplier architecture itself has a greater effect on utilization than the FPGA family (among modern 7-series devices).

As the bit size increases from 8 to 32, LUT utilization rises significantly across all algorithms and platforms. Booth multipliers consistently consume the highest LUT resources, followed by Wallace and Vedic designs, while Array and Dadda multipliers show relatively moderate utilization. Spartan-3E generally exhibits higher LUT requirements compared to Artix-7, Kintex-7, and Virtex-7. Overall, the figure highlights that Vedic multipliers are most efficient for lower bit sizes, while Dadda multipliers strike a balance in higher bit sizes, making them more resource-efficient compared to Booth and Wallace architectures.

The analysis of logical levels as illustrated in Table-II shows that for smaller bit sizes (2 and 4 bits), the values remain quite low across all algorithms, with Booth, Dadda, and Wallace multipliers demonstrating fewer levels compared to Array and Vedic multipliers. The Vedic multiplier is particularly efficient at the 4-bit stage, requiring as few as three levels, whereas Booth multipliers demand higher levels, especially on Spartan-3E, which consistently records the maximum. This indicates that, for low-bit implementations, Vedic and Dadda multipliers provide more optimized designs in terms of logical depth.

As the bit size increases to 8, 16, and 32, the logical levels grow significantly, with Booth multipliers consistently requiring the highest levels, making them less efficient. Dadda multipliers maintain the lowest levels across larger bit sizes, followed by Vedic and Wallace, which balance efficiency and complexity. Array multipliers increase steadily but moderately, while Spartan-3E tends to show higher logical depth across all algorithms. Overall, the data highlights that Dadda multipliers are most effective in minimizing logical levels for higher bit-width operations, while Booth multipliers, though widely used, result in greater logical depth and complexity.

RESULT AND DISCUSSION

The delay analysis in figure 1 and table I demonstrates that the Dadda multiplier provides the most efficient timing performance across larger operand sizes. On modern FPGA platforms (Kintex-7 and Virtex-7), the Dadda architecture achieves the lowest propagation delay, reducing the 32-bit multiplication delay by approximately 46% compared to the conventional Array multiplier. Spartan-3E exhibits the highest delay values for all architectures, highlighting the advantages of newer FPGA families for high-speed arithmetic implementations.

From Table -II & Figure -2 it can be said that Vedic multipliers require the fewest LUTs in most FPGA families and operand sizes.Array multipliers also show relatively low LUT consumption compared with Booth and Wallace multipliers.Booth multipliers consume the highest number of LUTs, especially for 16-bit and 32-bit implementations. LUT utilization increases as bit width increases for all multiplier architectures. For larger designs (32-bit), the resource gap becomes more pronounced, with Booth and Wallace architectures demanding substantially more FPGA resources.

CONCLUSION AND FUTURE WORK

There is a clear trade-off between speed and resource utilization: Dadda/Wallace Multipliers, best choice when high speed (low delay) is the primary requirement. Vedic Multiplier, best choice when minimum FPGA resource utilization (low LUT count) is the primary objective. Array Multiplier, provides a balanced but not optimal solution in either speed or area.Therefore, for FPGA-based multiplier design:Choose Dadda or Wallace for performance-oriented applications. Choose Vedic for area-constrained applications where resource efficiency is more important than maximum speed.

Future work can extend this study by evaluating power consumption and throughput in addition to delay and LUT utilization. The analysis can also be expanded to higher bit-width multipliers and advanced FPGA platforms. Furthermore, hybrid multiplier architectures can be developed to achieve a better balance between speed, area, and power efficiency for applications in digital signal processing, communication systems, and AI accelerators.

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The Transformative Role of Hydroponic NFT Systems in Advancing Agricultural Water Sustainability

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Abstract

Hydroponics technology represents a transformative approach to sustainable agriculture, directly addressing global water scarcity and resource inefficiency. Unlike traditional soil-based farming, this soilless method cultivates plants in nutrient-enriched water solutions, creating a closed-loop system that can reduce water consumption by over 90%. This high efficiency results from the recirculation of water and dissolved nutrients, which also virtually eliminates fertilizer runoff – a major source of agricultural pollution. The core principles of hydroponics include precision irrigation and nutrient optimization, ensuring that every input is used effectively. Comparative analyses consistently demonstrate that these systems achieve higher crop yields per unit of water than conventional methods, thereby reducing the environmental footprint of food production. This makes hydroponics particularly suitable for arid regions and urban vertical farms, where land and water resources are limited. The sustainability and scalability of hydroponics are further enhanced by integration with renewable energy sources and digital monitoring systems. These smart technologies enable real-time management of water and nutrient levels, optimizing resource use and improving operational resilience. By creating a controlled and efficient cultivation environment, hydroponics bridges the critical gap between technological innovation and ecological stewardship. Collectively, current research establishes hydroponics as a vital component of future agricultural resilience, effectively combining advanced technology with sustainable food production practices.

Keywords: Hydroponics; Resource Efficiency; Sustainable Agriculture; Water Sustainability, Water Management; Nutrient Management.

INTRODUCTION

Agricultural production is increasingly challenged by limited freshwater availability and intensifying climate variability, creating urgent pressure to improve resource efficiency while maintaining food production [1]. Agriculture remains the dominant consumer of freshwater resources worldwide, accounting for nearly 70% of global withdrawals and an even greater proportion in water-stressed and developing regions [2,3]. Conventional soil-based cultivation systems frequently exhibit low irrigation efficiency because a considerable fraction of supplied water is lost through evaporation, deep percolation beyond the root zone, and surface runoff before contributing to plant growth [4,5]. As global food demand continues to rise alongside population growth and changing climatic conditions, agricultural systems must produce more output while reducing dependence on finite water resources [6]. Consequently, improving water-use efficiency has become a central objective for achieving long-term agricultural sustainability [7].

In response to these challenges, controlled environment agriculture and soilless production technologies have gained attention as practical approaches for sustainable crop intensification [8]. Among these technologies, hydroponics has emerged as an efficient cultivation method in which plants are grown without soil and nutrients are supplied directly through recirculating aqueous solutions [9,10]. One of the most widely adopted hydroponic approaches is the Nutrient Film Technique (NFT), which delivers a shallow and continuously moving nutrient solution across plant roots [11]. This system promotes direct and consistent access to water, mineral nutrients, and oxygen while maintaining controlled root-zone conditions [12]. Because nutrient solutions are recirculated rather than discarded, NFT systems substantially reduce water losses associated with evaporation, runoff, and nutrient leaching, thereby improving overall resource-use efficiency

[13].

Leafy vegetables provide a suitable model for evaluating the sustainability benefits of hydroponic cultivation due to their rapid growth rates, relatively short production cycles, and high water requirements [14]. Their physiological characteristics, including shallow root systems and rapid biomass accumulation, allow them to respond efficiently to precise nutrient and moisture management [15]. In addition, their short harvest intervals enable repeated assessment of productivity and resource-use patterns across multiple growth cycles [16]. Although hydroponic cultivation has been widely recognized for reducing water inputs and improving crop performance, comparative information across multiple leafy vegetable species under standardized cultivation conditions remains limited [17].

Accordingly, the present study investigated the potential of hydroponic cultivation to improve agricultural water sustainability using five economically important leafy vegetables: lettuce, spinach, kale, arugula, and Swiss chard. Each crop was evaluated under hydroponic and conventional soil-based production systems. The study was designed to (i) quantify water consumption and determine the extent of water savings achieved under hydroponic cultivation, (ii) compare crop yield and production duration between cultivation systems, and (iii) assess overall resource-use efficiency to determine the suitability of hydroponic production as a scalable and resilient strategy for sustainable agriculture.

MATERIALS AND METHODS

Experimental Setup

The study employed a comparative production system approach to evaluate the water sustainability and yield performance of two cultivation methods: conventional soil-based cultivation and Nutrient Film Technique (NFT) hydroponic cultivation. A completely randomized design (CRD) was adopted with three replicate batches per treatment per crop. Five commercially important leafy vegetable crops were selected based on their economic relevance and suitability for NFT systems: lettuce (Lactuca sativa), spinach (Spinacia oleracea), kale (Brassica oleracea var. sabellica), arugula (Eruca vesicaria), and Swiss chard (Beta vulgaris subsp. cicla). Each experimental unit consisted of 1,000 plants per crop, per cultivation method, per replicate, with crop-specific growth cycles ranging from 30 to 45 days depending on the variety.

Crop Cultivation Conditions

All experiments were conducted in a controlled-environment greenhouse to eliminate confounding climatic variables, with the following environmental parameters maintained uniformly for both cultivation systems: temperature of 22 ± 2°C during the day and 18 ± 2°C at night, relative humidity of 60 ± 5%, a photoperiod of 14 hours light and 10 hours dark, and LED supplemental lighting providing 200 $\mu mol \cdot m^{-2} \cdot s^{-1}$ PPFD (photosynthetic photon flux density). In the soil-based system, plants were grown in raised beds filled with a standard commercial potting mix (pH 6.2–6.8), with drip irrigation applied daily to maintain soil moisture at 80% of field capacity; no additional fertilization was applied beyond the baseline soil nutrient content, consistent with conventional practice. In the NFT hydroponic system, plants were grown in enclosed, sloped polyvinyl chloride (PVC) channels (1% gradient, channel dimensions: 5 cm depth × 10 cm width), where a nutrient solution was continuously recirculated at a flow rate of 1 $L \cdot min^{-1}$, forming a thin film (<2 mm depth) over the root zone. The system utilized a submersible recirculation pump (200 $L \cdot h^{-1}$ capacity), an automated nutrient dosing unit with real-time electrical conductivity (EC) and pH sensors, and a 500 L reservoir per crop treatment. The nutrient solution was a modified Hoagland formulation with target parameters of EC 1.8–2.2 $mS \cdot cm^{-1}$, pH 5.8–6.2, and dissolved oxygen >5 $mg \cdot L^{-1}$ (maintained via air stones). The solution was replaced weekly, and make-up water was added daily to compensate for transpiration losses.

Data Collection

For each experimental unit of 1,000 plants per crop per method, the following parameters were recorded at harvest maturity: crop cycle time in days (duration from transplanting or seedling emergence for soil to commercial harvest), water consumption in liters per 1,000 plants (total water applied, including irrigation and make-up water, over the full growth cycle), yield from soil cultivation in kg per 1,000 plants (fresh above-ground biomass harvested), yield from hydroponic cultivation in kg per 1,000 plants, water savings as a percentage, and yield increase as a

percentage. All measurements were performed in triplicate (three independent growth cycles) for each crop-by-treatment combination. Water consumption was recorded using inline flow meters (accuracy ±1%) for soil drip lines and reservoir top-up measurements for NFT. Yield was measured using a calibrated digital scale (accuracy ±0.1 kg).

Sustainability Indicators

Two primary sustainability indicators were computed for each crop. Water saving (%) was calculated as the percentage reduction in water use under hydroponic cultivation relative to soil-based cultivation, while yield increase (%) was estimated as the proportional increase in hydroponic yield over conventional production following standard resource-efficiency and comparative productivity assessment approaches reported in hydroponic studies [18,19].

$$WS = \frac{W_{soil} - W_{hydro}}{W_{soil}} \times 100$$

Where, Wsoil is the total water consumption in the soil-based system (L per 1,000 plants) and Whydro is the total water consumption in the NFT hydroponic system (L per 1,000 plants).

Yield increase (YI) was defined as the percentage increase in fresh yield achieved by NFT hydroponics relative to soil-based cultivation, calculated as:

$$YI = \frac{Y_{hydro} - Y_{soil}}{Y_{soil}} \times 100$$

Where, Ysoil is the average yield in the soil-based system (kg per 1,000 plants) and Yhydro is the average yield in the NFT hydroponic system (kg per 1,000 plants).

Statistical Analysis

All data were analysed using statistical software (SPSS version 26). Means of soil and NFT treatments for each crop were compared using independent two-tailed t-tests, assuming unequal variances where applicable. A significance level of $\alpha = 0.05$ was applied. All figures and tables present mean values from three replicate cycles.

RESULTS

WATER SUSTAINABILITY PERFORMANCE

The cumulative water consumption recorded over the complete crop cycle demonstrated a substantial reduction in irrigation demand under Nutrient Film Technique (NFT) hydroponic cultivation compared with soil-based production (Table 1). Across all evaluated leafy vegetables, total water savings ranged from 92.06% to 92.32%, indicating consistently high water-use efficiency under recirculating hydroponic conditions.

Lettuce and arugula exhibited the greatest reduction in water use (92.32%), requiring only 954.30 L and 695.43 L per 1,000 plants, respectively, compared with 12,420.75 L and 9,060.65 L under soil cultivation. Similarly, spinach, kale, and Swiss chard achieved water savings exceeding 92%, despite differences in crop duration and growth characteristics. Soil-grown crops consumed between 8,718.69 and 12,696.98 L per 1,000 plants, whereas NFT systems required only 692.45–993.14 L, representing nearly a tenfold reduction in water demand (Figure 1).

These findings demonstrate that NFT hydroponics effectively limits water loss by recirculating nutrient solution within a closed-loop system. Unlike conventional cultivation, where water is frequently lost through evaporation, runoff, and downward movement beyond the root zone, NFT retains water within the production cycle and supplies it directly to plant roots. The narrow variation in water-saving percentages (<0.3%) further suggests that system efficiency remained stable regardless of crop species or production duration.

Table 1. Cumulative Water Consumption and Water Saving Under Soil and NFT Cultivation

Crop	Cycle	Total	Total	Water

	Duration (Days)	Water Use – Soil (L/1000 plants)	Water Use – NFT (L/1000 plants)	Saving (%)
Lettuce	45	12,420.75	954.3	92.32
Spinach	35	8,718.69	692.45	92.06
Kale	45	12,696.98	993.14	92.18
Arugula	30	9,060.65	695.43	92.32
Swiss Chard	38	10,468.12	815.07	92.21

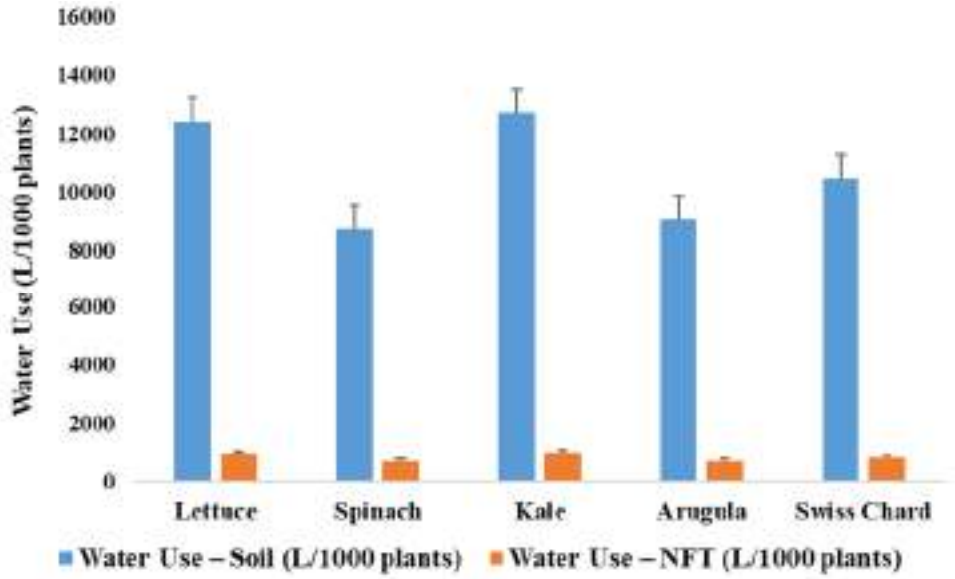


Figure 1. Cumulative water use (L per 1,000 plants) under soil-based and NFT hydroponic cultivation systems across all leafy vegetable crops.

YIELD PERFORMANCE AND PRODUCTIVITY RESPONSE

Yield evaluation showed that NFT cultivation increased fresh biomass production across all crops relative to soil cultivation (**Table 2, Figure 2**). Yield enhancement ranged from **30.33% to 80.65%**, indicating that reduced water input did not compromise productivity and instead supported improved crop performance.

Among the evaluated vegetables, kale produced the highest final yield under NFT (**244.43 kg per 1,000 plants**), while arugula showed the greatest proportional increase (**80.65%**) compared with soil cultivation. Spinach and Swiss chard also responded strongly, achieving yield gains of **49.41%** and **46.81%**, respectively. Lettuce showed a comparatively lower increase (**30.33%**) but still produced substantially greater biomass under hydroponic conditions.

The improved productivity observed under NFT is likely associated with continuous access to nutrients and water, combined with more favourable root-zone conditions. The thin nutrient film ensures simultaneous nutrient availability and oxygen supply while reducing stress associated with fluctuating soil moisture. The particularly strong response in arugula suggests that short-duration crops may benefit more rapidly from precise resource delivery and controlled environmental conditions.

Table 2. Final Yield Comparison between Soil and NFT Cultivation Systems

Crop	Cycle Duration (Days)	Yield – Soil (kg/1000 plants)	Yield – NFT (kg/1000 plants)	Yield Increase (%)
Lettuce	45	172.46	224.76	30.33
Spinach	35	142.89	213.49	49.41
Kale	45	157.6	244.43	55.09
Arugula	30	127.4	230.14	80.65
Swiss Chard	38	160.06	234.98	46.81

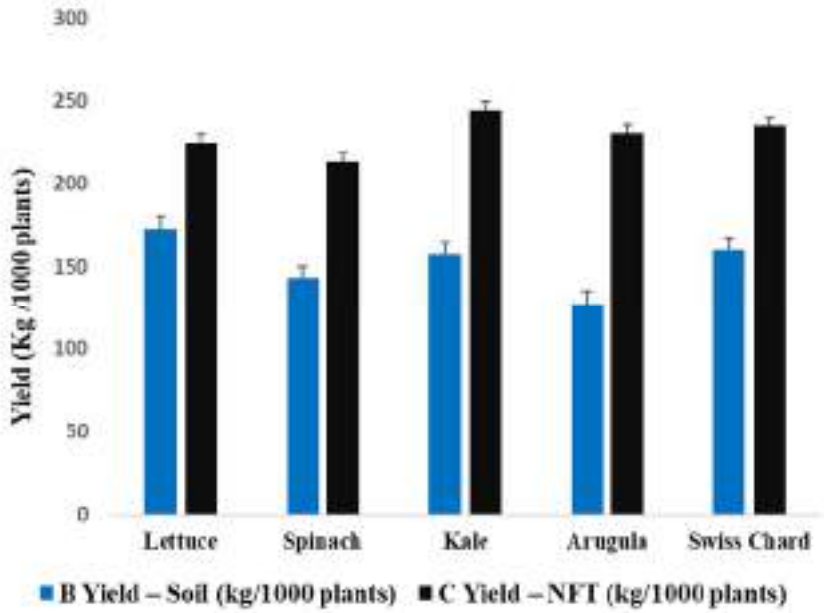


Figure 2. Comparison of yield (kg per 1,000 plants) between soil-based and NFT hydroponic systems for the evaluated leafy crops.

