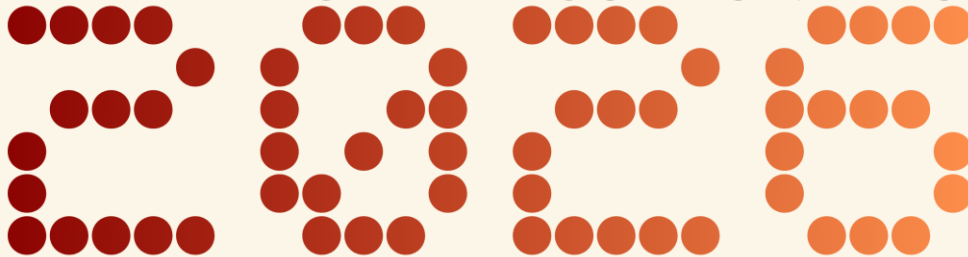




NATIONAL RESEARCH CONFERENCE

PROCEEDINGS

KERALA HIGHER EDUCATION EXPO



THE KERALA STATE HIGHER EDUCATION COUNCIL

APRIL 2026



NATIONAL RESEARCH CONFERENCE
Proceedings

KERALA HIGHER EDUCATION EXPO
2026



THE KERALA STATE HIGHER EDUCATION COUNCIL
APRIL 2026

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THE KERALA STATE HIGHER EDUCATION COUNCIL

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Foreword

This proceedings volume of a three-day global meet organised by the Kerala State Higher Education Council reflects an evolving academic vision that seeks to connect knowledge creation with social transformation, innovation, and global intellectual engagement. It has brought together a remarkable range of scholarly and institutional initiatives such as presentations of research findings by postdoctoral fellows, recognition of outstanding contributions by Kairali Research Awardees, discussions emerging from translational research centres.

The following pages will show that the event served as a vibrant interface of academia, technology, and entrepreneurial start-up exhibitions and interactions across disciplines. International scholars renowned in the humanities, social sciences, natural sciences, technology, and emerging domains including Artificial Intelligence. Their engagement not only enriched the academic deliberations but also strengthened the Council's continuing commitment to establish global collaboration.

I am confident that this volume will serve as a veritable resource for scholars, students, policymakers, and institutions interested in the future directions of higher education.

Vice Chairman

Kerala State Higher Education Council

Introduction

The ***National Research Conference and Kerala Higher Education Expo 2026*** represents a significant milestone in Kerala's ongoing efforts to strengthen its higher education and research ecosystem. Conceived as a comprehensive academic platform, the event brought together policymakers, scholars, researchers, and students in a shared space of dialogue, reflection, and intellectual exchange. Organised jointly by the Department of Higher Education, Government of Kerala, and the Kerala State Higher Education Council (KSHEC), in association with the Government College for Women, Thiruvananthapuram, the Conference was held from 9 to 11 February 2026 as an intensive three-day engagement with contemporary questions in research, innovation, and institutional transformation.

The proceedings that follow capture the breadth and depth of this engagement. The Conference was structured to integrate policy perspectives with academic inquiry and research capacity building, thereby creating a layered and inclusive intellectual environment. From pre-conference policy discussions and workshops to thematic academic sessions and plenary reflections, the event provided a coherent framework within which diverse strands of higher education discourse could intersect. The inclusion of the Kerala Higher Education Expo alongside the Conference further expanded this framework, connecting academic deliberations with institutional practice, public engagement, and student aspirations.

A defining feature of the Conference was its strong emphasis on emerging research communities. The active participation of early-career researchers, including post-doctoral fellows, awardees, and doctoral scholars, ensured that the proceedings reflect not only established academic perspectives but also new and evolving research directions. At the same time, the presence of distinguished national and international scholars, including members of the academic diaspora, enriched the discussions with comparative and global insights, particularly in relation to institutional reform, research funding, and interdisciplinary collaboration.

The range of thematic streams covered during the Conference—spanning the social sciences, humanities, sciences, engineering, health, commerce, and interdisciplinary policy research—underscores the commitment to fostering a holistic and interconnected approach to knowledge production. The papers, presentations, and discussions documented in these proceedings reflect this diversity, covering nearly eight knowledge streams and contributed by CMNPF scholars, Kairali Research Awardees and researchers from various higher education institutions in the country.

These proceedings are thus not merely a record of presentations but a reflection of a larger intellectual moment—one that seeks to align research, policy, and institutional development in meaningful ways. They are intended

to serve as a resource for scholars, administrators, and policymakers, and as a foundation for future initiatives aimed at strengthening the culture of research and innovation in Kerala and beyond. The KSHEC academic team painstakingly prepared the papers and secured the necessary ISBN registration for the publication of the volume. I am thankful to all Research officers in the KSHEC who were associated with NRC 2026 and publication of this proceedings.

28.04.2026
Thiruvananthapuram

Dr. Rajan Varughese
Member Secretary

ARTS AND HUMANITIES

Embracing Touchwood: Revitalizing Arts Education as Human Capital Infrastructure for a Resilient Knowledge Economy in Kerala

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Abstract

Arts education, human capital, resilience, sustainability, In the aftermath of the 2018 floods and the subsequent Re-build Kerala Initiative, Kerala's development vision has increasingly emphasized resilience, sustainability, and a knowledge-driven economy. While physical infrastructure and technical education have received priority, the "soft infrastructure" of higher education—particularly Arts and Humanities—remains marginalised, a condition aptly described as "embracing touchwood." This study argues that a resilient Kerala cannot be constructed solely through technological and infrastructural interventions; it requires the critical thinking, ethical reasoning, cultural awareness, and adaptive capacities cultivated through Arts education. Findings reveal that interdisciplinary curricular structures offer a translational bridge between traditional Arts pedagogy and contemporary employability through skill-based minors and hybrid competencies. The study further highlights the growing relevance of soft skills in Kerala's service-oriented economy and the role of Arts education in sustaining cultural and psychological resilience in post-disaster contexts.

1. Touchwood Paradox

The concept of the "*Touchwood Paradox*" reflects the contradictory position of Arts education in Kerala: it is symbolically preserved as a marker of cultural pride, yet functionally undervalued in development and reconstruction discourse. Following the 2018 floods, the Re-build Kerala Initiative (RKI) prioritized "hard" infrastructure such as roads, housing, and technical systems. In this process, Arts and Humanities were side-lined as non-essential to resilience-building.

This creates a central research problem: a widening **utility gap** between the competencies of Arts graduates—such as ethical reasoning, cultural mediation, and critical thinking—and the technical skills formally recognized within state reconstruction policies and higher education frameworks. The article seeks to question whether a development model that excludes these competencies can truly produce a resilient and inclusive society.

The research identifies a persistent “utility gap,” wherein Arts graduates are perceived as economically less valuable within the emerging knowledge economy, resulting in declining enrolments and curricular stagnation. Using qualitative analysis of recent higher education reforms in Kerala—specifically the Four-Year Undergraduate Programme and the Outcome-Based Education framework—this study examines their alignment with the objectives of the Re-build Kerala Initiative.

This study employs a qualitative policy analysis of RKI reports, project guidelines, and official FYUGP and OBE framework documents. Methodological steps included the thematic coding of competency statements into categories like ethics, community engagement, and technical skills to identify patterns of omission. The research aims to diagnose the utility gap, evaluate the potential of new curricular frameworks, and design strategies to embed arts as structural human capital.

The analysis reveals a persistent “utility gap” that manifests as disconnect between labour market demands and institutional recognition. While Kerala’s evolving service economy increasingly values soft skills such as communication, cultural understanding, and adaptability, recruitment systems and educational policies continue to privilege technical and professional qualifications. This has contributed to a decline in humanities enrolment and a perception crisis surrounding Arts education.

Curricular practices further reinforce this gap. Arts programmes remain largely text-centric and examination-oriented, with limited engagement in applied or policy-relevant contexts. Students are rarely exposed to real-world problem-solving environments where their competencies could be demonstrated and validated. As a result, the transformative potential of Arts education remains underutilised.

The introduction of the Four-Year Undergraduate Programme (FYUGP) represents a significant policy shift toward interdisciplinary learning. Its structure allows for cross-disciplinary exposure, skill-based minors, and flexible learning pathways. However, the implementation of FYUGP often reproduces existing academic silos, limiting its capacity to integrate Arts education meaningfully with development-oriented disciplines. Similarly, Outcome-Based Education (OBE), which is intended to align learning outcomes with employability, is frequently reduced to quantifiable metrics such as grades and credits. This reductionist approach fails to capture complex competencies like ethical reasoning, conflict mediation, and disaster communication, which are central to Arts education.

Despite these limitations, the study identifies significant potential within these frameworks. Interdisciplinary curricular models can act as a translational bridge, connecting traditional Arts pedagogy with contemporary skill demands. When effectively implemented, such models can produce graduates with hybrid competencies who are capable of navigating both technical systems and social contexts.

At a conceptual level, the paper argues for the recognition of Arts education as “human capital infrastructure.” Unlike physical infrastructure, which addresses material needs, human capital infrastructure focuses on the capacity of individuals and communities to adapt, innovate, and sustain development processes. Arts education contributes to this capacity by fostering critical consciousness, cultural sensitivity, and narrative-building skills. These competencies are particularly crucial in post-disaster contexts, where rebuilding involves not only physical reconstruction but also the restoration of social cohesion and collective identity.

In Kerala’s service-oriented economy, the economic value of these competencies is increasingly evident. Sectors such as tourism, media, education, and community development rely heavily on communication, cultural interpretation, and interpersonal engagement. Arts graduates, when equipped with applied skills, can play a vital role in these sectors by mediating between technological interventions and community acceptance.

2. SUGGESTIONS FOR INTEGRATION

Arts skills can be formally recognized by introducing targeted certification systems that translate arts-based competencies into standardized and employable qualifications. One effective approach is the development of disaster communication certificates that equip students with skills in risk communication, media literacy, and multilingual public messaging. These programs should be designed as credit-bearing modules within university curricula and co-developed in collaboration with disaster management agencies to ensure practical relevance. In addition, social auditing credentials can be established to certify competencies in participatory monitoring, rights-based evaluation, and community reporting, drawing upon humanities methodologies and field-based learning. Alongside this, arts-based facilitation badges can be introduced as micro-credentials that validate the application of theatre, visual arts, and storytelling techniques in community engagement and conflict transformation contexts.

Policy integration of humanities interns requires institutional mechanisms that ensure their structured participation in development initiatives such as the Re-build Kerala Initiative. This can be achieved by incorporating specific clauses within policy guidelines that mandate a minimum percentage of humanities interns in projects, particularly in areas involving community interaction, communication, and evaluation. Furthermore, joint university-government programs should be formalized through Memorandums of Understanding, enabling students to undertake credit-bearing fieldwork placements at project sites under the supervision of both academic faculty and project professionals. To ensure meaningful engagement, clear role descriptions must be defined, assigning tasks such as documentation, participatory mapping, and cultural programming, thereby preventing internships from becoming merely observational exercises.

The establishment of Social Labs or Humanities Clinics within Arts departments is essential to bridge the gap between academic learning and real-world application. These centres should function as Community Data Resource Centres that actively collaborate with Local Self-Government Institutions. By integrating research, fieldwork, and community engagement, Social Labs can provide a platform for applying humanities knowledge to address local

development challenges while simultaneously generating valuable community-based data and insights.

Employability within Arts education must be redefined beyond the traditional focus on salaried employment toward a broader model centered on social entrepreneurship and value creation. Graduates should be encouraged to design and implement services in areas such as community media, cultural tourism, and creative facilitation that directly respond to local resilience needs. To support this transition, entrepreneurship-oriented modules covering social enterprise models, funding mechanisms, and impact assessment should be embedded within Arts and Humanities curricula. Additionally, linking these initiatives to state procurement systems can create sustainable opportunities by allowing small arts-based enterprises to participate in development projects, particularly in components related to community engagement, cultural documentation, and communication.

In conclusion Arts education must transition from symbolic "touchwood" to structural "timber". Recognizing arts as critical infrastructure is not merely a cultural preference but an economic and ethical necessity. By complementing technical "hardware" with humanities-informed "software," Kerala can ensure a truly resilient and inclusive developmental architecture.

A resilient and inclusive "New Kerala" cannot be built solely on roads, bridges, and digital systems. It must also be grounded in strong social relationships, ethical governance, and cultural continuity. By integrating Arts education as a core component of human capital infrastructure, Kerala can develop a more holistic model of resilience that combines technological efficiency with social sustainability.

From Region to Repository: Digitally Preserving Kerala's Traditional Clothing and Textile Knowledge

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Abstract.

Traditional clothing practices are an important aspect of the Indian culture. It communicates indigenous knowledge related to material cultures, rituals, social identities and regional aesthetics. It is crucial to safeguard this rich data for the purposes of knowledge preservation and in educating the next generation. One of the most adopted methods in today's age is digital archiving. It ensures easy visibility, accessibility and durability. The government of India has made digital endeavours like the 'Indian Textiles & Crafts Repository' and the 'Indian Culture' portal to digitise the textiles and clothing heritage of the country. While the effort to digitise regional textile designs is appreciable, it needs deeper study of how regional garment traditions like those of Kerala are described, classified, and represented in these standardised digital formats. Currently, there is no single comprehensive platform available to obtain culturally relevant and context-rich information about Kerala's textiles and garments. Moreover, the state's official digital platforms do not adequately represent Kerala-specific clothing traditions. Therefore, this study aims to digitise a collection of Kerala's traditional clothing. The study has three objectives. First, to assess the current classification of traditional Kerala clothing (garments) in selected digital archives and museum catalogues. Second, to gather details of traditional textiles and fabrics of Kerala. The third objective is to archive the traditional Kerala textiles and fabrics on a single digital platform. The study falls under the theme of digital humanities, which utilises digital tools to digitally preserve cultural heritage. The study bases its theoretical framework on cultural semiotics and digital heritage theory. It studies the processes of preserving, translating, and mediating culture through ICT. The study uses visual analysis software MAXQDA to record visual materials and document the details. The analysis shows how digital platforms can enhance accessibility and visibility of traditional clothing practices. This study relies on the idea that regional specificity gets subsumed when presented under broader national categories and therefore aims to build a regional textile archive for Kerala. Highlighting indigenous knowledge will contribute to further scholarly reflection on ethical and culturally sensitive practices of digital heritage. The study's findings will benefit museums and archivists, cultural institutions, educators and students, policymakers, and the tourist sector, apart from digital heritage platforms.

1. Introduction

Traditional clothing in India carries cultural knowledge, regional identities, social practices and aesthetic values [1]. These garments combine material culture with rituals, climate and everyday life. The clothing practices in the country not only showcase craftsmanship but also represent local histories and ethnic communities. India has initiated programmes to preserve its textile heritage through various national platforms. Digital archiving has been a preferred

method [2] to safeguard the rich Indian textile data for the present and future generations. However, the digital repositories categorise the regional traditions under the national labels paving the way for the loss of a specific region's cultural context [3]. In the case of Kerala, the sheer absence of a digital archive for Kerala's traditional clothing results in a peripheral, generalised idea of Kerala textile knowledge and inadequate reserve of information of Kerala's clothing practices. This study therefore proposes a framework for a comprehensive, region-specific digital archive. It addresses the key questions on how textiles are currently classified, what are the gaps existing in their representation and how can a contextual digital archive be developed. The significance of the study lies in developing digital archival practices for culturally sensitive information which can be accessed easily by learners who cannot access it otherwise. It offers rich content for archivists, museums, and policymakers to improve the preservation and accessibility of regional textile knowledge. The limitation of this study resides in proposing a conceptual framework and not creating a digital repository for the state presently.

2. Theoretical Frameworks

The study incorporates the theoretical frameworks of cultural semiotics, digital heritage theory and indigenous knowledge systems. Cultural semiotics, as proposed by Barthes in *The Fashion System* [4], provides the necessary framework to understand clothes as a system of signs through which meanings can be conveyed within specific cultural context. Meanwhile, the digital heritage theory, as discussed in *Theorizing Digital Cultural Heritage* [5], uses the digital technologies to examine how cultural knowledge is mediated and preserved within the virtual space. Further, an emphasis on the indigenous knowledge system is able to expose the importance of preserving local knowledge and cultural practices. It advocates for more culturally context-based knowledge reserves and decolonial approaches in digital archiving.

3. Methodology

The digital representation of Kerala's traditional clothing and textile knowledge is methodologically evaluated using a qualitative and interpretive research design. The research focuses on an exploratory approach emphasising the need to understand how cultural meanings are constructed and mediated within the digital environments. The cultural dimension of the traditional clothing is closely analysed rather than subsuming it into a descriptive category. Also, the qualitative analysis brings in an in-depth evaluation of both visual and textual data.

The data for the study is to be collected from the existing digital archives that documents Indian clothes and textile knowledge. In addition to digital sources, the study also aims to collect archival images, data and other publicly available visual materials that represent Kerala's textiles. Data collection involves a combination of observation and documentation of the entries related to Kerala's traditional clothing. This consists of images, its descriptions, and different classifying categories. The process revolves around the identification of garments, how they are labelled, visually presented, and by keenly investigating the presence or the absence of culturally specific details. In order to organise and code the visual/textual data, digital qualitative analysis software such as MAXQDA are utilised to help in easy categorisation and comparison across different sources [6]. It also builds better reliability and consistency in analysing the qualitative materials. Through data analysis, patterns are identified in relation to the classification and representation, while codes are designed to capture key

issues such as generalisation, loss of terminology, and absence of specific cultural context. These identified issues are then interpreted on the basis of the theoretical framework.

4. Digital Representation of Kerala Textiles

A preliminary outlook shows that the current digital classification systems depend on broad and standardised categories. National digital platforms are inadequately equipped to represent the complexity of regional nuances in clothing practices. Garments of different regions are grouped under the generic labels such as “Indian textiles” or “South Indian attire”. Such titles fail to capture distinctions in fabric, form and cultural function, leading to a reductive way of classification that do not convey the depth of regional textile knowledge [3] [5]. Kerala’s textile traditions are closely related to local histories, climate and social practices. Local terminology, ritual significance and stylistic nuances may be minimised or entirely erased under wider classification on national platforms, leading to a homogenised representation of textiles.

Moreover, the study has identified gaps in contextual information across digital platforms. It provides limited information on production techniques and contextual or cultural meanings, emphasising more on the material composition or the visual appearances. Thus, the study proposes the development of a Kerala-centric digital textile repository that focuses on regional specificity, and to counter the limitations present in national digital platforms. The creation of a regional textile repository would systematically document garments, textiles and related practices within Kerala. This would ensure the usage of culturally accurate terminology and the inclusion of socio-historical narrative, leading to a more holistic representation of textile knowledge.

5. Reframing Digital Archives

The research findings support the existing scholarship that critiques the limitations of digital archives in representing culturally embedded knowledge [5]. Studies conducted earlier on textiles and heritage have detected on how standardised classification system often prioritise uniformity over cultural nuance. This study has demonstrated how Kerala’s traditional clothing is simplified when represented in national platforms. Thus, it emphasises on the regional specificity of clothes to treat it as a semiotic system than a material artefact. The study makes significant contribution to the field of digital humanities by preserving the culturally sensitive data digitally. It moves from mere accumulation to meaningful representation. The findings, also benefits policymakers, museums and educational institutions. The existence of such repositories can act as valuable resources for teaching cultural studies, fashion history and heritage preservation. However, digital preservation may pose its own challenges in conserving knowledge. Technical constraints or limited resources can hinder the development of a comprehensive digital archive. Moreover, there may be ethical concerns regarding representation and ownership of cultural knowledge and textiles. Though, the development of a digital representation is humongous, future research could benefit in deepening cultural understanding.

6. Conclusion

The study has inferred that the existing digital archives inadequately represents Kerala’s traditional clothing by depending on broad classifications and insufficient cultural context. It shows how regional textile knowledge is often generalised within the national frameworks that

leads to loss of specificity and meaning. The paper is a research proposal on the need of a more context-sensitive approach to digital preservation that recognise clothing as a carrier of cultural knowledge than a mere visual artefact. Theoretically, the study contributes to digital humanities by preserving cultural specificity within digital archives and practically, the study helps in the development of a Kerala-centric digital textile repository that contains local terminology and contextual narratives. This aids in developing a culturally grounded digital platform. Future research can expand this work by incorporating various fields and preserving its knowledge digitally.

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From Research to Resilience: Reimagining State-Owned OTT Platforms in Rebuilding Kerala

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Abstract

Over-The-Top (OTT) platforms are no longer limited to entertainment; they increasingly function as important public communication and knowledge infrastructures. In a state such as Kerala, which faces recurring climate-related disasters, public health challenges and socio-economic transitions, digital platforms can contribute meaningfully to rebuilding processes. This paper examines how state-owned OTT platforms can operate as translational digital public infrastructure for rebuilding Kerala, with special reference to the Government of Kerala's OTT platform, *CSpace*. The study adopts a qualitative and interdisciplinary approach, drawing on media studies, public policy, disaster communication and cultural economy literature. It analyses policy documents, publicly available information on *CSpace*, platform objectives and content categories, along with secondary research on Kerala's digital and governance ecosystem. The focus is on understanding how public OTT platforms can translate research and policy knowledge into socially useful outcomes. The paper concludes that reimagining state-owned OTT platforms as digital public infrastructure can strengthen Kerala's rebuilding and resilience strategies by linking research, culture and governance within a publicly accountable digital ecosystem. *Index Terms* – *Over the Top Platforms, Cultural resilience, Disaster communication, Rebuilding Kerala, Platform Studies*

1. Introduction

Digital platforms shape access to information, culture, education and public discourse, with Over-the-Top (OTT) services largely understood as commercial systems driven by market logics and profit-oriented circulation. However, the emergence of state-owned OTT platforms invites a reconsideration of their role, positioning them as developmental digital public infrastructure capable of translating research and policy into socially impactful outcomes. Development here extends beyond economic growth to include social resilience, cultural sustainability, democratic participation and inclusive knowledge access. As Nick Srnicek argues, platforms are “designed to extract and control data” (Srnicek 39), while José van Dijck notes they “shape the performance of social acts instead of merely facilitating them” (van Dijck et al. 5). In this context, Kerala's *CSpace* illustrates how such platforms can mediate between research, governance and everyday life in regions facing climate, health and social challenges.

1.1 OTT Platforms and the Limits of Commercial Models

Reimagining OTT platforms as public-interest media enables states to use digital technologies for resilience and development. Mainstream platforms prioritise scale, user retention and monetisation, with algorithms favouring popularity over social relevance, often sidelining regional, independent and development-oriented content. This creates a gap between research and public understanding. In this context, Kerala—despite recurring environmental and public health challenges—offers a strong case, where the state-owned platform *CSpace* highlights the potential of public digital media to support development and resilience.

2. Literature Review

Over-the-top (OTT) platforms are broadly understood as digital media services that deliver audiovisual content over the internet, bypassing traditional broadcast and cable systems. Scholars define OTT platforms as internet-based distribution systems that enable on-demand access to content across devices, thereby transforming audience autonomy and media consumption patterns (**Lotz; McQuail**). As

Amanda Lotz observes, internet-distributed television has fundamentally altered the structure of the television industry by decentralising content delivery and expanding user choice.

Recent scholarship further emphasises that OTT platforms must be understood within the broader framework of platform studies. According to Nieborg and Poell, cultural production is increasingly shaped by platform infrastructures, a process they describe as the “platformization of cultural production.” This perspective highlights that OTT platforms are not merely technological systems but socio-economic structures that influence visibility, access and content circulation. However, this transformation is largely shaped by corporate control. Platform studies scholars, particularly Tarleton Gillespie, emphasise that platforms are not neutral intermediaries but systems that “*curate, organize, and monetize content*” (Gillespie 347). This raises concerns about visibility, access and representation. In the context of cultural industries, David Hesmondhalgh highlights that media industries play a crucial role in shaping cultural production and identity, but are often structured by inequalities in distribution and access (Hesmondhalgh). Development communication scholarship, particularly the work of Everett M Rogers, underscores the importance of communication systems in spreading knowledge and enabling social change. Rogers argues that innovations spread through communication channels over time within a social system (Rogers). Despite extensive research on OTT platforms and digital media, limited attention has been given to **state-owned OTT platforms** as tools of development. This paper addresses this gap by examining their role in knowledge translation, cultural resilience and public communication.

2.1 State Owned OTTs

State-owned over-the-top (OTT) platforms represent an emerging but still limited segment of the global digital media landscape, primarily oriented toward public service and cultural preservation rather than commercial entertainment. In India, initiatives such as CSpace, launched by the Government of Kerala, and WAVES OTT (OTT Platform by Prasar Bharati) reflect early efforts to create publicly controlled digital streaming spaces that prioritise regional cinema, archival content, and educational programming. Similarly, OndaMedia in Chile provides free access to national films and documentaries, emphasising cultural accessibility and identity. In contrast, several countries have adopted indirect models, where public broadcasters such as the BBC deliver content through digital platforms like BBC iPlayer, thereby extending traditional broadcasting into the OTT domain (Government of Kerala; Ministry of Information and Broadcasting; Consejo Nacional de la Cultura y las Artes; Lotz). Overall, these platforms differ from privately owned OTT services in their institutional objectives, as they are typically designed to promote cultural heritage, ensure public access to media, and support non-commercial forms of content production.

2.2 CSpace

CSpace is India’s first state-owned over-the-top (OTT) platform, launched by the Government of Kerala through the Kerala State Film Development Corporation as part of its broader cultural and digital media policy. Conceived as a public service digital platform, CSpace aims to provide an alternative to commercially driven OTT ecosystems by prioritising cultural value, artistic expression and social relevance over algorithmic popularity and profit-oriented content distribution.

Unlike private OTT platforms, which largely operate within market-driven logics, CSpace is designed to function as a **public digital space for cinema and knowledge dissemination**. According to official descriptions, the platform gives primary importance to **award-winning films, independent cinema, documentaries, short films and regional content**, particularly those that may not find visibility on mainstream platforms (**Government of Kerala, CSpace**). Media reports have also highlighted that CSpace was conceptualised as a “**cultural intervention**” in the digital streaming space, aimed at resisting the dominance of corporate OTT platforms and ensuring that regional cinema and public-interest content receive sustained visibility (*The Hindu*). This reflects an institutional effort to support **non-commercial and socially meaningful content**, thereby strengthening Kerala’s cultural ecosystem.

3. Conceptual Framework: OTT as Digital Public Infrastructure

This paper conceptualises state-owned OTT platforms as digital public infrastructure, extending beyond their conventional role as entertainment systems. Contemporary scholarship on platform societies, particularly José van Dijck and Nick Srnicek, highlights how digital platforms are increasingly shaping social, economic and cultural interactions through algorithmic governance and data-driven logics. However, these platforms are largely embedded within what Srnicek terms “platform capitalism,” where profit maximisation determines visibility, access and content circulation.

In contrast, state-owned OTT platforms offer the possibility of reconfiguring platform logic towards public value and social accountability. Drawing from Jürgen Habermas’s notion of the public sphere, such platforms can function as mediated spaces for rational communication, civic engagement and knowledge dissemination. They can extend the public sphere into the digital domain, especially in regional and development contexts.

The concept of “research to resilience” is central to this framework. It refers to the translation of academic research, policy insights and social knowledge into accessible formats that enhance community preparedness, participation and adaptive capacity. This aligns with development communication theories, particularly those of Everett M Rogers, which emphasise the importance of communication channels in enabling the diffusion of knowledge and innovation within societies.

Thus, state-owned OTT platforms can act as translational media infrastructures by:

- converting research into audiovisual narratives,
- embedding public knowledge within popular media ecosystems, and
- ensuring accountability through institutional governance.

4. Methodology

This study adopts a qualitative and interpretive research design, focusing on the social and developmental role of OTT platforms rather than technical performance metrics.

The research employs documentary analysis, drawing on:

- policy documents related to Kerala’s digital governance and cultural sectors
- publicly available information on *CSpace*
- academic literature on OTT platforms and digital media

The study is also informed by platform studies approaches, which examine how platforms operate as socio-political systems shaped by governance and institutional frameworks (Gillespie). A thematic analysis is used to identify key domains of impact, including cultural resilience, disaster communication, creative economy, knowledge translation and governance.

5. Key Findings and Discussion

5.1 Cultural Resilience and Identity

One of the central findings of the study is that state-owned OTT platforms can strengthen cultural resilience. Cultural resilience refers to the ability of communities to maintain and adapt their cultural practices, languages and collective memory in the face of social and environmental disruption. Public OTT platforms can prioritise regional language content, local histories, community narratives and marginalised voices that often struggle to find space on commercial platforms. In the case of Kerala, Malayalam-language cinema, documentary practices and cultural storytelling form an important part of social identity. By curating and sustaining such content, a public OTT platform supports social cohesion and shared cultural memory, which are crucial during rebuilding and recovery processes.

Cultural rebuilding is therefore not merely symbolic. It reinforces community belonging and emotional recovery after crises and supports long-term social stability. State-owned OTT platforms strengthen cultural identity by promoting regional language content and marginalised narratives. As Hesmondhalgh argues, cultural industries are central to identity formation and social cohesion (Hesmondhalgh). In Kerala, this supports cultural continuity and community resilience.

5.2 Disaster Preparedness and Recovery Communication

The study identifies disaster communication as a key development function of public OTT platforms. Kerala’s frequent exposure to floods, landslides and public health emergencies highlights the importance of reliable, context-sensitive and locally grounded information systems. State-owned OTT platforms can translate scientific research on climate change, disaster risk and environmental

vulnerability into accessible audiovisual formats. Unlike short-form alerts or fragmented social media posts, OTT platforms enable structured, long-term educational content such as preparedness programmes, recovery guidance and community-based adaptation practices. Institutional credibility and editorial oversight further distinguish public platforms from commercial or social media spaces, which are often vulnerable to misinformation. As a result, OTT platforms can become complementary components of disaster management infrastructure.

5.3 Regeneration of the Creative Economy

Another significant finding relates to the creative economy. Cultural workers and independent filmmakers often face precarious employment conditions, limited distribution opportunities and unstable income, particularly after crises such as the COVID-19 pandemic. State-owned OTT platforms can support creative livelihoods by providing alternative distribution channels, transparent revenue-sharing models and visibility for socially relevant content. This enables creative workers to participate meaningfully in the development process while also contributing to cultural diversity and public education.

The creative economy thus becomes an integral part of development rather than an auxiliary cultural sector. Supporting cultural labour strengthens local economies and preserves regional creative ecosystems.

5.4 Public Knowledge Translation

A persistent challenge in development contexts is the limited public accessibility of academic and policy research. Scientific findings on climate adaptation, health, agriculture, digital literacy and governance often remain confined to institutional or professional circles.

The study finds that OTT platforms are particularly suitable for public knowledge translation. Visual storytelling, documentaries and short explanatory formats can communicate complex research insights in relatable and culturally grounded ways. By enabling collaboration between universities, research institutions and media professionals, public OTT platforms can bridge the gap between research communities and citizens. This process strengthens evidence-based public behaviour and supports informed decision-making, which are essential foundations for sustainable development.

5.5 Participatory Governance and Civic Learning

Kerala's decentralised governance system relies heavily on citizen participation, awareness and accountability. The study finds that state-owned OTT platforms can extend digital governance beyond service delivery portals into the broader public sphere. Public platforms can disseminate policy explainers, showcase successful local governance practices and document community-led development initiatives. Such content improves public understanding of governance processes and enables citizens to engage more meaningfully with institutions. In this way, OTT platforms become tools of civic learning and democratic participation, reinforcing development as a collective and participatory process. This aligns with Habermas's vision of media as a space for democratic participation.

6. Ethical Data Use, Policy Feedback and Development Implications

Public OTT platforms enable the ethical use of anonymised audience data to support policy learning and improve communication, ensuring transparency, accountability and alignment with public interest. Such feedback mechanisms allow governments and institutions to refine development communication, assess educational initiatives and design more inclusive outreach strategies. The findings highlight that state-owned OTT platforms should be integrated into broader development and digital governance frameworks rather than treated solely as cultural or entertainment initiatives. Policy approaches can recognise these platforms as digital public infrastructure, foster collaborations between universities and platform operators, and support public-interest content through dedicated funding. Additionally, establishing clear ethical guidelines for data use and content governance is essential. Embedding OTT platforms within development policy can strengthen research-to-impact pathways and enhance long-term social resilience.

7. Conclusion

This paper has argued that state-owned OTT platforms can play a transformative role in contemporary development by functioning as digital public infrastructure that connects research, culture and governance. Using Kerala's public OTT initiative as a contextual reference, the study demonstrates that such platforms can contribute to cultural resilience, disaster preparedness, creative economy regeneration, public knowledge translation and participatory governance.

Reimagining OTT platforms within a development framework enables a shift from market-oriented platform logics towards socially accountable digital ecosystems. By enabling research to be translated into accessible public narratives and by supporting inclusive cultural and civic engagement, state-owned OTT platforms can strengthen societal resilience and support sustainable development. The Kerala experience thus offers a valuable model for other regions seeking to align digital innovation with public interest and long-term social transformation.

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Translating The Coast : Documentary Films as Translational Narratives of Trauma , Survival and Resilience

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Abstract

This paper examines documentary films as translational narratives that demonstrate how literary research can move beyond textual interpretation to generate social and institutional impact. Focusing on documentaries that represent coastal trauma, survival, and resilience, the study argues that the documentary mode differs from other narrative forms through its claims to actuality, visual testimony, and ethical address. These qualities enable documentary narratives to translate localised lived experiences into forms of knowledge that are applicable across multiple domains. Drawing on trauma theory, documentary narrative analysis, the paper explores how documentaries become translational when they extend beyond public awareness to inform social consciousness and administrative understanding. In doing so, the study highlights the capacity of documentary cinema to function as a medium through which humanities research contributes to societal advancement.

INDEX TERMS : Documentary Narratives, Translational Narratives, Trauma theory, Narrative theory, Documentary theory, Social Impact etc.

1. Introduction

In an era of escalating social, political, and cultural challenges, literary narratives have become an indispensable medium for bringing these issues into the mainstream societal arena. Yet, literature often appears as a mode of illusory depiction and representation of reality, thereby instilling a sense of authenticity in society's reception of reality. In this context, documentary films stand out as a credible and realistic mode of representation. Bill Nicholas, an American film critic and theoretician has characterized the documentary in terms of a filmmaking practice, a cinematic tradition, and mode of audience reception, a practice without clear boundaries (Grant and Sloniowski 14).

This is vividly evident in the context of coastal communities, where issues such as environmental degradation, climate change, displacement, and livelihood crises remain both urgent and underrepresented. This paper sets forth the notion of translation not in linguistic sense, but as a medium through which the lived experiences of marginalized communities are transformed into meaningful and transferable knowledge. Documentary film as a visual

narrative, in this context acts as a translational mode that bridges the gap between localised experiences and societal acknowledgment. To further substantiate this argument, the study examines Sarvnik Kaur's *Against the Tide* and Dakshin Foundation's *Chronicles of Oblivion* as case studies to explore how documentary films translate coastal realities of trauma, survival, and resilience into broader social and administrative frameworks. This study adopts a qualitative analytical approach, drawing on trauma theory and documentary narrative analysis to examine how selected documentaries function as translational narratives.

2. Literature Review

Scholarly discussions on documentary films have traditionally focused on questions of realism, representation, and truth claims. Bill Nicholas, an American film theorist, proposes that "documentary is not a representation of the world we already occupy" (20). He further argues that documentary does not possess fixed technical conventions, a singular mode of narration, or a stable set of forms and styles. Instead, it remains a dynamic realm in which these elements continuously evolve (21). Drawing on Paul Ricoeur's narrative theory, the paper treats documentary as a form of narrative configuration through which lived experience is rendered intelligible.

Trauma theory is employed as a critical lens for evaluating the representation of suffering, memory, and displacement. Cathy Caruth, an American literary scholar and trauma theorist, establishes trauma as a belated and unclaimed experience rather than merely a painful event. It is too complex to apprehend the traumatic element at the moment of its occurrence, but it tends to emerge through indirect forms of representation (Caruth, 9). Another prominent trauma theorist, Shoshana Felman propounds the concept of testimony, which foregrounds, witnessing as a crucial process through which traumatic experiences are articulated and made intelligible. Hence, documentary films serve as a crucial medium that vividly captures the fragmented and belated nature of trauma, as theorized by Cathy Caruth, while at the same time functioning as sites of testimony and witnessing in line with Shoshana Felman's framework, thereby exhibiting lived experiences as socially and institutionally meaningful.

3. Documentary as Translation

Documentary films can be understood as translational narratives in that they transform lived experiences into structured and communicable forms. As Bill Nicholas makes explicitly clear that documentary addresses the viewer ethically positioning them not as passive spectators but as witnesses to social reality. This ethical address is crucial to the documentary's translational power, particularly in context of social rebuilding.

This translational function can be further supported through Michael Renov's theorisation of documentary, particularly his claim that documentary serves to record, preserve and interrogate reality. When read through translational humanities lens, this archival function as it enables documentary cinema to inform long term social consciousness rather than momentary awareness.

4. Translating Trauma, survival and Resilience

The translational capacity of documentary narratives becomes evident in the vivid depiction of trauma, survival, and resilience. The paper highlights two documentaries as case studies in order to bring forth how documentaries depict the invisible cultural, psychological, and historical facets of society, particularly among marginalized communities such as fisherfolks. It unveils the traditional Koli community, tracing its roots back to the twelfth century, before its entry into mainstream discourse.

Similarly, *Chronicles of Oblivion* engages with themes of memory, loss, and environmental change. It explores the harsh realities of fisherwomen in Odisha. It highlights how communities negotiate loss while striving to preserve cultural and ecological continuity. Importantly, these films move beyond awareness and thereby enhance social consciousness.

5. Conclusion

This paper has argued that documentary films function as translational narratives that transform localised coastal experiences into broader forms of knowledge and understanding. Even though the paper highlights coastal life, the argument it posits is not limited to coastal issues alone. The translational model proposed here suggests that when documentary cinema is institutionally supported - within educational, cultural and administrative frameworks, it can gradually cultivate societal awareness of diverse and ongoing crises, including mental distress, marginalization and rising suicidal tendencies.