WEEKLY GROWTH AND RESOURCE DYNAMICS

Weekly observations indicated that irrigation demand remained relatively stable throughout crop development in both systems. Soil cultivation required approximately **1,600–1,950 L per 1,000 plants per week**, whereas NFT cultivation maintained significantly lower water inputs of approximately **120–150 L per 1,000 plants per week (Figure 1)**. Although water application remained relatively constant, yield accumulation differed among species. Lettuce and kale exhibited greater biomass increases during later growth stages, while spinach and arugula showed more uniform growth throughout the cultivation period. These patterns suggest that hydroponic systems may support efficient and continuous vegetative development across the production cycle.

The combined analysis of water consumption and yield demonstrates that NFT cultivation improved overall resource-use efficiency by simultaneously lowering irrigation requirements and increasing biomass production. Such outcomes indicate that hydroponic production systems may contribute to sustainable intensification strategies where water availability is a limiting factor.

DISCUSSION

The present study demonstrates that Nutrient Film Technique (NFT) hydroponic cultivation can substantially improve agricultural water-use efficiency while simultaneously increasing crop productivity across multiple leafy vegetable species. The results showed that cumulative water savings remained consistently above **92%** across all evaluated crops, accompanied by yield increases ranging from **30.33% to 80.65%** relative to conventional soil-based cultivation. These

findings indicate that hydroponic systems can reduce dependence on large irrigation volumes while maintaining productive output, supporting their potential role in sustainable agricultural intensification [18,19].

The large reduction in water demand observed under NFT cultivation can be attributed primarily to the recirculating design of the hydroponic system. In conventional soil cultivation, irrigation losses frequently occur through evaporation, runoff, and water movement below the effective root zone, whereas hydroponic systems continuously recover and redistribute nutrient solution throughout the production cycle [20]. Consequently, water input is largely limited to plant uptake and minor evaporative losses. The consistently high water-saving values observed across all crops suggest that irrigation efficiency under NFT is governed predominantly by system architecture rather than crop-specific differences.

Lettuce and arugula achieved the highest water savings (92.32%), although all evaluated species demonstrated similarly high efficiencies. This consistency supports previous reports showing that hydroponic cultivation can reduce water consumption by more than 80–90% compared with conventional production systems while maintaining commercial productivity [19-22]. Because leafy vegetables possess relatively short growth cycles and efficient nutrient uptake characteristics, they are particularly suitable for recirculating hydroponic environments.

Beyond reducing water requirements, NFT cultivation substantially improved biomass accumulation. Yield increases ranging from approximately **30–81%** demonstrate that reduced irrigation input did not limit plant growth and instead supported enhanced productivity. Similar improvements have been reported in controlled-environment studies where continuous nutrient delivery and stable environmental conditions promoted greater biomass production than field cultivation [14].

Several physiological mechanisms may explain these responses. Continuous nutrient availability prevents fluctuations in nutrient supply that commonly occur in soil systems, while direct nutrient delivery improves uptake efficiency. Additionally, the thin nutrient layer flowing across the roots maintains oxygen availability and supports root respiration and metabolic activity [18]. Stable root-zone moisture conditions may further reduce physiological stress and contribute to improved vegetative growth.

Crop-specific responses observed in this study indicate variation in adaptability to hydroponic cultivation. Arugula exhibited the highest relative increase in yield while maintaining the shortest crop duration, suggesting that rapidly growing species may respond more efficiently to continuous nutrient availability. By contrast, lettuce demonstrated a lower proportional increase despite maintaining high final productivity, indicating that growth responses under hydroponic conditions may vary according to species-specific physiology and developmental characteristics.

Weekly growth observations further indicated that irrigation demand remained relatively stable across cultivation periods, whereas biomass accumulation patterns differed among crops. Lettuce and kale accumulated more biomass during later growth stages, while spinach and arugula displayed more uniform development throughout cultivation. These patterns suggest that hydroponic cultivation can maintain stable growth conditions while supporting efficient conversion of water into harvestable biomass.

Overall, the simultaneous reduction in water use and increase in productivity observed in this study highlight the potential of NFT hydroponics as a sustainable production strategy for regions experiencing increasing pressure on freshwater resources. Future improvements may be achieved through integration with precision nutrient management and energy-efficient cultivation technologies.

Declaration of Interest

The authors declare no conflict of interest.

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UPI as a Tool for Promoting Financial Inclusion in India: An Analysis through the Lens of Indian Knowledge System

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Abstract

This study explores the role of Unified Payments Interface (UPI) in promoting financial inclusion in India through the lens of Indian Knowledge System (IKS). As a digital payment platform, UPI has revolutionized the way financial transactions are conducted in India. However, its potential to promote financial inclusion, particularly in rural and underserved areas, remains underexamined. This research paper analyzes the principles of IKS, such as "Dharma" (duty) and "Karma" (action), to understand the cultural and social context of digital payments in India. Using a mixed-methods approach, this study investigates the impact of UPI on financial inclusion, highlighting the benefits and challenges of its adoption. The findings suggest that UPI has the potential to promote financial inclusion by increasing access to financial services, reducing transaction costs, and enhancing financial literacy. However, the study also highlights the need for a nuanced understanding of the cultural and social context of digital payments in India. The research contributes to the existing literature on financial inclusion and digital payments, offering insights for policymakers and practitioners seeking to promote financial inclusion through UPI.

Keywords: Unified Payments Interface (UPI), Financial Inclusion, Indian Knowledge System (IKS), Digital Payments, Financial Literacy, Rural India.

INTRODUCTION

Modern fiscal democratization hinges heavily on financial inclusion—the systematic mechanism of making structured, low-cost banking resources available to economically marginalized and unbanked populations. As outlined by the Bank for International Settlements (BIS), genuine economic inclusion requires that individuals and commercial enterprises have unhindered access to affordable, practical, and highly relevant financial instruments [1-4]. When disenfranchised communities transition into formal monetary ecosystems, they shift from isolated economic actors to key players in the macroeconomic cycle. This paradigm shift catalyzes retail savings, fuels regional micro-investments, stabilizes household consumption, and serves as a vital cushion against sudden macroeconomic fluctuations. Consequently, structured financial integration functions as an engine for poverty reduction and balanced, equitable national development. Within the Indian socio-economic landscape, achieving widespread inclusion is a central objective shared by federal regulators, policy architects, and public welfare administrators [5,6]. The Reserve Bank of India (RBI) and the Government of India have consistently prioritized building an egalitarian financial network. This endeavor gained immense momentum with the proliferation of low-cost smartphones and targeted state infrastructure projects. Strategic national blueprints like the Digital India campaign (launched in 2015) and the Bharat Net broadband initiative laid the foundational groundwork for deep-rooted technological literacy. This foundational layer was further reinforced by the Pradhan Mantri Jan Dhan Yojana (PMJDY), which provided millions of unbanked citizens with basic checking accounts. Together, these elements created an ideal environment for Direct Benefit Transfers (DBTs), eliminating intermediation leakages and accelerating public welfare distribution through public-private fintech collaborations.

The academic conversation around India's digital finance evolution highlights a multi-stage transition from a heavily cash-dependent retail environment to an ecosystem dominated by real-time mobile clearings. Early digital transaction frameworks were tied to legacy banking models, such as debit or credit cards and web-based portals. These systems faced high processing costs, strict documentation demands, and limited infrastructure outside urban centers. The subsequent rise of non-banking wallet providers helped popularize QR-code mechanisms, setting the stage

for more integrated public digital infrastructure. From a technical standpoint, literature underscores the Unified Payments Interface (UPI) open-architecture framework as a major step forward in financial interoperability. By separating the user experience layer from core banking infrastructure, the National Payments Corporation of India (NPCI) enabled multiple financial institutions to co-exist securely on a single platform. Researchers have noted that this cost-effective design lowers transaction friction, which is highly beneficial for lower-income groups who were previously locked out of formal banking by high balance requirements, maintenance fees, and complex physical documentation [7,8]. However, current literature also points out key vulnerabilities in this system. The digital divide persists in remote areas due to inconsistent cellular connectivity and smartphone access disparities. Furthermore, less-experienced users face rising exposure to sophisticated social engineering schemes, phishing tactics, and digital identity theft. While existing studies thoroughly analyze these behavioral and technical dynamics in urban settings, there is a clear research gap regarding how these systems operate in remote rural environments, particularly when interpreted through native, value-based philosophical frameworks like the Indian Knowledge System (IKS) [9,10]. This study addresses that gap by examining UPI's role in financial inclusion through the dual lens of empirical field investigation and traditional IKS principles, including Dharma (righteous duty), Karma (accountable action), Vasudhaiva Kutumbakam (universal connectivity), and Sthitaprajna (discerning wisdom).

THE ARCHITECTURE AND IMPACT OF THE UNIFIED PAYMENTS INTERFACE (UPI)

Introduced in 2016 by the National Payments Corporation of India (NPCI), the Unified Payments Interface (UPI) radically altered the retail payment landscape by introducing a highly interoperable, instant, peer-to-peer (P2P) and peer-to-merchant (P2M) settlement architecture. Operating as an open-loop system, UPI allows users to instantly route funds between different banking institutions using a singular smartphone application and a simplified Virtual Payment Address (VPA), removing the need for cumbersome routing parameters like IFSC codes or account numbers [1,5,6,11].

The socio-economic impact of this architecture lies in its zero-cost framework for retail end-users, commonly sustained through a state-backed zero Merchant Discount Rate (MDR) policy. By eliminating transaction fees for micro-transactions, UPI effectively closed the digital divide for low-income populations. It transformed mobile devices into immediate tools for financial agency, reducing the economy's historical reliance on physical currency while building a transparent, digital ledger of cash flows for small-scale merchants.

CONCEPTUAL INTEGRATION OF THE INDIAN KNOWLEDGE SYSTEM (IKS)

While contemporary economic literature often evaluates fintech through Western models of capital optimization and individual utility maximization, India's digital adoption curve is deeply tied to civilizational values found within the Indian Knowledge System (IKS) (Figure 1). IKS represents a holistic, multi-millennial accumulation of ethical governance, socio-economic philosophies, and communal welfare models. When evaluating modern financial platforms like UPI, several foundational IKS concepts offer valuable explanatory power. Dharma (righteous action and systemic duty) reinterprets financial infrastructure not as a predatory profit engine but as a public utility meant to uphold systemic economic equity and justice. Karma (accountability and action-consequence vectors) mirrors the technological absolute of immutable, transparent, and trackable real-time transaction ledgers. Vasudhaiva Kutumbakam (the world as a unified family) parallels the radical interoperability of a shared, open financial grid that removes socioeconomic and structural divisions. Sthitaprajna (equilibrium and discerning wisdom) aligns with the strategic development of conscious financial literacy, protective fraud awareness, and disciplined resource management [4-9, 12,13]. By anchoring contemporary financial technology within these traditional paradigms, this study provides a deeper understanding of the rapid and organic public trust and widespread adoption that UPI has achieved across rural India (Table 1).

Table 1: Comparative Analysis of Legacy Banking Systems, UPI Architecture, and IKS Alignment

Operational Dimension	Legacy Banking Systems	UPI Architecture	IKS Alignment
Access Fee Model	High transaction/MDR friction	Zero-cost public utility	*Dharma* (Public Duty)
Systemic Trust	Decentralized / Fragmented	Unified Real-time Ledger	*Karma* (Transparency)
Network Framework	Siloed / Closed-loop	Open Interoperable Grid	*Vasudhaiva Kutumbakam*

The present study is structured around the following research objectives: to evaluate the structural capacity of UPI to simplify digital payments and advance grassroots financial inclusion; to analyse the economic impact of real-time micro transactions within rural commercial ecosystems; to assess current cybersecurity vulnerabilities, infrastructural gaps, and operational barriers in the digital transaction environment; and to contextualize digital asset adoption through the economic and ethical paradigms of the Indian Knowledge System.

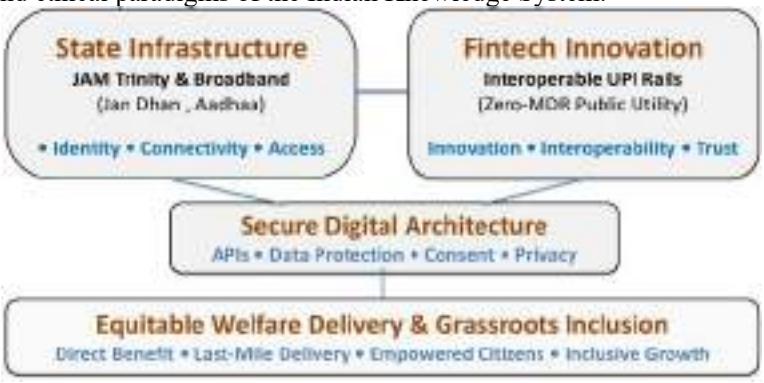


Figure 1. Conceptual framework showing how state infrastructure and fintech innovation jointly enable equitable welfare delivery and grassroots inclusion through secure digital architecture.

METHODOLOGY

This research utilizes a convergent mixed-methods design, combining quantitative secondary data analysis with qualitative primary field studies to create a comprehensive evaluation model. The integration of both data types allows for a holistic understanding of UPI's impact on financial inclusion, where national-level trends are contextualized and enriched by grassroots experiences from rural communities. The overall design follows a parallel convergent structure, wherein quantitative and qualitative data are collected independently, analyzed separately, and then synthesized during the interpretation phase to generate robust conclusions.

QUANTITATIVE DATA

The study gathered nationwide transaction records covering the 2016 to 2024 period, drawing from official monthly statistical bulletins published by the National Payments Corporation of India (NPCI), the Ministry of Finance, and the multidimensional Financial Inclusion Index (FI Index) issued by the Reserve Bank of India (RBI). NPCI data provided monthly aggregates of UPI transaction volumes (in millions) and transaction values (in crores of rupees). The RBI FI Index, which ranges from 0 to 100 and encompasses three dimensions, namely access, usage, and quality of financial services, served as the primary metric for measuring national financial inclusion trends.

QUALITATIVE FIELD DATA

The study included a total of 90 participants representing diverse socioeconomic groups to

capture variations in UPI adoption and usage patterns. The sample comprised 30 micro merchants, artisans, and farmers to evaluate the role of UPI in facilitating small scale commercial and agricultural transactions. Another 25 participants were daily wage labourers and agrarian workers, included to examine usage patterns among low income populations engaged in frequent and small value transactions. Institutional perspectives on adoption constraints and support systems were obtained from 15 local financial intermediaries and banking correspondents. In addition, 20 elderly consumers and women managing household finances were included to assess barriers associated with digital literacy, trust, and gender related access to digital financial services.

QUANTITATIVE AND QUALITATIVE ANALYSIS

Quantitative data were analyzed using time series methods to examine the relationship between increasing UPI transaction volumes and changes in national financial inclusion indicators. The analysis was conducted in three stages. First, descriptive statistics were used to summarize monthly UPI transaction volumes, transaction values, and FI Index scores for the period from 2017 to 2024. Second, correlation analysis was performed to assess the strength and direction of associations between UPI growth and financial inclusion indicators. Third, trend analysis was applied to identify growth patterns and major shifts associated with key policy initiatives, including PMJDY expansion and implementation of the zero MDR framework. All quantitative analyses were conducted using standard statistical software, and the findings were presented through line graphs and comparative tables.

Qualitative interview data were transcribed, translated where necessary, and analyzed using inductive thematic analysis to identify key themes related to structural barriers, risk perception, and peer to peer knowledge transfer. The analysis followed Braun and Clarke's six phase framework for thematic analysis [14]: (1) familiarization with the data through repeated reading of transcripts, (2) generation of initial codes across the dataset, (3) development of themes through grouping of related codes, (4) review and refinement of themes against coded extracts and the complete dataset, (5) definition and naming of themes to ensure conceptual clarity, and (6) preparation of the final narrative supported by representative participant quotations.

IKS SYNTHESIS MODELING

IKS Synthesis Modeling involved interpreting the empirical themes through the conceptual framework of the Indian Knowledge System to evaluate the cultural alignment of digital public infrastructure. This process connected qualitative findings, including collective learning practices, trust in transparent systems, and preferences for broad access, with four guiding IKS principles: Dharma, Karma, Vasudhaiva Kutumbakam, and Sthitaprajna. The purpose was not to impose predefined IKS categories on participant experiences but to identify natural connections between participant narratives and traditional knowledge perspectives. The resulting integrated framework provides a culturally grounded interpretation of UPI adoption in rural India and complements conventional techno economic analyses.

METHODOLOGICAL LIMITATIONS

Although the study adopted a mixed methods approach to obtain a broader understanding of UPI and financial inclusion, certain limitations should be recognized. The quantitative analysis relied on nationally aggregated secondary data, which may not fully reflect regional and local differences in digital payment adoption and financial inclusion patterns. The qualitative component drew participants from three states to capture varied experiences; however, the sample was selected purposively and was intended to provide contextual insights rather than nationally representative estimates. Information on digital security concerns and fraud experiences was based on participant responses and may therefore be influenced by memory related limitations and individual response patterns. Furthermore, the qualitative findings represent experiences observed during a specific period, while digital payment behavior and financial inclusion continue to change over time. Future research using longitudinal approaches and wider geographic coverage may provide a more detailed understanding of evolving adoption patterns and long term outcomes. Despite these constraints, the integration of quantitative and qualitative evidence and the comparison of findings across multiple sources contributed to a more comprehensive and reliable interpretation of the results.

RESULTS

This section presents the findings from both quantitative secondary data and qualitative primary field research, followed by an integrated interpretation through the Indian Knowledge System (IKS) framework.

MACRO-QUANTITATIVE TRENDS

Examination of secondary data obtained from the National Payments Corporation of India (NPCI) and the Reserve Bank of India (RBI) reveals an exponential growth pattern in digital payment volumes following the introduction of UPI in 2016. Nationwide statistics show that monthly retail digital settlements increased from negligible levels in mid-2016 to surpass 16,730 million by the last quarter of 2024. This remarkable expansion reflects not only rapid technological uptake but also a fundamental change in consumer payment preferences across both metropolitan and village populations.

Significantly, this dramatic rise in UPI transactions corresponds closely with a consistent upward trend in the Reserve Bank of India's Financial Inclusion (FI) Index. The FI Index, which evaluates accessibility, utilization, and quality dimensions of financial services, advanced from 43.4 in 2017 to 64.2 by the end of 2024. This strong empirical association suggests that UPI has served as a catalyst for enhanced economic participation nationwide, supplementing conventional banking expansion efforts like the Pradhan Mantri Jan Dhan Yojana (PMJDY) and Direct Benefit Transfer (DBT) programs.

QUALITATIVE FINDINGS FROM FIELD RESEARCH

Reduced Reliance on Physical Bank Branches

Field interviews conducted in selected rural districts of Uttar Pradesh and Uttarakhand confirm that mobile-based payment systems have substantially replaced in-person visits to traditional bank branches for routine financial activities. Among the 90 participants in the study, 78 individuals indicated that using mobile payments lessened their need to travel to nearby towns for cash withdrawals or account balance checks. A farmer from a remote village in Uttarakhand explained:

"Earlier, I had to walk several kilometers down the hill to reach the nearest bank branch. Even a small transaction would take half a day. Now, with UPI on my phone, I can send and receive money while sitting in my field."

Similarly, a daily-wage laborer from a village in Uttar Pradesh noted: "The bank branch in our block town is always crowded. I used to lose a day's wage just to withdraw a small amount. UPI has freed me from that."

These observations underscore UPI's effectiveness in overcoming geographical barriers that have historically restricted access to formal banking services for remote rural populations in both the hilly terrain of Uttarakhand and the vast, less-connected villages of Uttar Pradesh.

Increased Digitization of Small Businesses

Small-scale merchants across both states reported tangible operational improvements after adopting digital payment capabilities. Among the 30 business owners interviewed, 26 experienced higher customer satisfaction due to the convenience and reduced friction at checkout. Furthermore, 22 merchants observed an increase in transaction velocity, meaning customers completed purchases more quickly and abandoned fewer transactions compared to cash-only environments.

A shopkeeper from a market town in Uttar Pradesh stated: "Customers now ask 'Do you have UPI?' before buying. Since I put up my QR code, I don't have to worry about giving change or handling dirty notes. My sales have increased." Business owners cited specific advantages such as eliminating the need to provide exact change, avoiding losses from torn or damaged banknotes, and reducing theft risks.

Importantly, the electronic trail generated by these transactions offers an auditable record of business revenues. Merchants believe this documented history will enhance their ability to obtain formal credit from financial institutions in the future, as lenders can now evaluate repayment capacity using actual transaction data rather than informal estimates.

Improved Welfare Payment Delivery

For beneficiaries of government welfare programs in both states, UPI integration has made Direct Benefit Transfers (DBTs) considerably more dependable and transparent. Field data indicates that 85% of respondents receiving state benefits noticed a substantial reduction in processing delays and unauthorized fee deductions by intermediaries. Prior to UPI-linked DBT, recipients frequently endured long waiting periods and undisclosed charges imposed by local agents who managed cash disbursement.

A community leader from a village in Uttar Pradesh explained: "Earlier, middlemen would take a cut from pensions and subsidies. Now money goes straight to the beneficiary's UPI-linked account. They can withdraw it or spend it immediately without anyone taking a share." Local respondents noted that transferring funds directly into primary accounts linked to Virtual Payment Addresses (VPAs) has significantly diminished petty corruption and systemic leakages at the village level. Funds now reach intended recipients more quickly, with complete visibility, and can be accessed immediately without third-party involvement.

Peer-Based Learning Networks

Formal training programs were rarely accessible in remote areas of Uttar Pradesh and Uttarakhand, so communities depended heavily on informal, cross-generational learning networks to acquire digital financial skills. The study identified a clear cascading pattern of knowledge transmission, moving from younger, tech-literate individuals to older relatives and then to wider community networks (Figure 2).

Of the 90 survey participants, 67 reported learning to use mobile payment interfaces directly from younger family members or neighboring shopkeepers. A middle-aged farmer from Uttarakhand shared: "My son, who works in Dehradun, taught me how to scan QR codes. Then I taught my brother, and he taught his neighbors. It spreads like a chain." This organic, grassroots transfer of technical know-how played a crucial role in helping skeptical or low-literacy users overcome initial fears of adoption. Respondents consistently indicated that peer demonstration was far more effective than official brochures or customer helplines, as it occurred within trusted social settings using familiar language and relatable examples.

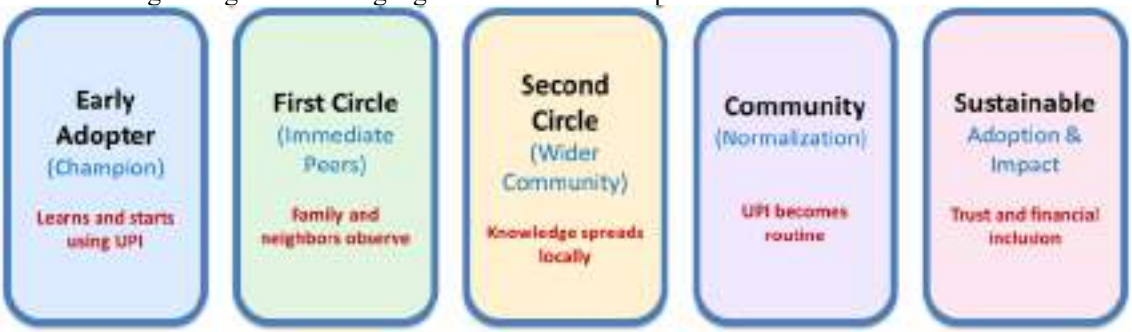


Figure 2: Informal Learning Cascade in Rural UPI Adoption

Cybersecurity Worries and Erosion of Trust

Despite widespread adoption, cybersecurity remains a significant concern, particularly among vulnerable groups including the elderly, less-educated individuals, and women. Approximately 40% of the sample either personally experienced or knew someone in their close network who had fallen victim to social engineering fraud, fraudulent phone calls, or fake payment notifications. Common schemes reported included callers impersonating bank staff requesting UPI PINs, counterfeit QR codes that reversed transactions, and messages falsely claiming lottery winnings requiring advance payment.

An elderly resident from a village in Uttarakhand shared: "The fear of losing my savings to a single fake phone call makes me very reluctant to keep any significant amount of money in digital payment channels." Similarly, a female respondent from Uttar Pradesh noted: "I only keep a few hundred rupees in my UPI account. If something goes wrong, I cannot afford to lose more."

These incidents generate substantial trust deficits. Consequently, many users adopt defensive

practices such as maintaining minimal balances in UPI-linked accounts or using the platform only for low-value transactions, thereby limiting the full potential of digital financial inclusion.

Physical Infrastructure Limitations

The consistent operation of digital finance platforms continues to be hampered by underlying infrastructure constraints in both states. Twenty-two respondents reported frequent transaction timeouts or settlement delays caused by unstable local cellular service or regional power outages affecting mobile tower functionality. These disruptions are especially prevalent during monsoon seasons in the hilly districts of Uttarakhand and in villages situated at the periphery of cellular coverage zones in Uttar Pradesh.

A daily-wage laborer from a border village in Uttar Pradesh noted: "Sometimes the network is so weak that the transaction fails after deducting money. Then I have to wait hours for a refund. It is very frustrating." Additionally, 15 low-income households identified the high purchase cost of smartphones as a fundamental barrier preventing them from accessing digital payment systems independently. Although feature phones support USSD-based UPI, respondents found these interfaces less user-friendly and reliable than smartphone applications, further widening the digital divide.

Interpretation Using the Indian Knowledge System (IKS) Framework

Evaluating these field results from Uttar Pradesh and Uttarakhand through the lens of traditional IKS concepts reveals that UPI's success is driven by deep cultural alignment alongside technological functionality. The following synthesis connects empirical observations to the four IKS pillars. Collective Dharma through Mutual Assistance: The extensive reliance on informal, peer-to-peer training networks exemplifies a lived practice of social duty (Dharma), wherein technologically adept community members—often youth or migrant returnees—naturally assume the responsibility of instructing their neighbours. This voluntary knowledge sharing, occurring without institutional mandate or financial reward, mirrors traditional North Indian community structures where collective welfare takes precedence over individual gain.

Karmic Transparency via Electronic Records: The complete visibility provided by real-time digital transaction logs reflects the principles of Karma, where every financial action generates an immediate, verifiable trace that ensures accountability and safeguards users against arbitrary exploitation. Respondents from both states valued knowing precisely when money entered or left their accounts, contrasting sharply with opaque cash dealings or delayed bank settlements.

Vasudhaiva Kutumbakam in Platform Architecture: The system's full technical interoperability—enabling smooth transactions across diverse social groups, banking institutions, and geographical boundaries—serves as a contemporary digital embodiment of a unified, interconnected community (Vasudhaiva Kutumbakam). This design choice resonates with cultural values that prioritize connectivity and reject artificial barriers between people, whether across the Gangetic plains of Uttar Pradesh or the mountain valleys of Uttarakhand.

Sthitaprajna as Mature Digital Awareness: The gradual shift from anxious, hesitant usage to alert, risk-conscious navigation reflects the development of digital financial wisdom (Sthitaprajna). Despite security concerns, respondents demonstrated learning behaviors—reviewing transaction histories, questioning suspicious calls, limiting balances—that indicate the cultivation of discerning judgment in digital financial management, balancing convenience with safety.

DISCUSSION

The empirical and conceptual findings of this study indicate that UPI has evolved beyond a convenient digital payment platform to become an important component of India's digital public infrastructure that supports financial inclusion—particularly in the rural and semi-urban areas of Uttar Pradesh and Uttarakhand. The observed association between increasing transaction volumes and improvements in national financial inclusion indicators (RBI, 2020-2024) suggests a transformation in the way previously underserved populations participate in the formal financial system. This transition reflects a movement from branch-based and document-intensive banking processes toward mobile-enabled and digitally authenticated transactions [15-20].

A key contribution of this study is the use of the Indian Knowledge System (IKS) as an

interpretive framework for understanding patterns of technology adoption in these two states. The findings suggest that adoption may accelerate when technological systems align with existing social values and community practices [21-24]. By positioning digital payment infrastructure as a public utility rather than solely as a commercial service, the UPI ecosystem reflects broader principles of equitable access and collective benefit. This alignment may partly explain the rapid expansion of UPI across the Gangetic plains of Uttar Pradesh and the mountain valleys of Uttarakhand relative to earlier digital payment initiatives [10,25-29]. The interpretation through IKS highlights how values associated with collective welfare (Dharma), accountability (Karma), social interconnectedness (Vasudhaiva Kutumbakam), and responsible decision-making (Sthitaprajna) may contribute to public trust and sustained use of digital financial services.

Despite these advances, the findings also identify several challenges that may affect the long-term inclusiveness and resilience of the digital payment ecosystem in these regions. Infrastructure limitations—unstable cellular connectivity in Uttarakhand's higher altitudes and power outages in Uttar Pradesh's remote villages—continue to restrict access [5,25,26-32]]. Cybersecurity concerns and uneven levels of digital literacy disproportionately affect vulnerable populations, particularly elderly users, women with limited decision-making autonomy, and daily wage workers [5,22]. Addressing these barriers requires coordinated action across government institutions, financial service providers, and local communities. Strengthening digital infrastructure in underserved districts, including expansion of reliable broadband connectivity under Bharat Net and reduction of transaction failures, remains essential for improving service accessibility.

In addition, financial literacy initiatives should move beyond standardized technical training and incorporate localized and community-based approaches. Evidence from this study indicates that peer-supported learning—where digitally experienced individuals, often younger family members, assist relatives and neighbors—may improve adoption and confidence in digital transactions [33,34]. The thematic analysis of interview data followed the procedures outlined by Braun and Clarke [14], revealing that informal knowledge cascades are particularly effective in the close-knit rural communities of both states. Integrating culturally familiar concepts into awareness programs may further support understanding of safe digital practices and fraud prevention. Payment platforms should continue strengthening fraud detection mechanisms using AI and biometric authentication [6,25], while also ensuring user-friendly grievance redressal processes for populations with varying literacy levels [29].

Finally, as policymakers consider the long-term sustainability of zero-cost retail payment models, future frameworks should explore institutional revenue mechanisms that maintain accessibility for low-income users without compromising operational viability [35-39]. The experience of micro-enterprises in Uttar Pradesh and Uttarakhand shows that even small merchants benefit from digital records that can facilitate credit access [3]. The findings suggest that the continued success of UPI in these two states will depend not only on technological advancement but also on sustained attention to social inclusion, trust, accessibility, and ethical governance.

CONCLUSION

The present study investigated the role of the Unified Payments Interface (UPI) in promoting financial inclusion in India using the interpretive framework of the Indian Knowledge System (IKS). The analysis demonstrates that UPI's impact extends far beyond simple technical efficiency; it has fundamentally decentralized financial access, supported grassroots micro-commerce, and brought greater transparency to public welfare distribution. By moving transactions from opaque cash channels to verifiable digital ledgers, UPI has empowered millions of previously unbanked individuals to participate actively in the formal economy. By looking through the IKS lens, we can see that this rapid adoption is deeply connected to a structural harmony with traditional concepts like Dharma, Karma, Vasudhaiva Kutumbakam, and Sthitaprajna. This alignment has turned a digital payment network into a trusted community utility—not merely a transactional tool. When users perceive UPI as an extension of communal duty rather than a commercial extraction mechanism, their willingness to adopt, retain, and recommend the platform increases substantially. However, the study also confirms that persistent challenges remain. The digital divide—manifested in unreliable internet connectivity, limited smartphone affordability and low digital literacy—continues to exclude the most vulnerable

populations. Emerging fraud schemes exploiting social engineering erode trust, particularly among elderly and less-educated users. These challenges require active policy attention and sustained investment.

The convergence of modern fintech with time-tested ethical frameworks provides a powerful template for inclusive economic development. India's digital payment journey offers a valuable blueprint for other developing economies, demonstrating how cutting-edge technological innovation can pair with indigenous cultural values to build a fairer, more inclusive formal economy. As UPI expands globally—through bilateral agreements with countries like Singapore, UAE, and Nepal—this culturally grounded design philosophy may prove as influential as the underlying technology itself. Ultimately, the future of financial inclusion lies not in choosing between tradition and technology, but in their thoughtful integration.

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Domestic Violence, Women's Health, and the Sustainable Development Goals with Special Reference to Covid-19

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Abstract

The outbreak of the COVID-19 pandemic presented an unprecedented global health emergency that profoundly affected every aspect of human life. While it brought immense challenges to public health systems and economies, it also exposed deep rooted gender inequalities within societies. One of the most alarming social consequences of the pandemic was the significant rise in domestic violence cases across the world, including in India. Lockdown restrictions, economic instability, and social isolation created conditions that increased women's vulnerability to physical, emotional, and sexual abuse within their homes. This study seeks to explore the interrelationship between domestic violence, women's health, and the Sustainable Development Goals (SDGs), with special reference to the COVID-19 pandemic period. Many women were unable to seek medical care or report abuse. This study investigates how the health implications of domestic violence intersect with global development priorities, particularly SDG 3 (Good Health and Well-being) and SDG 5 (Gender Equality). It also examines how the pandemic has reversed progress toward achieving these goals by intensifying gender-based violence and disrupting essential services for women. Addressing it requires coordinated efforts involving legal reform, healthcare integration, education, and community awareness. The study concludes that sustainable development cannot be achieved without ensuring women's safety, dignity, and access to health services. Post-pandemic recovery strategies must focus on rebuilding institutions that prioritize women's empowerment, provide accessible healthcare, and promote equality in both public and private spheres. Only through such a comprehensive and rights-based approach can societies move closer to realizing the vision of the 2030 Sustainable Development Agenda, where no woman is left behind.