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मालती जोशी के कहानी-संग्रह 'औरत एक रात है' और सारा जोसेफ के कहानी-संग्रह 'पाप भूमि'(पापत्तरा) में स्त्री अस्मिता: एक तुलना

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आज के युग संदर्भ में बहुचर्चित और बहुप्रचलित शब्द है 'स्त्री अस्मिता'। हिंदी साहित्य की बहुचर्चित लेखिका मालती जोशी के कहानी-संग्रह 'औरत एक रात है' और मलयालम की मशहूर लेखिका सारा जोसेफ के कहानी-संग्रह 'पाप भूमि' में चित्रित स्त्री अस्मिता की तुलना इस शोध प्रबंध का मुख्य विषय है। भिन्न सामाजिक व सांस्कृतिक परिदृश्य में स्त्री अस्मिता का चित्रण मालती जोशी व सारा जोसेफ की कहानियों में देखने को मिलता है। अब तक पितृसत्तात्मक समाज में स्त्री की जो पहचान थी, वह किसी की माँ, किसी की पत्नी या किसी की बेटी के रूप में थी। लेकिन स्त्री अस्मिता का संघर्ष इससे बढ़कर एक विशिष्ट पहचान से है, जहाँ वह असली 'मैं' होकर जीना व अभिव्यक्ति पाना चाहती है।

मालती जोशी और सारा जोसेफ दोनों की कहानियों में स्त्री अस्मिता एक केंद्रीय विषय है। मालती जोशी की कहानियों में स्त्री अस्मिता अंतर्मन की पीड़ा व आत्मबोध से उभरती है। मालती जोशी 'औरत एक रात है' की कहानियों के जरिए स्वतंत्रता, समानता व अपने अधिकारों के लिए आवाज उठाती स्त्री का चित्रण करती है। सारा जोसेफ के कहानी-संग्रह 'पाप भूमि' में लेखिका ने स्त्री के मातृत्व, अपने शरीर पर निर्णय लेने का स्त्री का अधिकार, अभिव्यक्ति का अधिकार जैसे कई मुद्दों को उभारा है। उनकी कहानी पुराने जमाने से छुपाई गई, अनदेखा की गई या दबाई गई स्त्री की अनुभूतियों का पुनःकथन है।

मालती जोशी अपनी कहानियों में स्त्री अस्मिता के भावनात्मक व मनोवैज्ञानिक पक्ष को बहुत ही सहज रूप से अभिव्यक्त करती है तो सारा जोसेफ स्त्री अस्मिता के सामाजिक पक्ष को बहुत ही सशक्त शब्दों में प्रकट करती है, पितृसत्तात्मक समाज द्वारा संचालित रूढ़ियों के प्रति विरोध प्रकट करती है। उनकी कहानियों में प्रतीकात्मक शब्द ज्यादा मिलते हैं। दोनों ही लेखिकाओं ने अपनी कहानियों में स्त्री अस्मिता को अत्यंत सशक्त रूप में प्रस्तुत करती हैं, जिसका प्रभाव आज भी बरकरार है।

KEY WORDS: स्त्री अस्मिता, पितृसत्तात्मक समाज, प्रतिरोध, अस्तित्व

मालती जोशी के कहानी-संग्रह 'औरत एक रात है' और सारा जोसेफ के कहानी-संग्रह 'पाप भूमि'(पापत्तरा) में स्त्री अस्मिता : एक तुलना

साहित्य में स्त्री अस्मिता की तलाश सतत चलने वाली प्रक्रिया है। प्राचीन काल से लेकर आधुनिक काल में भी स्त्रियों की सामाजिक भूमिका, स्वतंत्रता, अधिकार और पहचान पर गहन विमर्श हो रहे हैं। 'मैं कौन हूँ?' इस प्रश्न से अस्मिता की अवधारणा शुरू होती है। मैं कौन हूँ? समाज में मेरी क्या स्थिति है? और मेरे अधिकार और कर्तव्य क्या-क्या हैं? यही स्त्री अस्मिता के मुख्य प्रश्न हैं। अस्मिता का सीधा संबंध पहचान से है। इस पहचान के कई रूप हो सकते हैं। इसमें राष्ट्र, जाति, नाम, क्षेत्र, धर्म, वंश, लिंग, वर्ग, व्यवसाय आदि शामिल होते हैं। यानी अस्मिता व्यक्तिगत भी हो सकती है और सामाजिक भी। स्त्री अस्मिता स्त्री के अपने अस्तित्व, स्वतंत्र पहचान, समानता व अधिकारों पर केंद्रित है।

प्रस्तुत शोध प्रबंध में स्त्री अस्मिता के संदर्भ में मालती जोशी के 'औरत एक रात है' कहानी संग्रह और सारा जोसेफ के 'पापभूमि' कहानी संग्रह की तुलना करने की कोशिश की गई है।

मालती जोशी के कहानी संग्रह 'औरत एक रात है' की हर कहानी स्त्री की पारिवारिक व सामाजिक स्थिति को अत्यंत सूक्ष्मता के साथ प्रस्तुत करती है। 'औरत एक रात है' कहानी पितृसत्तात्मक समाज के नज़रिए में स्त्री क्या है? यह बताती है। वह पुरुष के लिए केवल एक रात है। 'निर्वासित कर दी तुमने मेरे प्रीत' कहानी की मुख्य पात्र सुमि तो शादी के बाज़ार में बिकाऊ चीज बनना पसंद नहीं करती, इसलिए उसने शादी तुड़वा दी और कुंवारी ही रहना पसंद की। 'माँ तुझे सलाम' कहानी द्वारा लेखिका सौतेली माँ के बारे में जो सामाजिक सोच है उस पर प्रकाश डालती है। सौतेली माँ कैसी भी हो लेकिन उसकी जो पहचान है वह आज भी संदिग्ध है।

'आवसान एक स्वप्न का' की नायिका भारती टंडन एक सजग स्त्री है जो पितृसत्तात्मक सोच और व्यवहारों पर विरोध करती है। शादी के बारे में पुरुषों का जो विचार है उसका विरोध करते हुए नायिका बताती है "भारतीय पुरुष जो खुद तो एक के बाद एक शादी रचता जाता है पर पत्नी ऐसी चाहता है जो दूध की धुली और गंगाजल सा पवित्र हो।"¹ इन शब्दों में स्त्री क्या है? स्त्री क्या चाहती है? समाज में स्त्री का क्या अधिकार होना चाहिए - इस पर लेखिका विचार व्यक्त करती है। 'स्मृति कल्प' कहानी वैधव्य जीवन में स्त्री की जो अस्मिता है, उसका हृदय भेदक चित्रण प्रस्तुत करती है। समाज की नज़र में पति के बिना पत्नी का अस्तित्व शून्य है। समाज की नज़र में विधवा स्त्री अशुभ एवं अमंगल है। वैधव्य जीवन में स्त्री और पुरुष के लिए जो भिन्न-भिन्न नियम हैं उस पर लेखिका प्रकाश डालती है साथ ही समाज को सोचने के लिए मजबूर करती है।

सारा जोसेफ के कहानी संग्रह 'पापा भूमि' उनकी लेखनी का एक नया मोड़ था। इस कहानी संग्रह की हरेक कहानी स्त्री स्वतंत्रता का, अधिकार का, जीवन संघर्ष का, अस्तित्व का खुला चित्रण बड़ी गंभीरता से प्रस्तुत करती है। 'पाप भूमि' की लक्ष्मी कुट्टी का चरित्र मातृत्व का प्रतीक है। वह केवल अपने अस्तित्व के लिए ही नहीं, बल्कि आने वाली स्त्री पीढ़ी के अस्तित्व के लिए भी आवाज़ उठाती है। स्त्री का इस धरती पर पैदा होने, स्वतंत्रता से जीने का हक है यही लेखिका बताती है। यह पितृसत्तात्मक समाज द्वारा दबाए गए स्त्री समाज का संघर्ष है।

'दांपत्य' और 'स्कूटर' कहानियाँ दांपत्य जीवन में अपने आप को खोकर जिम्मेदारियों के मुखौटे में पत्नी व माँ की पहचान में जी रही स्त्री का अत्यंत मार्मिक चित्रण प्रस्तुत करती हैं। यहाँ कहीं भी स्त्री 'मैं' होकर नहीं जीती। स्कूटर कहानी का पति पितृसत्तात्मक समाज का एक प्रतीक है। पितृसत्तात्मक समाज के नज़रिए में बच्चे स्त्री की जिम्मेदारी है और स्कूटर पति की अमानता।

'छायाचित्र' स्त्री की अनुभूतियों की कहानी है। यहाँ दादी माँ के द्वारा समाज में स्त्री का परावलंबी होना व उसकी पहचान पुरुष के अधीन कर दिए जाने वाली स्थिति का दर्दनाक चित्रण प्रस्तुत करती है। कहानी की दादी माँ ने अपनी पूरी जिंदगी परिवार के लिए समर्पित की। परिवार में रोशनी लाते- लाते उसके अंदर अंधेरा छा गया। लेखिका ने दादी माँ के ज़रिए स्त्री की पूरी जिंदगी का वर्णन बहुत कम शब्दों में किया है। वह इस प्रकार है - "अपने को जानने से पहले मैं अपने बच्चों को जन्म दिया। प्रसूति क्या है? यह समझने से पहले ही बच्चे बड़े हो गए। काजल लगाना जानने से पहले ही आँखों की रोशनी खत्म हो गई। बोलने से पहले ही शब्द खत्म हो गए।"² स्त्री जिंदगी की यही विडंबना है कि वह अपने पूरे जीवन में अपने को ढूँढने में, अपने लिए जीने में असमर्थ होती है। लेखिका पहले विचारों में परिवर्तन लाना चाहती है।

'बलिदान' और 'पाताल सोढ़ियाँ' कहानियाँ स्त्री की ममता को मुख्य रूप से उभारती हैं। साथ ही पितृसत्तात्मक समाज कितना खोखला है यह भी दर्शाता है। एक तरफ मातृपूजा का जुलूस चलता है तो दूसरी तरफ कई माताएँ हैं जो अपनी जान देकर भी बच्चे की रक्षा करती हैं। यहाँ की एक माँ जो है वह आग में कूद कर अपने नन्हे बच्चे की जान बचाती है। तब वह आधा जला बच्चा अपनी माँ के जले हुए सीने को खींच रहा था। फिर भी उसे आत्महत्या करने के जुर्म में गिरफ्तार किया जाता है। 'बालतिरा' कहानी की ललिता अपनी अस्मिता के लिए संघर्ष करती नज़र आती है। स्त्री के घने, लंबे बाल जो स्त्रीत्व व पुरुष के अधिकार का प्रतीक माना जाता था उसे लेखिका ने प्रतिरोध का हथियार बनाया है। लेखिका बाल को स्त्री स्वतंत्रता व उर्वरता का प्रतीक बताती है।

संक्षेप में कह सकते हैं कि दोनों ही लेखिकाओं की कहानियों में स्त्री अस्मिता पर गहरा चिंतन प्रस्तुत किया गया है। परिवार में बेटी के जन्म से मृत्युपर्यंत स्त्री की अस्मिता का खुल चित्रण इन कहानियों में हुआ है। जन्म से लेकर मृत्यु तक स्त्री होने का एहसास परिवार व समाज द्वारा दिलाते दिलाते वह 'मैं' होकर जीना भूल गई है। एक तरफ मालती जोशी जी अपनी कहानियों के ज़रिए शांत व सजग स्त्री का चित्रण करती है जो पारिवारिक एवं सामाजिक तौर पर अपनी अस्मिता के लिए आवाज़ उठाती है। तो दूसरी तरफ सारा जोसेफ जी की कहानियों के पात्र एकदम दबंग दिख रहे हैं, जो अपनी अस्मिता के लिए समाज से लड़ने के लिए भी तैयार होते हैं। यहाँ लेखिका स्त्रीत्व के व पुरुष के हक बने स्त्री के शारीरिक अंगों को प्रतिरोध का हथियार बनाती है, स्त्री अस्मिता का प्रतीक मानती है।

'औरत एक रात है ' की कहानियों के पात्र अपने एक दायरे में रहकर ही अस्मिता पर सोचते हैं, आवाज़ उठाते हैं और प्रतिक्रिया प्रकट करते हैं। 'पाप भूमि ' कहानी के स्त्री पात्र अपनी अस्मिता के लिए किसी भी हद तक जाने के लिए तैयार हैं। दोनों लेखिकाओं ने अपनी निजी भाषा शैली में स्त्री अस्मिता का अत्यंत सूक्ष्म व सजग चित्रण अंकित किया है। मालती जी घर-परिवार के भीतर सूक्ष्म रूप से स्त्री अस्मिता को उभारती है तो सारा जोसेफ जी स्त्री अस्मिता को व्यापक धरातल पर खड़ा कर देती है।

संदर्भ

1. मालती जोशी, औरत एक रात है पृष्ठ सं 67
2. सारा जोसेफ, पाप भूमि पृष्ठ सं 81

सहायक ग्रंथ सूची

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हिंदी और मलयालम सिनेमा में कवीर अस्मिता : 'मूत्तोन'(2019) और 'अलीगढ़'(2016)

फिल्मों के विशेष संदर्भ में

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Abstract: भारतीय सिनेमा में कवीर अस्मिता या पहचान का चित्रण धीरे-धीरे मुख्य धारा की चर्चा का विषय बनता जा रहा है। हिंदी और मलयालम सिनेमा, जो अपने विशिष्ट सामाजिक और सांस्कृतिक परिप्रेक्ष्य के लिए जाने जाते हैं, उसमें भी यह प्रवृत्ति स्पष्ट रूप से उभर रही है। प्रस्तुत शोध पत्र मलयालम फिल्म 'मूत्तोन'(2019) और हिंदी फिल्म 'अलीगढ़'(2016) के विशेष संदर्भ में कवीर अस्मिता के चित्रण का विश्लेषण करता है।

'अलीगढ़' प्रोफेसर श्रीनिवास रामचंद्र सिरास के जीवन पर आधारित है, जो लैंगिक पहचान और सामाजिक रूढ़ियों के बीच के संघर्ष को दर्शाती है। यह फिल्म न केवल कवीर समुदाय के प्रति सामाजिक पूर्वाग्रहों को उजागर करती है, बल्कि निजता और मानवीय गरिमा जैसे महत्वपूर्ण मुद्दों पर भी प्रकाश डालते हैं। यह फिल्म समाज में समलैंगिकता को लेकर व्याप्त पूर्वाग्रह पर सवाल उठाते हुए प्रगतिशीलता की ओर जाती है। 'अलीगढ़' के माध्यम से कवीर समुदाय की अस्मिता को स्वीकारने और उनके मानवाधिकारों की वकालत करने की दिशा में एक सकारात्मक परिवर्तन देखा जा सकता है। दूसरी ओर 'मूत्तोन' पारंपरिक लैंगिक और यौनिक मानदंडों को चुनौती देते हुए कवीर पहचान को मानवीय, संवेदनशील और जटिल रूप में प्रस्तुत करते हैं। लक्षद्वीप और मुंबई जैसे भिन्न भौगोलिक व सांस्कृतिक स्थलों की पृष्ठभूमि में फिल्म ने अकबर और अमीर के संघर्ष, प्रेम, बहिष्कार और आत्मस्वीकृति की कथा को सामने लाती है।

यह शोध पत्र दोनों फिल्मों की कथानक, पात्रों और कवीर सिद्धांत के माध्यम से जांच करेगा कि किस प्रकार ये फिल्में कवीर अस्मिता को प्रस्तुत करती हैं और समाज में व्याप्त पितृसत्तात्मक तथा विषमलैंगिक वर्चस्व को चुनौती देते हैं। साथ ही यह विश्लेषण करेगा कि हिंदी और मलयालम सिनेमा में कवीर पहचान के चित्रण में क्या-क्या भिन्नताएँ और समानताएँ होती हैं और सिनेमा किस हद तक सामाजिक स्वीकृति और संवेदनशीलता को बढ़ावा देने में सफल होते हैं।

Key words: कवीर सिनेमा, हिंदी-मलयालम सिनेमा, अलीगढ़, मूत्तोन, लैंगिक पहचान

“उससे प्यार करो और उसे भी तुमसे प्यार करने दो। क्या तुम्हें लगता है कि धरती पर और कुछ भी मायने रखता है?”

जेम्स बाल्डविन

- जियोवानीस रूम

सिनेमा हमारे समय का एक सशक्त माध्यम है और इसे सिर्फ मनोरंजन का माध्यम मानना पर्याप्त नहीं है और ना ही उचित। आजकल सिनेमा का अध्ययन एक प्रमुख विधा के रूप में आया है और हाल के कुछ दशकों से फिल्मों में प्रस्तुत लिंग प्रतिनिधित्व का अध्ययन एक अकादमिक अनुसंधान के रूप में उभरकर आया है। समकालीन संदर्भ में सिनेमा और साहित्य दोनों जगत में बराबर चर्चित विषय है LGBTQIA+ कम्युनिटी या कवीर समुदाय। कवीर एक अव्यक्त शब्द (umbrella term) है जो LGBTQIA+ व्यक्तियों के लिए एक सामान्य और सामाजिक रूप से स्वीकार्य तरीके के रूप में अपने और अपने समुदाय को संदर्भित किया है।¹ “Queer strive to be a more inclusive term than gay or lesbian. it encompasses bisexual, transgender transsexual and intersex people and anyone of non-straight community.” कवीर का अपना एक अस्मिता है। अस्मिता का अर्थ है पहचान या अस्तित्व। कवीर अस्मिता का संबंध कवीर समुदाय

की पहचान, अस्तित्व, सामाजिक स्थिति और सांस्कृतिक अनुभवों से होता है। कवीर सिनेमा वह है जो कवीर समुदाय की कहानियों, उनके संघर्षों और सामाजिक स्वीकृति की प्रक्रिया को चित्रित करता है।

भारतीय सिनेमा में कवीर अस्मिता या पहचान का चित्रण धीरे-धीरे मुख्य धारा की चर्चा का विषय बनता जा रहा है। हिंदी और मलयालम सिनेमा, जो अपने विशिष्ट सामाजिक और सांस्कृतिक परिप्रेक्ष्य के लिए जाने जाते हैं, उसमें भी यह प्रवृत्ति स्पष्ट रूप से उभर रही है। 2“ समाज की पूर्व परंपरा, अलिखित नियमों के प्रति उनका रोष और सामाजिक हक की लड़ाई का चित्रण फिल्मों में होने लगा। ” समलैंगिकता एक ऐसा वर्जित विषय है, जिसे संस्कृति एवं समाज दोनों द्वारा नकारा गया है। उसी प्रकार साहित्य व सिनेमा में भी यह वर्जित विषय था। लेकिन हाल के कुछ वर्षों से समलैंगिक लोगों के प्रति समाज का दृष्टिकोण बदल रहा है।

समलैंगिकता को केंद्रीय विषय बनाकर 26 जनवरी 2016 को रिलीज हुई एक बायोग्राफिक ड्रामा है ‘अलीगढ़’। समलैंगिकता पर बने अन्य हिंदी फिल्मों से अलीगढ़ अलग है क्योंकि पहली बात यह एक सच्ची घटना पर आधारित है। 3“यह सिनेमा सच्चाई पर आधारित था, अभिनय पर आधारित था, न्याय के लिए था और लोगों को अवगत कराने के लिए था।” हंसल मेहता द्वारा निर्देशित इस सिनेमा में मुख्य किरदार में मनोज बाजपेई है, जो कथानायक डॉ. श्रीनिवास रामचंद्र सिरास का किरदार निभा रहा है। 8 फरवरी 2010 को प्रोफेसर को इरफान नामक एक रिक्शा वाले के साथ यौन संबंध रखने के आरोप से यूनिवर्सिटी से सस्पेंड कर दिया जाता है। इस पूरी खबर पर दिल्ली का पत्रकार दीपू सेबास्टियन जांच करता है वहाँ से धीरे-धीरे कहानी आगे बढ़ती है और अंत में इलाहाबाद हाई कोर्ट इस केस में प्रोफेसर सिरास को निर्दोषी मानती है और विश्वविद्यालय में एक बार फिर उनकी बहाली हो जाती है और उसके ही अगले दिन विष अंदर जाने से उनकी मृत्यु हो जाते हैं।

इसमें लैंगिक पहचान और सामाजिक रूढ़ियों बीच के संघर्ष को दर्शाती है। यह फिल्म न केवल कवीर समुदाय के प्रति सामाजिक पूर्वाग्रहों को उजागर करती है, बल्कि निजता और मानवीय गरिमा जैसे महत्वपूर्ण मुद्दों पर भी प्रकाश डालते हैं। जहाँ दीपू पूछते हैं -आप ‘गे’ हैं सर तो प्रोफेसर सिरास कहते हैं- 4“मुझे उसे शब्द के साथ प्रॉब्लम है बाबा, कोई मेरे फिलिंग्स को केवल तीन अक्षरों में कैसे समझ सकते हैं?” यह फिल्म समाज में समलैंगिकता को लेकर व्याप्त पूर्वाग्रह पर सवाल उठाते हुए प्रगतिशीलता की ओर जाती है। ‘अलीगढ़’ के माध्यम से कवीर समुदाय की अस्मिता को स्वीकारने और उनके मानवाधिकारों की वकालत करने की दिशा में एक सकारात्मक परिवर्तन देखा जा सकता है।

गीतू मोहनदास द्वारा निर्देशित 2019 में निकली मलयालम फिल्म है ‘मूत्तन’। इस फिल्म में निविन पॉली, रोशन, शोभिता मुख्य भूमिका निभाई है। यह फिल्म अकबर और अमीर नामक दो युवकों के इर्द-गिर्द घूमती है। मुल्ला एक किशोर लड़की है, जो लड़के के समान वेशभूषा करके अपने बड़े भाई अकबर की तलाश में लक्षद्वीप से मुंबई आता है। मुंबई में उसकी मुलाकात ट्रस और अपराध की दुनिया से जुड़े लोगों से होती है और वह एक अंडरवर्ल्ड से जुड़े व्यक्ति के पास पहुंचता है। फ्लैशबैक में यह दिखाती है, कि वह व्यक्ति ही उसका भाई अकबर है। अकबर को अमीर नाम के एक युवक के साथ गहरा प्रेम संबंध था। लेकिन यह समलैंगिक संबंध को अकबर और अमीर दोनों के घर वालों ने तोड़ने की कोशिश करते हैं। उसी वक्त अमीर की शादी तय हो जाता है। अमीर, अकबर के पास पहुंचता है लेकिन घर वालों की जबरदस्ती के कारण वह कुछ नहीं कर पाया और इसलिए अमीर आत्महत्या कर लेता है। अमीर की मौत अकबर को अंदर से तोड़ देती है और वह रातों-रात वहां से मुंबई चले जाते हैं और वहां अंडरवर्ल्ड से जुड़े जाते हैं। आखिर में अकबर मुल्ला को पहचानते हैं कि वह लड़का नहीं लड़की है और अपने ही बहन है।

इस फिल्म का मर्म अकबर और अमीर के बीच का समलैंगिक प्रेम है। इसमें अमीर गुँगा है। वह भी प्रतीकात्मक है अमीर को मूक दिखाना समाज के हाशिए पर रहने वाले लोगों की में बे-आवाजी का प्रतीक है। यह उस कवीर प्रेम को दर्शाता है, जिसे खुलकर व्यक्त करने की अनुमति नहीं मिलती। जहाँ भावनाएँ शब्दों की वजह खामोशी, नज़रों और शरीर की भाषा से सामने आती है। कुछ दृश्य ऐसे हैं, जहाँ अमीर जो बोलते हैं बस अकबर ही समझ पाते हैं वैसे ही अकबर जो बोलते हैं अमीर समझ पाते हैं। यह भी प्रतीकात्मक है, क्योंकि प्रेम ऐसे है जो चाहे समलैंगिक हो या विषमलैंगिक कुछ भी हो, जो उनमें है उसकी गहराई बस वही समझ पाते हैं। बाहर से देखने वालों को शायद अपराध लगेगा। अमीर की छुपी आघात, शोषण और दबी हुई पहचान की ओर संकेत करती है, जबकि अकबर का बोलना यह दिखाता है कि समाज में हर किसी को अपनी बात करने का समान अधिकार नहीं होता। अकबर और अमीर का रिश्ता एक ऐसे समाज में है जहाँ समलैंगिकता को खुलकर बोलना मुश्किल है। यह बात इस फिल्म को केवल एक प्रेम कहानी नहीं बल्कि बे-आवाज लोगों की कहानी बना देता है। यह फिल्म मुख्य धारा मलयालम सिनेमा में कवीर अनुभव को हाशिये से केंद्र में लाने की प्रयास करती है, जहाँ कामुकता केवल सनसनी नहीं बल्कि सामाजिक, भावनात्मक और राजनीतिक यथार्थ के रूप में

उभरती है। इस प्रकार 'मूत्तोन' न केवल समलैंगिक प्रतिनिधित्व की नई भाषा गढ़ती है, बल्कि भारतीय सिनेमा में कवीर अस्मिता, स्वतंत्रता और मानवीय गरिमा पर व्यापक विमर्श को भी समृद्ध करती है।

निष्कर्ष

'अलीगढ़'(2016) और 'मूत्तोन'(2019) दोनों फिल्मों भारतीय सिनेमा में कवीर अस्मिता को मानवीय, संवेदनशील और यथार्थपरक दृष्टि से प्रस्तुत करती है। 'अलीगढ़' में कवीर पहचान संस्थागत हिंसा, सामाजिक नैतिकता और अकेलेपन के संदर्भ में उभरती है, जहाँ यौनिकता को अपराध और शर्म से जोड़ दिया जाता है। इसके विपरीत 'मूत्तोन' प्रेम को स्मृति, खामोशी और हिंसा के माध्यम से व्यक्त करते हैं। जहाँ बोल न पाना और बोलते न दिया जाना कवीर अस्तित्व की केंद्रीय अनुभूति बन जाता है। दोनों फिल्मों स्पष्ट करती है कि कवीर अस्मिता केवल व्यक्तिगत पहचान नहीं बल्कि सत्ता, समाज और संस्कृति से टकराने वाली एक राजनीतिक स्थिति है। इस प्रकार यह फिल्मों मुख्यधारा सिनेमा में कवीर अनुभवोंको दृश्यता प्रदान करती है और भारतीय समाज में लैंगिक व यौन विविधता पर पुनर्विचार की आवश्यकता को रेखांकित करती है।

सन्दर्भ

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Artificial Intelligence in Higher Education: Pedagogical Possibilities and Ethical Challenges

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Abstract:

It is plain to observe that artificial intelligence (AI) is making a swift revolution in the field of higher education not merely by intensifying efficiency but by changing the circumstances within which knowledge is generated and proven. This paper discusses AI being the reorganization of epistemic agency in learners and educators and has to do with how pedagogical schemes can be redone normatively to maintain intellectual autonomy in the face of algorithmic authority. The analysis is based on the deductive philosophical framework but based on the naturalistic theory of mind introduced by Dennett that AI systems are the epistemic mediators that re-distribute the cognitive labour and affect interpretive practices. Although AI promises to broaden pedagogic options, namely, personalization, accessibility, and cognitive extension, it can also present certain risks such as the development of epistemic dependency and the lack of insight into algorithmic actions. The paper goes further to propose a paradigm of decentralized epistemic accountability, that is, it is fundamental that human subjects maintain a vital oversight as they reflexively interact with AI systems. It concludes that intellectual autonomy is only valid through such a shift in education where the use of tools in education becomes passive and the interaction with technological systems is reflective rather than cognitive.

Keywords: Artificial Intelligence, Higher Education, Epistemic Agency, Algorithmic Authority, Intellectual Autonomy

1. Introduction

Artificial intelligence has infiltrated the sphere of higher education not as an adjunctive or auxiliary means but as a form of restructuring. From generative systems to adaptive platforms AIs continue to mediate the way knowledge is accessed, organized, and evaluated. The question of what occurs to epistemic agency when artificial systems take over a part of the cognitive processes is more philosophical than it seems. The classical model of higher education hypothesizes that both learners and educators are free actors who are involved in inquiry and are able to interpret evidence and make judgments. This assumption is disturbed by AI. It is not just helpful, but rather involved. It filters out irrelevancy, prevent the response and puts a privilege on the flow of thinking. By so doing, it creates some sort of influence which is neither quite external nor transparent. The paper discusses AI reorganizing the epistemic agency and deliberates on how education needs to react. Continuing on general philosophical description of cognition to the dynamics provided through AI to mediate learning, the purpose of the work is to propose a framework that can safeguard intellectual autonomy without refusing the transformational capabilities of AI.

2. Epistemic Agency and the Architecture of Mind in AI-Mediated Contexts

The epistemic agency is commonly considered to be an in-built ability, which is based on the reasoning and judgment of the individual. However, within a naturalistic standpoint this opinion is too limited. The explanation that Dennett gives about the mind, as a system, comprised of numerous, parallel interpretive processes, refutes the concept of an epistemic central hub (Dennett, 1991). Moreover what we think of as thinking is the product of rival interpretations as opposed to an effective internal authority. AI does not come to this already spread architecture as an external addition but as an extension of the latter. When a student is asking a question to an AI system, the system is not just providing information but it also takes part in the construction of meanings. It implies alliances, conceptualizes issues and, continues to create discourses. The division between the inner thinking and the outer reinforcements becomes semi-permeable. The deliberate position helps in explaining the importance of this (Dennett, 1987). Consumers would treat AI systems as having some knowledge as it gives them more of a quasi-agency. Such attribution is very practical but dangerous in terms of knowledge. It can promote the substitution of engagement with acceptance where products become accepted and not questioned as the constructive responses. The next thing is not the loss of the epistemic agency but its redistribution. Some of the tasks that take a central place in the process of learning the cognitive ones, namely, synthesis, evaluation, and articulation, all of which are partially offloaded. The redistribution is subject of inquiry as its result may enrich higher-order thinking and the redistribution may weaken engagement when it displaces instead of aiding interpretation, but it may also result in lower levels of interest in the redistribution case itself. The only thing that matters is not the existence of AI but the manner in which it is incorporated in the cognitive practice. The more general perspective that Dennett adopts with respect to cognition as a scaffold provides a critically corrective response. Human intelligence has never been independent as it has to rely on external aids, be it language or symbolic systems. This dependence is aggravated by AI, yet it does not bring it (Dennett, 2017). Whether cognition gets extended is not then the question, but whether the extension is reflective controllable.

3. Algorithmic Authority and the Reconfiguration of Pedagogical Power

With the integration of AI into the education process, it brings a different dimension of authority wherein it is not based on skills or discussion but rather based on the computational operations. This is a unique power of the system. In the case of a teacher, it is not always possible to question his or her reasoning. This change in opposition to AI systems, which is able to justify the results they generate. Further more this creates a minor but a significant change in pedagogical power. Students can be led to trust AI outputs as final, whereas teachers can use algorithmic systems in assessment and teaching. The power is diffused and made less challenging but in reality its working mechanisms are hard to challenge. The freedom described by Dennett as ability developed under restrictions will be a helpful criterion in this case (Dennett, 2003). AI does not completely do away with agency, rather; it simply shift the terrain of agency. In case of algorithmically mediated epistemic environment, the exercise of critical judgment is based on the acknowledgement of such mediation. These lack of recognition and the pretence of autonomy puts the learner to the dangers of his or her activities being passive. Simultaneously, there can be no doubt about the pedagogical benefits of AI. It is capable of adjusting to each person with learning patterns, can give an immediate feedback and can open a wide access to knowledge. It is not its efficacy but its authority particularly, the disposition of its outputs being subjected to epistemological special treatment. This demands redefining of a teachers role. Different teachers need to teach as decoders of the epistemic environment, as opposed to content expressors. It is their mandate to bring to view the procedures of how the AI systems produce outputs, and to instill the students with the ability to challenge those procedures. In this regard, authority will have to be re-allocated not to the machines but to the critical practices.

4. Normative Reconstruction of Pedagogy: Preserving Autonomy in Hybrid Epistemic Systems

This change in epistemic agency requires the subsequent change in pedagogy as well. The concept of intellectual autonomy is challenged due to the dependence on exterior systems anymore, but it should be redefined as the ability to interact with them critically. According to Dennett, though human beings are users of tools, they are in turn influenced by the same tools they use. In this regard, the tools themselves become instructive (Dennett, 2017). Moreover, the tools do not actually add capacity, rather, they restructure it. Education should not then be involved in contending with AI but in ensuring the circumstances under which an AI is employed. This implies developing a kind of reflexivity that will enable learners to be conscious of the way their thinking is mediated. An example of this change is the framework of distributed epistemic responsibility. The production of knowledge is an endeavor of both the human and artificial systems, although not at the same level. AI can help in the generation and arrangement of information, but the rest of the task of evaluating and justifying has to be done by the human agent. Such an imbalance is necessary in the case of preserving autonomy. This pedagogy requires the creation of practices that predicts the interaction as opposed to dependence. The products of AI should act like hints to investigate and not be final products. The students must be made to analyze, criticize, and where ever necessary, argue with what AI generate with. In such practices, the learner is brought back to the position of a participant in the construction of knowledge. This is placed in a wider ethical horizon by the idea of the infosphere offered by Floridi (Floridi, 2014). To live in the world of overflowing information technologies, what one knows is not the only question, but the very structure of knowing itself. Learning should also focus on changing the circumstances of knowledge production and teaching learners the ways to negotiate with enabling and constraining systems. What eventually comes out is an image of a non-technophilic, non-technophobic but critically integrative pedagogy. It acknowledges the disruptive nature of AI but demands that human judgment should be of primary importance.

5. Conclusion

The advent of AI has not only transformed the way education is delivered but also has changed the very nature of epistemic agency. AI confronts the traditional pillars of higher education by restructuring mental processes in new forms along with establishing new structures of authority. The paper has stated that these changes cannot be termed as the loss of autonomy since these changes can be reconfigured by paying close attention to normative issues. It has also been demonstrated, based on a Dennettian paradigm, that cognition is distributed in nature, and AI has the potential to both add to this distribution and initiate existing risks. The intellectual self-determination is retained by maintaining this extension. The future course of action is proposed by the suggested model of distributed epistemic responsibility, focusing on reflexivity, critical practice, and retention of the human appellative power. Research should not end at the abstract level in the future but should investigate the way such principles can be applied to real educational environments. It is not to fight with the technological change, but to make sure that in it, the process of thinking (the exercise of thinking) remains truly ours.

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From Emergency to Ethics: Communitarian Statecraft in Rebuild Kerala

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Abstract

Rebuild Kerala Initiative which addressed unprecedented challenges can be philosophically interpreted through the lens of communitarian ethics. It is both a physical endeavour and a cultural renaissance in which the state assumed the dual roles of facilitator of recovery and architect of future resilience. Disasters affect community as a whole, not just isolated individuals. Rebuild Kerala facilitated deeper dialogues between the state and community. Collective well-being was prioritized over individual pursuits. State is a part of community life. In the immediate aftermath of the catastrophe, the state mobilized local volunteers to provide aid to the affected population. Participatory approach is paramount in communitarian ethics. People saw themselves not just as victims of a disaster, but as contributors to the revival of their homeland. Their beneficiary status shifted toward a partnership model in sustainable recovery processes through the alignment of shared responsibility and foresights. Local voices and experiences complimented technical expertise. The state did not act alone. It did not control rather it guided. It streamlined recovery efforts by harnessing digital platforms to enhance communication and cooperation among various stakeholders. Rebuilding infrastructure and restoring livelihoods were the driving factors of the ethical governance. Sustainable green rebuild was recognized as the need of the hour, since the past developmental projects were solely based on environmental exploitation and urban expansion. The government encouraged the use of environment-friendly materials and innovative designs that could withstand future natural disasters. The welfare of the community is inherently linked to the health of the ecosystem. Rebuild Kerala showed how ethical theory moved into practice. The methodology adopted in this paper is purely qualitative and interpretative in nature. It relies heavily on conceptual analysis of philosophical theories. Policy documents, newspaper reports and scholarly literature are referred to link theoretical ideas with lived social practices. Today, Kerala stands as a testament to what can be achieved when a community comes together to overcome adversity, anchoring its identity in both tradition and progress. The interplay between state action and communitarian ethics serves as a powerful reminder of the strength in collective action. This paper examines the transformation of the affected population from passive beneficiaries to active partners in sustainable recovery processes with a strong emphasis on the role of the state.

1. Introduction

Kerala's floods can be analyzed not only as a natural disaster, but also as a moment that deeply reshaped philosophical thinking about human existence. This unforeseen event depicted the

limits of human control over nature and challenged the illusion of stability that structures everyday life. People were compelled to rethink the meaning of community, not as a choice but as a condition of survival. The crisis revealed that human life is fundamentally interdependent and not isolated. Ethical responsibility expanded beyond individual circles and began to include everyone as part of shared moral realm. The flood created a situation where duty was no longer optional but necessary for survival. Vulnerability forms the basis of ethical and political relations (Butler 20). The crisis transformed the meaning of governance by placing ethical responsibility at the center of political decision-making. The role of the state evolved from administration to moral stewardship, where care and inclusion were the driving forces. Public policy was judged by the ability to protect and support the vulnerable. The experience encouraged reflection on the nature of resilience as something rooted in shared bonds rather than personal strength. The boundary between self and the other became less rigid, allowing a deeper sense of connection to emerge. The rebuilding process carried forward these insights, shaping a vision of society grounded in care and cooperation.

2. Communitarianism and the Common Good

Communitarianism is a philosophical approach that places the community at the center of human life and moral understanding. It argues that individuals are shaped by their social relations rather than isolated individuals. This perspective challenges the idea that personal freedom alone defines human existence. The common good represents collective well-being. Here, individual interests are not valued. It insists that rights must be balanced with duties toward others. Moral obligations extend beyond personal benefit to include concern for the wider community. Ethical decisions are guided by traditions and cultural practices. Morality is rooted in social practices and histories (MacIntyre 222). The community becomes a source of meaning, especially in times of uncertainty. Solidarity is valued as a necessary condition for sustaining social harmony. Freedom without community lacks depth and purpose. Interdependence is the defining characteristic of existence. Civic participation is encouraged as a way to strengthen collective identity. The common good functions as a guiding principle for both personal conduct and public policy. Crisis demands collective action, shared sacrifice and mutual support. Communities that act together are able to ensure survival. During the 2018 and 2019 Kerala floods, people from different backgrounds came together to rescue those who were stranded. Fishermen used their boats to save thousands showing how community actions become a moral duty in times of crisis. Volunteers organized relief camps and shared resources without expecting personal gains.

3. Emergency as Ethical Awakening

Emergencies interrupt the normal flow of life and force people to confront the fragility of their existence. In such moments, individuals are compelled to reflect on what truly matters. Crisis situations awaken awareness by making vulnerability visible and unavoidable. This reveals that human beings are not self-sufficient, but deeply dependent on one another. Disasters cut across social divisions and show that wealth, status and power cannot fully protect anyone. This shared exposure to risk creates a sense of common humanity. It also brings attention to hidden inequalities that shape how people experience suffering. The realization of shared danger fosters empathy and concern for others. Gradually, survival becomes a collective effort rather

than a personal struggle. Individuals recognize that their actions affect the well-being of others. Responsibility arises in relation to others (Levinas 79). This awareness leads to cooperation and mutual assistance. Ethical values such as fairness and justice gain practical importance in distributing limited resources. Communities begin to rebuild not only physical structures, but also social bonds. Emergencies show that the common good is not an abstract ideal, but a practical necessity for survival and human flourishing.

4. Statecraft as Moral Stewardship

Statecraft can be understood as a form of ethical leadership and not a mere administrative control. It involves guiding society through principles that promote justice. A responsible state seeks to sustain these while ensuring fairness in all its actions. Ethical leadership requires a balance between individual freedom and social responsibility. Justice is the first virtue of social institutions, as truth is of systems of thought (Rawls 3). It resists corruption and rejects narrow self-interest in favour of the common good. Democratic governance becomes meaningful when it empowers citizens and protects their rights. Trust is built when government acts with accountability and transparency. Such trust strengthens the relationship between the state and society. A government guided by ethics acts as a moral compass that shapes public values. It defines priorities that reflect justice, equality and humanity. The experience of Kerala's rebuilding after floods offers a clear example of this ethical approach.

Both the state and citizens recognized need for collective responsibility. Public institutions worked to ensure that resources were distributed fairly. The rebuilding processes emphasized dignity and inclusion for all affected communities. Citizens actively participated in decision-making and local initiatives. Community engagement strengthened democratic practices and encouraged shared ownership of recovery. Community participation became central with volunteers showing that collective actions strengthen resilience at the grassroots level (Rajasekharan 48). Leaders valued the voices of different vulnerable groups. This participatory model of governance increased transparency and reduced mistrust. Cooperation between officials and citizens created a sense of unity. The rebuilding processes also highlighted the importance of resilience and hope in overcoming loss. Kerala's experience showed that ethical statecraft is possible even in times of crisis. It also revealed that moral leadership can inspire collective responsibility. The Chief Minister of Kerala Shri. Pinarayi Vijayan in his daily briefings reflected that clear communication builds public confidence in times of uncertainty (Vijayan 22). The rebuilding processes showed that strong coordination between institutions can improve the speed and effectiveness of recovery.

5. Conclusion

The crisis revealed the importance of preparedness and long-term planning in governance. Institutions remained flexible to respond to changing situations. The experience emphasized the value of learning from challenges to improve future responses. It highlighted the need to strengthen local capacities for effective action. Rebuilding processes focus on sustainability rather than restoration deserve special appreciation. A moral and just society was built during the times of crisis.



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The crisis of educational authenticity: A Philosophical reflection on contemporary Indian educational paradigm

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Abstract

Education, in its authentic sense, aims at the holistic development of the individual by nurturing intellectual autonomy, moral sensibility, emotional maturity, and practical life skills. However, contemporary Indian education reveals a widening gap between these normative aims and actual pedagogical practices, giving rise to what may be described as a crisis of educational authenticity. Even though modern facilities and advanced equipment are beneficial, education should first and foremost focus on the development of students' critical thinking, creativity, emotional intelligence, and collaboration skills. This paper offers a philosophical reflection on these issues, critically examining the mismatch between educational ideals and institutional practices in India, and argues for a re-orientation of education toward authenticity, grounded in human values, experiential learning, and holistic development. By discussing the issues of present system of education, the paper suggests to take some necessary steps to restore the academic integrity and to promote genuine learning. This transformation can be realized only through a change in the attitudes and expectations of educators, parents, institutions and society.

Index Terms - Authentic learning, critical thinking, education, evaluation process, promotion policy.

Introduction:

True education serves to refine the whole person, integrating cognitive growth with emotional intelligence, social fluency, and develop a thoughtful and creative individual. The fundamental goal of education is to equip the learners with the insight and integrity needed to contribute meaningfully to both their own lives and the society around them. A free and natural growth is needed and the task of any educational system is to guide and help the learners to grow as a confident individual. Knowledge is inherent and learning means unveiling that inherent knowledge. [1]. Through education a student can be able to develop decision making and problem-solving skill. Each student is unique with individual needs, interests, and learning

styles. Without understanding a child's needs and requirements, attempting to instil knowledge in them will be ineffective. With a uniform teaching method, a child's needs and requirements cannot be adequately addressed. Traditional learning methods are largely teacher-centred, content-driven, and examination-oriented. The Brazilian educator, Paulo Freire called this type of learning method as banking concept of education. He said, "In the banking concept of education, knowledge is a gift bestowed by those who consider themselves knowledgeable upon those whom they consider to know nothing. Projecting an absolute ignorance onto others, a characteristic of the ideology of oppression, negates education and knowledge as processes of inquiry." (Freire,1970, p. 45). [2] This necessitates a pedagogical shift towards authentic learning, which connects their learning experiences with real world experiences. The shift from this traditional method requires commitment and innovation from educators and institutions.

The contemporary education system, despite technological and pedagogical advancements, continues to exhibit a significant gap between academic learning and real-life application, increasingly driven by exam-oriented practices that prioritize marks over meaningful skill development. This paper examines the structural and social factors contributing to this disconnect and their impact on educational quality.

Methodology:

The study adopted a qualitative philosophical methodology primarily employing an analytic and critical method. It critically examines contemporary Indian educational practices through philosophical reflection. The study also interprets the educational ideas of major philosophers of education to provide a normative framework for evaluating the present system.

Challenges of the Present System of Education:

The field of education faces numerous challenges in the contemporary context. According to J. Krishnamurti proper education can mould human mind to live in any circumstance of the society. The real meaning and intention of education is that to bring about a change in one's own mind. He said: "the function of education is to give the student abundant knowledge in the various field of human endeavour and at the same time to free his mind from all tradition. So that he is able to investigate, to find out, to discover." (p.143). [3]

One of the most critical issues in the field of education today is the practice of promoting students to higher classes without ensuring that they possess the basic academic skills required at each level. NEP 2020 points out that there is a significant proportion of students drop out especially in higher classes. It is most common to see students in higher classes who struggle to articulate their thoughts clearly. This lack of foundational competence becomes a major barrier when they enter to the higher level of learning, where independent learning, critical thinking, and communication skills are essential.

The no-detention policy which introduced as part of the Right to Education Act (RTE) in 2009 with good intentions to reduce dropouts and promote inclusivity and complete their elementary education without being held back.[4]. But many students are promoted without adequate evaluation or basic knowledge of the content, resulting in accumulative learning gaps. Conceptual understanding, creative thinking, and application-based learning are often neglected. As a result, students may score marks without actually gaining meaningful knowledge or skills. Lack of language proficiency is also a big threat. Language is a tool for learning across subjects. Students who are not able to read, write, or express themselves effectively in the medium of instruction struggle across all disciplines, and this affects their

academic confidence and performance. Considering the decline of learning outcomes and losing the seriousness among students, in December 2024, Govt. of India amended the RTE Act. States are allowed to re-conduct examination if the students fail to meet the promotion criteria and if they still not able to pass, they may be forced to repeat the class. [5] However, the amendment must be carefully implemented to contribute to a more structured and supportive educational framework.

Teachers are often burdened with non-academic duties, resulting in a mechanical teaching approach that fails to address individual student needs. Limited individual attention, combined with overcrowded classrooms and time constraints, prevents teachers from identifying and addressing learning difficulties. Promoting students without ensuring foundational skills increases the problem, which can be led to increased dropout rates in higher education. In the introductory part of National Education Policy 2020, it is mentioned that the aim of education is “producing engaged, productive and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our constitution.” (p.5). [6]. If the goal is to improve access and success in higher education, the foundation laid in primary and secondary schooling must be strong, skill-based, and learner-centered. Teaching in most schools remains exam-oriented rather than concept-oriented. Students are trained to memorize information for exams, often without understanding the content. The emphasis on completing the syllabus and preparing for score-oriented assessments hides the need for critical thinking, creativity, and skill development. Harvey Siegel, a well-known philosopher of education addresses the decline of critical thinking in education. According to him “when education is reduced to mere training, to the accumulation of knowledge or skills without understanding, it ceases to be genuinely educational.” (p. 9) [7]

The evaluation process in many schools has become goal-oriented, but not learning-oriented. Teachers, under pressure from school administrations and public expectations, often feel compelled to relax standards to ensure that all students pass or secure top grades. This is particularly true in higher secondary levels, where institutional prestige, media attention, and public recognition are closely linked to academic results. Teachers feel compelled to compromise on standards, fearing that a low pass percentage in their subject might affect their reputation or job security. Teachers, too, are drawn into a competitive framework. There are reports and experiences from several schools where students are openly encouraged to copy during examinations to avoid failure and ensure the school’s reputation is maintained. Such practices compromise the very purpose of education and devalue the efforts of sincere learners and educators. Recently Maharashtra Chief Minister Devendra Fadnavis directed to dismiss school officials or teachers those who were involved in facilitating copying. (The Hindu daily, February 12, 2025). When evaluation becomes a tool for public image management, rather than an honest reflection of a student’s understanding, it loses its credibility and moral foundation. This culture creates an illusion of excellence, but leaves many students underprepared for higher education or real-world challenges. This attitude has led to unhealthy comparisons, mental stress among students, and the normalization of academic dishonesty. Societal validation has replaced educational value.

This problem is not limited to schools and teachers alone. Parents too have become active participants in this competitive display. Sometimes children are under tremendous pressure to perform, not for their own growth, but to meet the expectations of adults who seek validation through their achievements. Howard Gardner in his ‘unschooled mind’ points out “the problems in our educational system are due at least as much to values and priorities as to the

provision of resources.....As a nation, we must decide what we desire to have high quality education and that we are willing to work for it, with the same dedication that we draw upon in placing a man on the moon.” (p. 258) [8]. Without a shared commitment to intellectual excellence and authentic learning, increased resources alone cannot produce a truly effective educational system.

Measures for educational Improvements:

A key reform in the present education system is the effective implementation of competency-based promotion. Although the Government of India amended the Right to Education Act in 2024 to reintroduce detention, promotion with limited remedial support will not resolve the issue. Students may still advance without mastering basic skills in reading, writing, comprehension, and numeracy, leading to widening learning gaps, academic difficulty, and eventual dropout. The education system should be structured to ensure that students acquire a strong foundation before advancing to the next academic stage.

Teachers should be empowered to assess learning outcomes objectively and decide promotion based on readiness. The aim is to ensure that the students are not pushed forward unprepared for higher level. This requires targeted attention such as personalized remedial support, continuous diagnostic assessment, skill development programmes, teacher training, and structured bridge courses to help students overcome learning gaps and reduce the dropout crisis that currently afflicts our higher education system.

Admission to higher levels of education should not rely solely on marks. Instead, it should be based on an assessment of learners’ fundamental skills. This would reduce the over emphasis on scoring high marks without ensuring actual competence and encourage the development of essential academic abilities.

The Government of Kerala has implemented the Four-Year Undergraduate Programme (FYUGP) with the vision of addressing contemporary challenges and the evolving needs of students in a holistic manner. This initiative reflects a broader effort to reform higher education by promoting social responsibility and strengthening the knowledge economy.[9] However, a critical concern persists at the school level, where issues related to educational authenticity remain unresolved. This underscores the need for systemic change beginning at the high school and higher secondary levels to ensure a strong and meaningful educational foundation.

Conclusion:

Education should be understood in terms of changing man for the better future. Such change must manifest itself in behaviour. In the most rapidly changing environment to which man has ever been exposed, he becomes a misfit, because he is ignorant of how to cope with the situation. Lack of proper planning in education is the main reason for the present educational condition of India. It is in this context we remember the Paulo Freire’s conception of education. His system of education helps to promote a social transformation and it also ensure that the educational process will not break down under the weight of rapidly growing knowledge.

It is imperative to re-orient educational priorities toward meaningful learning outcomes. An excessive emphasis on grades over genuine merit undermines both the integrity of the system and the long-term development of learners. Education must extend beyond rote achievement to foster critical thinking, creativity, effective communication, and ethical values. Greater emphasis should be placed on holistic development, enabling students to apply

knowledge, solve problems, and contribute constructively to society. In this context, initiatives by the Government of Kerala, such as the Four-Year Undergraduate Programme, reflect a progressive shift in higher education. However, addressing the deeper crisis of educational quality and authenticity requires systemic reform beginning at the high school and higher secondary levels. Meaningful change ultimately depends on a collective shift in the attitudes and practices of educators, parents, institutions, and society.

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Configuration of 'Survival Kit' for obsessive-compulsive disorder from Psychoanalytical Novels: A Complementary Technique in the Treatment of OCD

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Abstract

Obsessive-compulsive disorder is a mental health condition that affects many people of all ages and from all walks of life. Obsessions are thoughts, images, fears or feelings that the person knows are wrong but cannot stop or get rid of. They can be intrusive and may be triggered by some event, image or situation, or they may be constant throughout the day, causing distress and functional disruption. These obsessive thoughts are hard to stop and often upsetting. With the attack of obsession, anxiety is escalated abnormally and may lead to a panic attack. The only solution to cope with this trauma is to do the compulsions, which is also another trauma. With compulsion, they get only temporary relief, and after some time another obsession is triggered. Exposure and Response Prevention Therapy is more effective for this phenomenon. If these therapies can be practised with the help of some selected novels without a therapist, it is highly appreciated and beneficial to a lot of OCD patients. So, this research focuses on how self-therapy is achieved through selected psychoanalytical novels.

Key Words: *Compulsions, mental Disorders, OCD, Self-therapy,*

Introduction

OCD is a serious issue with consequences of escalated anxiety, such as abnormal sweating and rapid heartbeat. OCD severely impacts not just the affected individual but also their family and friends. The World Health Organisation has listed OCD as one of the top ten most debilitating conditions, recognising its intensity and deterioration in quality of life [1]. Many individuals with OCD are present in our communities, often going unnoticed. In India, the prevalence rate is comparatively low in the records. There are some reasons to keep mental disorders private. The majority of OCD patients do not know it is a mental disorder. The majority of people believe that evil spirits possess them. Few people may recognise their problem as a personality disorder, but they never seek help, fearing the social stigma associated with psychiatric treatment. It is our society's practice that when a person seeks treatment from a psychiatrist, there is a common belief that he is mad. Because such talk affects patients' credibility and social status, many prefer to keep their mental health struggles private and seek alternative methods of treatment. In such circumstances, the self-therapy method is appreciated. Many studies have shown that self-therapy is highly effective. Ghosh and colleagues [2], Je-Min Park and six colleagues [3], Den Boer and colleagues [4], Schneider et al [5] and J. P. Klein et al [6] established that self-help therapy is effective and beneficial, just like therapy with a therapist.

The objective of this research is to acquaint people with OCD with some therapy methods and equip them with the ability to implement self-therapy techniques. This method of handling OCD is not intended to challenge any existing treatment methods. This research aims to open new windows of possibilities for people with OCD to lead an independent life without major external support. Because the trauma of all obsessions and related compulsions is somewhat similar, only two examples of self-therapy are provided,

Research Activities

The trauma of obsessions and compulsions are all most same for any type of OCD. The intensity of trauma may vary according to the variations of OCD. So, the initial focus of self-therapy was given to contamination OCD because it is common among other OCDs. With the help of social workers and friends, people with abnormal behaviours like OCD were approached and given a questionnaire based on the International Classification of Diseases by the World Health Organisation. For a diagnosis of OCD, either obsession or compulsion, or both, must be present. The person recognises that the obsessional thoughts, impulses, or images are products of their mind. The person should attempt to ignore, suppress, or neutralise such thoughts, impulses, or images, or replace them with other thoughts or actions. Individuals with OCD know that these mental phenomena are disturbing and unrealistic, and these intrusive and uncontrollable thoughts are unbearable. Obsessions are usually accompanied by fierce and intolerable feelings such as anxiety, fear, disgust, doubt, or a feeling that everything has to be done in a way that is 'perfect or just right'. For a person having OCD, obsessions are excessively time-consuming and could hurt their day-to-day activities and deteriorate their dignity and values, among others. It was very tough to get OCD patients to sit together. They are afraid to be stigmatised among the public as psychiatric patients. So, I got only eight people for these research activities. This researcher has categorised them as follows.

From analysing the OCD symptoms, it was clear that four people, Sara, Thara, Beena and Radhakrishnan, suffer from contamination OCD. To equip people with OCD to practise self-therapy techniques through selected OCD novels, they should be provided with the following details about their disorder.

- 1) Understanding an individual's OCD condition-
Gives insight into their OCD related traumas and the nature of compulsions.
- 2) A meticulous collection of information related to OCD-
To provide information that there are a lot of people who live with OCD, and you are not alone.
- 3) Choosing appropriate psychoanalytic fiction-
To get bibliotherapeutic effects, the Novels will narrate true stories about obsessions and compulsions. The authors who suffered from OCD give true narrations and explain how they overcame OCD traumas.

- 4) Implementing bibliotherapy goals
Recognising character with their OCD, **Examination** of the character with their experiences,
The juxtaposition of a character with an OCD person and the **Self-Application** of therapy methods.
- 5) Addressing OCD-triggering circumstances during ERP therapy-
 How to overcome the urge of compulsion when facing ERP therapy

These five points need to be taken care of to initiate self-therapy techniques for OCD. This systematic approach not only provides clarity but also enables the individual to navigate their ideas and behaviours constructively, promoting personal growth and healing.

After reading and analysing several novels, the following four were selected for reading to implement the self-therapy technique for people with OCD. They are

OCD Love Story by Corey Ann Haydu

The Casual Vacancy by J.K. Rowling

Turtles All the Way Down by John Green

OCDaniel by Wesley King

OCD Love Story depicts Harm OCD, contamination OCD and infatuation OCD. One of the novel's notable features is its emphasis on exposure and response prevention (ERP) therapy, an extensively accepted treatment for OCD. The author delivers ERP in an approachable and straightforward manner, making it simple for readers to learn and apply it in their own lives.

In J.K. Rowling's novel, *The Casual Vacancy*, readers can readily connect their daily life experiences with OCD as they follow the narrative of Colin Wall, the leading character afflicted by the disorder. Wesley King's *OCDaniel* depicts the actual trauma of compulsions. John Green's *Turtles All the Way Down* portrays the trauma of contamination OCD and sensorimotor OCD. These novels are the authentic descriptions of people who struggle constantly with OCD because all the authors were real OCD patients [8]

Self-Therapy

In the *OCD love story*, the hero, Beck, suffers from contamination OCD. Contamination OCD people anticipate death through the fierce attack of bacteria, fungi and viruses. So, they always clean their hands and the surroundings. With these obsessions triggered, when they failed to reduce anxiety, they suffer tachycardia, breathing difficulties, and severe sweating. So, they spontaneously start compulsions to reduce anxiety. In ERP therapy, these act of compulsions is not allowed. Before starting self-therapy for contamination OCD, meditation and breathing exercises are practised. A nine-day camp was organised to give training on how to control the urge to compulsions when obsessions are triggered. Exposure to obsession-triggering objects, from moderate to intense levels, was given to them in this camp.

To assess the increasing rate of fear/anxiety, a 'Fear Ladder Worksheet' was prepared. The patients were then given a nine-day schedule. Then, SUDS (Subjective Units of Distress Scale) are marked in the 'Fear Ladder Worksheet' properly. The Subjective Units of Distress Scale is a self-assessment tool rated on a scale from 0 to 10. This is used to measure 'nervousness' in people. If the measurement showed 0 to 2, it meant that there was no distress in the OCD patient. 3 to 7 indicated 'moderate anxiety', and 8 to 10 denoted 'extreme distress'. When anxiety levels were measured accurately, proper treatment methods were suggested. All the OCD patients in the field survey were asked to keep a daily record regarding the triggering circumstances, frequency of the intrusive thoughts and pattern of compulsions.

In *OCD Love Story*, Beck is a patient of therapist Dr Pat. Pat planned an excursion to the mountain top, which was mostly filled with a pile of dirt and brown, swampy rivulets (*OCD Love Story* 253). to do ERP therapy for Beck for contamination OCD. She decides not to give Beck any cleaning materials, including water, anti-bacterial soap, hand towels, etc. She wants him to hike the mountain, touch a tree, and come back down (250). But Beck's anxiety level increases as soon as he knows about Dr Pat's plans. He fears that he will be infected if he does things that Dr Pat wants him to do. He sweats profusely, and his heart beats faster without pause. But he tries to touch the tree because he knows the benefits of ERP therapy. After five minutes, the anxiety level starts to diminish.

Following the same technique narrated in the novel, an excursion was organised and conducted to the town's basement, where a conduit enabled water drainage. Sara, Thara, Beena and Radhakrishnan were called on to engage with the trees situated in an execrable environment. All of them accessed this location and avoided head-on contact with the polluted water. The individuals ignored their pervasive sense of discomfort, and this was very hard for them. Recognising the relevance of this ERP therapy-based session, they approached this task as an aspect of self-therapy. They all cooperated and memorised techniques of facing fears in their mind that they had learned independently. To touch the trees, they realised that they needed to walk around the untidy environment where the trees were standing. They came to a halt after a few timid steps, with a palpable lack of eye contact despite their proximity. They were immersed in thoughts regarding their exposure to an unkempt environment and consequent health risks. They were all anxious. When Beena was asked about her anxiety level, she reported that her nervousness was increasing to a level of five. Thara also seemed anxious, as if she would collapse on the ground.

They had to be reminded of how Aza and Beck, the literary characters, dealt with Contamination OCD. Since they were almost on an anxiety level of five, there was a possibility of escalating the condition to a level of eight and then to 10. They were asked to recall the technique of breathing exercises and practice it. Other OCD cluster members encouraged them. Both Thara and Beena profusely sweated. Sara and Radhakrishnan, on the other hand, managed to touch the tree after three failed attempts. This encouraged Thara and Beena. They exhibited an urge to do some compulsions, but they were reminded that they could control their compulsions through the self-therapy method described in the novels. Thus, Beena touched the tree before Thara, and both of them expressed their happiness in completing their task. They

all sat in the same place and ate sandwiches with their bare hands without washing, just like the narrations made in the novel *OCD Love Story* (102-03).

In Exposure and Response Prevention Therapy, the therapist encourages the OCD patient to do something that triggers the obsession. If it's the fear of contamination, the patient needs to touch the contaminated objects. If the patient could touch the tree for 5-10 minutes, the therapist as well as the patient could notice the decreasing level of anxiety in the patient. If the patient refuses to do the compulsions, over time, his/her anxiety will be greatly diminished. If the patient succeeds in one situation, he/she may be given more difficult circumstances to handle. The patient should continue the 'exposure' activities. The aim must be achieved gradually, and this method of making progress in ERP is known as 'shaping'. The 'Shaping' method allows the patient to expose himself/herself to unpleasant situations, including those that have been considered to be the most frightening.

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BIOLOGICAL SCIENCES

EVALUATING BIOACTIVITY OF *EVOLVULUS NUMMULARIUS* EXTRACT AND ITS GREEN-SYNTHEZED ZINC OXIDE NANOPARTICLES FOR ADVANCED WOUND HEALING APPLICATIONS

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Abstract

Wound healing is a complex biological process often impaired by oxidative stress, inflammation, and microbial infection. Medicinal plants offer valuable bioactive compounds for tissue repair. *Evolvulus nummularius* has traditional therapeutic relevance, while green-synthesized zinc oxide nanoparticles provide enhanced biological efficacy. This study evaluates the bioactivity, in silico interactions, and wound healing potential of *Evolvulus nummularius* extract and its green synthesized zinc oxide nanoparticles.

1. Materials and Methods

The medicinal plant *Evolvulus nummularius* was collected and authenticated with accession number RHK7660, and an ethanolic extraction of *Evolvulus nummularius* (ENE) was performed using a Soxhlet apparatus to isolate the bioactive compounds and evaluate its antioxidant, antibacterial, anti-inflammatory, cytocompatibility, and wound-healing activities. The antioxidant capacity was assessed using DPPH and ABTS assays, and antibacterial activity was tested against *Escherichia coli*, *Klebsiella pneumoniae*, and *Staphylococcus aureus*. The anti-inflammatory potential was assessed by inhibiting COX and LOX. Cytocompatibility and scratch assays were performed on L929 fibroblasts. HR-LCMS profiling identified bioactive constituents for in silico docking. Zinc Oxide (ZnO) nanoparticles were synthesized using the ENE plant extract and characterized using UV-Vis spectroscopy, FTIR, DLS, and zeta potential, followed by biological evaluation for antibacterial, anti-inflammatory, and wound healing applications.

2. Results and Discussions

The *Evolvulus nummularius* extract and its green synthesized zinc oxide nanoparticles exhibited significant bioactivity across multiple in vitro assays. Both samples demonstrated notable antioxidant and anti-inflammatory activities, with zinc oxide nanoparticles showing enhanced efficacy compared to the crude extract, suggesting a synergistic effect of phytochemical capping. Antibacterial studies revealed broad-spectrum inhibitory activity, supporting their role in preventing wound-associated infections. Cytocompatibility assessment using the MTT assay confirmed that normal cells were not affected at effective concentrations. The in vitro scratch assay demonstrated accelerated cell migration and wound closure, particularly in nanoparticle-treated groups. HR-LCMS analysis identified several bioactive phytoconstituents with antioxidant and wound healing properties. *In silico* molecular docking further supported these findings by revealing favorable interactions between selected ENE compounds and TNF- α , suggesting potential mechanistic pathways. Overall, the integrated experimental and computational results highlight the enhanced wound healing potential of green synthesized zinc oxide nanoparticles derived from *Evolvulus nummularius*.

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CHEMICAL SCIENCES

A Green and Scalable Aqueous Strategy for the Scramble-Free Synthesis of Unhindered meso-Aryl trans-A₂B₂ Porphyrins

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Abstract

Trans-A₂B₂ porphyrins, crucial for applications in photodynamic therapy, photovoltaics, and advanced functional materials, are often challenging to synthesize due to scrambling and complex mixture formation. Here, we report a sustainable synthesis of three trans-A₂B₂ porphyrins (4FNP, 3FNP, and 2FNP) via a two-step MacDonald-type 2+2 condensation in aqueous media using HCl as a green catalyst. Precursor compounds meso-aryldipyrrromethanes were also prepared under mild, room-temperature conditions. The compounds underwent efficient purification and were characterized using UV-Vis, ¹H NMR, and mass spectrometry. This approach aligns with Green Chemistry principles, replacing hazardous solvents with water and employing mild conditions, enabling cost-effective and scalable porphyrin synthesis.

1. Introduction

Synthetic porphyrins are multifaceted materials with a broad spectrum of applications. Trans-A₂B₂ porphyrins, a distinct subclass of meso-tetraarylporphyrins, have emerged as important molecular architectures for applications in photodynamic therapy, photovoltaics, and the development of advanced functional materials. In organic chemistry, the nitro group serves as a key functional moiety, enabling derivatization into diverse chemical frameworks. Porphyrins modified with nitro groups offer flexible platforms for conjugation with organic and inorganic functional units, significantly broadening their applicability as functional materials in biomedical and materials science applications. The incorporation of fluorine into porphyrin scaffolds enhances their electron-deficient character, lipophilicity, photostability, and singlet oxygen production, thereby rendering them particularly well suited for medicinal applications such as photodynamic therapy (PDT).

The most widely employed synthetic route to trans-A₂B₂ porphyrins involves the acid-catalysed condensation of a meso-aryl dipyrromethane with a second aldehyde in an equimolar ratio, typically using an acid catalyst (like TFA), followed by oxidative aromatization with an oxidizing agent (DDQ)[1]. Despite its prevalence, this methodology remains intrinsically challenging, as competitive scrambling processes frequently generate complex product mixtures and significantly diminish isolated yields[2]. These challenges are further exacerbated in the preparation of porphyrins derived from sterically unhindered aldehydes, which are particularly susceptible to scrambling and consequently yield highly complex product distributions[3]. In addition, conventional protocols often depend on hazardous reagents and energy-intensive reaction conditions, highlighting the growing need for more sustainable synthetic alternatives[1][4].

2. Methodology

2.1 General procedure for meso-aryldipyrromethane synthesis

Pyrrole (3 equiv.) was added to 100 mL of 0.18 M aqueous HCl, followed by the addition of the appropriate aromatic aldehyde (1 equiv, ~0.15 M), and the mixture was stirred at room temperature. Reaction progress was monitored by TLC until complete consumption of the aldehyde. After the indicated reaction time, the precipitated solid or semisolid product was filtered, washed with water and petroleum ether. The crude product was then purified using column chromatography using silica gel (PET: ethyl acetate).

2.2 General procedure for trans-A₂B₂ porphyrin synthesis

1.0 mmol aldehyde and 1.0 mmol dipyrromethane were added to a mixture of 100 ml MeOH and 50 ml of water, followed by 10 ml of HCl. The reaction mixture was stirred at the room temperature for 2 hours. Then it is filtered using whatmann filter paper and the precipitate was dissolved in minimum quantity of DMF solution. Then it is refluxed for 1.5 hour. This solution was transferred into a beaker and stirred overnight. The crude product was then purified using column chromatography using basic alumina (PET: Dichloromethane).

3. Results and Discussion

Trans-A₂B₂-porphyrins (4FNP, 3FNP, and 2FNP) were synthesized via a two-step MacDonald-type 2+2 condensation in aqueous media. Dipyrromethane precursors (2FD, 3FD, and 4FD) were prepared from fluorinated benzaldehydes and pyrrole using HCl-catalyzed condensation in water, yielding 58%, 47%, and 86% respectively. Porphyrin synthesis involved acid-catalyzed reaction between dipyrromethanes and 4-nitrobenzaldehyde, followed by reflux in

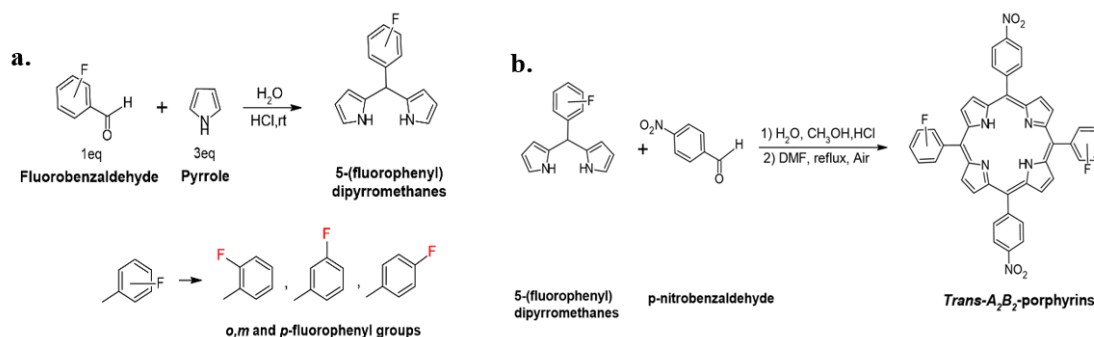


Figure 1. General reaction scheme for, a. meso-aryldipyrromethane synthesis and b. *trans*-a₂b₂ porphyrin synthesis.

DMF and air oxidation, yielding 4FNP (35%), 3FNP (40%), and 2FNP (32%). Single products were obtained, indicating no scrambling. Compounds were characterized by UV-Vis, ¹H NMR, and mass spectrometry.

3.1 Spectroscopic analysis of dipyrromethanes and *trans*-A₂B₂ porphyrins

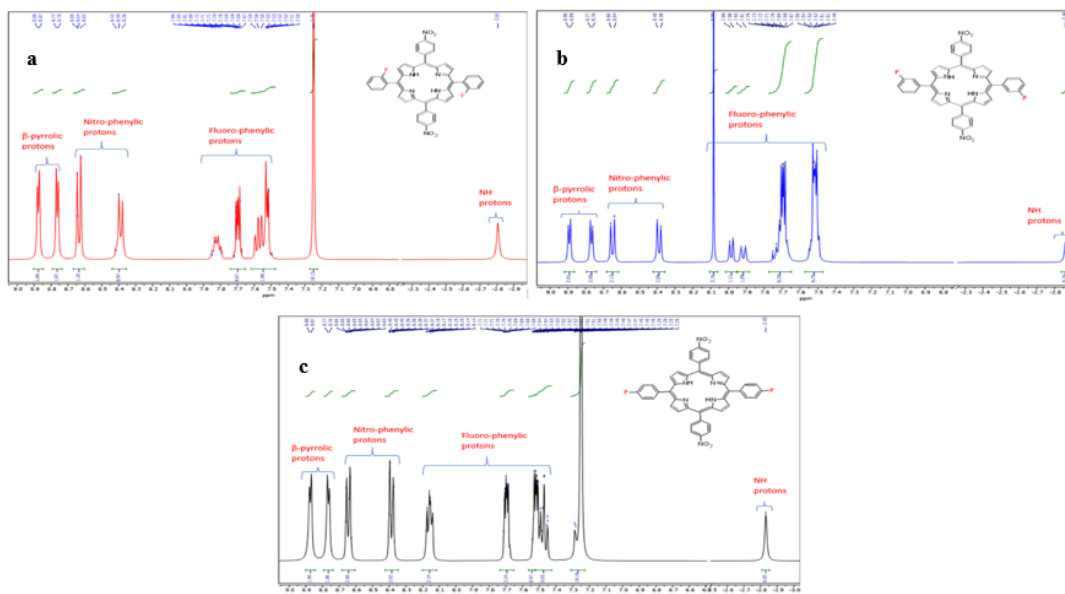


Figure 4. ¹H NMR spectra of *trans*-A₂B₂ porphyrins, a. 2FNP, b. 3FNP and c. 4FNP.

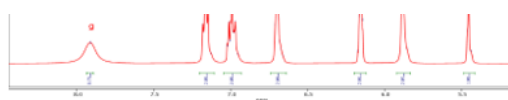


Figure 2. ¹H NMR spectra of fluorinated meso-phenyldipyrromethanes, a. 2FD, b. 3FD and c. 4FD

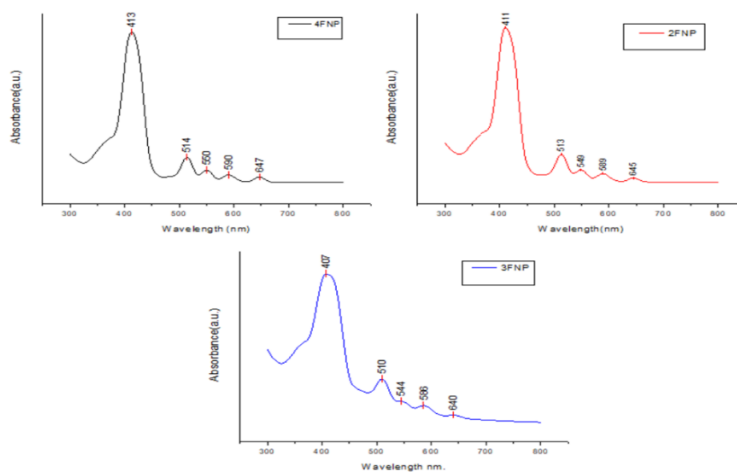


Figure 3. UV-Vis spectra of *trans*-A₂B₂ porphyrins.

Table 1. Mass spectral data of *trans*-A₂B₂ porphyrins.

Compound	Base peak (m/z)	Molecular ion peak (M ⁺) (m/z)
2FNP	620	741
3FNP	620	741
4FNP	620	741

4. Conclusions

Three fluorinated trans-A₂B₂ porphyrins (4FNP, 3FNP, and 2FNP) and their dipyrromethane precursors were synthesized under mild, aqueous conditions using HCl as a green catalyst. All compounds were isolated in good yields. The approach adheres to Green Chemistry principles, replacing hazardous solvents with water and eliminating expensive oxidizing agents. This enables efficient, cost-effective, and scalable porphyrin synthesis with high selectivity.

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COMMERCE AND MANAGEMENT

Adoption of Digital Technology: A Driving Force of Business Growth in the Kerala Dairy Co-operative Sector and its Impact on Organizational Performance

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Abstract

Purpose- The aim of this study is to examine the effect of digital technology adoption on the performance of dairy cooperatives. The study evaluates the advantages and effects of digitalisation on intermediary variables, which subsequently influence outcome variables such as financial, operational, and firm-level employee performance. **Design/methodology/approach-** The research employed a quantitative methodology with an explanatory design, gathering data using a questionnaire survey. A structured questionnaire is administered to 996 senior officials of dairy cooperative societies of Kerala. The study utilised SmartPLS for structural equation modelling. An importance-performance matrix analysis (IPMA) of path modelling was conducted to evaluate the effect of exogenous variables. **Findings-** The study's findings indicate that digitalisation is a crucial factor influencing organisational performance, encompassing financial, operational, and employee performance. Digitalisation directly influences the integration of digital infrastructure, human resources, business processes, marketing and sales, external stakeholders, supply chain and logistics, and strategic decision-making. **Originality/value-** This research is the debut study into the effects of digitalisation on the dairy cooperative sector in Kerala, despite the fact that prior studies have addressed digitalisation in other industries. The research examines the impact of digitalisation on the perceived organisational performance of dairy cooperatives and the degree of variation within the sector. The model's predictive capability facilitates managerial recommendations, highlighting the importance of predictive analytics in the dairy sector.

Keywords: Dairy Cooperatives, digitalisation, industry 4.0, automation, operational performance, financial performance, organisational performance, employee performance, digital technology

1.Introduction

Enterprises face challenges in assessing the impact of digitalisation on performance outcomes, which is crucial for business strategies and competitive advantage (Alsufyani and Gill, 2022).

The cooperative sector in southern India, despite its contributions to economic development, lacks research on digital transformation. The study focuses on the dairy cooperative sector, highlighting its role in economic development and the need for digitalisation due to rising internet usage and government initiatives. It examines the four phases of an organisation's digitalisation process and aims to assess the impact of digitalisation on operational, financial, and employee performance. This research fills a gap in empirical studies regarding digitalisation in dairy cooperatives, providing insights for practitioners to formulate effective digital strategies and understand the implications of digitalisation trends on performance.

The following are the research questions that are outlined in the study.

1. What is the impact of digitalisation on the operational and managerial practices of dairy cooperatives?
2. Is there any impact of digitalisation on the perceived financial performance of dairy cooperatives?
3. Does digitalisation have any impact on the perceived operational performance of dairy cooperatives?
4. Is there any significant effect of digitalisation on perceived firm-level employee performance of dairy cooperatives?

2. Literature review and theoretical background

This research utilised bibliometric analysis to identify prolific authors, significant works, influential journals, and contributing nations in the field of digital technology adoption and organizational performance. The Scopus database from 2007 to 2023 was scanned to retrieve academic papers on the subject. Out of 1667 identified articles, 67 high quality articles were selected for analysis using the VOS viewer® and RStudio Bibliometrix software packages. This allowed for the identification of contributing authors, publication frequency and trend, well-known countries, international collaboration, and fundamental research themes(Latha et al., 2025.b).

3.Hypothesis development and conceptual model

The study focused on the influence of digitalisation across multiple business dimensions, through a systematic literature review that identifies eight key dimensions. These include Integration of Digital Infrastructure (IDI), Integration of Human Resources (IHR), Integration of Business Processes (IBP), Integration of Marketing and Sales (IMS), Integration of External Stakeholders (IES), Integration of Procurement and Input (IPI), Integration of Supply Chain and Logistics (ISCLM), and Integration of Strategic Decisions (ISD). The hypotheses propose that digitalisation significantly affects these integrations, which in turn impact financial and operational performance, and employee performance.

H1: Digitalisation significantly impacts the integrated digital infrastructure, human resources, business processes, marketing and sales, external stakeholders, procurement and input, logistics and supply chains, and strategic decision

(Alma et al., 2018; Redoli et al., 2008; Alzadjali and Elbanna, 2020; Caldera et al., 2021; Nwankpa and Datta, 2017; Özşahin et al., 2022)

H2: Integrated digital infrastructure, human resources, business processes, marketing and sales, external stakeholders, procurement and input, logistics, and supply chains have a significant impact on financial performance (Kohtamäki et al., 2020; Khurana et al., 2022; Luftman et al., 2017; Bracci et al., 2022; Farida et al., 2022).

H3: Integrated digital infrastructure, human resources, business processes, marketing and sales, external stakeholders, procurement and input, logistics and supply chains, and strategic decisions have a significant impact on operational performance (Antai and Eze, 2023; Malik et al., 2024; Munien and Telukdarie, 2021).

H4: Integrated digital infrastructure, human resources, business processes, marketing and sales, external stakeholders, procurement and input, logistics and supply chains, and strategic decisions have a significant impact on firm-level employee performance. (Haque and Nishat, 2022; Hansen et al., 2020; Gasparovich et al. 2021)

As shown in Figure 1, the conceptual model lays out a comprehensive plan for digitalising dairy cooperatives. The goal is to improve financial, operational, and employee performance by combining digital infrastructure, human resources, business processes, marketing and sales, external stakeholders, supply chain and logistics management, and making strategic decisions.

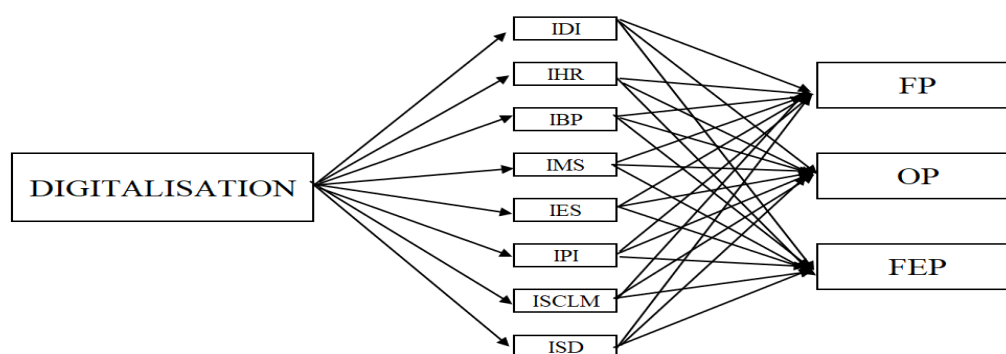


Figure 1 Conceptual Model

Source: Author composition

4. Research Methodology

This study employs a positivism paradigm and quantitative deductive approach to investigate digitalization in southern India's dairy cooperative sector, utilizing purposive sampling. A theoretical framework is established, and results are analyzed using the partial least squares (PLS) method, appropriate for empirical testing of multiple theories. Data was gathered through structured questionnaires assessing technology acceptance models (TAM), with 74 measurement items evaluating digitalization and performance across 1,670 cooperatives. The study successfully obtained 996 valid responses, achieving an 85% statistical power, and conducted a pilot study to enhance reliability. Analysis of common method bias (CMB)

indicated no significant threat to the findings, confirmed by Harman's test and marker variable approach showing minimal impact on results.