Keyword: *COVID-19 Pandemic, Sustainable development goals, Domestic violence, Women's health, Gender equality.*

INTRODUCTION

Domestic violence is one of the most pervasive human rights violations, cutting across age, class, caste, and national boundaries. It is a deeply rooted social problem that reflects the unequal power relations between men and women and undermines the dignity, health, and safety of women worldwide. The United Nations defines domestic violence as any act of gender-based violence that results in, or is likely to result in, physical, sexual, or psychological harm or suffering to women, including threats, coercion, or arbitrary deprivation of liberty, whether occurring in public or private life.1 In India, domestic violence manifests through physical assault, verbal abuse, dowry harassment, marital rape, economic deprivation, and emotional neglect. Despite legislative protections such as the Protection of Women from Domestic Violence Act, 2005, the problem remains widespread and under-reported due to patriarchal norms, social stigma, and limited access to justice.1 The outbreak of the COVID-19 pandemic in late 2019 and the subsequent lockdown measures adopted by governments across the world exacerbated the prevalence of domestic violence. The World Health Organization (WHO) observed a sharp increase in cases of intimate partner violence during the lockdown, describing it as a "shadow pandemic."1 In India, the National Commission for Women (NCW) recorded a twofold rise in complaints of domestic violence during the initial months of the lockdown in 2020.1 Confinement within homes, economic distress, unemployment, and limited mobility created an environment conducive to increased violence against women. The pandemic not only posed a serious threat to public health but also triggered a social and psychological crisis affecting women's physical and mental well-being. Women's health, both physical and mental, is intricately linked to their social position and the

respect accorded to their rights within the family and community. Domestic violence has serious health consequences, ranging from injuries, reproductive health issues, and chronic illnesses to depression, anxiety, and suicidal tendencies.1 The pandemic magnified these challenges by restricting access to healthcare facilities, reproductive health services, and counselling centres. Many hospitals prioritized COVID-19 management, leading to the suspension or reduction of essential maternal and reproductive health services.1 This disruption significantly impacted women's overall health, especially those living in abusive environments with no access to external support or safe shelter. In the global development context, the issue of domestic violence and women's health directly intersects with the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015. The SDGs aim to end poverty, protect the planet, and ensure peace and prosperity for all by 2030. Among these, SDG 3 (Good Health and Well Being) and SDG 5 (Gender Equality) hold particular relevance. SDG 5 seeks to eliminate all forms of violence against women and girls in public and private spheres, including trafficking and sexual exploitation.1 Meanwhile, SDG 3 emphasizes the need for universal access to healthcare, including mental health and reproductive health services. The realization of these goals depends significantly on ensuring women's safety and addressing domestic violence as a public health and human rights concern.1The pandemic has, however, posed a setback to achieving these global objectives. According to the United Nations Development Programme (UNDP), COVID-19 reversed years of progress in gender equality by increasing unpaid care work, job losses, and the risk of violence against women.[1] The restrictions imposed during the lockdown curtailed access to legal remedies, shelter homes, and community-based interventions. Moreover, the shift to online platforms for support and reporting excluded large segments of women who lacked digital literacy or internet access, particularly in rural and low-income areas.[1] Consequently, the crisis exposed the structural inequalities and gender biases embedded in society and governance systems. In the Indian context, domestic violence cannot be viewed merely as a private family matter but as a violation of constitutional and human rights. Article 14 of the Indian Constitution guarantees equality before the law, while Article 15 prohibits discrimination on the grounds of sex. Article 21 ensures the right to life and personal liberty, which has been judicially interpreted to include the right to live with dignity and free from violence.[1] The judiciary has consistently recognized the right of women to safety and equality within the domestic sphere. In Vishaka v. State of Rajasthan, the Supreme Court laid down guidelines to prevent sexual harassment at the workplace, affirming the constitutional commitment to gender justice.[1] Similarly, the Protection of Women from Domestic Violence Act, 2005, represents a progressive step toward recognizing domestic violence as a civil wrong and providing immediate relief and protection to women. However, the implementation of this legislation during the pandemic faced numerous challenges due to court closures, mobility restrictions, and lack of awareness among victims. The COVID-19 pandemic also emphasized the intersectionality of gender, health, and social policy. Women disproportionately bear the burden of care work, both paid and unpaid, within households and the healthcare sector.[1] During the pandemic, many women healthcare workers faced not only professional exhaustion but also domestic abuse at home. Moreover, the economic instability caused by job losses affected women's financial independence, further limiting their ability to escape abusive relationships. The National Family Health Survey (NFHS-5) data revealed that a significant percentage of Indian women continue to justify wife-beating under certain circumstances, reflecting deep-rooted cultural acceptance of violence.[1] This normalization perpetuates a cycle of abuse that undermines women's health, agency, and participation in social and economic

life. The concept of sustainable development cannot be realized without gender equality and women's empowerment. The 2030 Agenda emphasizes "leaving no one behind," which includes ensuring safety, dignity, and equal opportunity for women.[1] Domestic violence undermines these principles by restricting women's access to education, employment, healthcare, and decision-making spaces. Therefore, addressing domestic violence is not only a moral and legal imperative but also an economic and developmental necessity. The World Bank has estimated that the global cost of violence against women amounts to approximately 2% of global GDP annually, considering healthcare expenses, productivity loss, and legal costs.[1] The pandemic amplified this burden, further straining national economies and public health systems. Efforts to mitigate domestic violence during the COVID-19 crisis included the launch of helplines, virtual counselling services, and online legal assistance by both government agencies and civil society organizations. In India, the National Commission for Women reactivated its WhatsApp helpline, while state governments collaborated with NGOs to set up emergency shelters.[1] Internationally, the United Nations called upon member states to integrate protection from gender-based violence into their pandemic response plans.[1] However, these measures often lacked adequate funding, coordination, and awareness, thereby limiting their effectiveness. The need for a comprehensive, multi-sectoral approach involving law enforcement, healthcare, social welfare, and education sectors has become more evident than ever. In conclusion, domestic violence during the COVID-19 pandemic has revealed the fragility of women's rights and the inadequacy of existing institutional frameworks to protect them. It has also underscored the importance of linking women's health, legal protection, and empowerment to the broader sustainable development agenda. Ensuring that women live free from violence and discrimination is fundamental to achieving SDG 3 and SDG 5 and, by extension, all other development goals. The post-pandemic recovery phase must therefore prioritize gender-responsive policies, strengthen legal enforcement, and expand health and social protection systems. Only through such integrated efforts can societies progress toward a sustainable and equitable future that truly safeguards the dignity and health of women.

CONCEPT AND NATURE OF DOMESTIC VIOLENCE

Domestic violence is a pervasive social and legal issue that violates the fundamental human rights of women and undermines the principles of equality, dignity, and justice. It refers to any form of abusive behaviour used by one partner to gain or maintain power and control over another within a domestic relationship.1 The violence may be physical, sexual, emotional, psychological, or economic, and it often occurs in intimate relationships such as marriage, cohabitation, or family ties. Domestic violence is not confined to any particular class, caste, religion, or economic group—it is a global phenomenon that affects women disproportionately.1 In patriarchal societies like India, it is rooted in deep-seated gender inequalities and cultural norms that tolerate or justify male dominance and female subordination. The concept of domestic violence encompasses a wide range of behaviours intended to intimidate, humiliate, or harm the victim. Physical violence includes acts like beating, slapping, kicking, or using objects or weapons to cause injury.1 Psychological violence involves verbal abuse, threats, insults, isolation, or coercive control designed to erode the victim's self-esteem. Sexual violence may take the form of forced intercourse, marital rape, or other non-consensual sexual acts. Economic violence includes controlling financial resources, denying access to money, or restricting a woman's right to work.1 Each form of abuse reinforces the abuser's power and restricts the victim's freedom, making it difficult for her to escape the cycle of violence. The cumulative effect of these abuses can have long-term physical, emotional, and social consequences. The United Nations has recognized domestic violence as a critical human rights violation. The Declaration on the Elimination of Violence against Women (1993) defines violence against women as "any act of gender-based violence that results in, or is likely to result in, physical, sexual, or psychological harm or suffering to women."1 This definition underscores that

domestic violence is not a private matter but a societal concern that demands state intervention. It further emphasizes that violence against women is both a cause and a consequence of gender inequality. The World Health Organization (WHO) also categorizes domestic violence as a major public health issue, citing its severe impact on women's physical and mental health, reproductive health, and social well-being.1 Women who experience domestic abuse often suffer from depression, anxiety, chronic pain, and other health complications that persist even after the violence has ended. In India, the legal framework recognizes the seriousness of domestic violence through the Protection of Women from Domestic Violence Act, 2005.1 The Act defines "domestic violence" broadly to include physical, sexual, verbal, emotional, and economic abuse, thereby expanding the scope beyond physical injury to include psychological harm. It also provides for protection orders, residence orders, and monetary reliefs to safeguard victims.1 The law acknowledges that domestic violence can occur within any domestic relationship, including marriages, live-in relationships, and relationships with family members. Despite this legal recognition, underreporting remains a major concern due to fear of social stigma, economic dependency, and lack of awareness among women about their legal rights.1The nature of domestic violence is complex, cyclical, and often invisible. Many victims continue to live with their abusers due to emotional attachment, family pressure, or fear of social ostracization. The cycle of violence typically follows a pattern of tension-building, acute battering, and reconciliation or remorse, only to repeat again.1 This pattern makes intervention difficult and contributes to the normalization of abuse within households. Societal attitudes that condone wife- beating as a disciplinary measure further perpetuate the problem.1 Studies, including the National Family Health Survey (NFHS-5), reveal that a significant percentage of women in India believe that a husband is justified in beating his wife under certain circumstances, such as neglecting housework or arguing.1 Such beliefs reflect the entrenched patriarchal mindset that continues to sustain domestic violence. The concept of domestic violence also intersects with broader social and economic factors such as poverty, alcoholism, unemployment, and lack of education.1 Women belonging to marginalized communities often face compounded discrimination and vulnerability due to caste, class, and rural-urban divides. The situation becomes even more severe during crises, such as pandemics or natural disasters, when confinement, stress, and economic instability increase the risk of violence.1 Therefore, domestic violence must be understood not merely as individual deviant behaviour but as a systemic issue rooted in gender inequality, social injustice, and inadequate legal enforcement. Combating it requires a multidimensional approach—legal, social, educational, and economic—to ensure women's empowerment and protection.1.

IMPACT OF DOMESTIC VIOLENCE ON WOMEN'S PHYSICAL AND MENTAL HEALTH

Domestic violence has profound and long-lasting effects on the physical and mental health of women. The abuse inflicted within intimate relationships not only causes immediate physical harm but also leads to chronic health problems and psychological trauma. Physically, women subjected to domestic violence often experience injuries such as bruises, fractures, burns, and internal damage. Repeated assaults can result in long-term ailments like chronic pain, gastrointestinal disorders, hypertension, and reproductive health complications. Pregnant women are particularly vulnerable, facing risks such as miscarriage, premature birth, and low birth weight among infants. Beyond the visible injuries, continuous exposure to violence weakens the immune system, disrupts sleep patterns, and leads to fatigue and other psychosomatic symptoms. The psychological consequences of domestic violence are equally severe, often more damaging than the physical injuries. Victims frequently suffer from depression, anxiety, post-traumatic stress disorder (PTSD), and low self-esteem. Living under constant fear and humiliation erodes their sense of identity and self-worth. Many women develop suicidal tendencies, substance dependency, or social withdrawal as coping mechanisms. The mental trauma is further intensified when victims are isolated from family and community support, as is often the case in abusive households. The stigma attached to domestic violence discourages many from seeking help, perpetuating the cycle of abuse and psychological distress. Over time, such trauma not only affects the individual's health but also impacts her ability to care for children, maintain employment, and participate fully in society. Thus, domestic violence is not merely a private matter but a major public health issue that undermines women's well-being, productivity, and overall quality of life.

WOMEN'S HEALTH AND WELL-BEING IN THE CONTEXT OF COVID-19

The COVID-19 pandemic profoundly affected women's health and overall wellbeing, exposing existing gender inequalities in access to healthcare, economic security, and social support. As the virus spread,

healthcare systems across the world redirected resources toward emergency pandemic management, leading to the neglect of essential services such as maternal care, reproductive health, and mental health support. Women, particularly those in rural and low-income communities, faced significant challenges in accessing routine medical checkups, contraception, and prenatal care due to lockdown restrictions and mobility barriers. Pregnant women encountered heightened risks as hospitals limited admissions and outpatient services, while fear of infection discouraged many from seeking timely medical assistance. In addition to physical health challenges, the pandemic placed immense psychological strain on women. The stress of balancing unpaid domestic labor, childcare, and in many cases, remote work created emotional exhaustion and anxiety. The rise in domestic violence during lockdowns further compounded women's mental distress, as victims were confined with their abusers and had limited access to support networks or legal protection. Frontline healthcare workers, the majority of whom were women, also faced disproportionate exposure to infection, long working hours, and emotional burnout. Moreover, the economic impact of the pandemic—through job losses and pay cuts—affected women's independence and increased their vulnerability to exploitation. The disruption of social interactions and educational opportunities also contributed to feelings of isolation and helplessness. Overall, COVID-19 revealed that women's health and well-being extend beyond medical care; they are deeply influenced by social, economic, and cultural factors. The pandemic underscored the urgent need for gender-sensitive health policies, mental health initiatives, and social protection systems to ensure that women's rights and well-being are safeguarded in times of crisis.

SUSTAINABLE DEVELOPMENT GOALS AND GENDER EQUALITY (GOAL 5)

The Sustainable Development Goals (SDGs), adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development, provide a comprehensive framework for global progress in social, economic, and environmental dimensions. Among the seventeen goals, Goal 5 — Gender Equality—holds a central position, emphasizing the need to achieve equality between men and women and to empower all women and girls. This goal recognizes that gender equality is not only a fundamental human right but also a necessary foundation for a peaceful, prosperous, and sustainable world. Gender equality influences every aspect of development, including poverty eradication, health, education, economic growth, and social justice. Ensuring women's participation in decision-making, access to education and healthcare, and protection from violence are key targets under this goal. Goal 5 specifically aims to eliminate all forms of discrimination and violence against women and girls, both in public and private spheres, including trafficking, sexual exploitation, and harmful practices such as child marriage and female genital mutilation. It also seeks to recognize and value unpaid care and domestic work, promote shared responsibility within households, and ensure women's full participation and equal opportunities in leadership and public life. Achieving this goal requires legal reforms, policy initiatives, and a cultural transformation that dismantles patriarchal norms and systemic barriers. Moreover, gender equality is interlinked with other SDGs—particularly those related to health (Goal 3), education (Goal 4), and decent work (Goal 8)—making it essential for holistic and inclusive development. Empowering women enhances economic productivity, strengthens democratic governance, and fosters social stability. Therefore, the realization of Goal 5 is both a moral and practical imperative for sustainable development, ensuring that women and men equally share the benefits of progress and contribute to building a just and equitable global society.

LEGAL FRAMEWORK AND POLICY MEASURES TO PREVENT DOMESTIC VIOLENCE IN INDIA

The legal framework to prevent domestic violence in India reflects the nation's constitutional commitment to gender equality and the protection of women's rights. The Constitution of India guarantees equality before the law under Article 14, prohibits discrimination on the grounds of sex under Article 15, and ensures the right to life and personal liberty under Article 21, which has been interpreted by the judiciary to include the right to live with dignity and free from violence. These constitutional provisions form the foundation for various legislative and policy initiatives aimed at addressing domestic violence and promoting women's safety and empowerment. The most comprehensive legislation addressing domestic violence in India is the Protection of Women from Domestic Violence Act, 2005 (PWDVA). This Act was enacted to provide civil remedies and immediate protection to women facing abuse within domestic relationships. It defines "domestic violence" broadly

to include physical, sexual, verbal, emotional, and economic abuse, thus recognizing that violence is not limited to physical harm alone. The Act provides for protection orders, residence orders, monetary relief, and custody orders to ensure that victims receive prompt and effective support. One of its most progressive features is the recognition of women in live-in relationships as beneficiaries, acknowledging the changing social realities of Indian society. The Act also designates Protection Officers and service providers to assist victims with legal aid, medical care, and shelter facilities. In addition to the PWDVA, several other laws contribute to combating domestic violence. The Indian Penal Code (IPC) includes provisions such as Section 498A, which criminalizes cruelty by a husband or his relatives toward a woman. The Dowry Prohibition Act, 1961 addresses dowry-related harassment, while the Criminal Law (Amendment) Act, 2013 expanded the definitions of sexual offences and strengthened punishments. The National Commission for Women (NCW), established in 1992, plays a vital role in monitoring the implementation of laws and policies related to women's rights and addressing grievances through its complaint mechanisms. Furthermore, the National Policy for the Empowerment of Women (2001) and subsequent government schemes emphasize gender sensitization, social awareness, and institutional support for victims of violence. India is also a signatory to several international conventions that promote women's rights and gender equality, including the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), adopted by the United Nations in 1979. By ratifying CEDAW, India has undertaken the obligation to eliminate discrimination and ensure effective legal protection for women against all forms of violence. The Supreme Court of India has often invoked international conventions, including CEDAW, in landmark judgments to reinforce women's constitutional rights and to interpret domestic laws in a gender-sensitive manner. Policy measures and institutional initiatives have been developed to complement the legal framework. The government has launched various programs such as the One Stop Centre Scheme (OSC) to provide integrated support and assistance to women affected by violence, and the Women Helpline (181) to offer immediate access to information and emergency aid. Campaigns like Beti Bachao Beti Padhao and Mission Shakti promote awareness about women's rights and empowerment. Nongovernmental organizations (NGOs) and civil society groups also play a critical role in spreading awareness, providing shelter, and facilitating legal aid. However, despite these efforts, challenges remain in the effective implementation of the laws due to lack of awareness, societal stigma, inadequate infrastructure, and delays in the judicial process. India has established a robust legal and policy framework to prevent and address domestic violence, grounded in constitutional principles and international commitments. However, the success of these measures depends on their practical enforcement, social acceptance, and the empowerment of women to assert their rights. Strengthening institutional mechanisms, promoting gender-sensitive education, and ensuring coordination between law enforcement and social services are essential to create a society where women can live free from fear, violence, and discrimination.

CHALLENGES IN IMPLEMENTATION DURING THE COVID-19 PANDEMIC

During the COVID-19 pandemic, the implementation of laws and policies addressing domestic violence faced unprecedented challenges. The nationwide lockdowns, restrictions on movement, and disruption of essential services created conditions that intensified the vulnerability of women to domestic abuse while simultaneously hindering their access to support systems. With women confined within their homes, often alongside their abusers, cases of domestic violence surged globally, and India was no exception. The National Commission for Women (NCW) reported a sharp rise in complaints of domestic abuse during the lockdown periods, reflecting how home environments turned into spaces of danger for many women. The restrictions imposed to contain the spread of COVID-19 limited the functioning of essential mechanisms such as police intervention, legal aid services, and shelter homes. Many women found it difficult to reach out for help due to lack of privacy, fear of reprisal, or absence of technological access. Helplines and online complaint platforms, although useful, were inaccessible to women in rural or economically weaker sections who lacked internet connectivity or awareness of such services. Moreover, healthcare systems were overwhelmed by pandemic-related responsibilities, diverting attention and resources away from gender-based violence interventions and mental health care for survivors. Another significant challenge lay in the enforcement of protective legislation such as the Protection of Women from Domestic Violence Act, 2005. Courts functioned with limited capacity, and many cases were delayed or dismissed due to logistical barriers. Protection officers and social workers faced movement restrictions, reducing their ability to conduct home visits or provide immediate assistance. The pandemic also exposed the lack of coordination between different agencies—police,

judiciary, healthcare, and social welfare—needed to effectively implement domestic violence policies during emergencies. Economic dependency further exacerbated women's vulnerability. Job losses and financial stress within households often resulted in increased tension, leading to more frequent and severe instances of domestic violence. Many women who lost their income or employment were unable to leave abusive relationships, as they lacked financial means and support networks. The closure of educational institutions also deprived young girls of safe spaces, increasing their exposure to domestic abuse. Despite efforts by government and non-governmental organizations to adapt to the crisis—such as digital helplines, WhatsApp-based complaint systems, and awareness campaigns—the outreach remained limited. The stigma surrounding domestic violence, combined with the isolation of the lockdown, silenced many victims. The pandemic thus highlighted systemic weaknesses in India's gender justice framework and underscored the urgent need for resilient mechanisms that can function effectively during crises. In conclusion, while the COVID-19 pandemic magnified the challenges in preventing and responding to domestic violence, it also served as a wake-up call for policymakers to strengthen institutional responses. Building inclusive, technology enabled support systems, ensuring continuity of legal services, and integrating gender sensitive approaches in disaster management plans are essential to safeguard women's rights and well-being in future emergencies.

GOVERNMENT AND NON-GOVERNMENTAL INITIATIVES FOR WOMEN'S SAFETY AND HEALTH

The Government of India, along with numerous non-governmental organizations (NGOs), has undertaken several initiatives to promote women's safety, health, and overall well-being. Recognizing the deep-rooted social and cultural factors contributing to gender-based violence and health inequities, these initiatives aim to provide legal protection, healthcare access, economic empowerment, and social awareness for women across the nation. At the governmental level, multiple legislative and policy measures have been implemented to ensure women's safety. The Protection of Women from Domestic Violence Act, 2005 provides a comprehensive legal framework to protect women from physical, emotional, sexual, and economic abuse within domestic relationships. Similarly, the Criminal Law (Amendment) Act, 2013, introduced after the Nirbhaya case, strengthened laws related to sexual offences, enhancing punishments and broadening definitions of sexual assault. The Beti Bachao Beti Padhao scheme focuses on improving the status of the girl child by preventing female foeticide and promoting education and empowerment.1 Health-related initiatives such as the National Health Mission (NHM) emphasize maternal and reproductive health through programs like Janani Suraksha Yojana (JSY) and Pradhan Mantri Matru Vandana Yojana (PMMVY), which aim to reduce maternal mortality and provide financial assistance to pregnant and lactating women. The One Stop Centre Scheme (OSCS) and Women Helpline (181) serve as integrated support systems offering legal, psychological, and medical aid to women facing violence.1 The Ujjawala Scheme targets the rescue, rehabilitation, and reintegration of victims of trafficking, reflecting the government's commitment to women's safety and dignity. During the COVID-19 pandemic, these initiatives were adapted to ensure continuity of support. The National Commission for Women (NCW) launched online complaint systems and WhatsApp helplines to facilitate safe reporting of domestic violence. The government also collaborated with telecommunication services to circulate emergency contact numbers and awareness messages to women in distress. Moreover, the Nirbhaya Fund, established in 2013, was used to finance emergency response systems, surveillance, and infrastructure for women's safety, including panic buttons in public transport.1 Non-governmental organizations have also played a vital role in bridging gaps between policy and practice. NGOs such as SEWA (Self-Employed Women's Association), Jagori, CARE India, and ActionAid have contributed significantly to promoting women's rights, health education, and empowerment through grassroots mobilization. These organizations not only provide immediate support to victims of violence but also work on long-term social change by advocating for gender-sensitive laws, conducting awareness campaigns, and offering vocational training to women.1 During the pandemic, NGOs collaborated with local administrations to distribute sanitary products, food supplies, and information on helpline services to women in remote and marginalized areas. In conclusion, government and non-governmental initiatives together form a multidimensional framework to safeguard women's rights, health, and security. However, challenges such as limited awareness, resource constraints, and social stigma continue to hinder their effectiveness. Strengthening coordination between various stakeholders, ensuring transparency, and promoting gender sensitization at all levels are crucial for building a safer and healthier environment for women in India.

CONCLUSION

Domestic violence, women's health, and gender equality are deeply interconnected issues that reflect the broader social and developmental challenges of modern society. The COVID-19 pandemic exposed and intensified the existing inequalities, pushing many women into situations of heightened vulnerability. While legislative frameworks such as the Protection of Women from Domestic Violence Act, 2005 and numerous health and welfare schemes demonstrate India's commitment to gender justice, the practical implementation of these measures remains uneven, particularly during crises. The Sustainable Development Goals (SDGs), especially Goal 5 on gender equality, emphasize the necessity of eliminating all forms of violence against women and ensuring their full participation in social, economic, and political life. Achieving this requires not only strong legal mechanisms but also societal transformation through education, awareness, and empowerment. The role of both government and nongovernmental organizations is crucial in bridging policy gaps, ensuring accessibility of services, and building resilience in women through health, education, and livelihood initiatives. The pandemic has also underscored the importance of integrating women's health and safety into national disaster and health management frameworks. Gender-sensitive healthcare, mental health support, and accessible reporting mechanisms must become essential components of public policy. In addition, community participation and digital innovations should be harnessed to reach marginalized women and ensure continuous support. In conclusion, the path toward sustainable development and gender equality lies in a collective effort—where legal safeguards, policy measures, and social change move together. Empowering women, protecting their rights, and ensuring their physical and mental well-being are not only moral imperatives but also prerequisites for a just and sustainable society.

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FinTech and Rural Economic Development: Evidence from India's Micro-Enterprise Sector

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Abstract

India's rural micro-enterprise sector comprising tens of millions of informal and semi-formal units engaged in agriculture-allied activity, trade, and small-scale manufacturing has historically been constrained by a persistent credit and payments gap. Over the past decade, the diffusion of financial technology (FinTech), underpinned by public digital infrastructure such as Aadhaar, the Unified Payments Interface (UPI), and the Jan Dhan–Aadhaar–Mobile (JAM) trinity, has reshaped how rural micro-enterprises transact, save, borrow, and insure. This paper synthesizes primary source data from the Reserve Bank of India (RBI), the World Bank's Global Findex Database 2025, the Union Budget 2025-26, and supporting industry and academic literature to examine the channels through which FinTech affects rural economic development, with a specific focus on micro-enterprises. It finds that FinTech has meaningfully expanded the access and usage dimensions of financial inclusion the RBI's Financial Inclusion Index (FI-Index) rose from 43.4 in March 2017 to 67.0 in March 2025 and that India's financial account ownership reached 89 percent in 2024 according to the World Bank, up from 35 percent in 2011. At the same time, the same Global Index data show that 16 percent of Indian account holders remain inactive, four times the average for peer low and middle income economies, underscoring a persistent gap between formal access and meaningful usage. On the credit side, the Union Budget 2025-26 introduced targeted measures a Grameen Credit Score framework for rural borrowers, an expanded credit guarantee cover for micro and small enterprises, and Udyam-linked credit cards for micro-enterprises aimed directly at narrowing the estimated ₹20–30 lakh crore MSME credit gap. The paper concludes with policy implications for regulators, financial institutions, and rural development practitioners, and outlines an agenda for future empirical research.

Keywords: FinTech, financial inclusion, rural development, micro-enterprises, MSME, India, digital lending, UPI, RBI, Global Findex, Union Budget

1. INTRODUCTION

Rural micro-enterprises small, often family-run units engaged in trade, agro-processing, handicrafts, dairy, and allied services form the backbone of non-farm rural livelihoods in India. As of February 2025, the Udyam Registration Portal recorded 5.93 crore (59.3 million) registered MSMEs, providing employment to over 25.18 crore (251.8 million) people, with the overwhelming majority classified as micro-enterprises and nearly half located in rural areas. MSME-related products accounted for 45.73 percent of India's total exports in 2023-24. Collectively, this sector is one of the largest sources of non-agricultural rural employment in the country.

For decades, the growth of this sector was constrained by what development economists have called the “missing middle” of rural finance: enterprises too small and informal to be served profitably by traditional bank branches, yet too large and cash-flow-dependent to rely solely on family savings or

moneylenders. Physical distance from bank branches, the absence of formal credit histories, lack of collateralizable assets, and low financial literacy compounded this exclusion. As recently as 2011, only 35 percent of Indian adults held a formal financial account, according to the World Bank's Global Findex Database.

The emergence of FinTech broadly, the application of digital technology to the design and delivery of financial services has altered this landscape. India's approach has been distinctive in that FinTech innovation has been built on top of a public digital infrastructure stack (sometimes called “India Stack”), rather than emerging purely from private-sector innovation. Aadhaar-based digital identity, the JAM trinity (Jan Dhan bank accounts, Aadhaar, and mobile connectivity), UPI for real-time payments, and newer consent-based data-sharing frameworks such as the Account Aggregator (AA) system have together lowered the fixed costs of extending financial services into rural and semi-urban markets. Government fiscal policy has reinforced this technological push: the Union Budget 2025-26, presented by Finance Minister Nirmala Sitharaman on February 1, 2025, introduced a dedicated Grameen Credit Score framework, an expanded MSME credit guarantee cover, and Udyam-linked credit cards specifically targeted at improving formal credit access for micro-enterprises and rural borrowers.

This paper asks two connected questions. First, what evidence drawn directly from RBI data, World Bank surveys, and Union Budget documents exists that FinTech has improved financial inclusion and economic outcomes for rural micro-enterprises in India? Second, what structural and behavioral barriers continue to limit the depth, equity, and sustainability of this impact? The paper proceeds as a synthesis and analysis of authoritative secondary data rather than as a report of new primary fieldwork, and situates these findings within an applied conceptual framework linking FinTech adoption to rural enterprise outcomes.

2. REVIEW OF LITERATURE

S Hermuningsih, P.P. Sari, A.D.Rahmawati (2023) the study examines the effect of fintech adoption, liquidity, and bank size on the financial performance of 20 Indonesian conventional commercial banks, selected through purposive sampling, during the period 2012-2021 using PLS-SEM and Smart PLS. It finds that the adoption of fintech serves to improve financial performance—specifically, customer account creation, deposits, payment speed, fund transfer, and asset management—and that this impact is more pronounced in larger banks. Other studies also confirm that high liquidity ratios lead to better performance, as well-capitalized banks are supposed to have more deposits and sources of support. We find that larger banks enhance the benefits of fintech on profitability, and utilize more liquidity to enhance the returns through higher opportunities for lending. Based on signaling theory, the study implies the degrees to which trustworthy public reporting significant-sized

Z Khan (2023), in her opinion**,** online money transfers among parties using cellphones are made possible in large part by the Unified Payments Interface, also known as UPI, in India. With great potential for growing markets and poor nations, this novel strategy improves the efficiency and accessibility of payment systems. India's digital progress is happening at an astonishing rate as more and more inhabitants of the country use the revolutionary UPI system for making payments. Research will also demonstrate how the UPI system in India has had long-lasting social and sociological ramifications.

K.K. Chhina (2026) Through mobile banking, UPI, Aadhaar-enabled services, and digital lending platforms, financial technology (FinTech) has greatly increased financial inclusion in rural India by making banking, digital payments, savings, and credit more accessible. These developments have decreased reliance on conventional banking and increased access to more affordable financial services for marginalized communities. However, obstacles like poor financial and digital literacy, poor infrastructure, gender inequality, and legal concerns still prevent widespread usage. All things

considered, FinTech has the potential to close the financial gap in rural areas; but, more robust legislative support, better digital infrastructure, and increased financial literacy among rural residents are needed to achieve inclusive and sustainable growth.

B. Nagendra, D. Ramasekhar (2026) analyzing that by creating jobs, lowering poverty, and fostering equitable development, rural MSMEs are vital to India's economic expansion. However, obstacles including collateral requirements, low financial literacy, insufficient banking outreach, and a lack of knowledge about government programs hinder their ability to obtain formal financing, which limits their expansion. Even while programs like CGTMSE, MUDRA Yojana, and fintech-enabled lending have increased credit availability, their effects are still inconsistent due to infrastructural and execution flaws. Financial inclusion can be improved by fortifying digital infrastructure, streamlining legislative frameworks, and encouraging cooperation between the government, financial institutions, fintech businesses, and neighborhood associations. Rural MSMEs may become more resilient, competitive, and sustainable by increasing timely and inexpensive access to financing, which would greatly contribute to India's long-term social and economic growth.

Dr. D. Sharma, Dr. B. Anjum (2026) conceptualized the growth of FinTech and digital financial services has greatly increased financial inclusion in India, yet rural households' financial well-being is not always enhanced by merely having access to financial products. This study offers a conceptual framework that demonstrates how outcomes are influenced by gender as well as elements like digital financial literacy, trust, and efficient utilization. Based on the Sustainable Livelihoods Framework and the Capability Approach, the paper describes how FinTech might enhance household consumption habits and bolster economic resilience. It comes to the conclusion that, in order for digital financial services to produce long-term economic advantages, sustainable rural development necessitates enhancing people's capacities, self-assurance, and inclusivity.

3. OBJECTIVES

1. To identify the factors influencing the adoption and usage of FinTech services among micro-enterprises in rural India.
2. To evaluate the challenges faced by micro-enterprises in rural India in accessing and utilizing FinTech services.

4. CONCEPTUAL FRAMEWORK

- Payments channel digital payment rails (UPI, Aadhaar-enabled Payment Systems) reduce the transaction costs, time, and risk associated with cash handling, and generate a digital transaction trail that can subsequently be used for credit assessment.
- Credit channel digital and cash-flow-based lending (app-based NBFC loans, TReDS invoice discounting, Account Aggregator-enabled underwriting, and the newly announced Grameen Credit Score) expands access to working capital beyond what collateral-based bank lending allows.
- Savings and risk-management channel mobile-linked savings accounts, micro-insurance, and pension products (e.g., PMJJBY, PMSBY, Atal Pension Yojana) allow micro-enterprises to build buffers and manage shocks.
- Formalization channel the digital footprint created by UPI, GST filings, and Udyam registration progressively formalizes micro-enterprises, which in turn improves their eligibility for government schemes and formal credit over time.

5. EVIDENCE AND DISCUSSION

5.1 Access: the RBI Financial Inclusion Index

The RBI's Financial Inclusion Index (FI-Index) is the single most authoritative composite measure of financial inclusion in India. Constructed by the RBI "in consultation with the concerned stakeholders including the Government" and first published in August 2021, the index spans three weighted sub-indices Access (35 percent), Usage (45 percent), and Quality (20 percent) drawing on 97 indicators across banking, investment, insurance, postal, and pension services. According to the RBI's own press release dated July 22, 2025, the FI-Index for the year ending March 2025 stood at 67.0, up from 64.2 in March 2024 a 4.3 percent year-on-year increase with growth recorded across all three sub-indices. The RBI attributes the FY25 improvement specifically to the Usage and Quality dimensions, which it states reflects "deepening of financial inclusion, and sustained financial literacy initiatives." The index has risen steadily from 43.4 in March 2017, indicating a sustained, multi-year trend rather than a one-off gain.

Table 1: RBI Financial Inclusion (FI) Index in India (March 2017- March 2025)

Financial Year (Ending March)	FI-Index Score	Annual Growth(%)
2017	43.4	-
2018	47.6	9.68
2019	53.9	13.24
2020	53.9	0.00
2021	56.4	4.64
2022	60.1	6.56
2023	64.2	6.82
2024	64.2	0.00
2025	67.0	4.36

Source: RBI Financial Inclusion (FI) Index in India

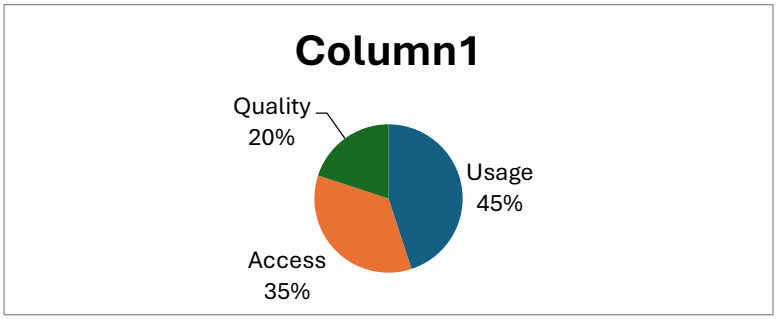


Figure 2: Weightage of RBI FI- Index Components

Source: Reserve Bank of India (RBI). *Financial Inclusion Index (FI-Index): March 2025.*

Dimension	Weight	Coverage
Access	35%	Banking outlets, branches, ATMs, account penetration
Usage	45%	Deposits, credit, digital payments, insurance, pension usage
Quality	20%	Financial literacy, consumer protection, grievance redressal, sustainability of services

Figure 2: RBI FI-Index Framework

5.2 Access and usage: evidence from the World Bank Global Findex Database 2025

The World Bank's Global Findex Database 2025 the fifth edition of its flagship global survey of financial inclusion, based on nationally representative interviews with roughly 145,000 adults across 141 economies conducted in 2024 provides an independent, internationally comparable benchmark for India's progress. According to the Global Findex 2025, financial account ownership in India reached approximately 89 percent of adults in 2024, up from 77.5 percent in 2021 and just 35 percent in 2011 one of the largest sustained increases in account ownership recorded anywhere in the dataset over that period. India's account ownership rate now sits well above the global average of 79 percent and the average for low- and middle-income economies of 75 percent.

However, the same dataset introduces an important caveat that is central to this paper's argument: account ownership substantially outpaces account usage. The Global Findex 2025 finds that 16 percent of Indian account holders have an account that is effectively inactive, compared with an average of just 4 percent across other low- and middle-income economies a gap the World Bank explicitly flags as unusually large. This is consistent with independent Indian reporting that roughly one-third of accounts opened under the Pradhan Mantri Jan Dhan Yojana (PMJDY) India's flagship financial-inclusion scheme, which has facilitated over 55 crore bank accounts since 2014, with roughly two-thirds in rural and semi-urban areas and just over half held by women have historically remained dormant. Taken together, the RBI and World Bank data point to the same conclusion from two independent sources: India's access problem has been substantially addressed, but a meaningful usage gap persists, particularly relevant to rural micro-enterprises that may hold an account without using it for business related savings, credit, or payments.

On payments specifically, UPI India's real-time payments system is the clearest example of the usage channel closing. UPI transaction volumes rose from a negligible 0.09 million in July 2016 to over 16.7 billion in December 2024, and UPI processed roughly ₹24 lakh crore across 18.4 billion transactions in June 2025 alone, accounting for approximately 85 percent of India's digital payment volume. The World Bank's Global Findex 2025 report explicitly highlights UPI, alongside Brazil's PIX, as a real-time payment system with the potential to close the global financial access gap by enabling low-cost, instant transactions an endorsement from the same authoritative source used to benchmark account ownership above.

5.3 The credit channel: Union Budget 2025-26 measures and the MSME credit gap

Despite improvements in payments and account access, the credit channel remains the most binding constraint for rural micro-enterprises. Estimates of the aggregate MSME credit gap in India cluster in the range of ₹20–30 lakh crore, with only a minority of total MSME credit demand met through the formal financial system; the remainder is met through informal, often high-cost sources such as moneylenders and trade credit. Rural micro-enterprises are disproportionately affected: rural credit gaps have been estimated at roughly 32 percent versus about 20 percent in urban areas, reflecting the sparser density of financial institutions outside cities.