5. Results

5.1 The measurement model

Before conducting formal hypothesis testing, we confirmed the psychometric properties of the scales used, mainly reliability and validity. As part of this, we examined factor loading of each item, composite reliability (CR) and average variance extracted (AVE) for each item across 12 latent constructs. High internal consistency values (0.7 to 0.9) indicate that the items are homogeneously measuring the underlying construct. Strong indicator representation is indicated by high loadings (>0.7), but loadings between 0.4 and 0.7 might still be retained in some circumstances (Mohd Dzin and Lay, 2021).

The convergent validity test assessed the extent to which the items of a construct accurately represent it, using the average variance extracted (AVE) as the measurement. The minimum acceptable value for AVE is 0.05 or higher. Discriminant validity of the measurement model was tested using the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio following Henseler *et al.* (2015). Discriminant validity is confirmed by the diagonal values that denote the square root of the average variance extracted (AVE) for each construct. To achieve discriminant validity, the square root of the average variance extracted (AVE) for each construct must exceed its correlation with any other constructs (Fornell and Lacker, 1981). The HTMT values were found to be within the threshold limit of 0.90. This analysis demonstrates that the constructs in the model are both reliable and valid, instilling confidence in the structural relationships represented in this study.

5.2 Structural model

The assessment of the structural model based on PLS-SEM results followed guidelines by Hair *et al.* (2016). Key steps included collinearity analysis, path significance assessments, evaluation of R^2 , and predictive relevance checks using the PLSpredict method. Collinearity was deemed satisfactory with VIF values below 3.3. Path analysis revealed significant impacts of digitalisation on various intermediary variables, notably ISCLM ($\beta = 0.391$), with other path coefficients also indicating substantial connections between digitalisation and financial (FP), operational (OP), and employee performance (FEP) outcomes. Significant R^2 values indicated strong explanatory power for FP (0.608), OP (0.734), and FEP (0.554), while predictive capabilities were confirmed with Q^2 values above zero. The model fit, assessed via SRMR, scored 0.073, indicating an adequate fit. Overall, digitalisation exhibits varying influences on intermediary performance metrics, significantly impacting organizational performance (Fig 2).

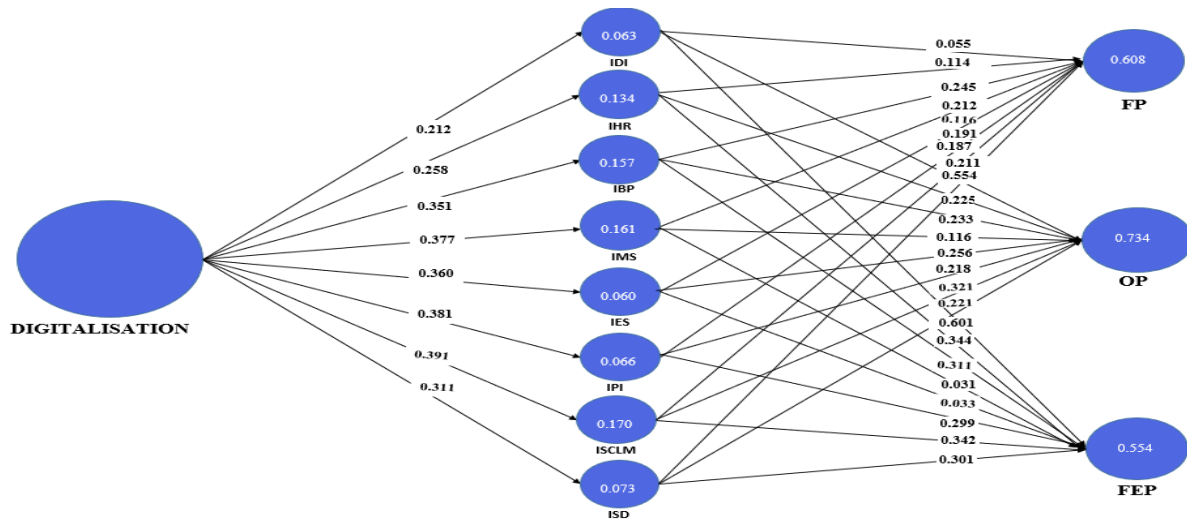


Figure.2 Structural equation model

Source: Author Composition

The structural equation model estimate demonstrates that digitalization affects various intermediary factors to differing extents, with the most substantial effect on IPI (coefficient 0.391) and the least on IDI (coefficient 0.212). These intermediary factors influence multiple outcomes, including Financial Performance (FP), Operational Performance (OP), and Firm-level Employee Performance (FEP). The primary influence on FP originates from IBP (0.245), while IES exerts the most substantial effect on OP (0.601). ISCLM has the most substantial impact on FEP (0.342). The study concluded that digitalization significantly influences various intermediary factors, impacting outcomes such as Financial Performance, Operational Performance, and Firm-level Employee Performance.

5.3 Importance and performance matrix analysis (IPMA)

An importance-performance matrix analysis (IPMA) was conducted to investigate the influence of exogenous variables on the strategic planning and resource allocation of dairy cooperatives amid digitalisation's impact on organisational performance. The IPMA assesses latent variable performance, highlighting areas needing managerial focus. Financial performance is heavily influenced by Integrated Business Planning (IBP) and Integrated Performance Indicators (IPI), while Integrated Data Infrastructure (IDI) and International Human Resources (IHR) require improvements. Operational performance is shaped by Integrated Supply Chain and Logistics Management (ISCLM) and IDI, while employee performance in Integrated Management Systems (IMS) and International Employee Satisfaction (IES) is low, suggesting a need for enhancement. Digitalisation is central to financial success and operational performance, emphasizing strategic focus on supply chain management and digital infrastructure, with an overall aim to improve resource management in underperforming areas.

6. Discussion

This study demonstrates that digitisation can effectively predict and clarify the organisational success of dairy cooperatives in southern India, revealing significant performance effects through PLS-SEM analysis. It highlights the necessity for reliable performance measurement amidst existing literature's ambiguity regarding digitalisation in this sector. Key findings indicate that digitalisation markedly impacts supply chain and logistics management, whereas its effects on digital infrastructure and human resources are less pronounced. The study validates a hierarchical component model comprising eight intermediary factors, reinforcing the need for digitalisation in dairy cooperatives. Additionally, the PLS-SEM algorithm has been enhanced by importance-performance map analysis (IPMA), improving performance metric comprehension and supporting the role of domain knowledge in operational practices. Overall, the research confirms the pivotal role of digital transformation in enhancing organisational performance in dairy cooperatives (Latha et al., 2025.a).

7. Conclusion and implications of the study

This study refines the understanding of digitalisation performance effects in dairy cooperatives and presents a unified model showing the interplay between digitalisation and various organisational performance outcomes. It identifies that optimal financial success stems from effective digitalisation of operational practices, especially in supply chain and logistics management (ISCLM) and inventory process integration (IPI). The research method employs a multidimensional hierarchical component model to analyze these relationships, highlighting significant managerial insights. These include prioritizing impactful digital initiatives, integrating processes, and utilizing predictive analytics for decision-making. Additionally, the study emphasizes the need for training in digital literacy, addressing ethical considerations regarding data protection, and promoting equitable access to digital technology. It advocates for public-private collaborations to enhance digital infrastructure and empower farmers, ultimately improving operational efficiency and market access within the dairy cooperative sector.

Acknowledgements

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Promotion of Innovative Women Business Start-ups through Local Self Government Institutions for Local Economic Development

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Abstract

This study explores the challenges, opportunities, and support systems affecting the sustainability of women-led micro-enterprises in Kerala, with special reference to Kudumbashree units. Using a mixed-method approach, data were collected from selected entrepreneurs across Panchayats, along with insights from interviews and discussions. The study examines key issues such as finance, marketing, production, and labour, and highlights the role of Local Self-Government Institutions (LSGIs) in promoting innovation and enterprise growth. Findings emphasize the need for better institutional support and capacity building to ensure long-term sustainability.

1. Background of the Study

Women Micro Enterprises have become increasingly significant contributors to Kerala's local economy, indicating a marked shift in gender dynamics and grassroots economic strategy. Fuelled by elevated female literacy, aggressive social policies, and decentralised governance structures, Kerala has witnessed a significant entrepreneurial transformation, with around 25% of the 2.6 million registered Micro, Small, and Medium Enterprises (MSMEs) being female-owned (Desai, *et al.* (2023)-*Role of Entrepreneurship in Women Empowerment in Kerala*).

Many women-led microenterprises still encounter significant challenges in embracing creativity. The ability of micro entrepreneurs to innovate in product design, business procedures, or marketing tactics is impeded by financial limitations, a lack of awareness regarding creative business models, and risk aversion influenced by socio-cultural factors (Thomas & Sreekumar, 2022).

A deeper understanding of the types of innovations currently emerging in women's microenterprises is necessary. Grassroots innovations frequently manifest in forms that conventional economic metrics overlook: enhancements in processes to increase efficiency, market innovations aimed at niche sectors and community-focused models that integrate economic goals with social welfare ideals. Recognising and promoting these many forms of innovation will enhance their impact. The potential for women-led enterprises to transform local economies remains untapped due to insufficient documentation and support for processes, markets, and community initiatives. This study is significant as it seeks to bridge the gap between institutional support systems and the real experiences of women micro entrepreneurs.

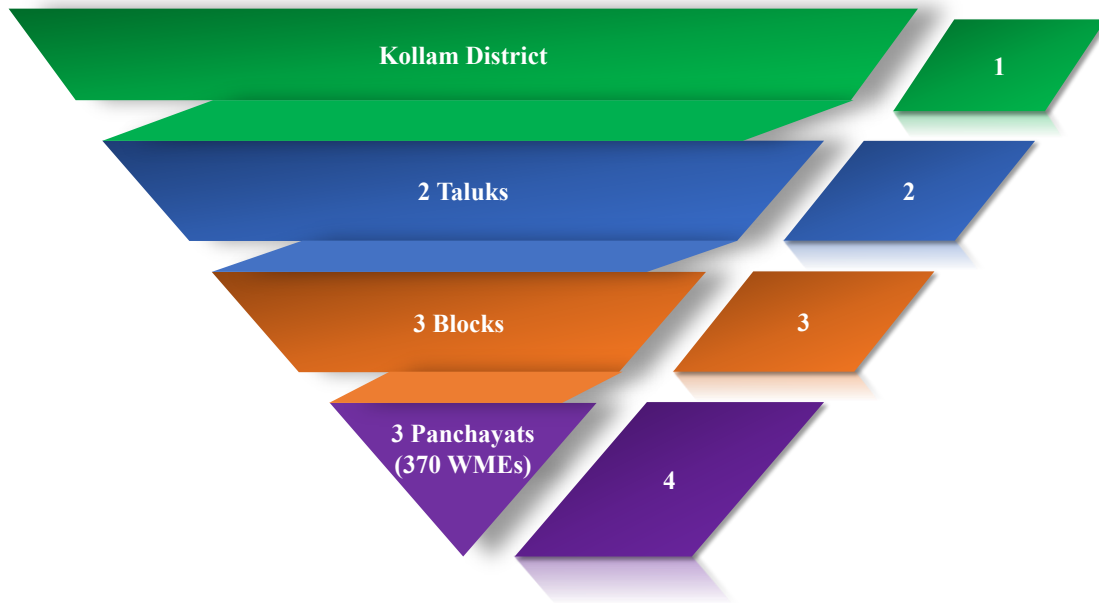


Figure 1. Stages of Sample Design

2. Objectives of the Study

1. **To assess the support of LSGIs in boosting innovation in women micro enterprises through specialized training and resource support.**
2. To identify and analyse the gap existing between the expectations and experience of **women micro enterprises** with regard to LSGI and other stakeholder supports.
3. **To analyze the problems and adaptation difficulties that women micro enterprises face in this innovation era.**
4. **To identify the women micro enterprises technological readiness and ecosystem support in improving technological adoption and business performance.**
5. To identify the elements of process, market, and community-based innovations within existing women's micro-enterprises.
6. **To evolve innovative solutions for the growth and performance of women micro enterprises based on the issues identified.**

3. Various Phases of Action Research

Phases	Activity	Expected Outcome
Phase I	Identification of LSGIs	Identifying appropriate Grama Panchayats for the implementation of the action research framework.
Phase II	Initial Immersion Process	Meeting with People Representatives and Immersion to LSGI executives in order to have good rapport with LSGI executives and authorities, NGOs working with them etc. and the purpose and objectives get immersed with them.



Phases	Activity	Expected Outcome
Phase III	Base Line Survey in selected LSGIs	To get awareness about socio-demographic profile, literacy, employment and natural resource profile, access to infrastructure and other facilities, functioning of SHGs for social mobilization and its status, position of existing Women Micro Enterprises etc.
Phase IV	Conduct of WME Meet	Establishing rapport with entrepreneurs and CDS members, involving stakeholders, and identifying core issues among WMEs
Phase V	Quantitative Data Collection	Gathering numerical data regarding business functions, challenges, and innovative methodologies.
Phase VI	Qualitative Data Collection-FGD of WMEs	Obtain a clear-cut picture regarding the issues which need further attention, i.e. extracting qualitative insights regarding support systems, adaptation challenges, personal experiences and innovation capabilities
Phase VII	Quantitative Analysis	Identifying significant trends, gaps, and patterns within statistical data.
Phase VIII	Qualitative Analysis	Understanding of underlying issues, innovative requirements, and organisational responses.
Phase IX	Evolving Solutions through MLP	Formulation of practical strategies to enhance the sustainability and creativity of WMEs for LED
Phase X	Vetting of Solutions suggested in MLP with LED Experts & Actionable Outcome Framework Development	Thorough evaluation and feedback are essential for confirming and refining proposed interventions. Actionable Outcome Framework will be Developed

4. Key Findings

- LSGIs as Innovation Enablers: LSGIs need to shift from uniform support providers to innovation ecosystem builders through context-specific training, partnerships with HEIs/R&D, and sector-focused innovation cells.
- Need for Demand-Responsive Support Models: Existing support mechanisms are supply-driven; participatory, need-based, and co-designed interventions improve uptake and impact of entrepreneurship schemes.
- Multidimensional Barriers to Innovation: Women entrepreneurs face psychological, infrastructural, technological, and socio-cultural constraints that limit sustained innovation and enterprise growth.
- Low Digital Readiness & Weak Tech Integration: Awareness of digital tools exists, but lack of structured training, follow-up support, and infrastructure restricts effective ICT and e-commerce adoption.
- Innovation Potential Exists but Remains Informal: Product, marketing, and organisational innovations are present but sporadic, unstructured, and constrained by weak market testing, R&D linkages, and regulatory guidance.

5. Actionable Outcome Framework

- FRENAP App for direct sale to customers (It is under consideration of KU Mission)
- Establishment of Common Production Centres (CPCs)
- Formation of Sectoral Consortiums of Units Working in the CPC
- HEI–LSGI–Consortium Tripartite MoUs

- Marketing System Transformation (Wholesale Distribution Units)
- Institutional Innovation Linkages MoUs with R&D Bodies
- Regionalisation and Competition Model of K-DISC and KSHEC to empanel interested HEIs

6. Conclusion

The Actionable Outcome Framework developed through this study presents a comprehensive, practice-oriented model for strengthening women-led micro-enterprises in Kerala by integrating economic empowerment with sustainability and decentralized development priorities. Central to this framework is the establishment of Common Production Centres (CPCs), which operate as shared, semi-mechanized facilities accessible to women entrepreneurs within local Panchayats. These centres enable higher production volumes, better quality control, and improved compliance with hygiene and safety standards, while reducing the individual capital investment burden. Incorporating environmentally responsible practices such as solar energy use and water recycling, CPCs address sector-specific needs in areas like food processing, garment manufacturing, and coir products, directly advancing Sustainable Development Goals such as Gender Equality (SDG 5), Industry Innovation and Infrastructure (SDG 9), and Responsible Consumption and Production (SDG 12). Their long-term viability is supported by ongoing skills development, targeted technical mentoring, and strong institutional partnerships. In conclusion, this framework moves beyond conventional enterprise promotion to create a dynamic and self-sustaining rural innovation ecosystem. By aligning infrastructure, skills, institutional partnerships, and market systems, it places women's economic agency at the centre of local development strategies, strengthens regional resilience, and fosters inclusive growth grounded in sustainability and self-reliance

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INSIDER ADVANTAGE OR POSITIVE SIGNAL? MARKET REACTIONS TO SHARE WARRANT ISSUANCES IN INDIA

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Abstract

This study examines the impact of ownership structure on stock returns of firms issuing share warrants in the Indian stock market. Using a sample of 130 warrant issuances from companies listed on the NSE and BSE during 2019–2024, the study employs an event study methodology to analyse price reactions. In a market characterized by promoter-controlled firms, warrant issuances to promoters may signal growth prospects but also raise concerns of insider trading and information asymmetry between majority and minority shareholders. The findings provide insights into investor perception across promoter and non-promoter issuances and highlight implications for corporate governance. The results are relevant for regulators, firms, and investors in improving information transparency and decision-making related to warrant issuance.

Introduction

Financial markets play a crucial role in enabling firms to raise capital through instruments such as equity, debt, and hybrid securities. While Initial Public Offerings (IPOs) and Follow-on Public Offerings (FPOs) have been extensively examined in the literature, relatively little attention has been given to share warrants, particularly in the Indian context. A share warrant is a financial instrument that grants the holder the right to purchase a specified number of shares at a predetermined price within a certain period (Suchard, 2004). Unlike traditional equity offerings, warrants allow firms to raise capital in stages, thereby aligning financing decisions with actual funding requirements and mitigating agency costs associated with excess cash flow (Jensen, 1986; Schultz, 1993; Byoun & Moore, 2003).

In India, where a significant proportion of firms are promoter-controlled or family-owned, share warrant issuances raise important concerns related to corporate governance, insider trading, and information asymmetry. Preferential allotment of warrants to promoters may signal confidence in the firm's future prospects; however, it may also provide opportunities for insiders to benefit from timing advantages at the expense of minority shareholders (Sarkar & Sarkar, 2008; Villalonga & Amit, 2006). Against this backdrop, the present study examines the stock price reaction to share warrant issuance announcements in the Indian stock market during the period 2019–2024. The study further investigates whether the market reaction varies based on the category of allottees—promoters, non-promoters, or both—and explores the possibility of information leakage prior to the announcement.

2. Literature Review and Hypothesis Development

The literature on seasoned equity offerings (SEOs) generally documents negative abnormal returns around announcement periods, primarily attributed to adverse selection and information asymmetry (Myers & Majluf, 1984). Investors often interpret equity issuance as a signal that the firm may be overvalued, leading to unfavourable market reactions (Mikkelson & Partch, 1986). Additionally, concerns regarding managerial opportunism and misuse of funds further contribute to negative perceptions of SEOs (Jung et al., 1996). However, empirical findings on share warrants are mixed. Some studies report positive market reactions, suggesting that warrant issuances may signal growth opportunities and future profitability (Balachandran et al., 2017; Suchard, 2004), while others highlight governance concerns, particularly in emerging markets (Suryawinata et al., 2020).

Corporate governance plays a significant role in shaping investor perception, especially in economies characterized by concentrated ownership structures. In such contexts, Type II agency conflicts arise when controlling shareholders exploit their position to extract private benefits at the expense of minority shareholders (Djankov et al., 2008; Denis & McConnell, 2003). Preferential allotment of warrants to promoters can therefore be interpreted in two contrasting ways: as a signal of confidence in the firm's growth prospects or as an opportunistic strategy to benefit from insider information.

Information asymmetry further complicates the interpretation of warrant issuances. According to the pecking order theory, firms prefer internal financing and resort to equity issuance when they perceive their shares to be overvalued (Myers & Majluf, 1984). Warrants, being a form of delayed equity financing, may enable insiders to capitalize on market mispricing (Lee, 1997a, 1997b; Smith, 1986). In emerging markets like India, where investor protection mechanisms are relatively weak (La Porta et al., 1998) and governance challenges persist (Chakraborty, 2018), the likelihood of information asymmetry and insider trading is heightened.

Based on these theoretical arguments, the study formulates three hypotheses. First, it tests whether abnormal returns prior to the announcement are insignificant, consistent with market efficiency (Fama, 1991). Second, it examines whether abnormal returns following the announcement are negligible. Third, it investigates whether there is any evidence of information asymmetry in the period leading up to the announcement (Bergh et al., 2018).

3. Methodology

The study employs the event study methodology to examine the stock price reaction to share warrant issuance announcements. The sample consists of 130 warrant issuances by firms listed on the Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) during the period 2019–2024, obtained from the ProwessIQ database. These issuances are categorized based on the type of allottees, namely promoters, non-promoters, and a combination of both.

The announcement date is defined as the event date (t_0), and an event window of 21 days, ranging from -10 to +10 days, is considered to capture the price effects around the announcement. An estimation window of 150 days prior to the event window is used to estimate normal returns, following standard event study practices (MacKinlay, 1997). The market model

is applied to calculate expected returns, where the return on a security is expressed as a function of market returns and a stochastic error term (Fama, 1965).

Abnormal returns are computed as the difference between actual returns and expected returns. These abnormal returns are then averaged across firms to obtain Average Abnormal Returns (AAR), while Cumulative Abnormal Returns (CAR) are calculated by aggregating abnormal returns over the event window. Statistical significance is tested using t-statistics to determine whether the observed abnormal returns differ significantly from zero. The event study framework enables the identification of abnormal price movements attributable to warrant issuance announcements and helps detect potential information leakage (Ball & Brown, 1968).

4. Empirical Results

The empirical findings reveal significant abnormal returns around the announcement of share warrant issuances. The analysis of Average Abnormal Returns indicates that positive abnormal returns are concentrated both before and after the announcement date. Notably, there is strong evidence of positive abnormal returns in the pre-announcement period, particularly in cases where warrants are issued to promoters. This suggests the possibility of information leakage, where insiders may act on privileged information prior to its public disclosure (Karpoff & Lee, 1991).

In contrast, warrant issuances to non-promoters exhibit relatively muted abnormal returns before the announcement, with significant positive reactions occurring primarily after the announcement. This pattern indicates that information is incorporated into stock prices more gradually in the absence of insider involvement. Issuances involving both promoters and non-promoters display intermediate characteristics, reflecting a combination of these effects.

The analysis of Cumulative Abnormal Returns further supports these findings. Significant positive CARs are observed across multiple event windows, including short-term windows such as (-1, +1) and (-3, +3). The highest abnormal returns are recorded in the pre-announcement period, particularly in the (-5, 0) window, reinforcing the evidence of early information dissemination. These findings are consistent with prior studies that document positive announcement effects associated with warrant issuances (Balachandran et al., 2017).

The results of hypothesis testing indicate that all three null hypotheses are rejected. Abnormal returns are found to be significant both before and after the announcement, and there is clear evidence of information asymmetry in the pre-announcement period. These findings challenge the assumptions of market efficiency and highlight the role of insider behaviour in influencing stock price movements.

5. Discussion and Conclusion

This study contributes to the limited literature on share warrant issuances in the Indian stock market by providing empirical evidence on their impact on stock prices. Contrary to the traditional SEO literature, which generally reports negative market reactions, the findings of this study indicate that warrant issuances are associated with positive abnormal returns. This suggests that investors perceive warrant issuances as signals of future growth and investment opportunities (Balachandran et al., 2017).

However, the presence of significant abnormal returns prior to the announcement raises concerns regarding information asymmetry and insider trading. The evidence is particularly strong in the case of promoter-driven warrant issuances, where stock prices appear to incorporate information well before the public announcement. This behaviour is indicative of potential governance issues and Type II agency conflicts, where controlling shareholders may exploit their informational advantage (Djankov et al., 2008).

The study also highlights the differential impact of warrant issuances based on the category of allottees. While promoter-related issuances exhibit early price adjustments, issuances to non-promoters show delayed market reactions, suggesting that information dissemination occurs more transparently in the latter case. These findings underscore the importance of ownership structure in shaping market behaviour and investor perception.

From a policy perspective, the results emphasize the need for stronger regulatory oversight to detect and prevent insider trading activities. Strengthening surveillance mechanisms, such as those employed by regulatory bodies, can help identify abnormal trading patterns and ensure a level playing field for all market participants. For investors, the findings highlight the importance of critically evaluating warrant issuances, particularly those involving promoters, to make informed investment decisions.

Despite its contributions, the study has certain limitations. It does not differentiate between family and non-family firms, nor does it incorporate firm-level governance variables or volatility dynamics into the analysis. Future research can address these gaps by integrating advanced econometric models and examining the role of governance mechanisms more comprehensively (Brown et al., 1988).

In conclusion, the study provides important insights into the price behaviour surrounding share warrant issuances in India, highlighting both their potential as a financing tool and the governance challenges they pose.

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A Study on Sustainable Investment Pattern of Generation Z

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Abstract

Environmental, Social, and Governance (ESG) factors are shaping the investment habits of young people, indicating a shift toward more responsible financial behaviour. However, sustainable investing is still at an early stage in Kerala, particularly among Generation Z, due to limited awareness, financial literacy, and practical accessibility. Based on primary data from 100 respondents in Thrissur district, this study examines the relationship between awareness, value orientation, financial expectations, income, and peer influence on sustainable investment patterns. The results indicate that although respondents exhibit positive attitudes toward sustainable investing, their actual investment behaviour is constrained by limited income and insufficient knowledge. The study highlights the importance of targeted awareness initiatives, financial education, and institutional support to promote wider adoption of sustainable investing among young investors in Kerala.

Keywords: Sustainable Investing, Environmental Social and Governance, Generation Z, Investment Pattern

1. Introduction

Sustainable investing is a significant component of the contemporary financial decision-making process due to its integration of environmental, social, and governance (ESG) factors with the conventional financial objectives. It does not substitute traditional investment techniques; rather, it introduces a wider-focus, centring on long-term value and responsible practices. Sustainable investing is becoming increasingly popular across the globe because of the issues associated with climate change, social and ethical business practices. This trend is slowly gaining momentum in India as more people are becoming aware of it, there is regulatory backing and the availability of investment opportunities that are ESG oriented.

Sustainable investing is gradually gaining traction in Kerala, primarily among educated and digitally savvy people, yet it remains ingrained in income, financial literacy, and anticipated returns. A significant part of this change is played by generation Z, as youth are more conscious of the problem of sustainability today due to education and social media. They tend to be interested in responsible investment and be oriented to the objectives of sustainability. But in reality, their investment choices are usually constrained by practical considerations like low income, financial ignorance and peer pressure. Although there is an increasing interest, little research specifically on Gen Z in Kerala exists. The purpose of the study is to comprehend the influence of the awareness, personal values, and financial factors in the formation of the sustainable pattern of investment among young investors.

1.1 Review of Literature

Sustainable investing integrates ESG (environmental, social, and governance) factors with traditional financial strategies to enhance long-term performance and risk management. Empirical studies, including those by Gunnar Friede et al. (2015) and Stuart L. Gillan et al.

(2021), confirm a generally positive relationship between ESG practices and financial outcomes. Research on emerging markets by Rajneesh Narula et al. (2023) supports this trend, though variations exist due to market conditions. Reports from Morgan Stanley (2023) and Deloitte (2024) highlight growing interest in ESG among Generation Z, despite limited awareness, income constraints, and the strong influence of social factors on their investment decisions (Raut et al., 2020).

2. Research Problem and Objectives

2.1 Research Problem

Despite the growing awareness and positive attitude toward sustainable investing among Generation Z, their actual investment patterns do not fully reflect these preferences. In Kerala, factors such as limited income, lack of financial literacy, peer influence, and insufficient knowledge of ESG investment options restrict young investors from actively participating in sustainable investments. Moreover, existing studies have largely overlooked region-specific analysis and the combined effect of multiple factors influencing investment decisions. Therefore, the key research problem is to understand how awareness, value orientation, financial expectations, income, and peer influence collectively impact the sustainable investment pattern of Generation Z in Kerala.

2.1 Objectives of the study

- To assess the level of awareness and value orientation of Gen Z towards sustainable investment practices.
- To examine financial expectations, income, and peer influence on the sustainable investment pattern of Gen Z.
- To identify the overall impact of the key factors influencing the sustainable investment pattern of Gen Z.
-

2.2 Hypothesis of the study

H₀: There is no significant relationship between awareness, value orientation, financial expectations, income, peer influence, and sustainable investment pattern.

3. Methodology and Theoretical Framework

3.1 Methodology

The study adopts a descriptive and quantitative research design to examine sustainable investment patterns among Generation Z. Primary data were collected from 100 respondents in Thrissur district using a structured questionnaire based on a 5-point Likert scale. Convenience sampling was used to select participants, mainly students and young individuals. The data were analysed using statistical tools such as percentage analysis, mean, standard deviation, and multiple regression to understand the influence of awareness, value orientation, financial expectations, income, and peer influence on investment patterns.

3.2 Theoretical Framework

The study follows the theoretical framework of the Theory of Planned Behaviour (TPB) explaining how the attitudes, social influence, and perceived control influence the investment decisions. Also, behavioural financial factors are taken into account, and the impact of financial literacy, personal values, and social aspects on sustainable investment decisions of young investors is discussed.

4. Results and Findings

4.1 Results

Descriptive Statistics: The demographic profile shows a slightly higher proportion of females (57%) than males (43%), with most respondents (86%) belonging to the 22–25 age group, indicating a focus on young adults. A majority (86%) reported no regular income, suggesting a largely student-oriented sample. The descriptive statistics indicate a generally positive inclination toward sustainable investing, with value orientation having the highest mean (4.1), followed by financial expectations (3.9) and awareness (3.8). Peer influence (3.7) and income (3.5) show moderate impact, suggesting that respondents are primarily value-driven, with awareness and contextual factors shaping their investment intentions.

Inferential Statistics: The regression analysis reveals a strong relationship between the variables, with an R value of 0.968 and R^2 of 0.938, indicating high explanatory power. The model is statistically significant ($F = 157.203$, $p < 0.05$), confirming that awareness, value orientation; financial expectations, income, and peer influence significantly influence sustainable investment patterns. Among these, awareness ($\beta = 0.312$) has the strongest impact, followed by value orientation ($\beta = 0.285$) and peer influence ($\beta = 0.276$). Financial expectations and income also show positive effects, and since all variables are significant, the null hypothesis is rejected.

4.2 Findings

- The findings suggest that Generation Z has a positive attitude towards sustainable investment with the support of a rather high degree of awareness and value-based preferences towards environmental and social responsibility.
- The results of the analysis indicate that sustainable investment behaviour is greatly influenced by awareness, value orientation, financial expectation, income and peer influence, with awareness coming out as the most dominant factor.
- The results also indicate that in addition to value-oriented factors, practical attributes like anticipated returns and financial ability are also critical in determining investment choices.
- There is an evident gap in intention behaviour despite the positive attitudes towards sustainability, which is mostly caused by low financial literacy and economic resources of young investors.

5. Recommendations and Conclusion

5.1 Recommendations

- To make it easier for Generation Z investors with low incomes to invest, banks and other financial institutions should create sustainable investment products that are affordable, flexible, and easy to understand.
- Structured education programs, workshops, and hands-on learning programs are needed to improve financial literacy and awareness of ESG issues.
- Digital platforms and social media should be used in a planned way to take advantage of peer pressure and raise awareness of sustainable investment among young investors.
- To build trust and help people make smart decisions, there should be clear, simple, and standardized information about sustainable investment options.
- Policymakers and banks should work together to create rules, incentives, and guidance systems that make it easier for people to invest in sustainable businesses.

5.2 Conclusion

The study finds that Generation Z is open to sustainable investing because they are aware of it and it is based on strong values. But in reality, their investment behavior is affected by things like income, financial expectations, and the influence of their peers. Even though a lot of people are aware of it, there is a big gap between what they want to do and what they actually do because they don't have enough money or knowledge. The results show that awareness is not enough; it needs to be backed up by financial knowledge and clear investment options. Improving financial literacy and making things easier to get to can help close this gap. Overall, Generation Z has a lot of potential to help with sustainable investing and support responsible financial growth over the long term.

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From Wardrobe Waste to Sustainable Value: Consumer Perception of Textile Re-commerce Platforms in Kerala

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Abstract

Dynamic fashion trends generate substantial household garment surplus and textile waste. Textile re-commerce—through resale, swapping, and recycling offers a sustainable alternative yet remains underutilized in Kerala due to stigma, low awareness, and hygiene concerns. This pilot study, based on survey data from 375 adult consumers in Thrissur district, reveals limited awareness of organized textile recommerce platforms but moderate behavioral intention toward them, particularly with government support and quality assurance. The findings highlight the need for awareness campaigns and institutional backing to embed textile re-commerce in Kerala's sustainability agenda.

Keywords: Sustainability, Textile re-commerce, Awareness gap, Consumer perception,

1. Introduction

Textile re-commerce involves the resale of used or refurbished clothing via online and offline platforms, including take-back and trade-in programs that convert garments into cash or credit. The proliferation of fast fashion has intensified textile waste, which India disposes at nearly 7.8 million tonnes annually. A single cotton T-shirt, for example, requires about 2,700 litres of water, and synthetic textiles contribute to micro plastic pollution, while weak recycling systems push large volumes into landfills.

In Kerala, despite high literacy and digital access, organized re-commerce channels remain underdeveloped. Households accumulate unused and rarely worn clothes yet often prefer donation or storage over resale, primarily due to stigma, hygiene concerns, and low awareness of platforms. Most prior research on recommerce focuses on Western markets, leaving emerging economies such as Kerala under-explored. This study therefore examines consumer perception, awareness, and behavioural intention toward textile re-commerce in Kerala, with a focus on wardrobe surplus, disposal practices, and key factors such as quality, hygiene, trust, price, social acceptance, and sustainability.

2. Research Problem and Objectives

2.1 Research Problem

The growing accumulation of unused clothing reflects a mismatch between consumption

and use. In Kerala, disposal tends toward donation or storage rather than active resale, signalling hidden barriers such as social stigma, hygiene and quality concerns, low trust in platforms, and limited awareness. The literature on recommerce is predominantly Western-centric, and Kerala-specific evidence on how local cultural, social, and economic factors shape recommerce behaviour is sparse.

2.1 Objectives

- To examine the extent of wardrobe surplus and clothing disposal practices among households in Kerala.
- To assess consumer awareness of textile re-commerce platforms in Kerala.
- To analyze consumer perception and attitudes toward textile re-commerce platforms based on quality, hygiene, price, trust, social acceptance, and sustainability.
- To examine the factors influencing consumer's intention to participate in textile re-commerce.

The findings aim to inform consumer-centric strategies and policy support for sustainable consumption and a circular textile economy.

3. Methodology and Theoretical Framework

3.1 Methodology

The research adopts a descriptive, quantitative design. Primary data were collected via structured questionnaires using a 5-point Likert scale from 375 adult consumers (students, professionals, and homemakers) in Thrissur district, selected through convenience sampling. Data were analysed using percentage distribution, mean, and standard deviation to explore wardrobe surplus, awareness, attitudes, and disposal practices.

3.2 Theoretical Framework

The study is framed by four theoretical lenses: Theory of Planned Behaviour (TPB), Value-Belief-Norm (VBN) theory, Perceived Risk Theory, and Social Stigma Theory. TPB emphasizes that behavioural intention is shaped by attitudes, subjective norms, and perceived control (platform ease and access). VBN theory suggests that ecological values and moral norms drive pro-environmental behaviour, though affordability limits action. Perceived Risk Theory highlights that uncertainty about hygiene, quality, and social image reduces trust, while transparency and assurance mitigate risk. Social Stigma Theory argues that second-hand clothing is associated with low status; normalization through branding and endorsements can reduce stigma.

4. Results and Findings

4.1 Results

The survey revealed that 82% of households (n=307) owned more than five unused clothing items, indicating strong underlying recommerce potential. Donation was the most common disposal method (36%, n=135), followed by informal resale (24%, n=90) and discarding

(20%, n=75); only 8% of respondents (n=30) reported using organized recommerce platforms. About 45% of respondents (n=169) indicated low or no awareness of such platforms (mean $M=1.92$, $SD=0.78$), while social acceptance was low ($M=2.85$, $SD=0.92$) and behavioural intention moderate ($M=3.23$, $SD=0.87$). Respondents viewed recommerce positively in terms of affordability and sustainability but perceived hygiene and quality as key constraints.

These patterns suggest that economic and environmental benefits increase interest, whereas perceived risks and social stigma curb adoption.

4.2 Findings

- High wardrobe surplus signals strong potential for resale and reuse;
- Awareness of recommerce platforms is low, and consumers prefer donating or storing garments;
- Social stigma, hygiene, and quality concerns, alongside moderate trust, constrain participation; and
- The recommerce market in Kerala is budding and requires coordinated awareness, reliability, and cultural normalization.

5. Recommendations and Conclusion

5.1 Recommendations

Based on the results, the study recommends:

- Awareness campaigns via social media, colleges, and community programmes to highlight environmental and economic benefits;
- Improved hygiene standards, quality assurance, and transparent pricing and return policies on platforms;
- Influencer and micro-influencer marketing to normalize second-hand fashion;
- Government incentives and policy linkages with waste-management bodies to strengthen circular-economy initiatives; and
- Integration of recommerce into household waste-management systems through local collection centres and resale channels.

5.2 Conclusion

This pilot study offers important insights into the potential of textile re-commerce in Kerala, while acknowledging certain limitations. The sample size of 375 respondents from Thrissur district restricts generalizability, and the use of convenience sampling may introduce bias. Moreover, the exclusive focus on consumer perceptions leaves out perspectives from businesses, platform operators, and policymakers. Despite these limitations, the study underscores considerable potential: the combination of high household garment surplus, limited awareness, and moderate behavioural intention suggests that consumers are receptive to textile re-commerce, provided that platforms ensure quality, hygiene, and receive government validation. To advance a circular fashion system in Kerala, coordinated efforts among consumers, businesses, and policymakers are essential. Such collaboration can

transform textile re-commerce into a driver of environmental conservation, economic opportunity, and social acceptance within the state's sustainability framework.

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TOWARDS A SUSTAINABLE COASTAL TOURISM MODEL; LESSONS FROM KERALA

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Abstract

Coastal tourism drives economic growth but often harms ecosystems and communities. Using Kerala as a case study, this research highlights how sustainable practices such as community participation, integrated coastal management, and responsible tourism can balance environmental, social, and economic goals. It demonstrates that place-based planning and strong governance are essential for developing sustainable and inclusive coastal tourism models applicable to other regions.

Index Terms – Coastal tourism, Sustainability, Responsible Tourism, Policy initiatives

Introduction

Coastal tourism has emerged as one of the fastest-growing segments of the global tourism industry, particularly in developing regions where coastal landscapes, marine biodiversity, and cultural heritage attract large numbers of visitors. While tourism contributes significantly to employment generation, foreign exchange earnings, and regional development, it also poses serious threats to fragile coastal ecosystems and traditional livelihoods when inadequately planned or managed (Anas et al., 2025). Issues such as coastal erosion, habitat degradation, waste accumulation, cultural commodification, and social displacement have become increasingly evident in many coastal destinations (Ghosh et al., 2012).

Kerala, located along the south-western coast of India, is internationally recognised for its scenic beaches, backwaters, rich biodiversity, and vibrant cultural traditions. Tourism plays a pivotal role in the state's economy, with coastal destinations such as Kovalam, Varkala, Alappuzha, and Marari forming major tourism hubs. However, the rapid growth of coastal tourism in Kerala has raised concerns regarding environmental sustainability, community well-being, and long-term economic resilience (Ezreth, 2018).

Against this backdrop, the present paper examines the evolution of coastal tourism in Kerala and explores how the state's experiences can inform the development of a sustainable coastal tourism model. By analysing policy frameworks, institutional mechanisms, and selected case studies, the paper seeks to identify key lessons that can guide coastal regions aiming to balance economic development with environmental conservation and socio-cultural integrity.

Review of Literature

Coastal tourism is one of the most prominent segments of global tourism, particularly in developing regions endowed with coastal and marine resources (UNWTO, 2018). While

coastal tourism contributes significantly to economic growth, employment, and infrastructure development, it simultaneously exerts pressure on fragile coastal ecosystems and local communities (Hall, 2001; Gössling, 2002). Scholars have identified environmental degradation, habitat loss, water pollution, and coastal erosion as some of the major consequences of unplanned coastal tourism development (Butler, 1999; Daby, 2003). The concept of sustainability has therefore become central to tourism research, with emphasis on balancing economic benefits with environmental conservation and socio-cultural well-being (WCED, 1987). Sustainable coastal tourism is increasingly viewed as an approach that ensures long-term viability by integrating environmental limits, community interests, and economic resilience (Bramwell & Lane, 1993).

Statement of the problem

In Kerala, tourism is a vital component of the state's economy, with coastal destinations playing a central role in its tourism landscape. Despite policy interventions such as Responsible Tourism initiatives, Integrated Coastal Zone Management, and Coastal Regulation Zone regulations, coastal tourism in Kerala continues to face challenges related to over-tourism, climate change impacts, uneven benefit distribution, and gaps in governance and regulatory enforcement (Anas et al., 2025). The coexistence of tourism infrastructure expansion alongside environmental vulnerability and socio-economic disparities highlights a critical tension between tourism-led development and sustainable coastal management (Sundari et al., 2025).

While several studies have examined tourism growth and environmental issues in Kerala, there remains a lack of integrated analysis that systematically links policy frameworks, stakeholder participation, and sustainability outcomes in coastal tourism contexts. Moreover, existing research often focuses on isolated destinations or individual dimensions of sustainability, limiting the ability to derive transferable lessons for broader application. Consequently, there is a need for a comprehensive assessment of Kerala's coastal tourism experience to understand how sustainability-oriented policies and place-based governance mechanisms can mitigate the adverse impacts of mass tourism.

This research addresses this gap by examining the evolution, practices, and governance of coastal tourism in Kerala and by identifying key lessons that can inform the development of a sustainable coastal tourism model. By integrating environmental, socio-cultural, and economic perspectives, the study seeks to contribute to policy-relevant knowledge that supports more resilient, inclusive, and sustainable coastal tourism development in Kerala and comparable coastal regions.

Objectives

1. To trace the evolution and patterns of coastal tourism development in Kerala
2. To examine the key environmental and socio-economic challenges associated with coastal tourism in Kerala
3. To identify best practices and lessons from Kerala's coastal tourism experience

Methodology

The study adopts a descriptive research approach based on secondary data analysis. The methodology includes a review of policy documents related to tourism development, coastal regulation, and environmental management in Kerala, case study analysis of selected coastal destinations, focusing on tourism practices, community involvement, and governance mechanisms and examination of reports and data published by tourism departments,

environmental agencies, and international organisations. This approach enables an in-depth understanding of institutional frameworks, challenges, and best practices influencing coastal tourism sustainability in Kerala.

Sustainable Coastal Tourism

Sustainable coastal tourism (Ghosh et al., 2012) is grounded in three interrelated dimensions:

1. **Environmental sustainability**, which focuses on conserving coastal and marine ecosystems, minimizing pollution, managing waste, and reducing resource overuse.
2. **Socio-cultural sustainability**, which emphasises respect for local traditions, community participation, equitable benefit-sharing, and protection of cultural heritage.
3. **Economic sustainability**, which seeks to ensure long-term economic viability, decent employment, and inclusive growth without excessive dependence on mass tourism.

Integrated Coastal Zone Management (ICZM) and responsible tourism principles provide an important framework for achieving sustainability by promoting coordinated planning, stakeholder collaboration, and adaptive governance across sectors and spatial scales (Anoop, 2022).

Coastal Tourism in Kerala

Tourism development in Kerala gained momentum in the late 20th century, with coastal destinations emerging as flagship attractions. Early tourism growth was largely market-driven, focusing on beach resorts, recreational activities, and international tourist inflows. The branding of Kerala as “God’s Own Country” significantly enhanced its global visibility and contributed to increased visitor numbers. However, unregulated construction along the coastline, rising tourist density, and inadequate infrastructure created environmental and social challenges (Pavithran et al., 2014). Coastal erosion, degradation of sand dunes, decline in fish stocks, and conflicts between tourism operators and fishing communities became increasingly evident (Krishna, 2007; Abraham, 2010). In response, the Government of Kerala gradually introduced sustainability-oriented initiatives, including coastal regulation measures, ecotourism guidelines, and community-based tourism projects. The launch of the Responsible Tourism (RT) Initiative in 2008 marked a significant shift toward participatory and inclusive tourism development (Savitha, 2019), particularly in coastal and rural areas.

Sustainable Tourism Practices in Kerala’s Coastal Regions

A. Community Participation and Livelihood Integration

One of the most significant lessons from Kerala is the emphasis on community participation in tourism planning and operations. Responsible Tourism initiatives have facilitated linkages between tourism enterprises and local producers, including fishers, farmers, artisans, and women’s self-help groups (Brijit et al., 2024). This has enhanced local income generation while fostering community ownership and social acceptance of tourism.

B. Integrated Coastal Zone Management

Kerala’s engagement with Integrated Coastal Zone Management has helped align tourism development with environmental conservation objectives. ICZM frameworks promote zoning regulations, ecosystem restoration, and disaster risk reduction (Vinayak et al., 2025), which are

critical for addressing climate change impacts such as sea-level rise and extreme weather events.

C. Environmental Conservation and Regulation

Regulatory mechanisms such as the Coastal Regulation Zone (CRZ) Notification have played a crucial role in controlling construction activities and protecting ecologically sensitive areas. In addition, initiatives promoting waste management, plastic reduction, and eco-friendly tourism infrastructure have contributed to reducing the environmental footprint of coastal tourism (Anas et. Al, 2025).

D. Responsible Tourism and Policy Support

The Responsible Tourism Mission in Kerala integrates economic, social, and environmental objectives through policy support, institutional coordination, and capacity building (Anas et. Al, 2025). By prioritising sustainability over short-term gains, Kerala has demonstrated that tourism growth can coexist with conservation (Savitha 2019) and community welfare.

Challenges to Sustainable Coastal Tourism in Kerala

Despite notable progress, several challenges persist and addressing these challenges requires continuous policy refinement, stronger institutional capacity, and adaptive management strategies. The core concerns in sustainable coastal tourism in Kerala (Brijit et al., 2024; Sundari, 2014; Swanth et al., 2013) can be summarized as:

- **Over-tourism** in popular beach destinations leading to congestion and resource stress.
- **Climate change impacts**, including coastal erosion and flooding, threatening tourism infrastructure.
- **Governance gaps**, particularly in enforcement of regulations and coordination across departments.
- **Unequal benefit distribution**, with smaller communities sometimes marginalised in tourism value chains

Lessons and Policy Implications

Kerala's experience offers several transferable lessons for sustainable coastal tourism development (Anas et al., 2025):

- Sustainability must be integrated into tourism planning from the outset rather than treated as a corrective measure.
- Community participation enhances social equity and strengthens destination resilience.
- Integrated governance frameworks are essential for balancing tourism growth with environmental protection.
- Responsible tourism initiatives can serve as effective instruments for inclusive and place-based development.

These lessons are particularly relevant for coastal regions in developing countries facing similar ecological vulnerabilities and development pressures.

Conclusion

This paper has examined the evolution of coastal tourism in Kerala and analysed the state's efforts to transition toward sustainability. The findings suggest that Kerala's emphasis on community participation, integrated coastal zone management, responsible tourism, and regulatory oversight provides a viable model for sustainable coastal tourism development. While challenges remain, Kerala's experiences demonstrate that place-based planning, stakeholder collaboration, and sustainability-oriented policies can mitigate the adverse impacts of mass tourism. The insights derived from this study contribute to broader discussions on sustainable tourism and offer practical guidance for coastal regions seeking more inclusive and resilient development pathways.

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Tourism-Led Development: Agri-Tourism's Contribution to Sustainable Tourism Development in Kerala Economy

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Abstract

Agri-tourism is becoming an important part of tourism-led development in Kerala by combining farming activities with visitor experiences. Many agritourism ventures are now using digital tools to improve their businesses, yet there is limited research on how farmers' participation in the digital economy in different branches of the agritourism industry supports sustainable tourism development in the state. This study examines how three key digital elements—digital production, digital sales, and digital finance—shape sustainability outcomes for agritourism enterprises and explains how these digital practices collectively contribute to sustainable tourism development in the Kerala economy.

Keywords: Agri-tourism, Digital production, Digital sales, Digital finance, Sustainable tourism, Digital economy, Kerala Economy.

1. Introduction

Agri-tourism has emerged as an innovative approach to rural development by combining agricultural practices with tourism experiences, offering farmers additional income and visitors authentic rural exposure. In Kerala, with its rich agricultural heritage, diverse landscapes, and strong tourism base, agri-tourism holds significant potential to promote sustainable development. It helps preserve traditional farming practices, supports local culture, and creates employment opportunities in rural areas, thereby strengthening Kerala's tourism-led growth model.

At the same time, the growing adoption of digital technologies is transforming agri-tourism enterprises in Kerala. Tools such as digital production methods, online marketing platforms, and digital financial systems enable farmers to improve efficiency, reach wider markets, and manage resources more effectively. These digital practices can enhance the sustainability of agri-tourism by supporting economic stability, environmental conservation, and social well-being. Therefore, understanding the role of digitalization is essential for strengthening agri-tourism as a key component of sustainable tourism development in Kerala.

2. Literature Background

(Fan & Ha, 2025) Tourism plays a key role in economic growth, though its impact varies across countries. Studies highlight both tourism-led and economy-driven growth, with mixed

evidence in ASEAN nations. Overall, the relationship between tourism and economic development is complex and context-dependent.

(Ma et al., 2024) Agro-tourism integration and tourism-driven poverty reduction play a significant role in promoting rural development and economic growth. These approaches help generate income, create employment, and support rural revitalization. However, their effectiveness depends on proper planning and policy support.

(Djuwendah et al., 2023) Community-based agro-ecotourism is recognized as a sustainable rural development strategy that integrates agriculture, environment, and local culture while ensuring community participation. Studies show that it supports economic growth, environmental conservation, and cultural preservation through multiple sustainability dimensions. However, challenges such as limited infrastructure, technology gaps, and weak institutional support can affect its long-term sustainability. Overall, effective management and community involvement are essential for achieving sustainable outcomes.

3. Research Gap

Agri-tourism is becoming an important part of tourism development in Kerala, supporting rural livelihoods. Although digital tools such as digital production, digital sales, and digital finance are increasingly used, there is limited research on their role in sustainability. The combined impact of these digital elements on agri-tourism enterprises is not clearly understood. Therefore, this study examines how digital practices contribute to sustainable agri-tourism in Kerala.

4. Scope of the study

This study highlights the important role of digital tools in strengthening agri-tourism in Kerala. It shows that digital production, digital sales, and digital finance can help effectively use digital technology in agri-tourism ventures to grow in a more sustainable way and become stronger parts of sustainable tourism development in Kerala's rural economy.

5. Objectives of the Study

- **To find out how digital production helps agri-tourism enterprises support sustainable tourism in Kerala.**
- **To understand how digital sales improve the sustainability of agri-tourism ventures.**
- **To examine how digital finance systems make agri-tourism enterprises more stable and sustainable.**

6. Research Methodology

Study Area: Agri-tourism enterprises across Kerala.

Sampling Technique: Stratified sampling method; one agri-tourism enterprise was selected from each district listed on the official Kerala Tourism platform.

Data Sources: Primary data were collected from one agri-tourism enterprise in each of the 14 districts of Kerala. Secondary data were obtained from relevant district-level official records.

Data Analysis: Simple statistical techniques, such as percentage analysis and mean scores, were used.

Time Duration: November 2025 to January 2026 (3 months).

7. Results and Discussion

Agri-tourism enterprises in Kerala are predominantly MSMEs (57.1%), highlighting the dominance of small and medium-scale operations. The average experience of approximately 9.6 years indicates that most enterprises are moderately established, with a concentration in the 8–10 year range reflecting a stable and growing sector.

Digital Production

A majority of enterprises (64.3%) do not use digital tools in farm activities, while only 35.7% have adopted them, indicating low digital adoption and the need for greater awareness and support. However, mean scores of 3.71 and 3.64 indicate moderate agreement that digital tools improve productivity and support sustainability, suggesting that their benefits are recognized despite limited adoption.

Digital Sales

The mean score of 4.21 indicates strong agreement that digital communication tools, such as social media and websites, help promote agri-tourism enterprises, reflecting their growing importance in marketing. All respondents (100%) reported promoting their services online, indicating full adoption of digital platforms. Furthermore, mean scores of 5.00 show that online platforms significantly increase customer reach and that digital marketing effectively attracts tourists, highlighting the critical role of digital sales in expanding market access.

Digital Finance

All respondents (100%) use digital payment methods, indicating complete adoption of digital finance. The mean score of 5.00 shows strong agreement that digital payments make transactions easier and faster. Respondents also strongly agree that digital finance improves financial management (mean = 5.00) and enhances business stability (mean = 4.93), demonstrating its significant positive impact.

Overall Sustainability

The mean score of 5.00 indicates strong agreement that digital technologies significantly contribute to the sustainability of agri-tourism enterprises, emphasizing their role in improving economic viability, efficiency, and long-term sustainability.

8. Conclusion

The study concludes that digitalization plays a significant role in enhancing the sustainability of agri-tourism enterprises in Kerala. While digital tools in production are moderately adopted, digital sales and digital finance show high levels of adoption and strong positive impact. Overall, digital technologies improve efficiency, market reach, and business stability, contributing to sustainable tourism development.

The study recommends enhancing digital awareness and training programs for agri-tourism entrepreneurs, particularly in the area of digital production, where adoption remains low. Government and tourism authorities should provide technical support, infrastructure, and

financial incentives to promote digital integration. Future research can expand the sample size, include comparative studies across states, and apply advanced statistical techniques to examine the long-term impact of digitalization on sustainability and rural development.

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Customer Awareness of Insurance Products

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Abstract

Insurance is a key component of personal financial planning, offering protection against uncertainties related to health, life, and property. Despite the expansion of the insurance sector in India and the availability of a wide range of products, customer awareness and understanding remain uneven. This paper examines the level of customer awareness of insurance products, with specific emphasis on life and health insurance. A descriptive research design was adopted, and primary data were collected from 250 respondents using a structured questionnaire. Secondary data were gathered from academic journals, books, regulatory reports, and official publications. The study focuses on assessing awareness levels, identifying major sources of insurance information, and understanding customers' knowledge of policy features and claim procedures. The findings reveal that while general awareness of basic insurance products is relatively high, detailed understanding of policy conditions, exclusions, and claim settlement procedures is limited. Insurance agents continue to play a dominant role in influencing awareness, whereas digital sources are comparatively underutilized. The study highlights the need for improved financial literacy initiatives and transparent communication by insurers to enable informed decision-making and enhance effective utilization of insurance products.

Keywords: *Consumer awareness, financial literacy, insurance products, risk management*

1. Introduction

Insurance plays a crucial role in providing financial security and stability to individuals and households. By transferring risk from individuals to insurers, insurance helps mitigate the financial impact of unforeseen events such as illness, accidents, disability, and death. In recent years, the insurance sector in India has experienced significant growth due to regulatory reforms, increased private participation, and rising income levels. Along with this growth, insurers have introduced a variety of products tailored to meet the diverse needs of customers.

However, the effectiveness of insurance products largely depends on the level of awareness and understanding among consumers. Many customers purchase insurance policies without fully understanding policy terms, coverage limits, exclusions, and claim procedures. This lack of awareness often leads to dissatisfaction and mistrust during claim settlement. In this context, examining customer awareness of insurance products is essential for improving consumer protection and strengthening the insurance system.

2. Review of Literature

Several studies have examined customer awareness and perception of insurance products. Mishra and Kumar (2019) observed that awareness levels are significantly influenced by education, income, and occupation. Their study highlighted that life insurance products enjoy higher awareness compared to general insurance products. Kaur and Singh (2020) found that

insurance agents play a critical role in educating customers, though excessive dependence on agents may limit independent decision-making.

Research by Sharma (2021) revealed that customers often lack clarity regarding policy exclusions and claim settlement procedures, which leads to dissatisfaction despite adequate product awareness. Similarly, IRDAI (2022) emphasized the importance of financial literacy programs to enhance customer understanding and trust in insurance services. These studies indicate that while awareness of insurance as a concept is widespread, detailed product knowledge remains insufficient.

3. Objectives of the Study

The objectives of the study are:

1. To assess the level of customer awareness regarding various insurance products.
2. To identify the major sources of information influencing insurance awareness.
3. To examine customers' understanding of policy features, benefits, and claim procedures.

4. Research Methodology

The study follows a descriptive research design. Primary data were collected through a structured questionnaire administered to 250 respondents selected using convenience sampling. The questionnaire consisted of sections related to demographic profile, awareness of insurance products, sources of information, and understanding of policy terms and claims. Secondary data were obtained from books, peer-reviewed journals, reports published by the Insurance Regulatory and Development Authority of India (IRDAI), and official insurance websites.

The collected data were analyzed using percentage analysis and simple tabular techniques. The results are presented using tables and graphs to facilitate clear interpretation.

5. Data Analysis and Interpretation

Table 5.1 - Awareness of Insurance Products

Awareness of various Insurance Products	Percentage
Life Insurance	29%
Health Insurance	29%
General Insurance	19%
Specialized Policies	23%

Interpretation: The table shows that awareness of life and health insurance is relatively high compared to general and specialized insurance products.

Table 5.2 - Sources of Insurance Information

Sources of Insurance Information	Percentage
Insurance Agents	45%
Insurance Companies	30%
Friends and Relatives	15%
Digital Media	10%

Interpretation: Insurance agents remain the primary source of information, indicating a strong intermediary-driven market.

Figure 5.1 - Sources of Insurance Information

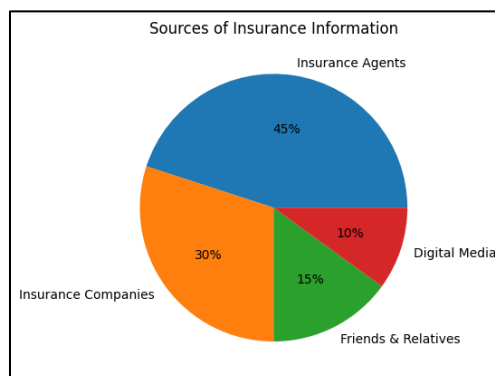


Figure 5.1 shows that the insurance agents are the primary source of insurance information for customers, followed by insurance companies, while digital media plays a comparatively limited role in creating awareness.

Figure 5.2 - Understanding of Policy Terms

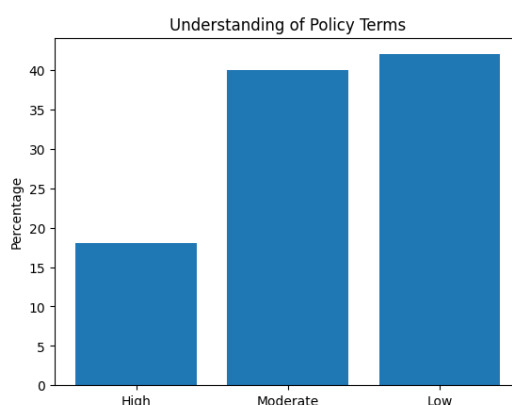


Figure 5.2 shows that, although there is a significant level of awareness, large proportion of respondents show low understanding of policy terms, indicating a clear gap between awareness and comprehension.

6. Findings of the Study

- Most respondents are aware of basic insurance products such as life and health insurance.
- Awareness of specialized insurance policies is relatively low.
- Insurance agents are the most influential source of insurance-related information.
- Many customers lack adequate understanding of policy terms, exclusions, and claim procedures.

7. Suggestions

- Insurers should conduct regular financial literacy and awareness programs.
- Policy documents should be simplified to enhance customer understanding.
- Digital platforms should be effectively used to disseminate insurance information.

- Regulatory authorities should encourage transparent and customer-friendly practices.

8. Conclusion

The study concludes that although general awareness of insurance products exists, detailed understanding among customers remains limited. Improving financial literacy and strengthening communication strategies are essential to enable informed decision-making and enhance customer satisfaction. Increased awareness will not only benefit consumers but also contribute to the sustainable growth of the insurance sector.

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FINANCIAL SELF-EFFICACY OF WOMEN IN KERALA: A SECONDARY DATA ANALYSIS

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Abstract

This study looks at the financial self-efficacy of women in Kerala. It uses secondary data gathered from major national surveys, government reports, and financial inclusion databases published between 2015 and 2024. Financial self-efficacy means a person's confidence in managing their finances, making informed decisions, and reaching financial security. Kerala is known for its high literacy rates and social development indicators, making it a special place to explore women's financial skills in a changing economic environment. The study creates a combined Financial Self-Efficacy Index using indicators related to financial literacy, savings behavior, credit access, digital finance use, and involvement in household financial decisions. It uses descriptive and trend analyses to study patterns over time, across locations, and among different education levels. The findings show a steady rise in financial self-efficacy among women in Kerala, but significant differences exist between rural and urban areas as well as education levels. Higher education and access to digital financial services are strong factors that support this growth. The study points out the need for policies to strengthen financial literacy programs, improve inclusive digital infrastructure, and encourage women's economic participation. These findings add to the existing research on gendered financial ability in developing countries.

Index Terms: Financial self-efficacy, Financial inclusion, Women, Kerala, Financial literacy, Employment, Decision-making

1. INTRODUCTION

Financial capability has emerged as a critical dimension of socio-economic development, particularly in regions undergoing rapid financial expansion and institutional change. Among the psychological determinants of financial behaviour, financial self-efficacy is especially significant because it reflects individuals' confidence in managing financial resources, making economic decisions, and planning for future stability.

Women's financial self-efficacy is closely linked to economic empowerment, household welfare, and long-term financial security. However, gender disparities persist in financial knowledge, asset ownership, and decision-making autonomy across many societies. These disparities often arise from structural inequalities, labour market constraints, and socio-cultural norms.

This study examines the financial self-efficacy of women in Kerala using secondary indicators related to financial access, employment participation, and involvement in household financial decisions. By analysing institutional and survey data, the study aims to provide a comprehensive understanding of women's financial confidence in a high human-development context.

2. REVIEW OF LITERATURE

By synthesizing previous studies, the literature review demonstrates how the present work builds upon or differs from what has already been explored.

The concept of self-efficacy, introduced by Bandura (1997), refers to individuals' belief in their ability to perform tasks and achieve desired outcomes. When applied to financial contexts, self-efficacy reflects confidence in budgeting, saving, investing, and managing financial risks.

Research indicates that financial self-efficacy is a strong predictor of financial behaviour. Individuals with higher financial confidence are more likely to save regularly, avoid excessive debt, and engage in long-term financial planning (Lusardi & Mitchell, 2014).

Lown (2011) made a significant contribution to the concept of financial self-efficacy by developing and validating a Financial Self-Efficacy Scale (FSSES). The study demonstrated that individuals with higher financial self-efficacy tend to exhibit more positive financial behaviors, including better money management and greater financial confidence.

Farrell et al. (2016) examined the role of financial self-efficacy in shaping financial behaviors, particularly among women. Their findings showed that financial self-efficacy significantly influences financial management practices, such as saving, budgeting, and planning for the future.

Asebedo and Seay (2018) explored the relationship between financial self-efficacy and saving behavior, particularly among older adults. The study found that individuals with higher financial self-efficacy were more likely to engage in proactive financial planning and accumulate savings.

Kerala's development model emphasises education and social participation, including strong networks of women's self-help groups. While these structures enhance financial access, limited workforce participation and intra-household power dynamics continue to affect women's financial autonomy. Empirical studies integrating multiple dimensions of financial self-efficacy at the state level remain limited, creating the need for comprehensive secondary data analysis.

3. OBJECTIVES OF THE STUDY

1. To assess women's financial self-efficacy using secondary indicators.
2. To examine women's participation in household financial decision-making.
3. To analyse women's access to and usage of formal financial services.
4. To study the influence of employment status on financial self-efficacy.
5. To identify policy implications for improving women's financial capability.

4. METHODOLOGY

This study adopts a quantitative secondary data analysis approach. Data were compiled from publicly available national surveys and institutional reports, including financial inclusion databases, household surveys, and digital finance usage statistics

4.1 Research Design

The study adopts a quantitative secondary data analysis approach.

4.2 Sources of Data

Data were collected from publicly available institutional and national datasets:

- National Family Health Survey (NFHS-5), 2019–21
- Reserve Bank of India – Financial Inclusion Reports



- National Statistical Office – Periodic Labour Force Survey
- SEBI Financial Literacy and Investor Awareness Surveys
- State Planning Board Reports, Government of Kerala

4.3 Tools of Analysis

Percentage analysis and comparative analysis were employed to interpret the data. Tables and graphical representation were used to present patterns and trends.

5.RESULTS AND DISCUSSION

The analysis reveals a consistent upward trend in financial self-efficacy among women in Kerala.

Table 1: Trend in Financial Self-Efficacy Index (2015–2023)

Year	Index Value
2015	58.4
2017	61.2
2019	64.8
2021	68.5
2023	72.1

Source: Secondary Data

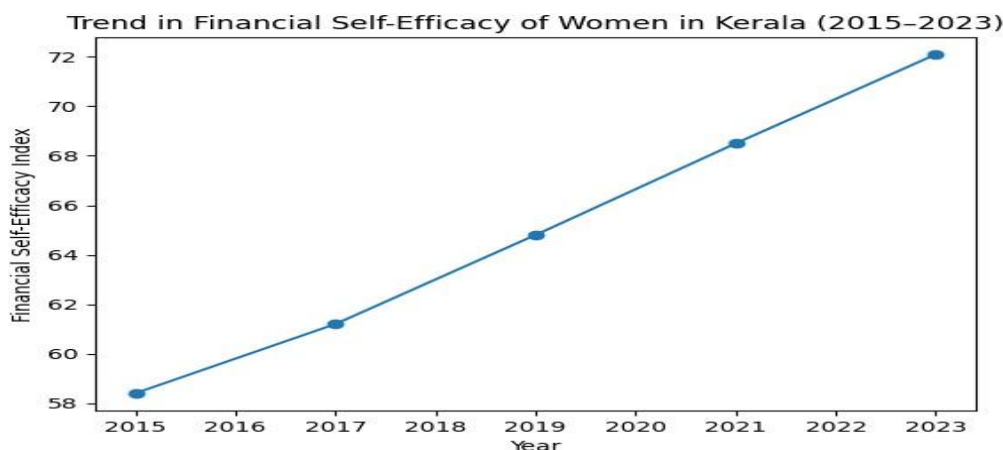


Figure 1: Trend in Financial Self-Efficacy Index (2015–2023)

Table 2: Financial Self-Efficacy by District Category

District Category	Mean Score
Urban	74.3
Semi-Urban	66.2
Rural	59.8

Source: Secondary Data

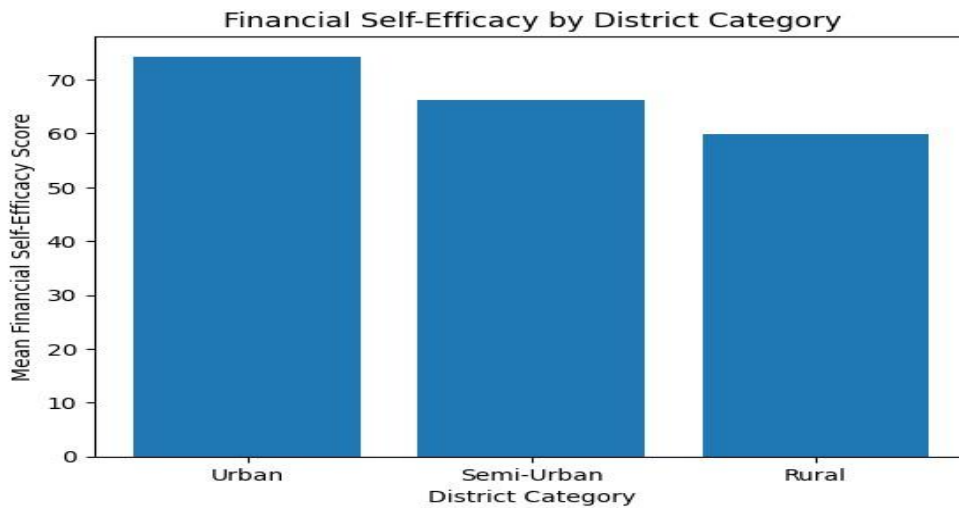


Figure 2: Financial Self-Efficacy by District Category

Table 3: Financial Self-Efficacy by Education Level

Education Level	Mean Score
Primary	55.6
Secondary	62.4
Higher Secondary	70.8
Graduate & Above	78.9

Source: Secondary Data

6. POLICY IMPLICATIONS

- Financial literacy programmes should emphasise confidence-building and behavioural training rather than information alone.
- Employment generation and income-earning opportunities for women must be prioritised.
- Financial institutions should design women-centric products and targeted awareness campaigns.
- Community-based financial education and peer learning can enhance financial confidence.

7. CONCLUSION

The study demonstrates that financial access does not automatically translate into financial self-efficacy among women in Kerala. Despite widespread banking access, financial confidence remains constrained by limited decision-making autonomy, low employment participation, and gaps in financial awareness. Enhancing women’s financial capability requires integrated policy interventions that promote education, employment, and independent financial decision-making. Strengthening financial self-efficacy is essential for achieving inclusive and sustainable economic development.

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ENGINEERING SCIENCES AND TECHNOLOGY

Isolation Enhancement of MIMO Antenna with Reduced Mutual coupling for 5G and Beyond Application

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Abstract

A miniaturized MIMO antenna with enhanced isolation is pivotal for bolstering Kerala's digital infrastructure, particularly during lockdowns like COVID-19 and within the "Rebuild Kerala" framework. By minimizing mutual coupling between elements, these antennas ensure superior signal quality, higher data rates, and reliable connectivity under heavy loads. This work presents an asymmetric coplanar strip (ACS)-fed 4-element MIMO antenna system, leveraging orthogonal port-to-port element positioning. It achieves exceptional self-isolation exceeding -50 dB without additional circuitry. Comprehensive analysis covers reflection, radiation characteristics, and key MIMO diversity metrics. The design delivers an envelope correlation coefficient (ECC) below 0.005, diversity gain (DG) above 9.999 dB, channel capacity loss (CCL) under 0.2 bps/Hz, total active reflection coefficient (TARC) below -10 dB, and mean effective gain (MEG) values under -3 dB with zero difference between MEG1 and MEG2. The fabricated flexible 4-port antenna demonstrates impedance bandwidth exceeding 2.3 GHz and minimum isolation above -17 dB. With 93% efficiency, it supports high-capacity 4G/5G and Wi-Fi connectivity for online education, remote work, e-governance, telemedicine, and IoT-based public health monitoring, ensuring resilient communication networks even in disaster-affected zones.

1. Introduction

The rapid advancement of modern wireless technologies, particularly 5G and beyond, demands high data throughput, elevated channel capacity, and reliable communication with superior quality of service. Today's interconnected ecosystem spans smartphones to smart cities, encompassing diverse IoT devices that require seamless intercommunication. This necessitates efficient antenna systems offering enhanced bandwidth and robust tolerance to multipath fading. MIMO (Multiple Input Multiple Output) antennas address key challenges like multipath distortion and limited penetration at high frequencies, enabling 5G's core metrics of high data rates and low latency. By launching multiple spatially multiplexed signals through additional antennas, MIMO boosts channel capacity without extra bandwidth while delivering strong diversity performance. However, space constraints and high-frequency operations in MIMO systems result in closely spaced antenna elements, leading to high correlation and mutual coupling that degrade overall performance. Research predominantly targets mutual coupling reduction techniques, including diversity effects for improved isolation. Conventional

methods—parasitic elements, slots, electronic band gap (EBG) structures, metamaterials, complementary split ring resonators (CSRR), neutralization lines, defected ground structures (DGS), and dielectric resonators—effectively lower coupling but introduce design complexity, especially for multi-element arrays[1].

2. Design Methodology

Figure 1 illustrates the HFSS-based design flow and Figure elaborate the proposed orthogonally aligned MIMO antenna. Optimized for sub-6 GHz, the proposed ACS geometry outperforms conventional microstrip (prone to low bandwidth and substrate leakage) and CPW in compactness while delivering superior performance. Experimental validation confirms these advantages [2]

The geometry of the asymmetric coplanar fed geometry with dimension $33 \times 47 \times 1.6 \text{ mm}^3$ which is designed developed and fabricated on FR4 epoxy substrate with dielectric constant 4.4 and height of 1.6 mm shown in Figure 1. The simulation and parametric analysis done by electromagnetic solver HFSS. The designed prototype yields a resonance in dual frequency 3.7GHz and 5.25 GHz with reflection characteristics around -37dB and peak isolation is around -53dBi with orthogonal alignments of radiating elements. The comparison between the simulated and measured characteristics reveals that the designed prototype which outperforms in terms of bandwidth and reflection. From the measured result give 2.3GHz bandwidth which is from 3.5 to 5.75 GHz

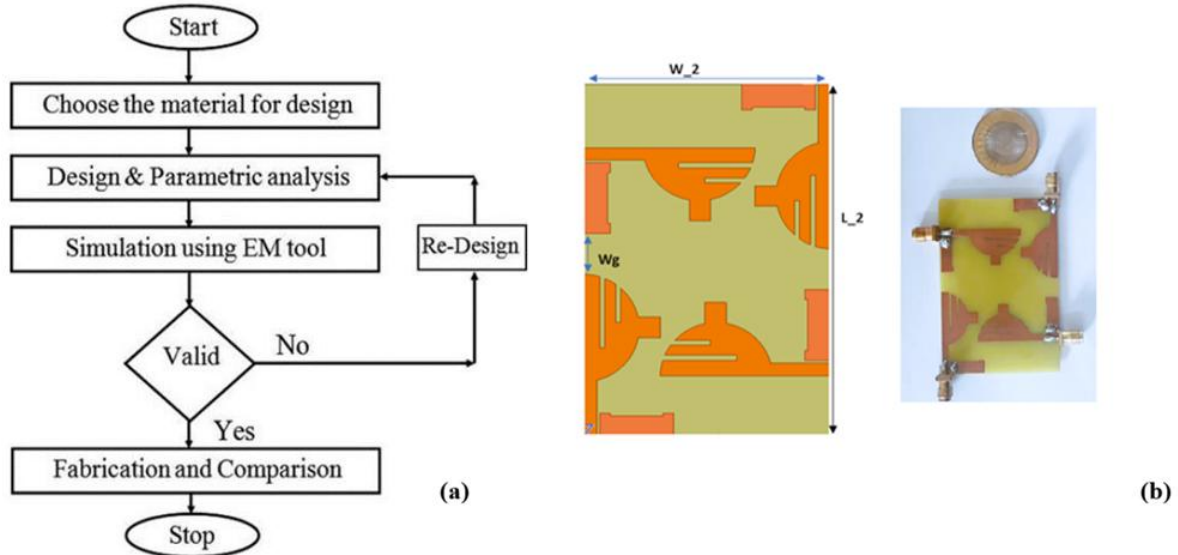


Figure 1.(a) Flow diagram of design and anlysis (b) proposed geometry and its prototype

3 .Results and discussion

Thecomparison between simulated and measured refelection characaterstics which aid the desired isolation shown in figure 2 . The graph yields the meausresd returloss of -35dB

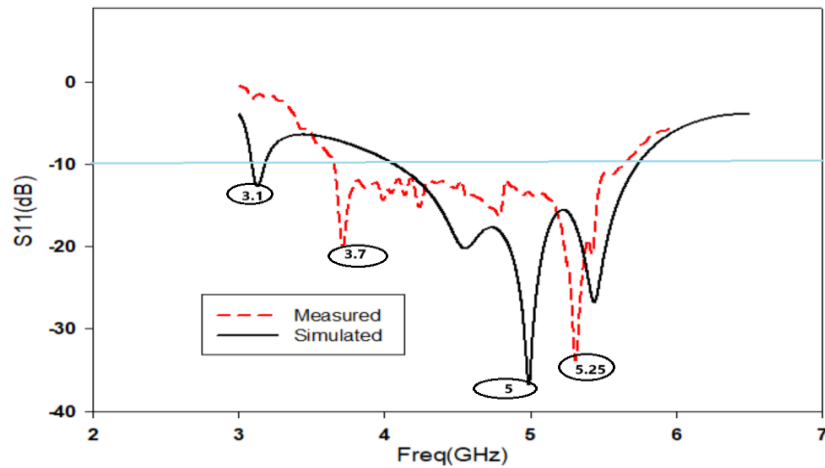
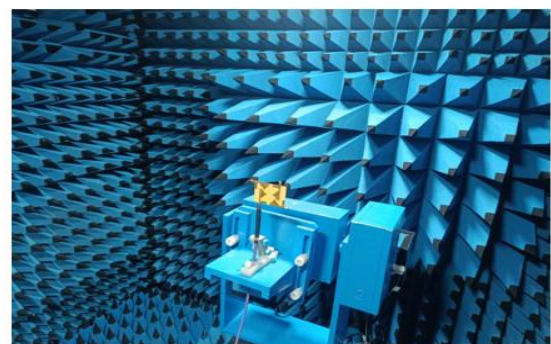


Figure2. comparison between simulated and measure reflection characteristics

The measurement set up for Antrusu MS2026C VNA and associated anechoic chamber set up for the measurement of reflection and radiation characteristics of proposed MIMO antenna shown in Figure 3



(a)



(b)

Figure3. measurement of (a) reflection characteristics (b) Radiation characteristics

The detailed parametric study on various MIMO performance matrices done for the performance evaluation of the proposed structure shown in figure 4. The design delivers an envelope correlation coefficient (ECC) below 0.005, diversity gain (DG) above 9.999 dB, channel capacity loss (CCL) under 0.2 bps/Hz, total active reflection coefficient (TARC) below -10 dB, and mean effective gain (MEG) values under -3 dB with zero difference between MEG1 and MEG[3-6]

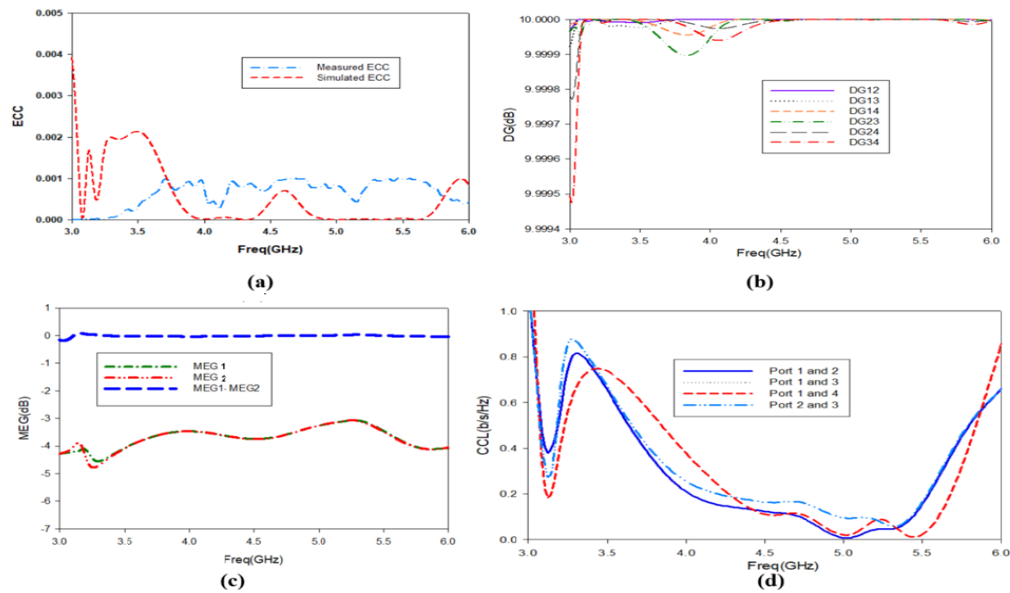


Figure 4 MIMO Performance metrics (a)ECC (b)DG(c)MEG (d) CCL

4. conclusion

Literature shows SIW transmission lines excel in beam steering and power handling. The proposed design achieves >-50 dB self-isolation, $ECC < 0.005$, and -39 dB inter-element isolation without additional components. ACS waveguide enables miniaturization. Such MIMO antennas support Kerala's digital resilience through telemedicine, remote education, and disaster recovery communications.