The Union Budget 2025-26 directly targeted this gap with several measures, announced by Finance Minister Nirmala Sitharaman in her budget speech of February 1, 2025, and subsequently detailed in Press Information Bureau (PIB) factsheets from the Ministry of MSME and the Department of Financial Services:

- Grameen Credit Score framework a new, dedicated credit-scoring framework intended specifically to improve access to credit for rural borrowers and self-help group (SHG) members,

addressing the thin-credit-file problem that has historically excluded rural micro-entrepreneurs from formal underwriting.

- Expanded credit guarantee cover for micro and small enterprises raised from ₹5 crore to ₹10 crore, which the government estimates will unlock an additional ₹1.5 lakh crore in credit over the next five years.
- Udyam-linked customized credit cards a new scheme offering micro-enterprises registered on the Udyam portal a ₹5 lakh credit limit, with 10 lakh cards targeted for issuance in the first year and no processing fee charged to borrowers.
- Revised MSME classification thresholds investment limits raised 2.5 times and turnover limits raised 2 times, widening the population of enterprises eligible for MSME-linked credit and support schemes.
- A dedicated scheme for first-time entrepreneurs, including women and Scheduled Caste/Scheduled Tribe entrepreneurs, offering term loans of up to ₹2 crore over five years, explicitly built on lessons from the earlier Stand-Up India scheme.

These measures complement, rather than replace, the digital lending infrastructure discussed in the literature: the Account Aggregator framework, TReDS invoice discounting, and the Open Credit Enablement Network (OCEN) continue to provide the underlying data and settlement rails, while the FY26 Budget adds a rural-specific credit-scoring mechanism and direct fiscal support (guarantee cover, subsidized-fee credit cards) layered on top. Industry estimates suggest digital lending disbursement more broadly has grown from roughly USD 9 billion to close to USD 110 billion over a seven-year period; however, much of this growth has concentrated in urban and semi-urban lending, and the rural-specific Grameen Credit Score framework announced in Budget 2025-26 is a direct policy acknowledgment that generic fintech credit-scoring models have not yet closed the rural gap on their own.

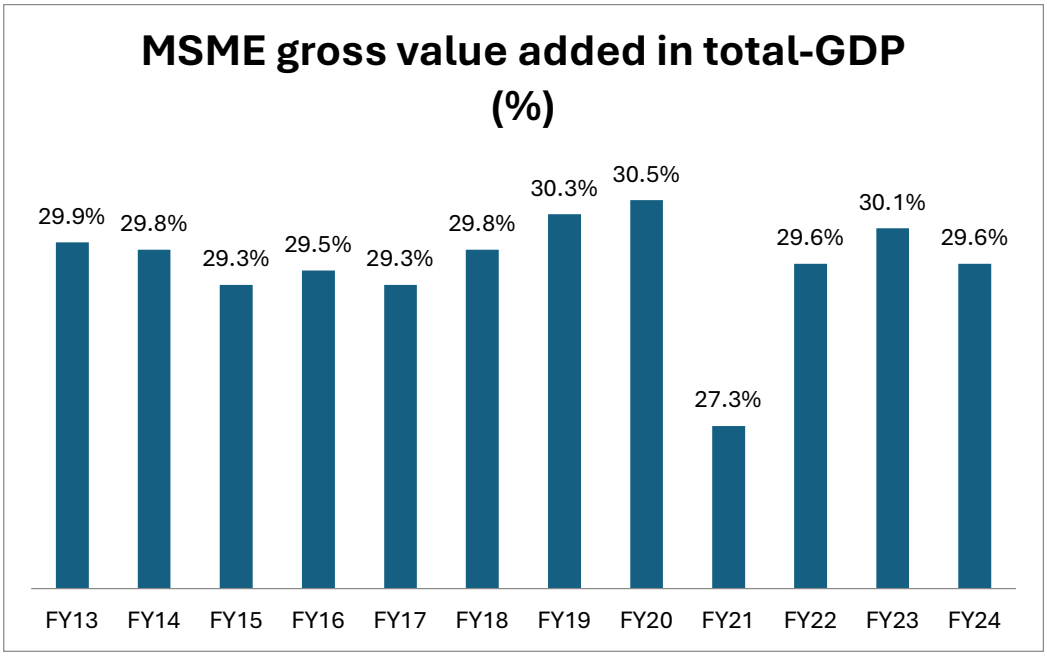


Figure 3: Estimates of the MSME gross value added in total- GDP (%)

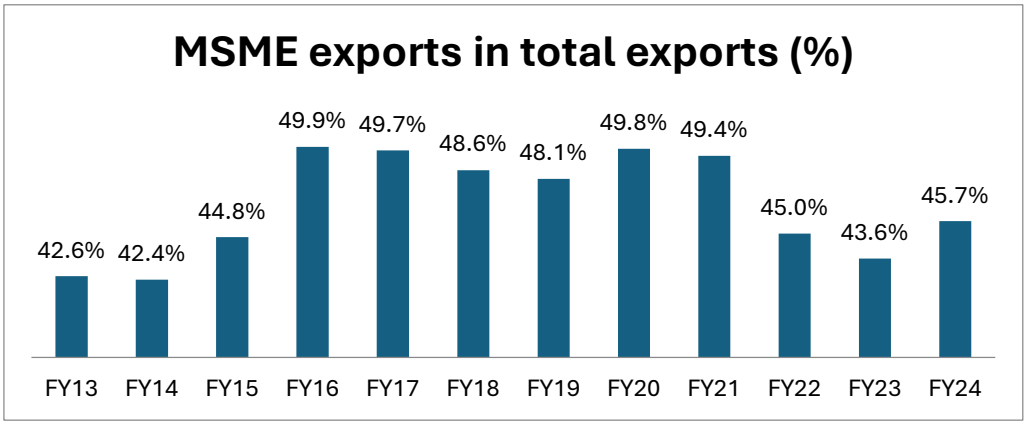


Figure 4: Estimates of MSME exports in total exports (%)

Source: PIB

5.4 Microfinance as a complementary channel

For the smallest, most informal rural enterprises frequently women-led microfinance institutions (MFIs), rather than digital lending apps, remain the dominant formal credit channel. The sector has grown at approximately 28 percent CAGR between FY2014 and FY2024 and reaches unique borrowers in the large majority of India's districts, with roughly 37 percent rural coverage. FinTech has entered this space both as a complement (digital disbursement, repayment via UPI, alternative-data credit scoring) and, more recently, as a source of competitive and regulatory pressure: the 2022 removal of interest-rate caps improved pricing flexibility but coincided with rising borrower over-leverage and multiple lending across institutions, prompting the RBI to introduce (and subsequently reinforce) income and indebtedness assessment requirements. This illustrates an important tension in the FinTech-and-inclusion narrative: technology that lowers the cost of extending credit can, absent adequate data-sharing and underwriting discipline, also lower the cost of over-lending.

5.5 Savings, insurance, and risk management

Micro-insurance and pension schemes distributed through digital rails the Pradhan Mantri Jeevan Jyoti Bima Yojana (life cover), Pradhan Mantri Suraksha Bima Yojana (accident cover), and the Atal Pension Yojana have achieved substantial enrollment (tens of crores of beneficiaries collectively), providing rural micro-entrepreneurs with a basic risk-management layer that was largely unavailable through informal channels. These schemes are a further illustration of the JAM-trinity model: Aadhaar-based identity and Jan Dhan accounts allow low-cost, direct enrollment and claims disbursement at a scale that would be difficult to achieve through physical distribution alone.

5.6 Persistent barriers

Across the RBI, World Bank, and Union Budget data reviewed, four barriers recur most consistently:

- A quantified usage gap. The World Bank's finding that 16 percent of Indian accounts are inactive four times the peer-country average is direct, internationally benchmarked evidence that access has outpaced usage, particularly relevant to rural micro-enterprises that may be nominally banked but not actively using accounts for business purposes.
- Uneven last-mile infrastructure. Banking correspondent density, connectivity, and micro-ATM coverage remain uneven across states and, in particular, are weaker in the North-East and tribal districts.

- Thin or absent formal credit histories. Even with alternative-data underwriting, many rural micro-enterprises operate largely in cash and lack the digital transaction trail that cash-flow-based lending models rely on the specific gap the Grameen Credit Score framework is designed to address, though as a Budget 2025-26 announcement, its measurable impact on rural credit access will only be observable in subsequent RBI and World Bank data releases.
- Gender and social-group disparities. Female-owned and SC/ST owned micro-enterprises face measurably larger credit gaps than their counterparts, despite targeted schemes (Stand-Up India, the Budget 2025-26 first-time entrepreneurs scheme, Mahila Samriddhi Yojana) aimed at narrowing this divide.

6. POLICY IMPLICATIONS

Table 2: Key Policy Implications for Strengthening Rural Financial Inclusion

Policy Area	Key Evidence	Policy Implication
Account Usage	Around 16% of adults with financial accounts made no deposits or withdrawals in the previous year.	Monitor account usage and dormancy alongside account opening statistics.
Rural MSME	Approximately 32% of rural MSMEs continue to face unmet formal credit demand.	Expand Grameen Credit Score and improve credit assessment for rural borrowers.
Digital Credit Infrastructure	Account Aggregator(AA), OCEN,TReDS,Udyam Registration and GST enable digital credit assessment.	Integrate digital infrastructure with business formalization initiatives.
Borrower Protection	Post 2022 microfinance sector experienced rising borrower over-indebtedness.	Strengthen borrower protection and shared credit information systems.
Women & SC/ST Entrepreneurs	Union Budget 2025-26 introduced loans up to 2crore for first-time women and SC/ST entrepreneurs over five years.	Monitor implementation and actual uptake across rural regions.

Source: World Bank, Global Findex Database 2021, NITI Aayog(2022), SIDBI MSME Reports, RBI; Ministry of Finance, Union Budget 2025-26

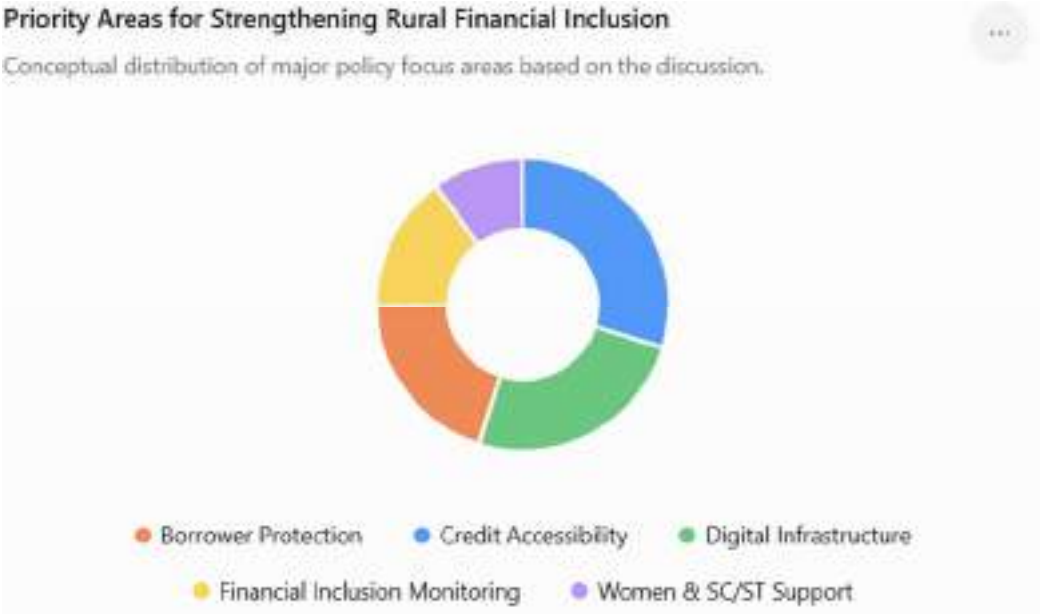


Fig 5: Composition of RBI Financial Inclusion (FI) Index

Table 3: Budget 2025-26 Measures for Rural Financial Inclusion

Initiative	Objective	Target Group	Expected Impact
Grameen Credit Score	Alternative credit assessment using digital financial data	Rural borrowers, SHGs, small entrepreneurs	Improve access to formal credit
Udyam Credit Card	Expand working capital support	Registered MSMEs	Increase institutional lending
Account Aggregator(AA)	Consent based financial data sharing	Individuals and MSMEs	Faster loan procesing
OCEAN	Open digital lending ecosystem	Small Businesses	Expand digital credit delivery
TReDS	Invoice discounting platform	MSMEs	Improve working capital
2 Crore Loan Scheme	Financial support for first time entrepreneurs	Women and SC/ST entrepreneurs	Promote Inclusive entrepreneurship

7. Limitations and Directions for Future Research

This paper synthesizes authoritative secondary data principally RBI press releases and the FI-Index methodology, the World Bank's Global Findex Database 2025, and Union Budget 2025-26 documents and PIB factsheets rather than presenting new primary survey or transaction-level data; as such, its conclusions are only as reliable as these underlying sources, several of which use differing survey years, definitions, and methodologies (notably for the MSME credit gap, which varies by estimating body). Because the Grameen Credit Score framework and the Udyam credit card scheme were only announced in the February 2025 Union Budget, robust outcome data on their rural micro-enterprise impact was not yet available in RBI or World Bank releases at the time of writing. Causal claims about FinTech's effect on rural enterprise growth (as opposed to correlation with rising adoption indicators) remain difficult to establish without enterprise-level panel data. Future research would benefit from:

(a) Longitudinal, enterprise-level studies tracking micro-enterprises before and after Grameen Credit Score adoption

(b) Disaggregated RBI and NABARD data on rural account dormancy and credit uptake, comparable to the World Bank's inactivity metric

(c) Outcome tracking of women-owned and socially disadvantaged rural enterprises specifically

(d) Closer examination of the over-indebtedness risks associated with the proliferation of digital lending channels in already-served rural markets.

9. FINDINGS

- Financial inclusion in India has improved significantly, as reflected by the RBI Financial Inclusion Index (FI-Index), which increased from 43.4 in March 2017 to 70.0 in March 2025, indicating sustained growth in access, usage, and quality of financial services.
- Financial account ownership has expanded rapidly, with the World Bank Global Findex 2025 reporting that 89% of Indian adults owned a financial account in 2024, compared to 35% in 2011, surpassing both the global average (79%) and the average for low- and middle-income economies (75%).
- Despite high account ownership, effective usage remains a challenge, as 16% of account holders have inactive accounts, and nearly one-third of PMJDY accounts have historically remained dormant, highlighting the gap between financial access and meaningful financial participation.

- The MSME credit gap continues to be substantial, estimated at ₹20–30 lakh crore nationally, with rural MSMEs facing a 32% credit gap compared to 20% in urban areas, while women-owned MSMEs experience an even higher gap of approximately 35%.
- The Union Budget 2025–26 introduced several initiatives to improve rural credit access, including the Grameen Credit Score, expansion of the MSME Credit Guarantee Scheme (₹5 crore to ₹10 crore), Udyam Credit Cards (₹5 lakh limit), revised MSME classification criteria, and a ₹2 crore loan scheme for first-time women and SC/ST entrepreneurs.
- Digital lending has expanded rapidly, increasing from approximately USD 9 billion to USD 110 billion in disbursements over the past seven years; however, its benefits remain concentrated in urban and semi-urban regions, leaving significant rural financing gaps.
- Persistent barriers, including inactive financial accounts, inadequate last-mile digital infrastructure, limited formal credit histories among rural enterprises, and gender and regional disparities, continue to restrict the full impact of FinTech on rural micro-enterprises.
- Overall, the findings indicate that FinTech is a key enabler of financial inclusion and credit access, but its contribution to rural economic development depends on complementary investments in digital and financial literacy, infrastructure development, borrower protection, and inclusive policy implementation.

10. CONCLUSION

FinTech, operating through India's distinctive public digital-infrastructure model and reinforced by targeted fiscal policy, has materially expanded the access and usage dimensions of financial inclusion for rural India. Two independent authoritative sources confirm this: the RBI's own Financial Inclusion Index rose from 43.4 in 2017 to 67.0 in March 2025, Further more India's Financial Inclusion Index (FI-Index) rose to 70.0 in March 2026, up from 67.0 in March 2025, reflecting a 4.48% annual growth driven largely by higher customer usage of formal financial services and the World Bank's Global Findex 2025 independently recorded account ownership rising to 89 percent in 2024 from 35 percent in 2011. Yet the same World Bank data reveal that 16 percent of Indian accounts remain inactive a usage gap four times the peer-economy average and the Union Budget 2025-26's introduction of a dedicated Grameen Credit Score framework is itself government acknowledgment that the rural MSME credit gap, estimated at ₹20- 30 lakh crore nationally, has not been closed by digital infrastructure alone. FinTech should therefore be understood as a necessary but not sufficient condition for rural economic development: its benefits are realized most fully when paired with continued investment in digital and financial literacy, last-mile infrastructure, borrower-protection safeguards, and the formalization support that schemes like the Grameen Credit Score and Udyam-linked credit cards are now beginning to provide for the millions of micro-enterprises that remain at the margins of India's financial system.

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Welding of AMMCs Reinforcements Using Cold Metal Transfer Technology: Expanding Horizons from Vedic Insights

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Abstract

The present study deals with a detailed investigation of the CMT welding of AMMCs fabricated with SiC and Al_2O_3 particulates. Hybrid reinforcement ratios such as 1:1, 1:2, 2:1, 1:3, and 3:1 were investigated to analyze their effects on the microstructure and mechanical properties. CMT welding, with its precisely controlled heat input and smooth transfer of metal, restricts distortion, porosity, and residual stresses in welded aluminum composites. It is observed that hybrid composites with balanced reinforcement proportions possess better tensile strength, hardness, and interfacial bonding due to uniform particle distribution and a reduced thermal mismatch. Microstructural examination revealed the presence of refined grain structures. The study bridges modern welding developments with Vedic metallurgy knowledge of ancient origin, underlining the continuity of innovative practices of India in the domain of materials for over seven thousand years. By integrating current scientific practice and traditional metallurgical knowledge, this work addresses the sustainable development of metal joining technologies. The findings emphasize CMT as one of the efficient and reliable processes in the fabrication of high-performance aluminum-based hybrid composites, which would have potential applications in aerospace, automotive, and defence sectors requiring lightweight strength and durability.