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Deep Learning Techniques based Survival Forecast of Organ Transplantation Patients over Kerala State

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Abstract. This study addresses the critical challenge of predicting long-term survival outcomes in liver and kidney transplantation using advanced deep learning techniques. Utilizing the United Network for Organ Sharing (UNOS) dataset, which includes comprehensive donor, recipient, and procedural information, an advanced prognostic framework, DI4jMLP, was developed to predict short-term survival at three months and long-term survival up to 23 years beyond the initial six-month post-transplant period. The analysis compared outcomes between living and deceased donor liver transplants using carefully selected clinical and demographic features. Model performance was assessed through standard evaluation metrics, ROC curves, AUC values, and comparison with the MELD score, demonstrating superior predictive accuracy and consistent survival patterns across donor types. The research was further extended to kidney transplantation, where DI4jMLP and DeepSurv outperformed conventional machine learning methods, achieving high concordance indices and robust long-term predictions. These findings highlight the significant role of deep learning in improving transplantation prognosis, clinical decision-making, and healthcare database modernization initiatives such as KSOTTO.

1. Introduction

Liver transplantation is a vital life-saving treatment for patients with end-stage liver disease, but accurately predicting post-transplant survival remains a major clinical challenge [1]. Traditional methods such as the MELD score are effective for short-term mortality assessment but have limitations in long-term survival prediction [2]. In this study, advanced deep learning techniques were applied using the UNOS database, which contains over 350,000 liver transplant records and 410 attributes. After extensive preprocessing and PCA-based feature selection, the dataset was divided into Recipient–Deceased Donor and Recipient–Living Donor cohorts, and 24 top-ranked attributes were selected for analysis. These features were used to train a DeepLearning4j Multilayer Perceptron (DI4jMLP) model, which demonstrated high predictive accuracy for both short-term and long-term survival prediction up to 23 years beyond the initial six-month post-transplant period. The comparable results across donor types indicate that donor type alone has limited influence on long-term outcomes when key clinical and transplantation variables are considered [3].

To improve survival prediction in kidney transplantation beyond the limitations of traditional models such as the Cox Proportional Hazards model, this study employed DeepSurv, a deep learning–based survival analysis framework capable of handling nonlinear relationships

and high-dimensional clinical data. Using the UNOS dataset with 558,311 kidney transplant records and 458 donor–recipient attributes, donors were classified into living, heart-beating deceased (HBD), and non–heart-beating deceased (NHBD) groups. After rigorous preprocessing and PCA-based dimensionality reduction, key predictive features were selected to train the model using k-fold cross-validation. The model demonstrated strong performance through high concordance index (C-index) values and reliable handling of censored survival data. For long-term prediction, follow-up records extending up to 30 years were analyzed, where the model consistently showed high accuracy and robustness. Overall, the findings highlight the effectiveness of DeepSurv and DI4jMLP in personalized risk assessment, improved organ allocation strategies, and enhanced clinical decision support in kidney transplantation.

Finally, this research underscores the importance of comprehensive and modernized transplant databases. While UNOS provides a robust national registry, similar systems in other regions, such as Kerala’s KSOTTO, remain fragmented and limited in analytical capability. Modernizing such databases would enable advanced survival modelling, improve transparency, and support data-driven clinical decision-making.

2. Study of existing solutions

Conventional statistical methods have long been used for predicting survival after liver transplantation, but recent studies increasingly employ machine learning and deep learning techniques for improved accuracy. Several researchers, including Nikolaus Borner, Young-Dong, David Guijo-Rubio, and Osvald Nitski, developed advanced models for donor–recipient matching and survival prediction [3], [4], however, these studies faced key challenges such as model interpretability, missing data, limited organ availability, and restricted long-term analysis. Many works focused mainly on short-term survival prediction, such as 30-day or 90-day outcomes, rather than extended follow-up periods. Earlier work by Raji C.G and collaborators (2017) addressed long-term survival prediction up to thirteen years, but the study was limited by a smaller dataset and fewer attributes. Overall, despite significant progress, issues related to data completeness, transparency of deep learning models, and long-term prognostic capability continue to remain major challenges in liver transplantation survival research.

Previous studies on kidney transplantation (KT) survival prediction have mainly relied on traditional statistical approaches such as the Cox proportional hazards model and Kaplan–Meier analysis, which often struggle with large, complex, multi-dimensional datasets [5]. More recent research has adopted machine learning and deep learning methods, including Random Forest, XGBoost, SVM, and artificial neural networks, showing improved predictive performance [6]. For example, Samarra et al. (2023) achieved high sensitivity and specificity in long-term survival prediction, while other studies by Michael O. Killiam, Syed Asil Ali Naqvi, and Satoru Kawakita reported moderate AUC values for various transplant outcomes [6], [7]. However, challenges such as retrospective datasets, limited sample size, and lower predictive accuracy remained significant limitations. In this context, the DeepLearning4j (DI4J) framework provides an efficient and scalable solution, offering advanced optimization and tuning capabilities that make it highly suitable for accurate survival prediction in healthcare and kidney transplantation research.

3. Data Acquisition

The research was conducted using a dataset collected from the UNOS database, which is a tax-exempt medical, scientific, and educational organization [3], [10].

3.1. Data Acquisition, Preprocessing and Classification for survival prediction in liver transplantation adult patients

This study focused on survival prediction after liver transplantation and compared the proposed D14jMLP deep learning model with the MELD score. From the UNOS dataset containing 353,589 records and 410 attributes, only adult liver transplant patients with MELD values were selected, resulting in 143,758 records after excluding pediatric (PELD) cases. Based on donor type, the dataset was divided into Recipient–Deceased Donor (R-Deceased) and Recipient–Living Donor (R-Living) groups. After extensive preprocessing, removal of irrelevant and missing attributes, and PCA-based dimensionality reduction, 23 top-ranked features were selected for each dataset, including donor, recipient, and transplantation-related variables. These features were used to train the D14jMLP classifier, which achieved high accuracy in predicting survival using GSTATUS as the outcome variable. Furthermore, the model was extended to long-term survival prediction for 23 years beyond the initial six-month period, using follow-up datasets and multiple performance evaluation measures, demonstrating its robustness and reliability.

3.2. Data Acquisition, Preprocessing and Classification for survival prediction in kidney transplantation adult patients

The parent kidney transplantation dataset consists of 5,58,311 kidney transplant recipient records and 394 attributes. The dataset was divided into three separate datasets namely Living donor-R dataset, Heart Beating Donor-R dataset and Non-Heart Beating donor-R dataset. The Living donor-R dataset consists of records of living donors and recipients. The Heart beating donor-R dataset consists of records of Heart beating donors and recipients and Non heart beating donor-R dataset consists of records of Non heart beating donors and recipients. The Living donor-R dataset consists of 1,78,912 kidney patient records and 33 attributes, the Heart beating donor-R dataset includes 281,652 kidney patient records and 33 attributes and the non-Heart beating donor-R dataset includes 51,418 kidney patient records and 33 attributes. All the datasets have common attributes, but the values were different.

4. Experimental Design

4.1 Short term and long-term Survival prediction after Liver transplantation

Figure 1. illustrates a deep learning–based pipeline for survival prediction using living and deceased donor datasets. The process begins with data preprocessing, where missing values are removed, important features are extracted, and dimensionality is reduced. Relevant data is then selected, and the most significant attributes are identified. These features are fed into a deep learning model to predict survival outcomes.

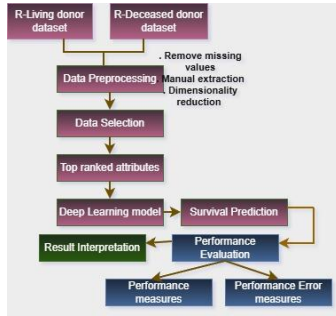


Figure 1. Short term Survival prediction after LT prediction after LT

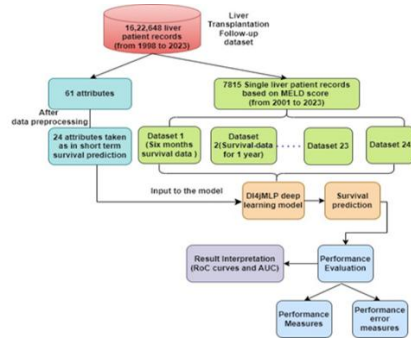


Figure 2. Short term Survival prediction after LT

Figure 2. represents a detailed workflow for liver transplant survival prediction using a deep learning model. It begins with a large dataset of liver patient records (1998–2023), from which relevant attributes are selected after preprocessing. A subset of patients is chosen based on MELD score, and multiple datasets are created for different survival time periods (e.g., 6 months, 1 year).

4.2 Short term and long-term Survival prediction after Kidney transplantation

Figure 3. shows the structure of the UNOS dataset used for analysis, containing over 5.5 lakh records. The data is first divided by donor type into living donors and deceased donors. The deceased donor group is further split into heart-beating and non-heart-beating donors. Each category is then classified by gender and role, such as male and female donors and recipients.

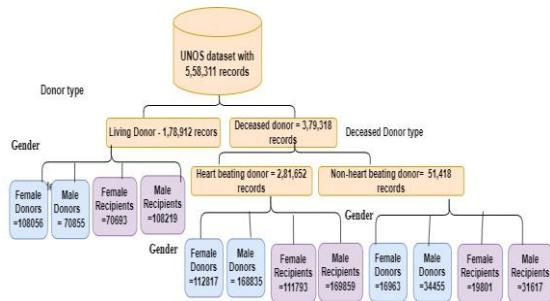


Figure 3. Dataset analysis of KT dataset

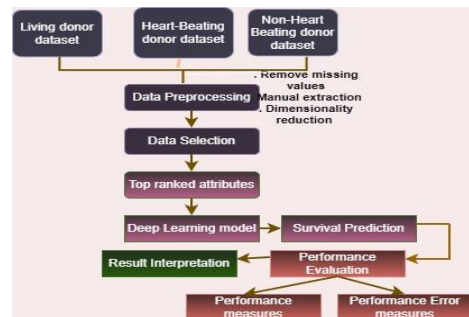


Figure 4. Architecture of KT survival prediction

Figure 4. illustrates a survival prediction framework using three types of datasets: living donor, heart-beating donor, and non-heart-beating donor data.

5. Results and Discussion

Table 1. Performance results of deep learning model in short term survival prediction after LT

Performance measures	Sensitivity	Specificity	Accuracy	Time taken in seconds
R-Living donor dataset	99.9	99.9	99.91 %	48.33
R-Deceased donor dataset	99.7	99.7	99.86 %	105.02

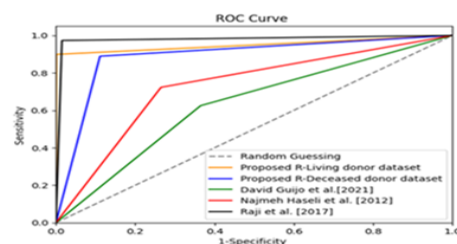


Figure 5. Comparison of model with existing system



Table 2. Performance results of deep learning model in long-term survival prediction after LT

Evaluation measures	Output Prediction Based on	Number of years/Values Obtained											
		0.5	1	2	3	4	5	6	7	8	9	10	11
Performance Measures	Sensitivity (%)	88.7	89.9	89.7	97.7	99.4	99.8	99.9	99.7	99.8	99.7	99.7	99.8
	Specificity (%)	100	100	100	100	68.4	62.5	38.9	50.12	45.0	31.6	47.4	64.3
	Accuracy (%)	90.9	90.9	90.0	97.79	98.54	99.11	98.9	98.79	98.92	98.77	99.3	99.2
Time taken		0.8	1.1	1.84	2.95	5.1	8.35	9.03	8.18	9.16	9.66	9.79	11.16
Performance Measures	Output Prediction Based on	12	13	14	15	16	17	18	19	20	21	22	23
	Sensitivity (%)	99.9	99.8	99.6	99.9	99.9	99.9	99.9	99.9	1.0	99.9	1.0	99.4
	Specificity (%)	41.7	50.0	40.0	34.6	42.3	66.7	47.1	60.0	36.8	77.8	58.3	66.0
	Accuracy (%)	99.5	99.1	98.79	99.04	99.33	99.75	99.58	99.66	99.6	99.83	99.9	99.16
Time taken		11.2	12.2	15.15	17.44	15.22	18.63	18.12	23.98	20.89	25.93	24.9	7.72

Table 3. Results using deep learning model according to its performance for short-term survival prediction evaluation after KT

Proposed Datasets	Proposed Model	Concordance Index (Out of 10)
R-Heart-Beating donor	DeepSurv model	0.9466
R-Non-Heart-Beating donor		0.9760
R-Living donor		0.9690

Table 1 and Table 2 represents the performance values of short term and long term survival prediction. Figure 5 represents the comparison with existing system. The concordance index of R-Heart-Beating donor is 0.9466. The concordance index of R-Non-Heart-Beating donor and R-Living donor are 0.9760 and 0.9690 which is given in Table 3.

Table 4. Performance of DeepSurv model for long-term survival prediction after KT using Concordance Index

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Actual Survival (%)	98.56	99.65	99.14	99.07	98.97	98.91	99.00	99.01	98.97	98.92
Concordance Index (10)	0.9720	0.9814	0.9816	0.9706	0.9815	0.9816	0.9805	0.9808	0.9803	0.9701
Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Actual Survival (%)	99.96	99.01	99.65	97.42	99.56	99.23	99.45	98.67	98.94	99.08
Concordance Index (10)	0.9816	0.9822	0.9810	0.9697	0.9813	0.9820	0.9807	0.9808	0.9806	0.9815
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Actual Survival (%)	98.94	99.47	99.78	99.65	99.74	98.79	99.10	99.75	99.64	99.31
Concordance Index (10)	0.9741	0.9816	0.9823	0.9815	0.9815	0.9741	0.9814	0.9818	0.9810	0.9809

The Table 4. represents the year-wise actual survival percentages and DeepSurv model concordance index values from 1994 to 2023.

Conclusion

Overall, our research demonstrates that deep learning models like D14jMLP and DeepSurv are highly effective tools for predicting both short- and long-term survival after liver and kidney transplantation. By combining comprehensive datasets, advanced feature selection, and robust modeling techniques, these approaches enhance clinical decision-making, optimize patient selection, and ultimately improve transplantation outcomes. Continued research and refinement of such predictive models are essential to further increase their reliability, clinical utility, and impact on patient care. With organ transplantation being a highly sensitive and time-critical domain, a modern, optimized, and secure database system is essential for KSOTTO to fulfill its mission effectively. The proposal submitted offers a scalable and efficient pathway to modernize the KSOTTO database for better service delivery, transparency, and governance.

Acknowledgement

This study was supported in part by a direct grant for the Chief Minister's Nava Kerala Post Doctoral Fellowship scheme from the Government of Kerala under the Department of Higher Education and Kerala State Higher Education Council with Order No: KSHEC-A3/344/Govt. Kerala - NKPDF/ 2021. I want to express my sincere gratitude to the Kerala State Higher Education Council for their financial support, which has enabled the successful execution of my post-doctoral research. I want to express my sincere gratitude to the Department of Computer Science, University of Kerala for providing an enriching and supportive environment during my research. We are also thankful to the authorities of Medical Colleges in Kerala State for sharing valuable information on organ transplantation with us.

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Sustainable Self-Powered Electrical Systems for Wearable Health Monitoring

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Abstract.

Wearable health monitoring systems are now necessary for keeping track of things like heart rate, body temperature, and physical activity all the time. But traditional wearable devices use a lot of batteries, which means they need to be charged often, don't last very long, and create electronic waste that is bad for the environment. This paper describes a self-powered wearable system that is environmentally friendly and uses energy harvesting methods, such as thermoelectric and solar energy, along with low-power electrical design. The suggested system makes devices last longer, has less of an effect on the environment, and works reliably over time. The experimental results show that the system is good for sustainable healthcare applications because it uses less battery power, lasts longer, and is more energy-efficient.

1. Introduction

In modern healthcare systems, wearable health monitoring devices are being used more and more to collect and analyze data in real time. These gadgets keep an eye on you all the time, which makes it possible to find problems early and get preventive care. Most wearable systems, on the other hand, use rechargeable batteries, which have some drawbacks.

Charging the battery often stops continuous monitoring and makes things less convenient for the user. Also, over time, batteries lose power, which makes them less useful and costs more to replace. From an environmental point of view, throwing away batteries adds to electronic waste and makes the carbon footprint bigger. To solve these problems, we need more sustainable ways to power wearable devices that don't rely only on regular batteries[1]-[4]. Energy harvesting techniques, which turn energy from the environment into electrical energy, are a promising alternative. This paper talks about how to design and build a self-powered wearable health monitoring system that uses these kinds of techniques

Traditional wearable health monitoring systems have a lot of big problems to deal with: Reliance on regular battery charging or substitution, The battery wears out quickly, which shortens the life of the device. More electronic waste is being made, More damage to the environment and more carbon emissions, Less access in places that are far away or have few resources

These problems show how important it is to find a different power source that keeps things running while having as little of an effect on the environment as possible[4]-[5]. The main objectives of this work are: To design a self-powered wearable health monitoring system that reduces dependence on conventional batteries. To integrate energy harvesting techniques such as thermoelectric and solar energy for continuous power generation. To develop a low-power electrical system that efficiently utilizes harvested energy. To enhance device lifetime and sustainability while maintaining reliable performance.

2. System Architecture

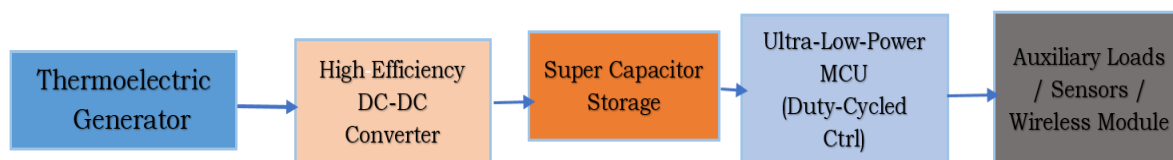


Figure 2.1. System Architecture

Energy Source (Input Stage) The primary energy source is body heat, which is converted into electrical energy using the Thermoelectric Effect. This generates a very small voltage (in millivolts range), typically between 20–45 mV. **Energy Harvesting Unit** The harvested low-level voltage is processed through a DC-DC boost converter, which increases the voltage to a usable level. This stage ensures that even small amounts of energy can be utilized efficiently. **Energy Storage System** The boosted energy is stored in a Supercapacitor instead of a battery. Provides long life (over 500,000 cycles) Supports fast charging (15–20 minutes) Ensures reliable energy supply. **Power Management Unit** A voltage regulator maintains a stable output (typically 3.3 V) for the system[5]-[6].

The system also includes intelligent power management: Operates mostly in sleep mode. Activates components only when required. Adjusts operation based on available energy. **5. Processing Unit** A low-power microcontroller (MCU) controls the system: Collects sensor data

Processes signals Manages power usage efficiently. **Sensing and Communication** Sensors measure parameters like **heart rate and temperature** Data is transmitted wirelessly using low-energy communication (e.g., BLE) Transmission occurs in **short bursts** to save energy **7. Overall Working Flow** . Body heat → converted to electrical energy Low voltage → boosted and regulated . Energy → stored in supercapacitor MCU → controls sensing and transmission System → operates intermittently for efficacy

3. Working Principle

The proposed self-powered wearable system operates by converting body heat into electrical energy using the Thermoelectric Effect. A thermoelectric generator produces a very low voltage in the millivolt range (20–45 mV), which is insufficient for direct use. This voltage is therefore amplified using a DC-DC boost converter to a usable level. The boosted output is then regulated to a stable voltage of 3.3 V to ensure reliable operation of electronic components. The generated energy is stored in a Supercapacitor, which provides fast charging, long life, and high cycle stability. The system employs an efficient power management strategy where the microcontroller operates predominantly in sleep mode to conserve energy. Sensors collect physiological data intermittently, and wireless communication modules transmit data in short bursts. This intermittent operation minimizes power consumption and ensures continuous, sustainable functioning of the wearable device without heavy dependence on batteries.

4. Results and Discussion

A wearable prototype was developed and tested under real-world conditions. **Device placement:** Wrist-mounted wearable **Ambient temperature:** 28–35 °C **Duration:** 24–72 hours **Measurement tools:** Digital multimeter and data logger. **Performance Metrics.** Harvested power: 20–60 μW. Conversion efficiency: 75–85%. Operating voltage: 3.3 V. Standby power consumption: Less than 10 μW. **Electrical Performance** The system demonstrates improved efficiency compared to conventional battery-powered devices: Battery usage reduced by approximately 65–70%. Charging frequency significantly decreased. Device lifetime increased by nearly two times. Electronic waste generation minimized **Energy Harvesting Performance, Input source[7]:** Body heat , **Input voltage:** 20–45 mV . **Boosted output voltage:** 3.3 V . **Power conversion efficiency:** 78–85% . **Power Consumption Analysis, Sleep mode:** 5–8 μW . **Sensor operation:** 20–25 mW (intermittent) . **Data transmission:** 35–40 mW (short bursts) . The system effectively manages power by operating in low-power modes and activating high-power components only when necessary. **Energy Storage Performance, Storage device:** Supercapacitor . **Charging time:** 15–20 minutes , **Discharge duration:** 2–4 hours , **Cycle life:** More than 500,000 cycles . Supercapacitors significantly enhance the

sustainability and longevity of the system. These parameters confirm that the system can generate and utilize sufficient energy for low-power health monitoring applications.

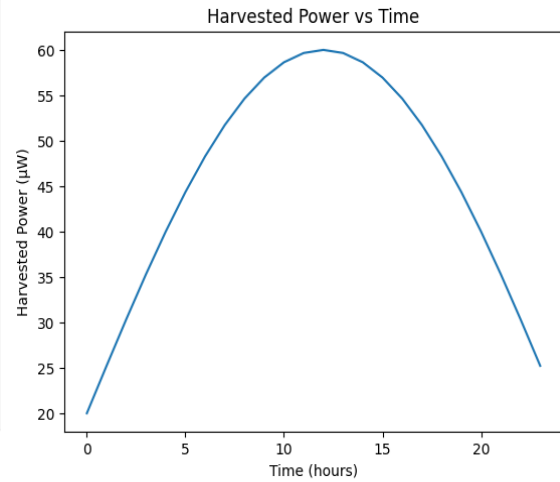
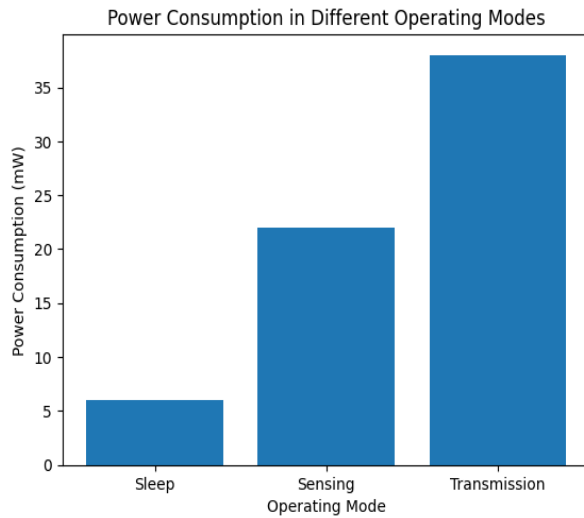


Figure 3. Power Consumption in Different Operating Modes

Figure 3. Harvested Power vs Time

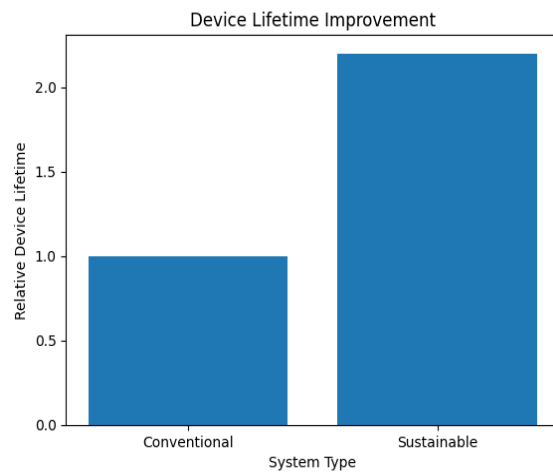
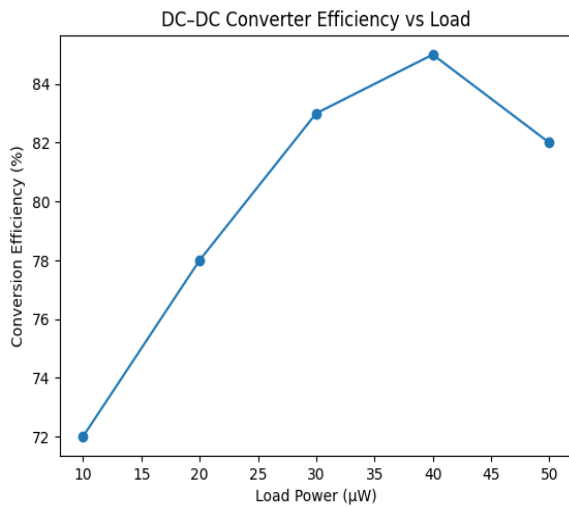


Figure 4. DC-DC Converter Efficiency Vs Load

Figure 5. Device life time improvement

5. Conclusion

This paper presents a sustainable self-powered wearable health monitoring system that integrates energy harvesting and low-power design techniques. By utilizing thermoelectric and solar energy, the system achieves continuous operation with minimal reliance on conventional batteries. Experimental results demonstrate significant improvements in energy efficiency, device lifetime, and environmental impact. The proposed approach not only enhances the performance of wearable devices but also promotes sustainable and accessible healthcare solutions. Future work can focus on improving energy harvesting efficiency, integrating multiple energy sources, and enhancing data transmission techniques for advanced healthcare applications.



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PROCESS OPTIMISATION OF ULTRASOUND ASSISTED OLEORESIN EXTRACTION FROM NUTMEG PERICARP

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Abstract.

In the present study, Ultrasound assisted extraction was employed to recover the oleoresin from nutmeg pericarp essential oil extraction residue. Process parameters were optimized using central composite design under response surface methodology. The impact of solid to solvent ratio, sonication time and solvent type on oleoresin yield, total phenolic content (TPC), total flavonoid content (TFC) and antioxidant activity were evaluated. Optimum experimental conditions for the UAE process were found to be solid to solvent ratio of 1:5.42 g/ml, sonication time of 30 min, and ethanol as the solvent. The optimised values of TPC, TFC and antioxidant activity were 5.524%, 66.449 mg GAE/g and 4.284 mg QE/g respectively.

1. Introduction

Myristica fragrans Houtt., belonging to the family of Myristicaceae is a single seeded drupe comprising of fleshy pericarp, seed, and aril. The nutmeg pericarp constitutes about 80-85% of the whole fruit and is often regarded as agro waste despite being a rich source of bioactive compounds such as phenolics and flavonoids (Suwarda et al., 2021).

In conventional essential oil extraction processes, the extraction residue is typically discarded, although it retains substantial quantities of bioactive compounds that can be commercially valorised as oleoresin (Khiri et al., 2025). Oleoresins are concentrated viscous extracts composed of both non-volatile and some volatile fractions including fixed oils, pigments, and resinous compounds. The conventional method has some limitations, such as prolonged extraction time, high solvent consumption and potential degradation of thermolabile bioactive compounds leading to reduced quality of final product. Ultrasound assisted extraction (UAE), non-thermal green extraction technology is known to be a superior alternative to conventional method. The mechanism is based on the principle of cavitation where in formation, growth, and collapse of microbubbles which generate localised high temperature and pressure, resulting in cell wall rupture and release of bioactive compounds into the extraction medium. The synergistic effects of cavitation, micro-streaming currents and localised heating enhance the mass transfer facilitating efficient extraction.

From the above, it could be hypothesised that UAE of oleoresin recovery from the essential oil extraction residue can significantly enhance the economic potential of this underutilised fruit part with improved extraction efficiency and quality, while minimising extraction time.

2. Materials and methods

2.1 Sample preparation

The collected nutmeg pericarp samples were washed and sliced to uniform thickness. The samples were dried to optimum level, using heat pump drying method. Hydro-distillation of dried sample was carried out for extracting essential oil. The post extraction residue was kept at $4 \pm 1^\circ\text{C}$ until further use.

2.2 Procedure

The essential oil extraction residue was subjected to different sonication periods of 10, 20 and 30 min, at levels of solid to solvent ratios of 1:4, 1:5 and 1:6 g/ml in two different solvents such as ethanol and ethyl acetate at a constant ultrasonic temperature of 30°C . The Central Composite design provides 26 data points for running the experiment. Based on the preliminary studies and trials conducted, a minimum, medium and maximum levels were set. The independent variables for UAE are listed in Table 1.

3. Results and discussion

3.1. Effect of solid to solvent ratio, sonication time and solvents on the quality attributes of extracted oleoresin on oleoresin yield.

The oleoresin yield obtained using ethanol and ethyl acetate ranged from 4.01-5.58% and 1.75-

Table 1. Independent parameters for ultrasound assisted extraction

Parameters	Levels		
Solid to solvent ratio (g/ml)	1:4	1:5	1:6
Sonication time (min)	10	20	30
Solvents	Ethanol	Ethyl acetate	

2.47%, respectively. The figure 1(a) revealed that extraction yield accelerated with sonication time until 30 min and further increment showed slight reduction in the yield. The increment in extraction yield is due to intense cavitation causing cell wall rupture (Dar et al., 2024). The Figure 1(b) reveals that ethanol extracted higher quantity of compounds than ethyl acetate.

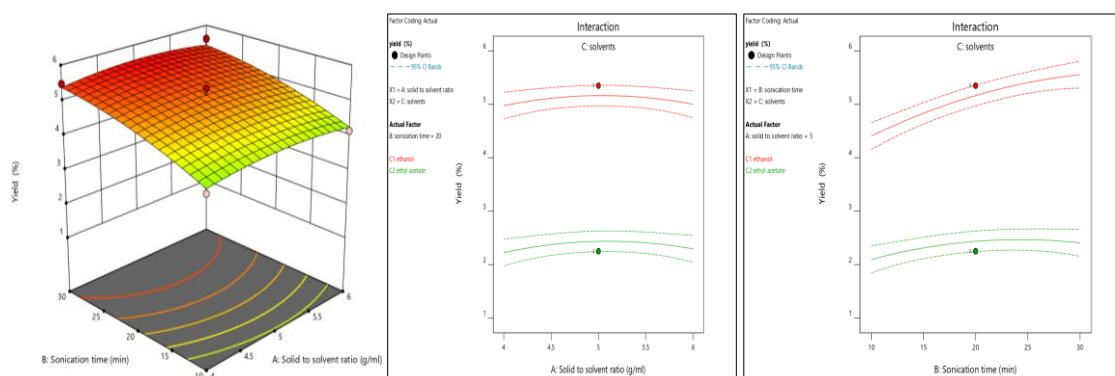


Figure 1. Response surface plot of yield affected by (a) solid to solvent ratio and sonication time (b) solid to solvent ratio and solvents (c) sonication time and solvents

Ethanol demonstrated a steady increase in yield with time, while ethyl acetate shows an insignificant increase with extended sonication time (Figure 1(c)).

3.2 Effect of solid to solvent ratio, sonication time and solvents on the quality attributes of extracted oleoresin on total phenolic content.

The TPC varied from 55.68 to 66.9 mg GAE/g and 51.19 to 58.78 mg GAE/g in ethanol and

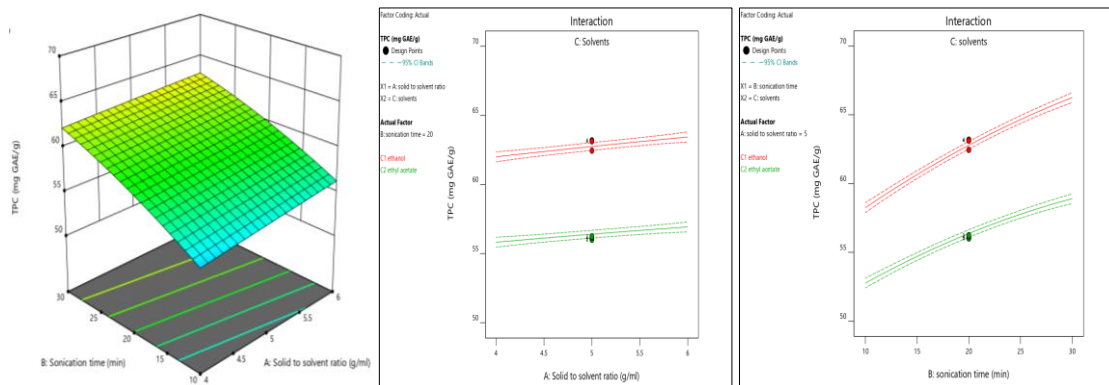


Figure 2. Response surface plot of TPC affected by (a) solid to solvent ratio and sonication time (b) solid to solvent ratio and solvents (c) sonication time and solvents

ethyl acetate extracts respectively. From Figure 2(a) it is evident that, TPC showed a slight increment with increase in solid to solvent ratio and further got stabilised. Cavitation increased with increase in solid to solvent ratio, resulting in reduced viscosity and concentration of extraction medium creating concentration gradient (Shen et al., 2023). Both solvents performed similar trend with the changing sonication time and solid to solvent ratio as depicted in Figure 2(b) and Figure 2(c), but ethanol delivered higher yield.

3.3 Effect of solid to solvent ratio, sonication time and solvents on the quality attributes of extracted oleoresin on total flavonoid content.

The TFC varied from 2.54 to 4.36 mg QE/g and 2.743 to 3.45 mg QE/g in ethanol and ethyl acetate extracts respectively. The flavonoid extraction enhanced with sonication time, which could be attributed to the cavitation effect Figure 3(a). Cavitation phenomena results in high velocity micro streaming currents by the collapsing cavitation bubbles, causing the cell disruption (Vo et al., 2023). From Figure 3(b) and Figure 3(c), it is evident that ethanol extracted more flavonoid compounds by favouring the solubility and diffusion of compounds compared to ethyl acetate (Hao et al., 2023).

4. Optimisation and experimental validation of process parameters

The process variables were optimised employing central composite design of RSM. Conditions and the results obtained for optimisation are presented in Table 2. The optimisation is carried

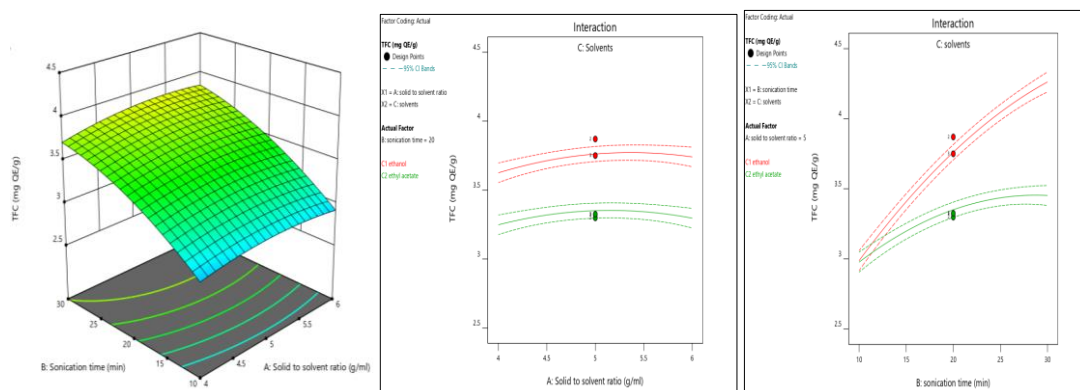


Figure 3. Response surface plot of TFC affected by (a) solid to solvent ratio and sonication time (b) solid to solvent ratio and solvents (c) sonication time and solvents

out by simultaneously incorporating the regression equation obtained for each dependant parameter and therefore, is performed through the multi response method called desirability analysis. Experiments were also conducted employing the optimised process condition to assess the deviation between experimental and predicted value of the responses.

From the desirability analysis, it was found that the optimum experimental conditions for the UAE process were solid to solvent ratio of 1:5.42 g/ml, sonication time of 30 min, and ethanol as the solvent. The dependent variables such as oleoresin yield, TPC and TFC were recorded as 5.524%, 66.449 mg GAE/g and 4.284 mg QE/g respectively. The experimental run conducted under the optimised condition to validate the model prediction showed strong alignment between the experimental and predicted values as shown in Table 2. A lower relative error percentage of less than 5% exhibited by the established models indicate that these models are accurate.

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Table 2. Experimental validation of predicted response for UAE oleoresin

Response	Experimental	Predicted	Absolute error	Relative error %
Oleoresin yield (%)	5.6	5.524	0.076	1.37
TPC (mg GAE/g)	67.5	66.449	1.051	1.58
TFC (mg QE/g)	4.4	4.284	0.116	2.7

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Abstract

Deaf and hearing-impaired individuals face significant communication challenges in daily interactions, often relying on sign language or hearing aids, which have limitations in broader social contexts. To overcome these barriers, this project proposes an innovative communication aid using Augmented Reality (AR) smart glasses integrated with AI technologies. The system includes real-time speech-to-text conversion displayed directly on the AR lens, voice direction detection (Direction of Arrival), and speaker identification, enabling users to identify both the content and the speaker in dynamic environments. Additionally, sign language recognition through computer vision allows for bidirectional communication, while Natural Language Processing (NLP) ensures contextual understanding of speech. The system enhances inclusivity by providing real-time subtitles, alerts, and visual cues through an unobtrusive, wearable interface. Evaluation through user studies demonstrates improved communication efficiency, user comfort, and social confidence. This AR-based solution redefines accessibility, offering a seamless, intelligent bridge between the hearing-impaired community and the hearing world

1. INTRODUCTION

In recent years, rapid advancements in digital technology have significantly transformed the way humans communicate, collaborate, and interact in everyday life. Innovations in artificial intelligence, machine learning, and immersive technologies have enabled communication systems to become faster, smarter, and more responsive than ever before. However, despite these technological advancements, equal access to communication remains a major challenge for the Deaf and Hard of Hearing (DHH) community. Spoken language continues to dominate social, educational, and professional environments, often placing DHH individuals at a disadvantage during real-time, face-to-face interactions. This communication gap can lead to social isolation, reduced participation, and dependency on external assistance, highlighting the need for more inclusive and adaptive solutions.