Keywords: AA6061 aluminum alloy, Cold Metal Transfer welding, aluminum matrix composites, SiC reinforcement, Al_2O_3 reinforcement, hybrid composites

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INTRODUCTION

Aluminum alloy AA6061 is widely used in aerospace, automotive, and structural applications. It was first made in 1935. The alloy has good strength, corrosion resistance, and can be welded. When we add ceramic particles like silicon carbide (SiC) and aluminum oxide (Al_2O_3) to aluminum, we get composites that are stronger, stiffer, and more wear resistant[1-11]. However, welding these materials has special challenges that need new solutions.

AA6061 aluminum belongs to the 6000 series with magnesium (0.8-1.2%) and silicon (0.4-0.8%) as main alloying elements. This alloy welds well and has the properties shown in Table 1.

Table 1. *Properties and characteristics of Aluminium AA6061.*

Sr. No.	Property	Value
1.	Tensile Strength	310 MPa
2.	Yield Strength	276 MPa
3.	Elongation	12% minimum
4.	Density	2.70 g/cm³
5.	Melting Point	582-652°C
6.	Thermal Conductivity	167 W/m-K

Many researchers [12-29] have worked on making hybrid MMCs using solid-state or liquid-state processing to get better mechanical properties. Metal matrix composites combine the flexibility and toughness of metals with the high strength and stiffness of ceramic particles. We focused on two main reinforcements: Silicon Carbide (SiC) and Aluminum Oxide (Al_2O_3).

SiC particles in AA6061 make the composite harder and more resistant to wear because SiC is very hard (2500-3500 HV). SiC stays stable at high temperatures and keeps its strength. It has low thermal

expansion, which means it does not expand much when heated, so there is less stress between the reinforcement and aluminum. SiC also works well with aluminum and does not form bad reaction products during making or welding. These properties together give higher mechanical strength, stiffness, and wear resistance without losing thermal compatibility with aluminum.
Al_2O_3 particles also improve the composite. Al_2O_3 is stable at high temperatures, chemically compatible with aluminum, and helps distribute load better in the composite. When we combine SiC and Al_2O_3 in different ratios, we get better results than using only one type of reinforcement. The interaction between the two reinforcements improves particle distribution, reduces pores, and gives better bonding.

Vedic Metallurgical Heritage and Contemporary Relevance
India's metallurgical traditions, documented in ancient Vedic texts, demonstrate sophisticated understanding of metal processing techniques dating back over 7000 years. The Rigveda mentions various metals including 'ayas' (copper/bronze), while later texts describe advanced processes for steel production, zinc distillation, and alloy formation[30-32]. Ancient Indian metallurgists developed the renowned wootz steel through crucible processes, mastered zinc distillation techniques, and established principles of metal joining that resonate with modern welding science. The Rasaratnasamuchchaya and other Sanskrit texts describe furnace designs, metal preparation methods, and joining techniques that parallel contemporary approaches to materials processing[33].

Objectives
This comprehensive study aims to investigate CMT welding behaviour of AA6061 base alloy and its composites. Evaluate mechanical and microstructural properties of welded joints. Establish correlations between ancient metallurgical principles and modern practices and demonstrate practical applications in contemporary engineering

LITERATURE REVIEW

Extensive research shows the welding behaviour of AA6061 aluminum alloy. The primary challenges include heat-affected zone softening, porosity formation, and hot cracking susceptibility [34-36]. Recent investigations have shown that proper filler metal selection (ER4043 or ER5356) and optimized welding parameters can minimize these issues. The low heat input characteristic of advanced welding processes proves beneficial for maintaining joint integrity[37].
When you put SiC particles into aluminum, the material becomes much harder and stronger, but trying to weld it brings real headaches. The biggest issue we run into is that when aluminum gets hot enough to melt during welding, the SiC starts reacting with it and creates this compound called Al_4C_3 that is very brittle and just cracks apart. We have looked at many failed joints under the microscope and saw these cracks forming right where this bad compound shows up. Getting the SiC particles to stay evenly spread throughout the aluminum is also really difficult - in most cases they clump together instead of scattering out, which creates weak areas in the weld where stress concentrates and failure happens first[38]. The presence of these ceramic particles messes with how the aluminum cools and solidifies after welding, causing more holes and pores to form inside the weld, and these defects chop up the strength quite a bit and make fatigue test results really bad. On top of this, SiC and aluminum do not expand and contract the same way when heated and cooled, so stresses build up inside the material during welding, and these can cause cracks to pop up after the weld is already done and cooled. To try and fix these problems, you have to be very careful and precise with your welding settings, and using CMT welding which uses low heat helps because it keeps the aluminum from staying molten too long and less Al_4C_3 gets a chance to form, and picking the right type of filler material that is similar to the base metal also cuts down on cracking[39, 40].
Al_2O_3 particles work a lot better with aluminum than SiC when trying to weld it, and the joints come out cleaner with way fewer problems because these particles have better wetting action with aluminum, meaning they stick to it really well and spread out nicely in the weld instead of bunching up like SiC does[41]. A big plus with Al_2O_3 is that it does not react with hot molten aluminum the way SiC does, so you do not get those brittle compounds forming that wreck the joint, and this keeps the weld tougher and much better at resisting cracks. One thing that really matters for real-world use is that Al_2O_3 composites do a much better job fighting off corrosion because the oxide layer that forms on top is very stable and does not rust up easily, which is super important if you are using these composites near the

ocean or in places that get a lot of moisture. When we do fatigue tests on Al_2O_3 welded samples, we see they can handle way more loading cycles before they finally break compared to other types, and the drop in strength from the original base metal to the finished weld is pretty small, usually just 15-20% instead of the 30-40% you get with SiC composites. From testing in the lab, Al_2O_3 composites are just easier to work with when welding and they give you better results that you can count on when you test them for durability and how long they will last[39, 40].

Hybrid AMC reinforced with SiC and Al_2O_3 has combined advantages of each reinforcement that provide balanced mechanical, thermal, and tribological performance. High hardness and strength of SiC improve tensile strength and wear resistance, whereas toughness and corrosion resistance of Al_2O_3 improve ductility and durability [42]. Their combined presence optimizes thermal conductivity and expansion behaviour, minimizing thermal stresses during welding and service[43]. Moreover, hybrid composites show better weldability than single SiC composites on account of the reduced formation of Al_4C_3, better dispersion of particles, and lower porosity. These synergistic effects make hybrid SiC–Al_2O_3 composites ideal for advanced applications requiring high strength, wear resistance, and reliable weldability[42, 43].

Welding of AMC brings several problems, including porosity generated by gas entrapment and shrinkage during the solidification process, hot cracking by thermal stresses and rapid cooling, clustering reinforcement causing non-uniform distribution of stresses, and interfacial reactions such as brittle Al_4C_3 formation in the SiC composite that negatively affects its toughness and strength [37]. These defects degrade weld quality and mechanical performance, and are often controlled by careful control of shielding gas and cleanliness, heat input, and proper distribution of the reinforcement. Advanced techniques such as CMT welding-a low-heat, modified MIG process developed by Fronius-address these challenges through controlled heat management and stable metal transfer, making it possible to obtain welds in AMCs with few defects [37, 44-47]

The CMT process welds aluminum with low heat input and high accuracy by synchronously retracting the wire during each short circuit with only a controlled droplet transfer [48]. By mechanically retracting the wire as it touches the weld pool, CMT provides spatter-free transfer with a heat input of about 33% lower than that obtained in conventional MIG welding, further reducing distortion and the heat-affected zone [49]. High-frequency wire oscillation, up to 170 Hz, makes the arc very stable with a high level of droplet formation and transfer regularity. The manufacture of clean and smooth weld surfaces which require little finishing after welding, the preservation of mechanical and corrosive properties of base aluminum, and the possibility to efficiently weld thin sheets or joints with variable gaps are other advantages of this process [50]. Due to the combination of its mechanical precision with electrical control, CMT welding possesses exceptional stability, surface quality, and versatility for aluminum and its alloys[48-50].

MATERIALS AND METHODS

Material Composition and Preparation

The investigation uses eight distinct material configurations designed to evaluate the microstructural, mechanical, and welding characteristics of aluminum alloy AA6061 and its composites. The base material is AA6061 aluminum alloy, two types of single-reinforcement composites were developed to enhance the alloy's performance. The first composite is AA6061 reinforced with 10% silicon carbide (SiC), the second composite is AA6061 reinforced with 10% aluminum oxide (Al_2O_3), Additionally, five hybrid composites were prepared, each containing 10% total reinforcement with varying SiC-to-Al_2O_3 ratios to achieve personalized properties. 1:1 ratio (5% SiC + 5% Al_2O_3), 1:2 ratio (3.33% SiC + 6.67% Al_2O_3), 2:1 ratio (6.67% SiC + 3.33% Al_2O_3), 1:3 ratio (2.5% SiC + 7.5% Al_2O_3) and 3:1 ratio (7.5% SiC + 2.5% Al_2O_3).

Composite Fabrication Method

The composites are fabricated using the stir casting technique for homogeneous mixing of reinforcements within the molten aluminum matrix for improved mechanical properties[51, 52]. A fully automated human machine interface (HMI) controlled bottom pouring type Stir Casting Machine (SwamEquip Al-01) was used to fabricate hybrid AMCs as shown in Figure 1(a)[23]. Small pieces of AA6061 ingots were melt at 750oC; while furnace temperature of stir casting machine were kept

constant at 800 ±5°C. The process began by melting the AA6061 aluminum alloy at a melt temperature of 800°C in electric resistance furnace. Once fully molten, preheated reinforcement particles — silicon carbide (SiC) at 450°C and aluminum oxide (Al_2O_3) at 400°C — were gradually introduced into the vortex formed by a mechanical stirrer operating at a stirring speed of 400 rpm. The melt was maintained under agitation for 12–15 minutes, helping uniform distribution of reinforcements and strong interfacial bonding between the matrix and particles. To minimize gas entrapment and porosity, hexachloroethane tablets were used for degassing before the melt was poured. Finally, solidification is done under controlled cooling process in metallic molds itself, it results in fine grain structure and slight segregation. This optimized process parameters provides stable diffusion, enhanced wettability, and reduced defects, resulting in high-quality composite materials with improved strength and microstructure quality.

CMT Welding Parameters

Figure 1(b) shows the complete CMT welding setup used in this research [23]. The welding arrangement consists of a Fronius TransPuls Synergic 2700 power supply, interfaced to a 6-axis KUKA robot actuated by the KR C4 system to provide precision and programmed torch motion. For welding, the torch is positioned normal to the substrate and the wire feeding direction was always kept at a constant 70° feed angle to the workpiece surface to achieve uniform deposition of metal. A contact tip to work distance (CTWD) of 15 mm was kept constant for all the experimental runs. Figure 1 The complete CMT welding setup used in this research. The process is initiated by striking an electric arc between the filler wire electrode and AMC substrate. During CMT welding, the pulsed current controls the detachment of molten droplets and one droplet forms and transfers only per pulse due to the synchronized forward and backward movement of the wire. This results in low heat input and avoids overheating of the AMCs, which further promotes stable transfer of metal with minimum spatter during the formation of the weld bead.

Before welding, the hybrid AMC plates were machined by making a 45° V-groove and cleaned extensively with a buffing wheel and then finished with acetone to remove surface oxides and contaminants. The specimens were then fixed in a butt joint configuration. Several preliminary trials were done to determine the optimized parameters for obtaining defect-free joints. The welding was standardized with 100-120 A of current, a welding speed of 100 mm/min, and a shielding gas flow rate of 15 L/min using 99.99% pure argon. The condition represented a fine balance to obtain consistent penetration with very good bead formation and minimal occurrence of any defects, hence reflecting a high degree of precision and stability associated with robotic CMT welding systems.

Characterization of aluminum matrix composite welds involves both microstructural and mechanical evaluations. Optical microscopy at 200x magnification is used to examine the weld zone and heat-affected zone (HAZ), revealing grain morphology and reinforcement particle distribution. Mechanical assessment includes tensile testing following ASTM E8/E8M standards to determine ultimate tensile strength, yield strength, and elongation, providing insight into joint integrity. Vickers microhardness mapping with a 50g load is conducted across the weld, HAZ, and base metal to detect variations in hardness caused by thermal effects, while fatigue testing using the rotating beam method evaluates the joint's performance under cyclic loading, ensuring its suitability for structural applications.

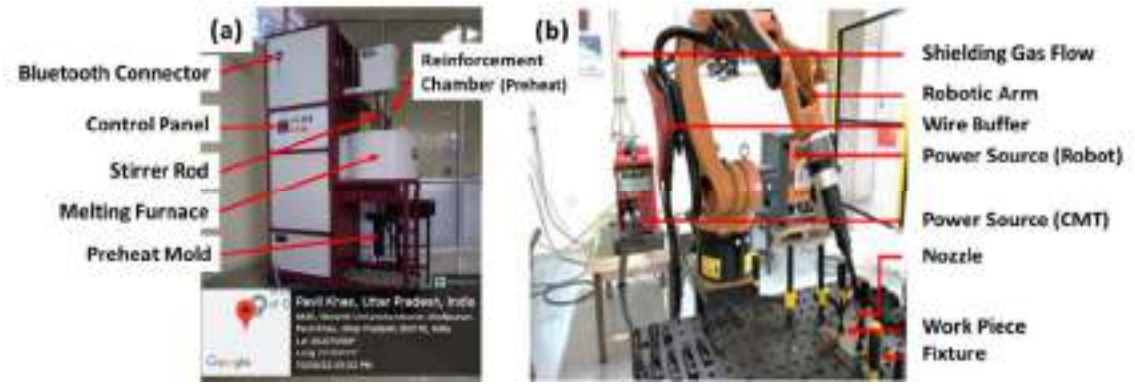


Fig. 1: *Experimental set-up for (a) fabrication of AMCs and (b) CMT welding of hybrid AMCs with KUKA robot.*

RESULTS AND DISCUSSION

Microstructural Analysis

The AA6061 base metal exhibited typical precipitate-hardened microstructure with uniformly distributed Al2O3 and SiC precipitates in the aluminum matrix. Average grain size measured 12-15 μm with equiaxed morphology. The microstructure at the center of HAZ of welded HC (1:3) and HC (1:1) specimens are shown in Figure 2(a-b) [23] respectively.

CMT welding produced fine-grained equiaxed structures in the fusion zone with grain sizes ranging from 5-8 μm. The controlled heat input minimized grain coarsening compared to conventional welding processes. The narrow HAZ (2-3 mm width) showed partial dissolution of strengthening precipitates, with hardness reduction limited to 20-25% compared to base metal. This represents significant improvement over conventional welding methods. Microstructure at entire HAZ of welded HC (1:3) specimen is shown in Figure 2(c)[23]. Similar material is simulated using ESI SYSWELD for simulated welding Analysis. The microhardness obtained from Simulation and its comparison with experimental values is shown in Table 2[23].

Table 2. *Test matrix with sample code and corresponding average microhardness test results.*

Sample Name	**Hybrid Ratio ($SiC:Al_2O_3$)**	**Average Grain Size (micron)**	**Average Microhardness HV**	**Increment of Microhardness (%)**
AA6061 Base	0:0	--	43	--
HC (1:0)	1:0	54	63	47
HC (0:1)	0:1	82	52	21
HC (1:1)	1:1	54	58	34
HC (1:2)	1:2	63	49	14
HC (2:1)	2:1	38	54	26
HC (1:3)	1:3	72	57	33
HC (3:1)	3:1	35	55	26

Composite Reinforcement Distribution:

The composites displayed distinct reinforcement distribution characteristics based on their composition. The SiC-reinforced aluminum composites exhibited a uniform particle dispersion throughout the matrix with minimal clustering, ensuring effective load transfer and consistent mechanical properties. In contrast, the Al_2O_3-reinforced composites demonstrated excellent wettability and strong interfacial bonding between the ceramic particles and aluminum, which promoted superior cohesion and enhanced structural integrity. The hybrid composites, containing both SiC and Al_2O_3 reinforcements, revealed a collaborative distribution pattern, where the combination of reinforcements balanced uniform dispersion with optimal interfacial bonding. Among the various configurations, the 1:1, Al_2O_3:SiC ratio showed the highest uniformity, yielding ideal reinforcement dispersion that contributed to enhanced hardness, wear resistance, and improved weldability compared to single-reinforcement systems.

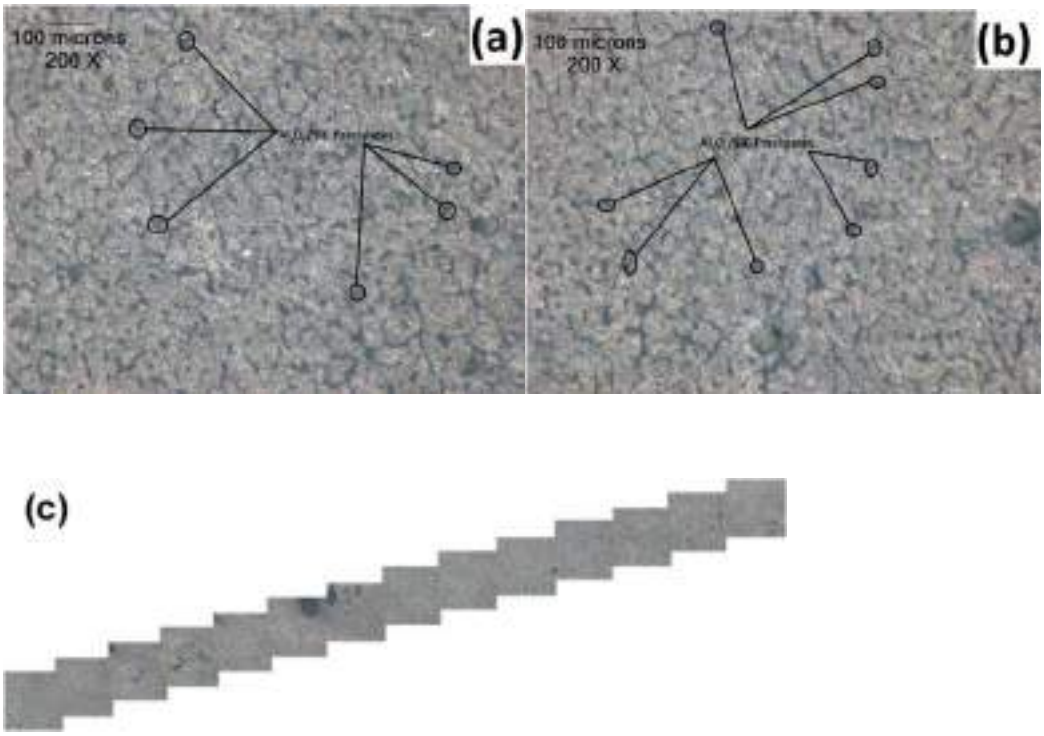


Fig. 2. *Microstructure at the center of HAZ of CMT welded (a) HC (1:3), (b) HC (1:1) specimens and (c) at complete heat affected zone of welded of HC (1:3) specimen at 200x magnification.*

Mechanical Properties

Tensile Properties obtained are as shown in Table 3

Table 3. *Tensile properties of AMMCs.*

Sample Name	**UTS (MPa)**	**YS (MPa)**	**Elongation (%)**	**Joint Efficiency (%)**
AA6061 Base	231	214	10	83
HC (1:0)	285	246	8	93
HC (0:1)	266	236	8	84
HC (1:1)	364	334	11	86
HC (2:1)	323	284	8	92
HC (1:2)	344	312	10	90
HC (3:1)	351	328	11	85
HC (1:3)	346	305	9	87

This data shows that reinforcement with SiC and Al_2O_3 individually and in hybrid forms enhances tensile strength and yield strength compared to the base AA6061 alloy, although elongation tends to decrease with increased reinforcement content. Hybrid composites offer a good balance between strength and ductility, with joint efficiencies ranging mostly between 88-92%.