Although several assistive technologies have been developed to support DHH individuals, many existing solutions are limited in practicality and effectiveness. Traditional approaches such as sign language interpreters are not always readily available and may not be feasible in spontaneous or informal settings. To overcome these limitations, this project introduces A.U.R.A (Augmented Utility for Responsive Accessibility), an intelligent wearable

communication system designed to enable natural and bidirectional interaction between DHH and hearing individuals. By integrating Artificial Intelligence, computer vision, speech processing, and Augmented Reality into a smart glass platform, AURA aims to deliver real-time translation of sign language into text or speech and spoken language into readable text displayed directly within the user’s field of view. The wearable nature of the system ensures hands-free operation, minimal distraction, and continuous engagement in conversations. Through this approach, AURA not only enhances communication accessibility but also promotes independence, inclusivity, and social confidence among DHH individuals.

2. RELATED WORKS

2.1 Research Papers

The paper “Evaluating the Translation of Speech to Virtually-Performed Sign Language on AR Glasses” presents a proof-of-concept system that converts spoken language into sign language using virtual avatars displayed on AR glasses [1]. The goal is to help Deaf and Hard-of-Hearing (DHH) individuals see signed translations of spoken dialogue in real time, improving inclusivity and accessibility. The authors conducted interviews with DHH participants to confirm the need for such a wearable solution and used a Wizard-of-Oz experiment (manual simulation of system behavior) to validate feasibility. Results showed strong user interest and positive feedback, but technical limitations were noted—especially in recognizing complex finger-based signs. Large arm gestures were well captured, but subtle finger movements were often unclear due to AR display constraints. The study highlights the need for better gesture recognition models and display optimization.

The paper “Augmented Reality Supporting Deaf Students in Mainstream Schools: Two Case Studies” explores the use of AR to improve classroom learning and teacher-student interaction for DHH students [2]. In the first case study, wearable AR glasses were used to provide real-time feedback during lessons. Although effective in improving communication, the student reported that the glasses were bulky and aesthetically unappealing, creating a psychosocial barrier to classroom adoption. In the second case study, a tablet-based AR solution using QR codes was employed to enhance vocabulary development and reading comprehension. Students and their special education teacher reported positive engagement, indicating that AR can be a valuable literacy aid. The paper concludes that AR can support learning but must address comfort and design concerns for wider acceptance.

The paper “Social and Communication Apps for the Deaf and Hearing Impaired” addresses gaps in communication accessibility for DHH individuals by reviewing 55 mobile applications [3]. The authors analyzed core features such as sign language recognition, text-to-speech conversion, video chat with live captions, and vibration alerts. They found that only six apps were explicitly designed for DHH users, and most tools failed to fully meet user needs or were difficult to use. The study emphasizes the importance of developing more user-friendly, inclusive mobile applications and provides design insights for future developers.

The paper “Bridging the Auditory Gap: AR Smart Glasses for Real-Time Speech-to-Text and Directional Audio Visualization” introduces an AR-based solution that displays three crucial

pieces of information on AR glasses—Direction of Arrival (DoA), real-time speech-to-text transcription, and speaker identification [4]. The system integrates Voice Activity Detection (VAD), speech recognition, and speaker identification algorithms to help hearing-impaired users locate who is speaking and read transcribed dialogue in real time. This approach allows participation in conversations without relying on hearing aids or requiring both parties to know sign language. The paper demonstrates that combining visual cues with AR technology can significantly enhance communication inclusivity but notes that accuracy depends heavily on speech recognition performance.

The paper “Enhancing Mobile Interaction for Individuals with Tremors via Optical See-Through Augmented Reality” proposes an AR system that stabilizes shaky hand movements, enabling smoother interaction with mobile interfaces [5]. The authors conducted controlled experiments comparing task completion times with and without the stabilization filter, using one-way ANOVA for statistical validation. Results showed significant performance improvements and reduced user frustration. A second comparative study with simulated tremor conditions revealed that AR-based interaction was considerably more accessible than traditional mobile interfaces, especially with redesigned UI layouts. The study highlights the potential of AR to improve accessibility for users with motor impairments but calls for further validation with real patients.

3. PROPOSED METHODOLOGY

The proposed system aims to bridge communication between Deaf/Hard-of-Hearing (DHH) individuals and hearing individuals by using an **Augmented Reality (AR) Smart Wearable**. The wearable is equipped with essential hardware components such as an AR display for overlaying text and visuals, an embedded camera for capturing hand gestures, and a microphone for recording speech. An on-device processor handles lightweight computations, while Wi-Fi or Bluetooth ensures seamless data exchange. Optional speakers or earbuds may be integrated for users with residual hearing, making the device versatile, adaptive, and inclusive.



Figure 1 :- The wearable device

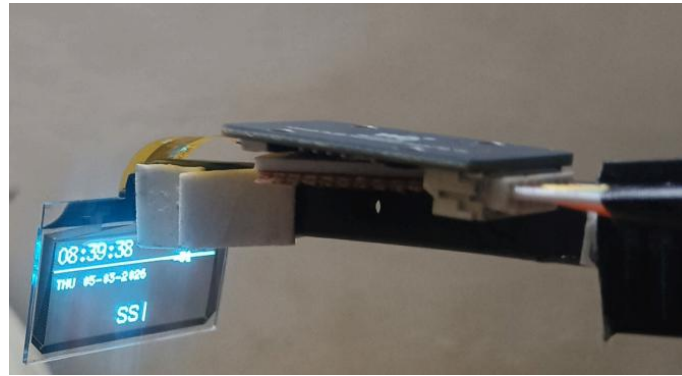


Figure 2 :- The text transcription

3.1 Model Architecture

The core of the AURA system is a deep Convolutional Neural Network (CNN) designed specifically for spatial feature extraction and multi-class classification of isolated sign language gestures. The architecture is optimized to balance classification accuracy and computational efficiency, ensuring real-time inference on embedded hardware.

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HEALTH AND ALLIED SCIENCES

PHASE I CARDIAC REHABILITATION FOLLOWING CABG SURGERY: EVIDENCE FROM A TERTIARY CARE CENTRE IN KERALA

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Abstract

Cardiovascular disease remains a leading cause of morbidity and disability, with coronary artery disease posing a major burden in Kerala. Coronary artery bypass graft (CABG) surgery is frequently performed, yet postoperative recovery is often complicated by physiological instability and psychological distress. This randomized controlled trial evaluated the effectiveness of Phase I cardiac rehabilitation among 50 CABG patients. Participants were allocated to an experimental group receiving structured rehabilitation plus routine care and a control group receiving routine care alone. Outcomes assessed included cardiac parameters, respiratory function, wound status, and anxiety. Significant improvements were observed in mean arterial pressure, oxygen saturation, arterial blood gas parameters, and anxiety levels in the experimental group ($p < 0.05$). No significant difference was noted in wound infection rates. Phase I cardiac rehabilitation enhanced functional recovery, psychological well-being, and readiness for discharge. Integration of early cardiac rehabilitation into routine care may improve outcomes and reduce healthcare burden in public health settings.

Index Terms: Cardiac rehabilitation, CABG, postoperative outcomes, anxiety

1. Introduction

Cardiovascular disease remains the leading cause of mortality globally, with India contributing substantially^{1,2}. Kerala shows a high prevalence of coronary artery disease due to epidemiological transition and lifestyle factors^{3,4}. CABG surgery is a standard intervention for advanced disease^{5,6}, but postoperative recovery is often complicated by respiratory dysfunction and psychological stress^{7,8}.

Phase I cardiac rehabilitation, initiated during hospitalization, improves cardiopulmonary function, reduces complications, and enhances recovery^{9,10}. Despite global recommendations, its implementation in India remains limited^{11,12}.

2. Methodology

A single-blinded randomized controlled trial was conducted (IRB No: CNT/IEC/42/10/2020). Fifty CABG patients were randomly assigned to experimental (n=25) and control (n=25) groups.



The experimental group received structured Phase I cardiac rehabilitation (breathing exercises, early mobilization, education) along with routine care, while the control group received routine care alone.

Outcomes assessed included:

- Cardiac parameters (EF, MAP)
- Respiratory parameters (SpO₂, ABG)
- Postoperative complications
- Wound infection
- Anxiety

Assessments were done on postoperative day 3, before discharge, and at first follow-up.

3. Results

3.1 Baseline Characteristics

Groups were comparable in age, gender, BMI, and clinical variables ($p > 0.05$).

3.2 Key Clinical Outcomes

- **Ejection Fraction:** No significant difference ($p > 0.05$)
- **Mean Arterial Pressure:** Significant improvement in experimental group ($p = 0.005$)
- **Respiratory Parameters:** Significant improvement in SpO₂ and ABG ($p < 0.05$)
- **Complications:** Lower incidence of MI and arrhythmia in experimental group (NS)

Table 8
Effectiveness of phase I cardiac rehabilitation on wound infection

Wound infection	Experimental		Control		χ^2	df	p
	n	%	n	%			
Yes	2	8.3	4	17.4	2.4	1	0.12
No	22	91.7	19	82.6			

From Table 8 it was evident that 17.4% participants in the control group developed wound infection and in experimental group it was 8.3% ($p > 0.05$). This implies that there was no significant difference in wound infection between experimental and control group.

Effectiveness of phase I cardiac rehabilitation on psychological function anxiety was analysed by Mann Whitney U test.

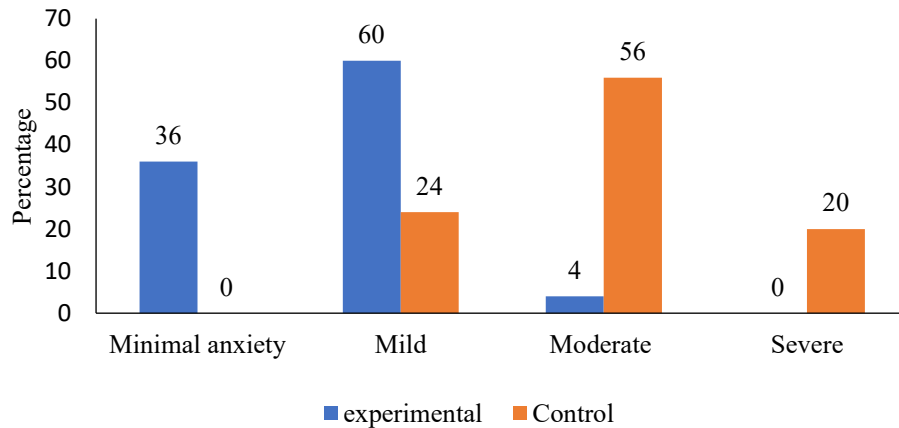


Figure. 2 Bar diagram depicting grading of post operative anxiety between experimental and control group .

Figure 2 illustrates that, in control group 56% participants had moderate, 24 % had mild and 20% had severe post operative anxiety. In experimental group 60% participants had mild, 36% had minimal and 4% had moderate post operative anxiety.

4. Discussion

Phase I cardiac rehabilitation significantly improved physiological and psychological outcomes. Improvements in MAP and respiratory parameters support the role of early mobilization and breathing exercises^{9, 10}.

The marked reduction in anxiety highlights the importance of structured nurse-led interventions in postoperative care^{7, 8}.

No significant effect on wound infection was observed, likely due to multifactorial causes unrelated to rehabilitation alone.

In resource-limited settings, Phase I rehabilitation offers a cost-effective strategy to enhance recovery and reduce hospital stay^{11, 12}.

5. Conclusion

Phase I cardiac rehabilitation is an effective intervention for improving recovery and reducing anxiety following CABG surgery. Its integration into routine care is strongly recommended.

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THE INVISIBLE TRANSITION: A SYSTEMATIC REVIEW OF HOW MENOPAUSE SHAPES THE MODERN WORKFORCE

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Abstract

Natural menopause, defined by the World Health Organization (WHO) as the permanent cessation of menstruation due to the loss of ovarian follicular activity, typically occurs between ages 45 and 50. However, hormonal imbalances and lifestyle factors are increasingly triggering onset as early as 40. Despite the rising participation of women in the workforce, notably growing from 32.3% to 36.4% in Kerala according to the Periodic Labour Force Survey (PLFS)-menopause remains a "silent" transition. Research by Abbott indicates that 48% of women experience severe symptoms, leading 20% to consider quitting their jobs due to a lack of support. Existing health and labour policies largely overlook this demographic, necessitating a multidisciplinary framework to ensure quality of life and career longevity. This study investigates the impact of menopausal symptoms on work performance and the necessity for menopause-specific workplace interventions and policy frameworks. Menopause is a socio-economic event intersecting with the peak of women's professional lives. To move beyond viewing menopause as a "problem to be fixed," organizations must adopt inclusive policies and awareness campaigns. Implementing multidisciplinary workplace interventions is critical for women's health equity and economic productivity. Future research should prioritize longitudinal studies to track the efficacy of specific policy frameworks across public and private sectors.

Keywords: Menopause, Workplace Policy, Women's Health, Productivity, Workforce

1. Introduction

Menopause, a natural biological transition affecting half the population, is increasingly acknowledged as a significant yet overlooked factor in workplace dynamics. As women increasingly participate in and lead the global workforce, understanding the impact of menopause on their professional lives is crucial. Despite its prevalence, menopause remains shrouded in stigma and misconception, leading to a lack of support and accommodations in the workplace. This systematic review aims to shed light on the intersection of menopause and work, exploring how this transition influences women's careers, workplace policies, and overall well-being.

The modern workforce is undergoing a significant shift, with more women than ever before delaying menopause until after establishing their careers. This demographic trend has brought menopause-related challenges to the forefront, yet many employers and employees remain unprepared to address them. Symptoms such as hot flashes, sleep disturbances, and cognitive changes can significantly impact a woman's quality of life and productivity, often leading to decreased job satisfaction, absenteeism, and even early retirement.

The lack of discussion around menopause in the workplace perpetuates stigma, forcing women to suffer in silence or hide their struggles, fearing judgment or career repercussions. This not only affects individual women but also has broader implications for organizational performance, diversity, and inclusion efforts. As the workforce continues to evolve, it is essential to break the silence surrounding menopause and develop strategies to support women navigating this critical life transition. This review seeks to contribute to this effort by synthesizing existing research on menopause in the workplace, highlighting gaps in current policies, and charting a path forward for more inclusive and supportive work environments.

2. Materials and Methods

A systematic review of literature was conducted focusing on working women aged 40–65 in perimenopausal, menopausal, or postmenopausal stages. The general databases included: MEDLINE, PsychInfo, Scopus, Science Direct and Google Scholar. Inclusion criteria targeted healthy, currently employed women and studies reporting work performance metrics such as productivity, absenteeism, and job retention. Exclusion criteria included surgical menopause, non-working populations, and clinical/medical interventions. The search was limited to English-language primary research. Search terms included combinations of "working women", "employed women", "perimenopause", "menopause", "postmenopause", "productivity", "absenteeism", and "job retention", with Boolean operators AND, OR, and NOT used to refine the search. The search strategy yielded 372 records through database searching and 7 additional papers, totaling 379 records. After title screening, 295 records were excluded, leaving 84 records for abstract screening. Abstract screening resulted in 35 exclusions, leaving 49 records for full-text assessment. Of these, 12 records were excluded due to unavailability of full text, resulting in 37 records included in the final review.

3. Results and Discussion

The systematic review identified 37 studies that met the inclusion criteria. The studies were conducted across various countries, including the United States, United Kingdom, Australia, and several European nations. Sample sizes ranged from 30 to over 1,000 participants, with ages spanning 40-65 years.

Menopause symptoms can last up to 10 years or longer. According to Periodic Labour Force Survey female participation in the workforce in Kerala grew from 32.3% in 2020-21 to 36.4% in 2023-24. A 2022 survey conducted by life sciences company Abbott revealed that 48% reported experiencing severe symptoms that demand greater care and workplace support. The lack of workplace support lead to quitting the job (20%). There are existing number of labor and health policies but there is no policies for these age group women

There is a mixed evidence on the impact of menopausal symptoms. It is suggest that menopause not only one factor that consistently associated with work outcomes (Taylor et al ,2025). Women with severe symptoms have adverse work outcomes including absenteeism and job-related decisions such as quitting, retiring early, or declining promotions than women



experiencing few symptoms (Safwan et al 2024) . Lack of awareness, inflexible work conditions, and high-stress jobs can increase the severity of menopausal symptoms.

According to Kausto 2025 menopause can cause physical, emotional psychological symptoms which may make working more difficult. Many studies report that women going through the menopause feel reticent to seek support in the workplace, and a fear that further interventions could lead to increased stigma for older women in the workplace. Menopause remains unrecognised and unaddressed within an organisational context (verdonk et al 2022).

Number of studies suggest that menopause symptom affect their work (Faubion et al 2023, High et al, 1994, Hammond et al,2022) and also planning to leave the job (Geukes et al 2016, Cronin et al 2024). Several studies point out that social inequality is a factor in coping with the menopause including financial (Gartoulla et al, 2016; Hammond et al,2022)

Menopause's impact on working women is substantial, yet often overlooked. Symptoms can significantly impair daily functioning, leading to decreased productivity, increased absenteeism, and career disruptions. The stigma surrounding menopause exacerbates these challenges, forcing women to hide their struggles.

Workplace policies and accommodations can mitigate these effects. Flexible work arrangements, wellness programs, and manager training on menopause-related issues can improve job satisfaction and retention. However, gaps in current policies and lack of awareness hinder support.

Employers must recognize menopause as a natural life transition and develop inclusive policies. This includes providing education, resources, and accommodations to support women navigating menopause. By addressing these needs, organizations can enhance diversity, equity, and inclusion efforts, ultimately improving performance and reducing turnover.

A multidisciplinary approach is essential because menopause is not merely a biological milestone; it is socio economic event that intersects with the peak of a women’s career.

Table 1. Multidisciplinary Framework for Addressing Menopause in the Workplace

Discipline	Primary Focus	Key Intervention
Medicine	Physiological focus	Clinical treatment and symptom relief
Psychology	Mental wellbeing	Stress management and CBT
Sociology	Workplace culture	Reducing stigma and normalizing the conversation
Economics	Labor participation	ROI of retention and flexible

The table outlines four key disciplines-Medicine, Psychology, Sociology, and Economics and their respective primary focuses and recommended interventions for managing menopause among working women. It illustrates how integrating physiological, psychosocial, and economic perspectives can shift menopause from being treated as a medical “problem” to a normalized life stage requiring supportive, inclusive workplace strategies.

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PHYSICAL SCIENCES

Photoresponsive Resistive Memory Devices Using Graphene Oxide-Phosphor Complex for Neuromorphic computing

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Abstract

The development of energy-efficient and photoresponsive memory devices has become a critical research focus to meet the growing demands of next-generation optoelectronic technologies. In this work, we demonstrate the design, fabrication, and characterization of a photoresponsive resistive memory device based on a graphene oxide-phosphor (GO:LuAG:Ce) composite structure. The device employs a multilayer architecture of ITO/GO:LuAG:Ce/rGO/Al₂O₃/ITO, where light act as an external stimulus to induce and control resistive switching behavior, enabling fast, stable and low power operation. Transparent indium tin oxide (ITO) electrodes serve as both top and bottom contacts, ensuring efficient light transmission to the active layer while enabling effective charge collection. The GO:LuAG:Ce composite functions as the active switching medium. Graphene Oxide provides tunable conductivity and efficient charge transport, while the LuAG:Ce supports oxygen vacancy migration, enabling memristive behavior, stable analog switching and reduced variability. The rGO helps in forming controlled conductive paths and act as a current spreading layer. The Al₂O₃ interfacial layer plays a crucial role in regulating conductive filament formation and rupture, thereby enhancing switching stability, reducing leakage currents and improving endurance. This demonstrated architecture offers a scalable route toward transparent and flexible optoelectronic memory devices, optical switches and smart sensing platforms for photonic-electronic systems.

Keywords: Keywords—Graphene Oxide, Phosphor, Resistive switching, neuromorphic computing

1. Introduction

Neuromorphic hardware relies on memristive devices commonly known as memristors which are capable of modulating and storing resistance states in response to external stimuli. These devices emulate biological synapses by encoding synaptic weights in their variable resistance, thereby enabling learning and plasticity in brain-inspired computing systems. While extensive research has focused on electrically driven memristors to replicate neural behavior, a major limitation remains most existing devices respond exclusively to electrical signals, restricting their interaction with optical and other sensory inputs [1]. To replicate the brain's ability to integrate multimodal sensory information such as vision, touch, and hearing memristive devices must respond to both electrical and optical stimuli.

Photoresponsive resistive memory devices address this requirement by integrating electronic and photonic functionalities within a single device. Such hybrid memristors exhibit resistance modulation driven by either electrical bias, light, or their combined effects, enabling dual-mode operation [2]. This capability closely mimics biological synapses that dynamically adjust their strength in response to multisensory excitation. Photoresponsive memory devices are particularly attractive for near-sensor and in sensor computing architectures. Instead of transmitting raw sensory data to remote processing units an approach that incurs latency, energy loss, and bandwidth constraints these devices enable local data storage, computation, and learning at the sensor level. This paradigm significantly reduces power consumption and enhances processing speed, which is critical for real-time edge-AI systems [3].

2. Experimental

ITO-coated glass substrates were cleaved into 2 cm × 2 cm pieces and cleaned ultrasonically in acetone, isopropyl alcohol (IPA), and deionized (DI) water for 10 minutes each to remove organic contaminants and particulates. The substrates were dried with high-purity nitrogen gas, followed by a brief acetone rinse and low-temperature heating to remove residual solvent. Cleaned substrates were stored in a desiccator prior to film deposition. A layer of Al₂O₃ is coated on the ITO with a thickness of 12nm using Atomic Layer Deposition (ALD) using Trimethylaluminum as a source at 60⁰ C temperature. The next layer is coated above Al₂O₃ using rGO using spin coating having a thickness of 10 nm, now the layer of GO:LuAG:Ce is coated above this with 50 nm thickness using spin coating where the solution is obtained by preparing LuAG:Ce solution of concentration 9 mg/ml with water as solvent and 40% of this solution should be mixed with 60% of GO solution which is then sonicated for 15-20 minutes. Now the top ITO layer is coated using sputtering with a thickness of 120nm.

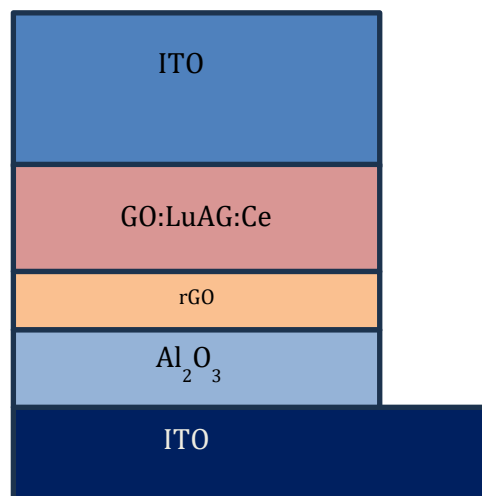


Figure 1. Structural representation of this device.

3. Results

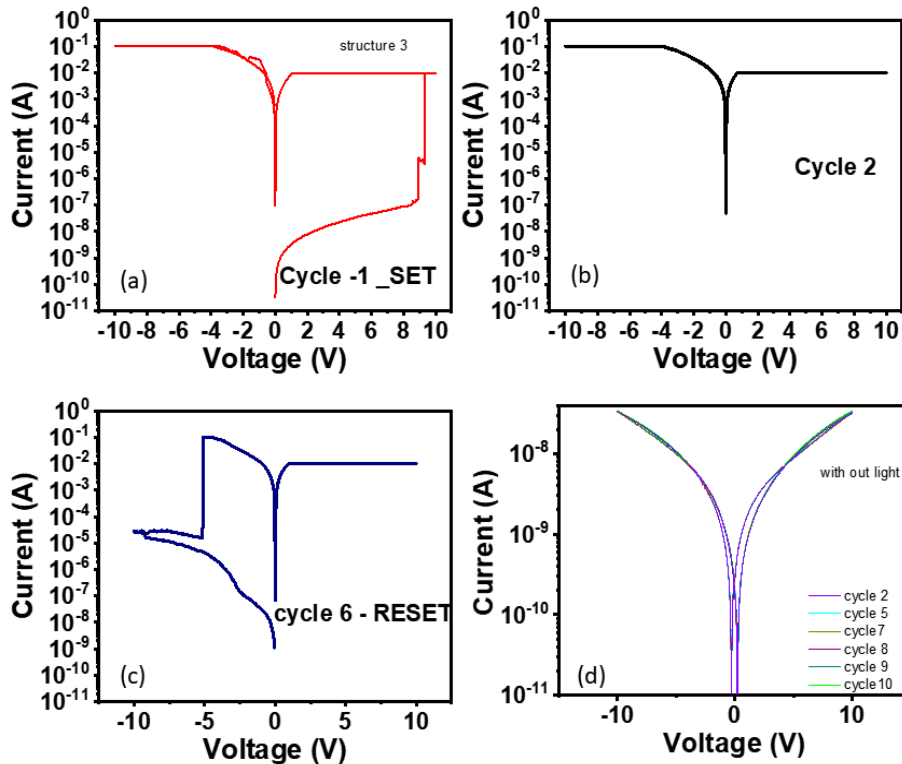


Figure 2. The current-voltage (I-V) characteristics of the devices (a-c) With light, d) With out light

The result is signifying clear set and reset behaviour which is essential for neuromorphic memory devices. In the first cycle sharp SET is obtained at +8V (Fig. 2(a)) and current jumps from $\sim 10^{-7}$ A to $\sim 10^{-2}$ A. It is having a On/Off current ratio is 10^5 . In the cycle 2 (Fig. 2(b)) device remains in low resistance state which signifies stable memory retention. Reset (Fig 2(c)) takes place at -6V, it shows bipolar switching behaviour and the drop in the current indicates the conductive filament rupture. In the absence of light, (Fig 2(d)), no abrupt SET/RESET switching takes place, there is gradual increase in current over layers which exhibits analog non-volatile characteristics and it mimics synaptic behaviour. The On/Off ratio is 1 in this case. In short, under light it acts as high-performance non-volatile memory and in dark it mimics neuromorphic behaviour which is important for optoelectronic memory and brain-inspired AI hardware such as neuromorphic computing.

The device demonstrates considerable potential for integration into advanced optoelectronic and neuromorphic systems. The observed light-dependent resistive switching, characterized by a high ON/OFF ratio ($\sim 10^5$) and stable bipolar behavior, supports its suitability for non-volatile memory applications such as RRAM. In contrast, the gradual modulation of conductance under dark conditions reflects analog switching behavior, which is desirable for emulating synaptic functions in neuromorphic computing. The incorporation of the GO:LuAG:Ce layer contributes to photo-induced charge trapping and detrapping processes, enabling optical tunability and the possibility of multi-level data storage. This dual-mode functionality allows the device to perform both memory storage and signal processing within a single architecture, offering a pathway to reduce energy consumption and latency associated with conventional computing systems. Overall, these characteristics suggest that the device is a promising candidate for applications in optically controlled memory, neuromorphic computing platforms, and emerging artificial intelligence hardware.



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Flexible Piezoresistive Tyre-Pressure Sensor Based on Graphene-PVDF-Natural Rubber Latex Composite

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Abstract

Flexible piezoresistive pressure sensors are attracting increasing interest for next-generation smart systems owing to their mechanical flexibility, ease of fabrication, and real-time sensing capability. However, many conventional flexible sensors suffer from a limited sensing range and unstable performance under large or non-uniform pressures, such as those encountered in vehicular environments. Accurate and real-time tyre pressure monitoring is critical for vehicle safety and performance. In this work, we report a newly developed flexible tyre pressure sensor fabricated using a graphene–natural rubber latex–polyvinylidene fluoride (PVDF) composite. The high elasticity and mechanical robustness of natural rubber, combined with the excellent electrical conductivity of graphene, enable the formation of a pressure-sensitive conductive network exhibiting a pronounced piezoresistive response. Rubber latex further enhances flexibility and stretchability, allowing the sensor to withstand large deformations without mechanical failure. Unlike conventional silicon- or metal-based sensors, the atomic thickness of graphene offers superior tensile strength, high carrier mobility, and low noise electrical transport, leading to improved signal-to-noise ratio and fast response. In addition, graphene doped PVDF fibres enhance the piezoelectric response and output voltage, enabling the detection of subtle pressure variations. The sensor can be successfully integrated onto a tyre surface to monitor dynamic pressure changes during inflation and rolling conditions. These results demonstrate the strong potential of the graphene–rubber–PVDF composite as a scalable and reliable platform for real-time tyre pressure monitoring, with promising applications in intelligent tyre systems, soft robotics, and smart vehicular safety technologies.

Keywords: Piezoresistive pressure sensors, Graphene, Natural rubber latex, Polyvinylidene fluoride.

Introduction

Next-generation smart vehicles require continuous, accurate, and real-time information on tyre pressure and contact conditions to enhance safety, fuel efficiency, and driving stability [1]. Conventional tyre-pressure monitoring systems (TPMS), which are typically based on rigid silicon sensors, often suffer from limited flexibility, complex packaging requirements, and relatively high costs when deployed over large areas [2]. These limitations restrict their ability to conform to curved or deformable surfaces such as tyres under dynamic operating conditions. Flexible piezoresistive sensors, which convert mechanical pressure or strain into measurable changes in electrical resistance, have emerged as a promising alternative to conventional rigid sensors [3]. Owing to their mechanical compliance, lightweight nature, and compatibility with scalable fabrication techniques, such sensors can be readily integrated onto curved and stretchable surfaces. Among the various material systems

investigated for flexible sensing applications, polymer–nanofiller composites have attracted significant attention due to their tunable mechanical and electrical properties [4]. Natural rubber latex offers exceptional stretchability, resilience, and toughness, making it an ideal mechanical backbone for deformable sensor platforms [5]. Graphene, with its atomic-scale thickness, high Young’s modulus, superior electrical conductivity, and large specific surface area, can form an efficient conductive percolation network within a polymer matrix, resulting in strong piezoresistive behaviour under mechanical deformation [6,7]. Polyvinylidene fluoride (PVDF) is a

semicrystalline fluoropolymer known for its strong piezoelectric properties in the polar β phase [8]. When combined with conductive nanofillers such as graphene, both the piezoelectric response and electrical output of PVDF can be significantly enhanced [9]. Recent studies on graphene–rubber and graphene–PVDF composites have demonstrated their potential for highly sensitive strain, pressure, and motion sensing applications [10–12]. In graphene–rubber composites, resistance changes are typically governed by microcrack formation, tunnelling effects, and the reorganization of conductive pathways during stretching or compression [10]. Graphene–PVDF composites, in contrast, can exhibit a combined piezoresistive and piezoelectric response, enabling enhanced sensitivity and multifunctional sensing through simultaneous resistance modulation and voltage generation [11,12]. Despite these advances, many reported systems face challenges when applied to tyre-pressure monitoring, including restricted sensing ranges, nonlinearity under large strains, and poor durability during repeated bending and rolling cycles [13]. Therefore, there is a clear need for flexible composite sensor systems that can withstand large deformations, maintain stable and repeatable performance, and be fabricated using economically viable and scalable methods [14]. The objective of the present study is to develop and preliminarily characterize a flexible piezoresistive sensor sheet based on a graphene–PVDF–natural rubber latex composite, specifically tailored for tyre-pressure monitoring and motion sensing applications.

Materials and Methods

Graphene nano powder was used as the conductive material for the composite and Polyvinylidene fluoride (PVDF) served as the polymer matrix, contributing mechanical integrity and potential piezoelectric activity. Natural rubber latex (rubber milk) provides high elasticity, resilience, and flexibility to the composite sheet. N, N-dimethylformamide (DMF) was used as the solvent for both graphene dispersion and PVDF dissolution due to its excellent solvating capability for polymers and nanomaterials. PVDF dissolution, was carried out under controlled heating to facilitate complete polymer solvation

A graphene dispersion was prepared by adding 1 g of graphene nano powder to 50 mL of DMF, corresponding to a concentration of 20 mg mL^{-1} and heated to 60 degree for 20 minutes. The mixture was subjected to mechanical stirring to ensure a stable colloidal suspension and the resulting dispersion is referred to as solution A.

PVDF solution was prepared by dissolving 20 g of PVDF pellets in 250 mL of DMF under controlled heating of 70 degree and the solution is denoted as solution B. To incorporate the conductive graphene phase into the PVDF matrix, 50 mL of solution A was mixed with 100 mL of solution B, corresponding to a volume ratio of 1:2. The mixture was stirred thoroughly to ensure uniform dispersion of graphene within the PVDF–DMF medium and this mixture is referred to as solution C.

Solution C was subsequently mixed with 20 mL of natural rubber latex. The combined mixture of graphene, PVDF, natural rubber latex, and DMF was stirred until a uniform and stable dispersion was obtained. The homogeneous mixture was then cast and shaped into a sheet, followed by drying and curing processes to remove DMF and solidify the composite. The resulting flexible graphene–PVDF–rubber composite sheet is named as GPR.

The piezoresistive behaviour of the GPR compound was investigated by monitoring its electrical resistance as a function of time under a tensile stretching method. Two electrodes were attached at fixed positions separated by the initial gauge length of 5 cm. Mechanical deformation was applied by stretching the sample from 5 cm to 9 cm and returning it to the original length following a programmed incremental return pattern.

Results and Discussion

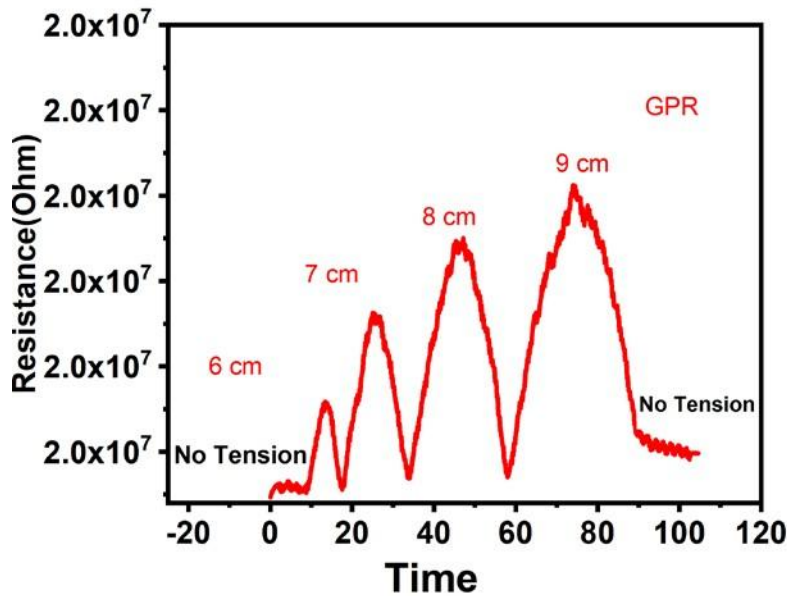


Figure 1. Time-dependent resistance response of the graphene–PVDF–rubber (GPR) composite sensor under incremental tensile deformation from 6 to 9 cm, followed by relaxation to the no-tension state.

Time-dependent electrical resistance response of the fabricated GPR sensor is shown in Figure 1. Starting time, the gauge length of the sensor was 5 cm, and sensor was subsequently stretched to 6, 7, 8, and 9 cm, followed by relaxation and finally to the no-tension time and the resistance was continuously monitored during this period. During the initial state (no-tension), the sensor shows a resistance of around 20 Mega Ohm, depicting a conductive path formed due to the presence of graphene compound. During tensile strain, a systematic and reproducible increase in resistance is observed. When the extension length increases from 6 cm to 9 cm, a clear strain-dependent piezoresistive pattern is observed depicting the ability the property of the sensor to resolve different deformation levels with good sensitivity. During the tensile deformation, the peak resistance values increase, clearly shows the breakdown of conductive networks within the sensor film. This is because the tensile stress increases inter-flake separation, reduces contact area, which eventually increases tunnelling resistance between graphene conductive networks. During the unloading phase, the resistance returns close to original value, indicates the recovery of the conductive pathways, which demonstrates good mechanical robustness of the sensor under deformation. The observed resistance modulation arises from a combination of mechanisms. This resistance change originates due to the piezoresistive effect of the graphene pathways, and the presence of PVDF also contribute to piezo resistive response. The rubber latex plays a prominent role by incorporating large strains, making the sensing material suitable for reversible deformation,

and also mimics the deformation conditions encountered in tyre environments during inflation, loading, and rolling. The clear distinction during different strain states, describes the acceptability of our GPR material and make it ideal for real-time monitoring of dynamic pressure / strain variations in curved surfaces. Thus, our results demonstrate that the GPR sensor exhibits reliable, strain dependent piezoresistive behaviour with potential applicability in intelligent tyre pressure monitoring and other large-strain sensing applications.

Conclusion

A flexible piezoresistive sensor based on a graphene–PVDF–natural rubber latex composite was successfully fabricated using a solution processed method. The sensor combines the high elasticity of natural rubber with the piezoresistive behaviour of graphene and PVDF, providing a sensing platform for strain applications. The observed response clearly shows the capability of the sensor to reversibly reproduce and transduce mechanical strain into electrical signals under large and repeated deformations. The fabricated graphene–rubber–PVDF composite sensors, offer a scalable and reliable solution for intelligent tyre monitoring systems, soft robotics, and other high-pressure or high-strain sensing applications in next-generation smart transportation and automation platforms.

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A Comparative Study on the Structural and Optical Response of Synthetic and Green Carbon Dots

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Abstract

The present work demonstrates the synthesis of carbon dots (CDs) via a simple and cost-effective 'bottom-up' hydrothermal route, owing to its high quantum yield and versatility in the choice of the precursor, from chemicals to biomass sources. Here, the synthetic CDs were prepared using conventional chemical precursors - citric acid and urea, whereas green CDs were derived from two different natural sources - corn flour and orange peel. X-ray diffraction (XRD) confirmed the amorphous nature of the synthesized carbon dots. Fourier-transform infrared (FTIR) spectroscopy was employed to identify surface functional groups, including carboxyl, carbonyl, hydroxyl, epoxy and amino groups. The UV-Visible spectroscopic analysis revealed an absorption peak around 332 nm for synthetic CDs, while green CDs exhibited optical absorption peaks at 255 nm and 278 nm in the ultraviolet region, attributed to $n-\pi^*$ electronic transitions of C=O sp^3 hybridized orbitals. The optical band gap energies were estimated to be 3.13 eV for synthetic CDs, and 3.95 eV and 4.24 eV for green CDs. Under daylight, the samples appeared dark yellow, while exposure to UV light resulted in blue-green fluorescence. On varying the excitation wavelength from 300 to 450 nm, the photoluminescent (PL) emission exhibited a red shift, along with a variation in intensity. In addition, the photocatalytic response of the synthesised carbon dots was assessed against degradation of methylene blue under solar irradiation. The degradation efficiency of synthetic CDs was found to be $\sim 83\%$ as against the 35 - 37% degradation capability of green CDs.

1. Introduction

Carbon dots (CDs) have emerged as a novel class of zero-dimensional carbon-based nano materials with sizes typically below 10 nm. With exceptional physicochemical and optical properties, quite different from their bulk counterparts, CDs have drawn considerable attention over metal-based dots, owing to their excellent biocompatibility, water solubility, and low toxicity. [1]. CDs generally exhibit tunable luminescence, high photo stability, good biocompatibility and less toxicity [2]. Various synthesis approaches have been developed for the preparation of CDs, broadly categorized into top-down and bottom-up methods. Chemical oxidation method [3], hydrothermal and solvothermal synthesis [4], pyrolysis [5], microwave method [6] etc are some of these methods. Among these, hydrothermal and solvothermal techniques are widely employed due to their simplicity, cost-effectiveness, and ability to yield uniform nanoparticles with controllable properties. The method of synthesis and selection of carbon precursors influence the final properties of synthesized carbon dots. Depending on the

choice of precursors, CDs can be synthesized via conventional chemical routes (synthetic CDs) or through environmentally benign green synthesis methods using natural biomass such as fruits, plant extracts, and agricultural waste.