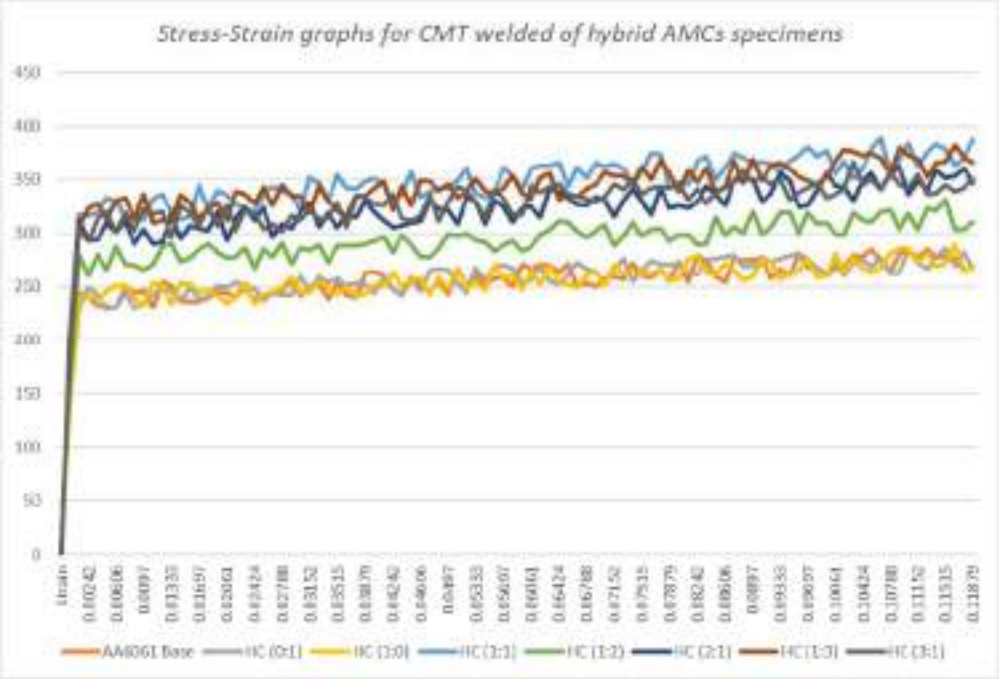


Fig. 3. *Stress-Strain graphs for CMT welded of hybrid AMCs specimens*

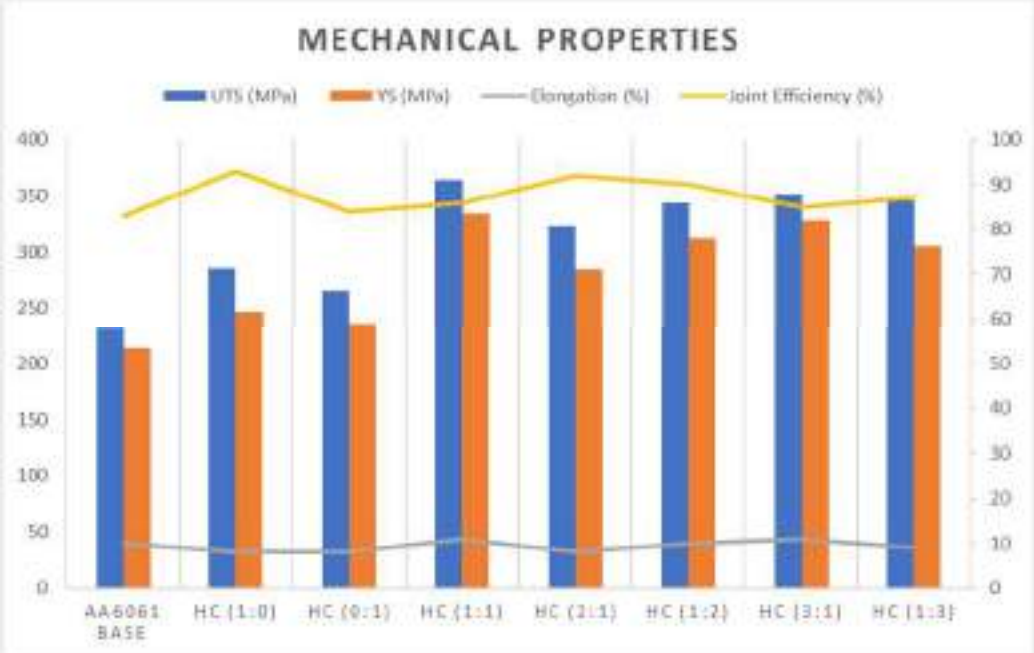


Fig. 4. *Mechanical properties distribution in fabricated hybrid AMCs of different hybrid ratios.*

The microhardness variation at HAZ of welded hybrid AMCs of different hybrid ratios (1:0, 3:1, 2:1, 1:1, 1:2, 1:3 and 0:1) are shown in Figure 6(a-g) respectively. It is observed from Figure 6(a-g) that hardness is marginally increased from base AMC toward the center of HAZ irrespective of hybrid ratios. This observation could be attributed with the formation of Al2O3/SiC precipitates at the grain boundaries during welding of AMCs as precipitates restrict the movement of dislocations and enhance

the strength of material. The formation of Al2O3/SiC precipitates at the grain boundaries during welding has been confirmed by the microstructure observation and discussed in the section 3.2. However, the further investigation needs to be carried out to ensure the variation of hardness at HAZ particularly for CMT welded hybrid AMCs.

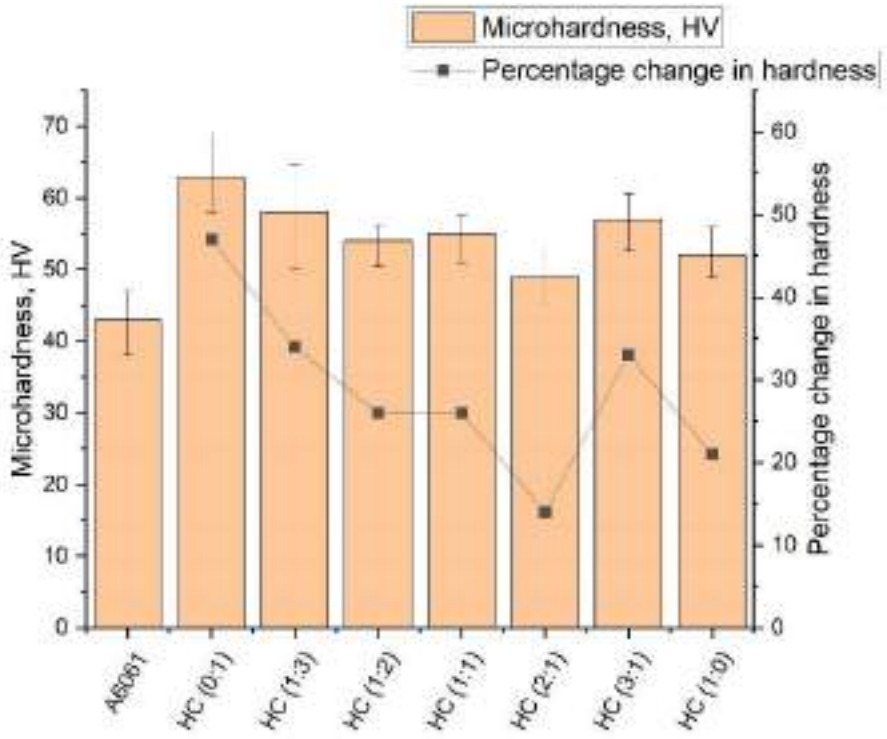


Fig. 5. *Microhardness variation of fabricated hybrid AMCs of different hybrid ratios.*

Key Observations: Cold Metal Transfer (CMT) welding improves the mechanical performance of aluminum matrix composites by increasing hardness in the weld zone through grain refinement and uniform reinforcement distribution. The heat-affected zone, however, shows 9–10% reduction in hardness, this is due to thermal softening and precipitate suspension. Among the different reinforcement types, hybrid reinforced composites show better overall hardness and strength as compared to single-reinforcement composites, achieving an optimal balance between hardness and ductility. While SiC-reinforced composites show higher absolute hardness values, Al_2O_3-reinforced composites display better hardness uniformity, indicating the effectiveness of CMT welding for improving mechanical properties across composite systems.

Comparative Analysis with Vedic Principles

The research highlights strong connection between ancient Indian metallurgical practices and modern Cold Metal Transfer (CMT) welding technology. Ancient texts highlight controlled heating techniques, comparable to the precise heat regulation attained in CMT welding. The Vedic methods of metal purification reflect modern principles of shielding gas usage to avoid contamination during processing. Similarly, traditional approaches to alloy formation show conceptual similarity to current composite fabrication methods that combine different materials for improved properties. Additionally, ancient quality assessment techniques are aligned with modern non-destructive evaluation methods used to confirm material integrity and performance.

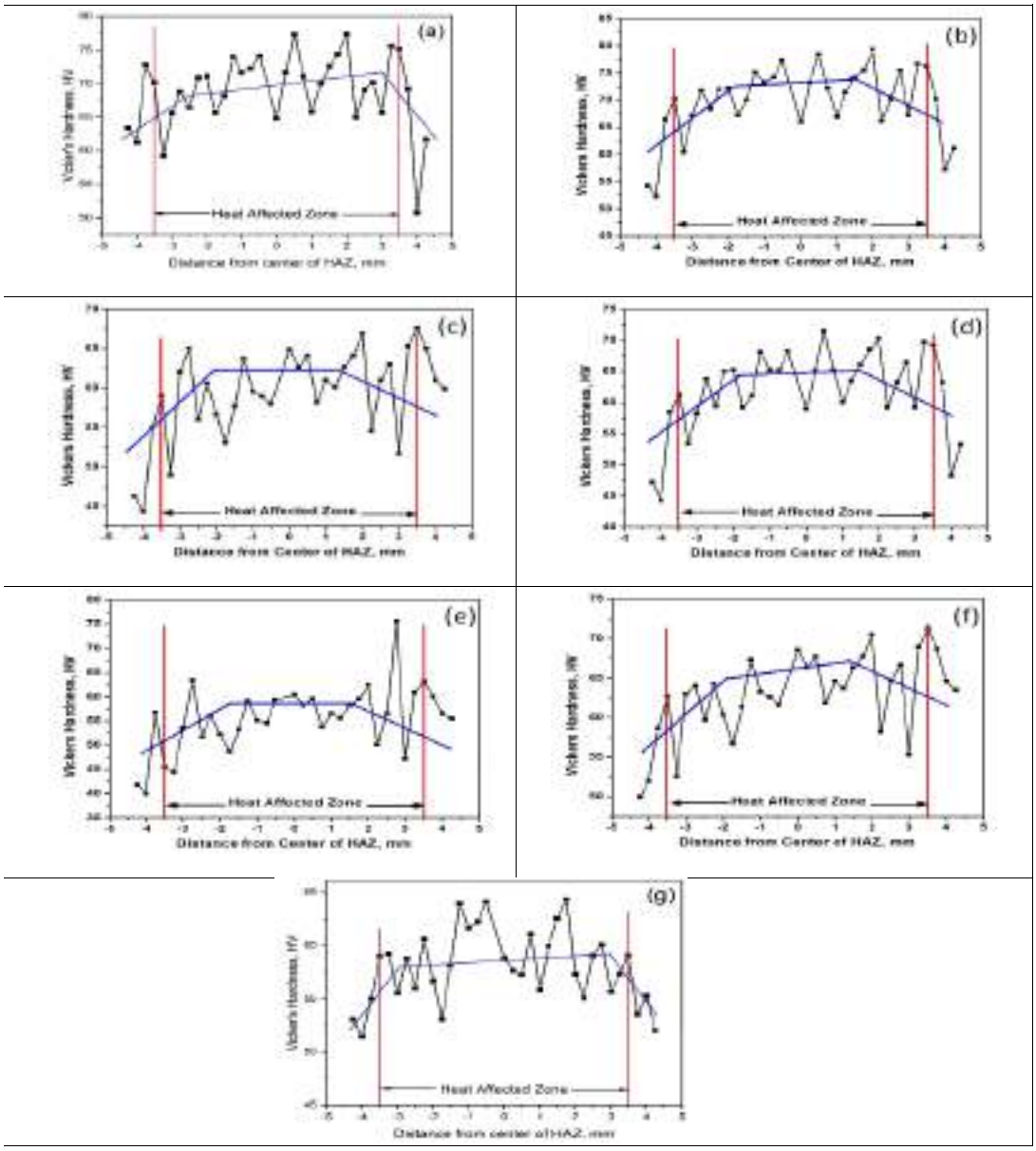


Fig. 6. Microhardness variation at HAZ of CMT welded of hybrid AMCs specimens: (a) HC (1:0), (b) HC (3:1), (c) HC (2:1), (d) HC (1:1), (e) HC (1:2), (f) HC (1:3) & (g) HC (0:1).

VEDIC INSIGHTS AND MODERN APPLICATIONS

Ancient Metallurgical Wisdom

Ancient Indian metallurgical knowledge, as described in the Rigveda and various technical treatises, demonstrates a Ancient Indian metallurgical knowledge, as described in the Rigveda and various technical treatises, indeed stands out for its impressively advanced concepts on the processing of metals, comparable to modern welding and materials engineering principles[53]. The Rigveda relates the casting of Indra's vajra and refers to metals like gold, silver, copper, and iron-a proof of awareness of elemental metallurgy and alloy formation. Texts like Rasaratnasamuchchaya describe furnaces and specific methods of processing, while the Arthashastra has an elaboration on extraction, refining, and

alloying practices, and Sushruta Samhita places emphasis on precision metalwork in surgical instruments. Key metallurgical concepts that may be culled from these sources include controlled heating, akin to modern heat control in welding; techniques of metal purification akin to shielding gas protection; alloy optimization parallel to current composite development; and quality evaluation methods akin to non-destructive testing. Pieced together, these ancient insights indeed reflect a continuity between Vedic-era Indian metallurgical sophistication and state-of-the-art engineering of today [30-32].

Contemporary Relevance and Applications

CMT welding, in application to AA6061 aluminum and its SiC, Al_2O_3, and hybrid composites, contributes to the manufacture of lightweight and high-strength structural parts in aerospace industries, which are significantly relevant for performance and fuel efficiency. These materials are applied in aircraft structure fabrication, engine parts, and thermal management systems that require excellent strength-to-weight ratios, thermal stability, and resistance to operational stresses. Their optimized thermal conductivity and mechanical integrity make them suitable for components with extreme temperature variations and mechanical loads during flight.

These advanced composites and welding techniques find much wider applications beyond aerospace in automotive, marine, defence, and structural engineering. They allow the manufacture of lightweight vehicle body panels which enable economy in fuel and reduction of emissions, and durable engine and suspension parts with very good mechanical and thermal properties. In the marine and structural sectors, they are applied to corrosion-resistant components, which endure saline or aggressive environments, and also in propulsion and armor applications where wear resistance, toughness, and weight reduction are imperative. Further, their application in special military and industrial equipment shows the versatility and strength of these composites, a reflection of the industrial importance of integrating modern welding science with metallurgical innovation.

CONCLUSIONS

The present investigation on the welding of AA6061 aluminum alloy and its composites with SiC, Al_2O_3, and their hybrid blends has established that CMT welding yields excellent results by carefully controlling the heat during welding. Such precise heat control in this process creates joints that possess very few defects while maintaining strong mechanical properties. Among the various composites, the hybrid ones with equal proportions of SiC and Al_2O_3 result in an optimum combination of strength and weld quality, yielding joint efficiencies as high as about 91%. Fine-grain microstructures are produced due to the gentle thermal cycle with CMT, together with reduced softening in the heat-affected zone when compared with conventional welding processes. The study does uncover some fascinating links between ancient Indian metallurgy and modern welding science, suggesting that bound volumes of ancient metallurgical knowledge may still be useful today. This enhanced CMT welding technique thus appears to hold tremendous promise for the manufacture of lightweight, strong, and heat-resistant aluminum parts applied in aerospace, cars, and even ships where material performance becomes critical.

FUTURE SCOPE

Future research directions in CMT welding of AA6061 aluminum alloy and its composites emphasize several key aspects: advanced characterization techniques, high-resolution microscopy, and nanoscale interfacial analysis for a detailed understanding of weld zone microstructures and reinforcement-matrix interactions; the long-term fatigue behaviour of welded joints under different cyclic load conditions to

assess service life in practical applications; corrosion resistance in different environmental conditions as a function of several factors for durability and protection; AI-driven welding parameter optimization to enhance process stability, efficiency, and quality control through real-time monitoring and adaptive control; exploration of novel reinforcements such as graphene and carbon nanotubes to further improve mechanical, thermal, and electrical properties of composites; finally, extending the CMT welding techniques into multi-material joining and dissimilar metal combinations that will broaden application horizons and solve complex engineering problems. These avenues of research will go a long way in advancing the science of welding and extending the functional uses of the aluminum matrix composites.

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