Liu *et al.* synthesized Nitrogen-doped carbon dots (N-CDs) with strong blue emission via a simple mild hydrothermal strategy using citric acid and ethylenediamine as co-precursors [7]. Shabbir *et al.* reported an eco-friendly synthesis of carbon dots by hydrothermal method, for metal in salt identification. They used 180-190 °C for different durations of hydrothermal treatment [8]. Prasanna *et al.*, synthesized carbon dots from orange peel waste via hydrothermal method and investigated their photocatalytic activity against naphthol blue-black dye [9].

The present work focuses on the facile hydrothermal synthesis of green and synthetic carbon dots and a comparison of their structural and optical properties. In addition, the photocatalytic applications were also investigated against methylene blue dye.

2. Experiment

Citric acid (C₆H₈O₇, Merck), urea (NH₂CONH₂, NICE), Corn flour powder and orange peel were collected from a local market.

Green carbon dots were synthesised from orange peel and corn flour powder. For the orange peel-derived carbon dots, the orange peels were boiled in 50 ml of distilled water and concentrated to 20 ml. The orange peel extract was transferred to a teflon lined auto clave and subjected to hydrothermal treatment at 180 °C for 4-hours. Similarly, 1 g of corn flour powder was dispersed in 20 ml of distilled water and hydrothermally treatment under similar conditions.

For the synthesis of synthetic carbon dots, 1 g of citric acid and 2 g of urea were dissolved in distilled water, followed by hydrothermal treatment (Figure 1).

The resultant solutions were collected, filtered, and taken for further characterizations.



Figure 1. Hydrothermal synthesis of carbon dots

The structural characterizations were performed using X-ray diffractometer - XRD (Rigaku Miniflex), and Fourier Transform Infrared Spectroscopy-FTIR (Shimadzu, IR Spirit). The optical characterizations were done using UV-Visible Spectrophotometer (Shimadzu, UV-2600) and photoluminescence were recorder using Shimadzu RF 5301 PC Spectrofluorophotometer.

2.1 Photocatalysis

Photocatalytic activity of synthesized carbon dots was evaluated by monitoring the degradation of methylene blue dye under natural sun light. A 2ppm methylene blue (MB) dye solution was prepared, and 0.1 ml of the samples were added under constant stirring. Prior to light exposure, the solutions were stirred in the dark for 30 minutes to establish adsorption –

desorption equilibrium between the photocatalyst and the dye molecules. The reaction mixture was then exposed to sunlight, and 3 ml aliquots were collected at 1-hour intervals during irradiation. The degradation efficiency of each sample was evaluated by monitoring the decrease in the characteristic absorbance peak of 2 ppm methylene blue at 663 nm. UV–Visible spectra were recorded at regular intervals of 1 hour over a total irradiation period of 3 hours.

3. Results & Discussions

The XRD spectra of synthesised samples obtained soon after the hydrothermal treatment, without any passivation are shown in Figure 2. It confirms the amorphous nature and small particle size of the synthesised carbon dots. The FTIR spectra revealed a broad absorption band observed in the region of 3200–3600 cm^{-1} is attributed to O–H/N–H stretching vibrations, indicating the presence of hydroxyl and amine groups. Peaks in the range of 2921 and 2930.4 cm^{-1} correspond to aliphatic C–H stretching vibrations. The peak at around 1708 and 1674.1 cm^{-1} is assigned to C=O stretching, suggesting the presence of carbonyl or carboxyl groups. The band observed in 1614.6 cm^{-1} is attributed to C=C stretching vibrations, indicating graphitic domains. The peak near 1388 cm^{-1} corresponds to C–N stretching vibrations. These confirm the successful formation of carbon dots (Figure 2).

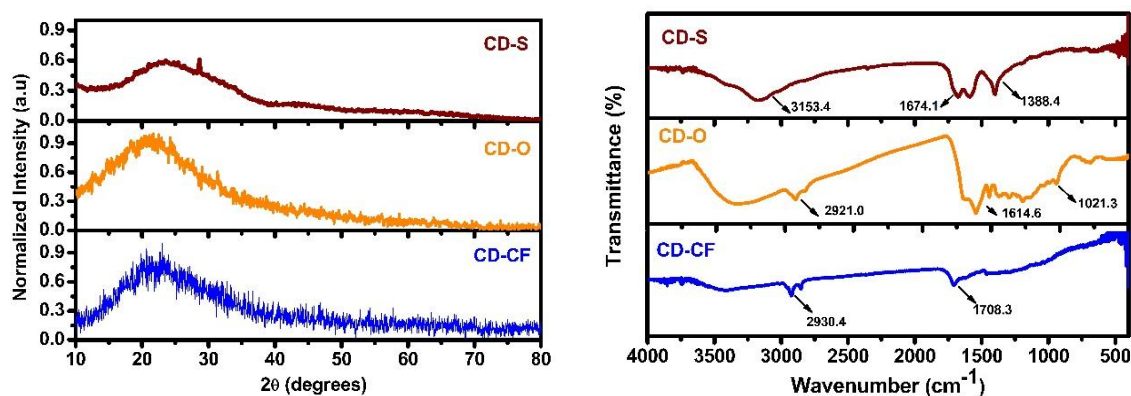


Figure 2. XRD (left) and FTIR spectra (right) of synthesized carbon dots

The optical characterizations of synthesised samples were done using UV-Visible Spectrophotometer. The absorbance spectrum of synthetic carbon dots shows a peak around 332 nm. On the other hand, green CDs exhibited optical absorption peaks at 255 nm and 278 nm in the ultraviolet region (Figure 2). These peaks were attributed to $\pi-\pi^*$ transitions of C=C bonds and $n-\pi^*$ electronic transitions of C=O functional groups. The optical band gap energies were estimated using Tauc plots (Kubelka-Munk model). The band gap was found to be 3.13 eV for synthetic CDs, while 3.95 eV and 4.24 eV for green CDs (Figure 3).

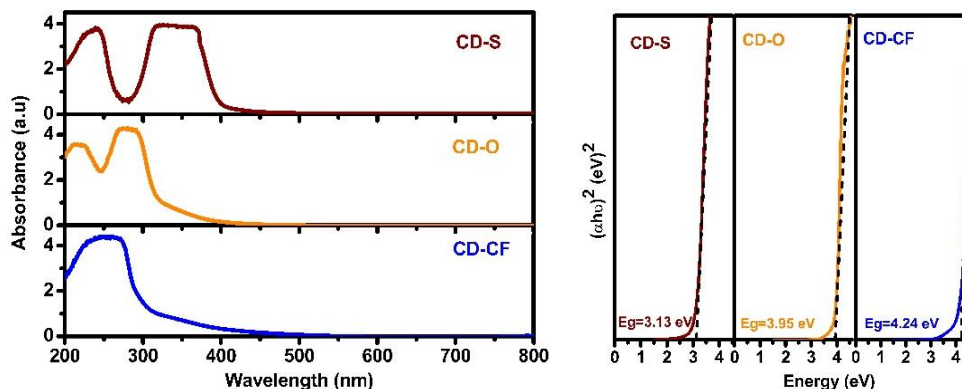


Figure 3. Absorption spectra (left) and Tauc plot (right) of synthesized carbon dots

The carbon dots appear brown-yellow colour in day-light, and shows green-blue colour under UV light. The photoluminescence (PL) spectra recorded to evaluate the emission behaviour of synthesised samples. They show excitation-dependant emission, with a noticeable red shift when excitation wavelength varied from 300 – 450 nm, along with variation in intensity (Figure 4).

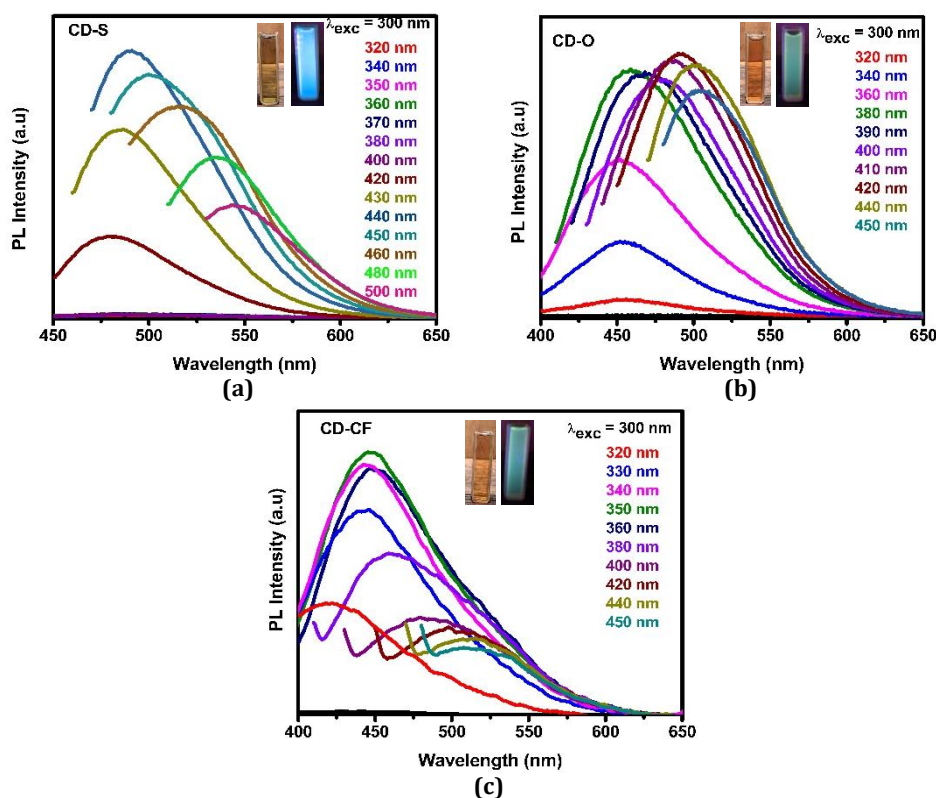


Figure 4. PL spectra of synthesized carbon dots

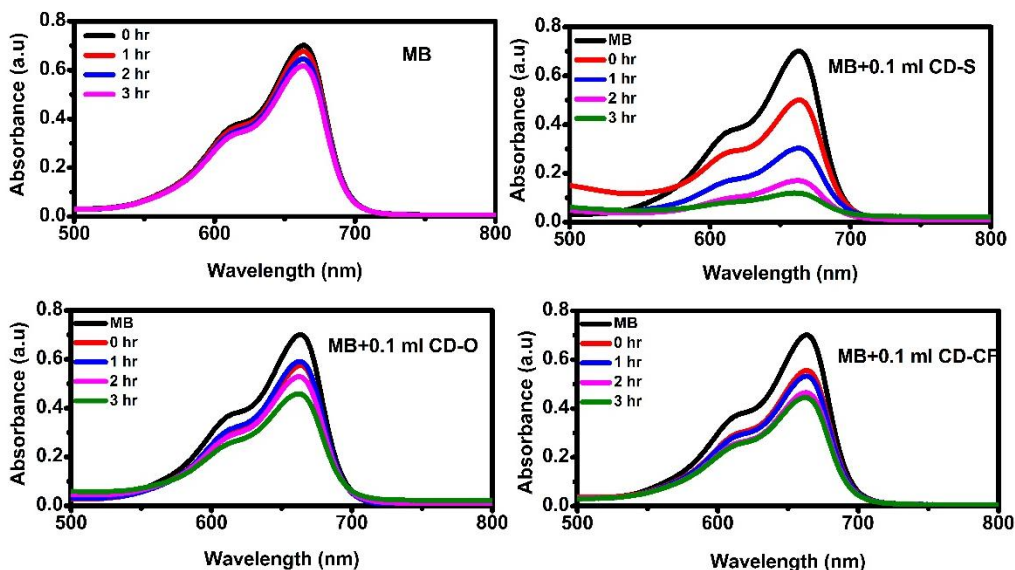


Figure 5. UV-Visible absorption spectra of methylene blue dye without and with catalysts

UV-visible absorption spectra of MB dye solution, both in the presence and absence of catalysts, were monitored under sunlight irradiation for up to 180 minutes (Figure 5). Among the catalysts, synthetic carbon dots (CD-S) demonstrated superior photocatalytic performance, which exhibit highest degradation efficiency of 83.38%. The self-degradation of MB dye is 11.78%. In comparison, the green carbon dots can be considered as good catalysts, which exhibited a moderate degradation efficiency of 35.22% and 36.93%, which can be improved by further modification (Figure 6).

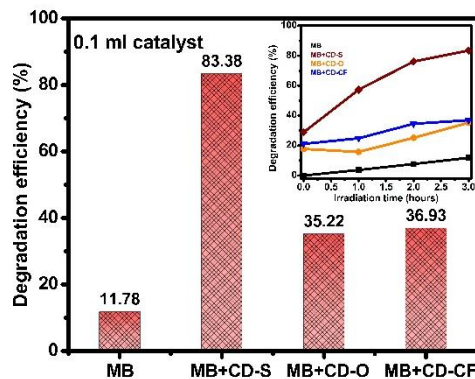


Figure 6. Photocatalytic reaction kinetics

4. Conclusions

Fluorescent carbon dots were successfully synthesized via facile hydrothermal method. XRD analysis confirmed their amorphous structure, while FTIR analysis revealed the presence of various functional groups. The optical band gap energies were determined to be 3.13 eV for the synthetic CDs, and 3.95 eV and 4.24 eV for the green synthesized CDs. The photoluminescence studies show an excitation dependant red shift, transitioning from blue to green emission. Furthermore, the prepared carbon dots exhibited notable photocatalytic performance in the degradation of methylene blue dye. The study reveals that chemical-based CDs are more efficient photocatalysts for wastewater treatment and industrial effluent

remediation. Hitherto, in future works, one may check if surface functionalisation can further improve the photocatalytic response of the synthesised sustainable and environmentally benign green CDs.

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Efficient Dye Degradation Using Sol–Gel Derived LaFeO₃ Nanoperovskites

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Abstract

The presence of toxic, non-biodegradable dye-containing effluents in aquatic systems, reducing light penetration, disrupting photosynthetic activity, and causing severe ecological and human health concerns, poses a serious threat to environmental sustainability. Henceforth, development of efficient technologies for dye removal from industrial wastewater becomes a critical research challenge. The present work investigates the photocatalytic response of perovskite lanthanum ferrite (LaFeO₃) nanoparticles against common dye pollutants. The perovskite matrix was successfully synthesized via a sol–gel method involving an aqueous solution of metal nitrates and a chelating agent, followed by low-temperature calcination at 700 °C. X-ray diffraction (XRD) confirmed the formation of single-phased orthorhombic LaFeO₃ without any detectable impurity phases. The average crystallite size, estimated to be approximately 22 nm using the Scherrer equation, was further validated by Williamson–Hall (WH) analysis, indicating minimal lattice strain and good crystallinity. Fourier transform infrared (FTIR) spectroscopy was employed to investigate the vibrational characteristics of the synthesized nanoparticles. The optical absorption spectrum of LaFeO₃ nanoparticles, examined using UV–visible diffuse reflectance spectroscopy (DRS), revealed strong absorption in the visible region. The relatively narrow band gap of 2.32 eV, determined using the Kubelka–Munk (KM) function opened the possibility of efficient utilization of visible light, that prompted to check LaFeO₃ as a photocatalyst for solar-driven wastewater treatment applications. The photocatalytic activity of the synthesized LaFeO₃ nanoparticles was evaluated against the degradation of three widely present dye pollutants—methylene blue (MB), congo red (CR), and malachite green (MG)—under solar light irradiation. The degradation kinetics, evaluated via the Langmuir–Hinshelwood model, showed a degradation efficiency of 23% for MB, 66% for CR, and 57% for MG under 120 minutes irradiation of sunlight for 2 ppm dye solutions using 0.001 g of catalyst. Degradation efficiency further enhanced over 3 hours of irradiation.

1. Introduction

Synthetic dyes are extensively utilized in paper, textile, and leather industries to impart color and enhance product appeal. However, the large-scale discharge of these toxic dye-containing effluents into aquatic systems reduces light penetration, disrupts photosynthetic activity, and causes severe ecological and human health concerns. Moreover, the high resistance to biodegradation poses a serious threat to environmental sustainability. Henceforth, development of efficient technologies for dye removal from industrial wastewater becomes a critical research challenge.

Over the past few decades, a wide range of metal oxides and composite materials have been extensively developed to remove dye pollutants from aqueous systems through photocatalytic processes [1]. Among these materials, perovskite oxides with the general formula ABO₃ have attracted considerable attention due to their excellent chemical and thermal stability. Many

perovskite-based photocatalysts, including titanates such as SrTiO_3 , BaTiO_3 , and CaTiO_3 , as well as tantalates like NaTaO_3 , LiTaO_3 , and KTaO_3 , exhibit high photocatalytic activity under ultraviolet irradiation owing to their wide band gaps [2]. However, the development of photocatalysts that can effectively utilize visible light remains an ongoing challenge. LaFeO_3 (LF), a ferrite oxide belonging to the perovskite family, fulfills this requirement by possessing a relatively narrow band gap in the range of 2.1–2.4 eV, making it suitable for visible-light-driven photocatalytic applications [1]. In addition, LaFeO_3 is a versatile, environmentally benign, and cost-effective material system with significant potential for applications in gas sensing and energy storage. The strong interaction between Fe^{3+} ions and oxygen ions in orthorhombic LaFeO_3 contributes to its diverse functional properties, including sensing behavior, magnetic characteristics, and catalytic activity. Consequently, synthesis methods that allow precise control over the final particle size of the nanomaterial play a crucial role in determining its overall performance and efficiency [3].

Hongfang *et al.* investigated the photocatalytic performance of LF nanoparticles synthesized via conventional calcination and vacuum microwave oven methods for the degradation of methyl orange (MO) dye, reporting degradation efficiencies of 74% and 90%, respectively [1]. Armal *et al.* synthesized LF nanoparticles, with particle size of 39.8 nm, using the sol–gel method and achieved 90% degradation of Congo red (CR) dye [4]. Ritwik Maity *et al.* developed sol–gel synthesised LF nanoparticles and reported a degradation efficiency of 68% against Rhodamine B (RhB) [5]. Dinesh Kumar *et al.* synthesized LF nanoparticles via a hydrothermal route (180 °C for 20 h), followed by calcination at 800 °C for 6 h, and demonstrated 83% photocatalytic degradation of MO dye [6]. All such similar works were found to include complex synthesis routes, long processing times, the requirement of activity enhancers such as H_2O_2 during photocatalytic experiments, and the need for relatively large amounts of catalyst to achieve high degradation efficiencies.

The novelty of the present work lies in the facile synthesis of LaFeO_3 nanoparticles using a simple and cost-effective sol–gel method, followed by a systematic investigation of their photocatalytic performance toward the degradation of toxic and non-biodegradable primary organic dyes - Congo Red, Methylene Blue, and Malachite Green, covering both anionic and cationic dye classes. This comprehensive assessment demonstrates the versatility of LaFeO_3 as a visible-light-active photocatalyst and highlights its potential for practical wastewater treatment applications using a single, environmentally benign material system.

2. Experiment

The precursors - Lanthanum nitrate ($\text{La}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$; Merck), Ferric nitrate ($\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$; Merck) and Citric acid ($\text{C}_6\text{H}_8\text{O}_7$; Nice) - were weighed in 1:1: 3 molar ratio and dissolved in 20 ml distilled water to form 0.1M, 0.1M and 0.3M solutions of lanthanum, ferric and citric acid solution respectively. After complete dissolution, the citric acid solution was first added to the lanthanum nitrate solution, followed by the gradual addition of the ferric nitrate solution. The resulting sol was continuously stirred at 70 °C until gel formation occurred. The obtained xerogel was then subjected to a combustion process on a hot plate, followed by calcination of the resulting powder at 700 °C for 2 h to obtain LaFeO_3 nanoparticles.

The powder X-ray diffraction (XRD) pattern was recorded using a PANalytical Aeris X-ray diffractometer with Cu- K_{α} radiation ($\lambda = 1.5406 \text{ \AA}$, X-ray tube voltage = 40 kV, and current = 15 mA). Fourier transform infrared (FTIR) spectra were collected on a Shimadzu IR Spirit spectrophotometer in the wavenumber range $400 - 4000 \text{ cm}^{-1}$, using KBr pellets. The optical band gap was determined using Diffuse Reflectance Spectroscopy (DRS) with a Shimadzu UV-Vis spectrophotometer (UV 2600).

3. Results & Discussions

The synthesis of crystalline LaFeO_3 (LF700) with crystallite size 22 nm, without any detectable impurity phases, was confirmed using X-ray diffraction (XRD) (Figure 1). The calculated lattice parameters ($a = 5.57 \text{ \AA}$, $b = 7.86 \text{ \AA}$, and $c = 5.61 \text{ \AA}$) confirmed the formation of orthorhombic phase. The average crystallite size of 36 nm, investigated using Williamson-Hall analysis, further affirms the successful formation of a nanostructured material.

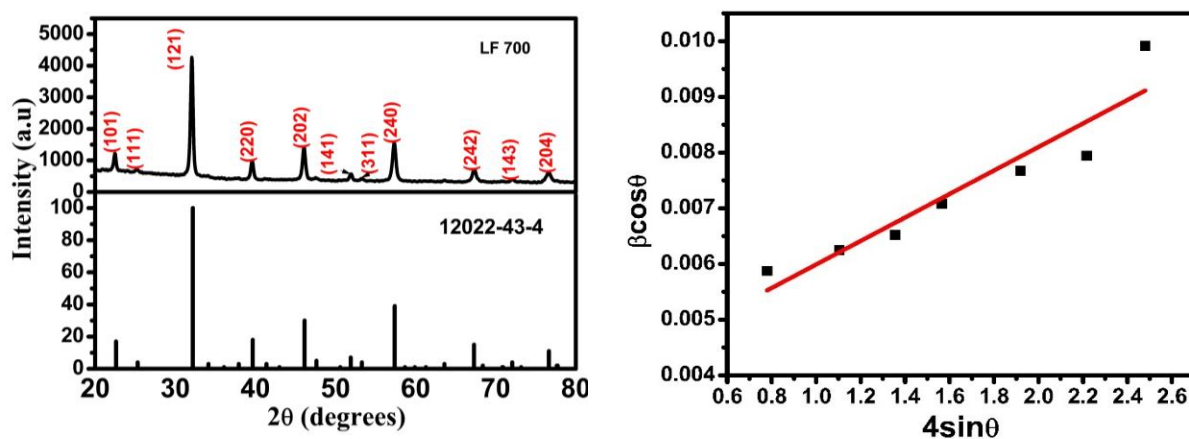


Figure 1. XRD pattern (left) and W-H plot (right) of LF700

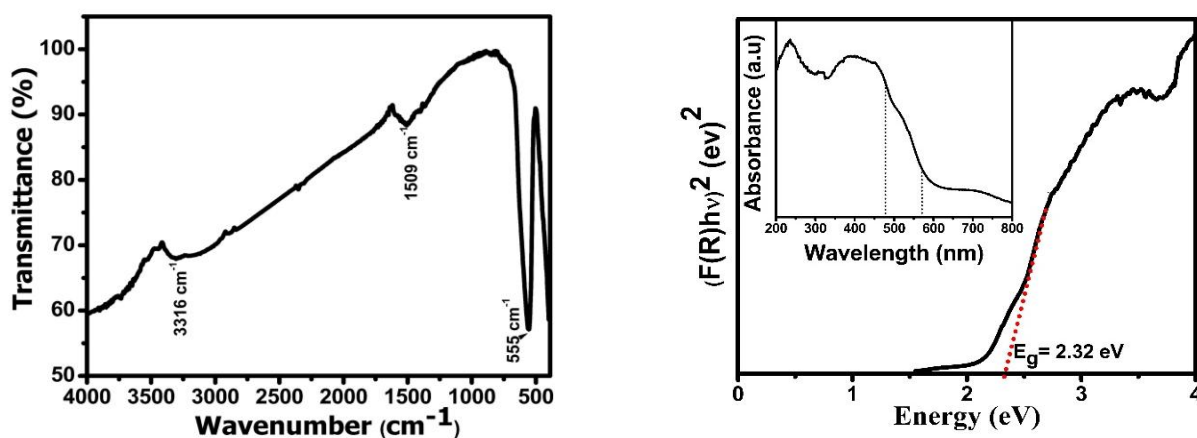


Figure 2. FTIR spectrum (left) and DRS analysis (right) of LF700

Fourier transform infrared (FTIR) spectrum (Figure 2) revealed characteristic stretching vibrations around 550 cm^{-1} , attributed to FeO_6 octahedral units, which are consistent with the XRD findings. The optical properties, examined through diffuse reflectance spectroscopy (DRS) (Figure 2), showed strong absorption in the visible region of the solar spectrum. The corresponding band gap was estimated to be 2.32 eV using the Kubelka–Munk plot.

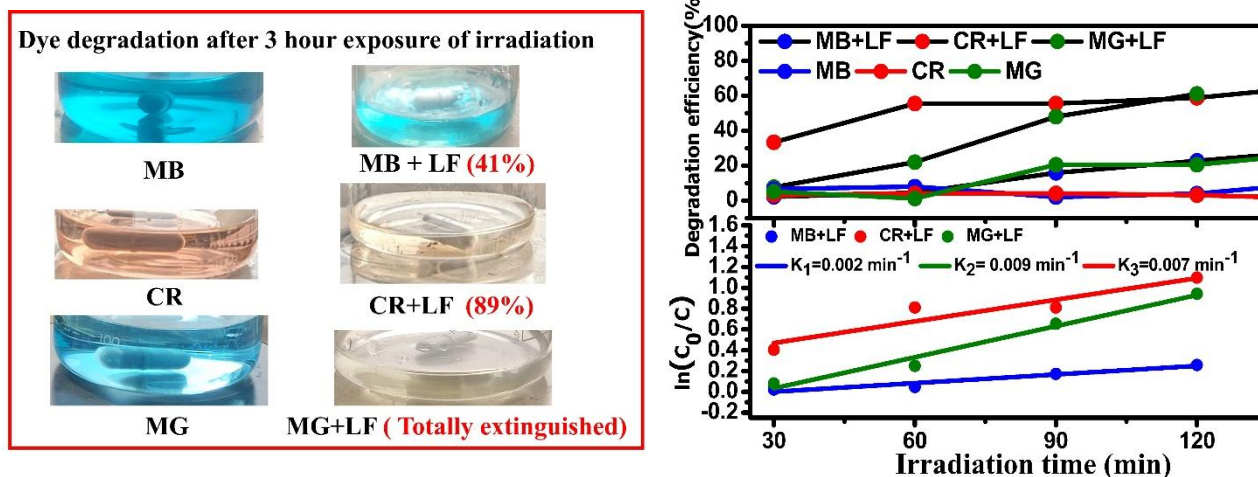


Figure 3. Degradation efficiency and Degradation kinetics of LF700

The visible-light-driven photocatalytic activity of LF700 nanoparticles was evaluated under sunlight irradiation (Figure 3). Stock solutions of each dye - Congo Red (CR), Malachite Green (MG), and Methylene Blue (MB) - were prepared at a concentration of 2 ppm. For each solution, 0.001 g of LaFeO_3 catalyst was dispersed and the mixture was kept in the dark for 30 min to establish adsorption - desorption equilibrium. During the photocatalytic experiment, 3 mL aliquots were withdrawn from each suspension at 30 min intervals, centrifuged at 3000 rpm to separate the catalyst, and the supernatant was analyzed using UV–Vis spectroscopy. The degradation of the dyes was monitored by observing the decrease in absorbance at their characteristic wavelengths: 498 nm for CR, 618 nm for MG, and 664 nm for MB. The photocatalytic degradation efficiency of LaFeO_3 toward each dye was recorded after 180 min of solar irradiation. The degradation kinetics was estimated by Langmuir-Hinshelwood analysis and the rate constants was observed as 0.007 min^{-1} , 0.009 min^{-1} and 0.002 min^{-1} for catalyst in CR, MG and MB dye.

4. Conclusions

LaFeO_3 nanoparticles were successfully synthesized via a citric acid assisted sol–gel method with a low calcination temperature of $700\text{ }^\circ\text{C}$ resulting in a well-crystallized orthorhombic perovskite structure. XRD analysis revealed a crystallite size of 22 nm, while Williamson–Hall analysis indicated an average size of 36 nm, confirming the nanocrystalline nature of the material. The presence of a strong absorption band at 555 cm^{-1} , corresponding to the stretching vibrations of FeO_6 octahedra, further verifies the formation of LaFeO_3 . Optical studies based on DRS measurements showed a band gap of 2.32 eV , indicating strong absorption in the visible region of the solar spectrum. Notably, a low catalyst dosage of 1 mg of LaFeO_3 demonstrated excellent photocatalytic performance. Overall, the high degradation efficiency

of LaFeO₃ makes it a potential candidate as a sustainable and effective photocatalyst for industrial wastewater treatment and for a wide range of visible-light-driven applications.

5. Acknowledgment

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SOCIAL SCIENCES

Fiscal Implications of Government Funded Health Insurance Schemes: An Empirical Evidence from Kerala State.

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Abstract

The purpose of this study is to look at the Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) as it was carried out in Kerala through the Karunya Arogya Suraksha Padhathi (KASP), with particular emphasis on the implications of the revised cost-sharing arrangement for state-level fiscal sustainability. Set against the backdrop of the Rebuild Kerala initiative, the study aims to assess the extent of fiscal liability borne by the Government of Kerala following the shift in the Centre–State financing ratio from 75:25 to 60:40. The shift in the cost-sharing pattern of centrally sponsored health insurance schemes has significantly increased the financial burden on the state government, constraining fiscal space during the post-disaster rebuilding phase. Despite the Centre's strong focus on these schemes, a larger share of the spending burden falls on the states. Building on these fiscal pressures, the study examines the effectiveness of the KASP scheme across districts in Kerala.

I. Introduction:

In India's federal governance structure, the Constitution brings a separation of powers between the national and sub national governments. Within this framework, public health played a crucial role in shaping policy responses. In the Indian context, the pursuit of Universal Health Coverage (UHC) has been accompanied by the introduction of several government-funded health insurance initiatives, most notably the Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana (AB-PMJAY), which represents the largest health assurance programme in the world. The Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) is a flagship health insurance scheme to provide financial protection of Rs. 5 lakhs per family per year for secondary and tertiary care hospitalization and improve access to quality health care services for households in the bottom 40% of the population. Although the scheme has nationwide relevance, its implementation and outcomes differ across states due to variations in fiscal capacity, health infrastructure and governance priorities. Kerala, a southern Indian state characterised by relatively high per capita public health expenditure and sustained budgetary commitment to health, provides a particularly relevant context for analysis. In 2018, the state consolidated its existing health insurance programmes under AB-PMJAY and introduced the Karunya Arogya Suraksha Padhathi (KASP). Karunya Arogya Suraksha Padhathi (KASP) providing a health cover to over 42 Lakhs poor and vulnerable families (approximately 64 lakhs

beneficiaries) that form the bottom 40% of the Kerala population. Under the revised cost-sharing framework, the Centre share 60 per cent of the scheme, while the remaining 40 per cent is met by the state. The subsequent reclassification of Centrally Sponsored Schemes into Core of Core, Core, and Optional categories has reduced central support for key welfare programmes, thereby intensifying Kerala's fiscal burden in the absence of commensurate Finance Commission transfers or additional central assistance. This financing arrangement limits the state's fiscal space for social sector spending and carries broader implications for human development outcomes (Chakraborty et al., 2010). A substantial body of literature has examined governmental responses to external fiscal transfers, with evidence consistently showing that inter-governmental transfers of funds generate a stronger-than-anticipated expenditure response. Earlier studies demonstrate that such transfers lead to increased public spending beyond theoretical expectations (Courant et al., 1975; Inman, 2008; Lu et al., 2010; Rao & Choudhury, 2012; Nikolov & Bonci, 2020; Gupta et al., 2019). Recent evidence further suggests that this tendency extends to the health sector, where intergovernmental transfers are associated with rising public health expenditure (Ramponi et al., 2024). Kerala's implementation of the Ayushman Bharat–Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) through the Karunya Arogya Suraksha Padhathi (KASP) must be understood within this context. The shift in the scheme's cost-sharing pattern from 75:25 to 60:40 has substantially increased the financial burden on the state government, thereby constraining fiscal space during the post-disaster rebuilding phase. In this setting, the study assesses the extent of fiscal liability borne by the Government of Kerala arising from the implementation of AB-PMJAY–KASP.

II. Data and Methodology :

Secondary data were collected from the State Health Agency, Kerala and the Department of Economics and Statistics. Except for population, all variables were obtained from secondary sources, including publications of the Comptroller and Auditor General of India, State budget documents, niyamsabha.org, Reserve Bank of India's State Finance data and the EPWRF Time Series Database. Details about public spending were taken from the State budget documents. This analysis focuses on the State's own health spending and Centres Share for this scheme. This approach helps to understand the fiscal burden and changes in spending patterns.

III. Major Findings :

Result I. Public spending on health insurance schemes sponsored by the Government of Kerala.

During the period 2011–2016, when the funding pattern for the scheme was 75:25, the actual contribution by the state government toward the scheme amounted to Rs. 7,630.9 crore. However, in the 2017–2023 period, when the funding pattern shifted to 60:40, the state’s actual contribution surged to Rs.31,455.5 crore. Under the previous 75:25 cost-sharing pattern, the state would have needed to contribute only Rs. 9,665.7 crore, implying a much larger additional burden of approximately Rs.21,789.8 crore during this period.

The results show a clear increase in the financial responsibility of the state after the cost sharing pattern for centrally sponsored health schemes was revised. After the cost sharing pattern changed to 60:40, the state’s average share rose to 7.48%. This represents an extra burden on the state’s health budget.

Table 1. Public spending on health insurance schemes sponsored by the Government of Kerala

Year	Average Scheme Share (%)
2011–2016 (75:25)-(RSBY period)	6.50
2017–2023 (60:40)-(RSBY and AB-PMJAY KASP period)	7.48

Source: Author’s estimation.SHA, niyamsabha.org data

The scheme enrolment is based on SECC criteria. However, the state can enroll extra deserving families if it wishes, but it must cover the full cost. Due to this, the state's additional burden is calculated and shown in two cases in the following Table 2: Case I by including the extra families, while Case II shows while excluding them. This illustrates the added financial burden on the state government under the scheme. Kerala state enrolled additional around 23 lakh families to the scheme.

Table 2.Kerala-KASP -PMJAY Scheme- Additional Financial Liability of the State Government

Year	Case I-Total State Share (Based on all enrolled families) (Rs.in Lakhs)	Case II-State Share Only-Without adding additional families enrolled (Rs.in Lakhs)	Additional liability- Difference between Case 1 and Case 2
	Additional liability	Additional liability	
2019-20	34317	----	----
2020-21	23277	2909	20368
2021-22	71715	3417.25	68297.75

2022-23	63716.5	3191.50	60525
2023-24	55720.75	4690.75	51030

Source: SHA, Author Calculation.

The additional financial liability on the state is not balanced by transfers from the Finance Commission or by more central funding through Centrally Sponsored Schemes (CSS). The state addresses this extra financial burden through its plans. This could result in less spending on other important areas, especially with the decrease in unconditional transfers.

Policy Suggestions :

Performance-based grant allocation is essential for CSS schemes, as a uniform “one-size-fits-all” approach fails to account for inter-state and intra-state variations in capacity, health needs and implementation outcomes. States with a larger share of elderly populations additional central funding for health programs. This will help meet the growing healthcare needs and ensure financial stability.

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A Study on Factors Affecting School Dropout among Tribal Children in Edamalakudy

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Abstract

School dropout among tribal children remains a major concern in India despite constitutional safeguards and education-focused policies. This study examines the factors affecting school dropout among tribal children in Edamalakudi, Kerala's only exclusively tribal panchayat inhabited by the Muthuvan community. The study adopts a survey method and uses questionnaires and interview schedules as tools for data collection. The sample consists of students, teachers, and parents selected through purposive sampling. The findings reveal that geographical constraints, prolonged absenteeism, inadequate infrastructure facilities, poor hostel conditions, lack of staff quarters, parental illiteracy, social and cultural constraints, and safety concerns due to the presence of wild animals significantly contribute to school dropout. The study highlights that dropout is not an individual failure but a systemic issue shaped by contextual and institutional factors. The paper concludes with policy implications, recommendations, and suggestions for future research.

Keywords: School dropout, tribal children, Edamalakudi, survey method, social constraints

Introduction

Education plays a vital role in promoting social inclusion, human development, and social mobility. However, children belonging to tribal communities continue to experience educational exclusion due to structural and contextual disadvantages. School dropout among tribal children is a persistent issue that undermines the goal of universal elementary education.

Kerala is often recognised for its high literacy rate and educational achievements, yet significant disparities exist within the state. Edamalakudi, located in the Idukki district, presents a unique case as it is the only tribal panchayat in Kerala and is exclusively inhabited by the Muthuvan community. The region is characterised by difficult terrain, forested landscapes, and scattered hamlets, which pose serious challenges to regular school attendance. Understanding the factors leading to school dropout in such a context is essential for designing effective and inclusive educational interventions.

Need and Significance of the Study

The study is significant as it focuses on a marginalised and geographically isolated tribal community whose educational realities are often overlooked in macro-level analyses. By concentrating on Edamalakudi, Kerala's only exclusively tribal panchayat, the study draws attention to the specific social, geographical, and institutional factors contributing to school dropout among tribal children. Although Kerala is widely recognised for its educational achievements, micro-level disparities in remote tribal regions such as Edamalakudi often remain hidden within aggregate statistics. The absence of systematic, field-based research on school attendance, absenteeism, and dropout in Edamalakudi highlights a significant research gap. By addressing this gap, the present study offers original, context-specific insights that are valuable for education planners, administrators, and policymakers, and contributes meaningfully to the broader discourse on inclusive education and tribal development.

Methodology

The study adopts a survey method to examine the factors affecting school dropout among tribal children in Edamalakudi.

Tools of Data Collection

- Questionnaire
- Interview Schedule

Sample of the Study

The total sample consisted of 60 respondents, including 30 students, 5 teachers, and 25 parents. All respondents belonged to the Muthuvan tribal community, as Edamalakudi is an exclusively tribal panchayat. Purposive sampling was used to select respondents who were directly involved in the schooling process.

Findings and Analysis of Data

Geographical Constraints

Geographical constraints emerged as a major factor influencing school dropout. A significant proportion of students (73.3%) reported difficulties related to long walking distances, forest paths, and difficult terrain. Teachers and parents corroborated that during monsoon seasons accessibility becomes severely restricted, leading to irregular attendance.

Prolonged Absenteeism Leading to Dropout

Sixty percent of students and parents reported irregular attendance over extended periods. Once children remain absent for long durations, learning gaps widen, academic confidence declines, and re-engagement with schooling becomes difficult, ultimately resulting in dropout.

Inadequate Infrastructure Facilities

About 66.7% of students and 56% of parents reported poor classroom facilities, lack of sanitation, and insufficient learning resources.

Poor Hostel Facilities (100%)

All students (100%) and all teachers (100%) reported poor hostel facilities, including inadequate living conditions, lack of basic amenities, insufficient supervision, and limited academic support.

Lack of Staff Quarters (100%)

The absence of staff quarters was unanimously reported by teachers (100%). Teachers residing far from school premises face difficulties in regular attendance, especially during adverse weather conditions.

Illiterate Parents and Limited Educational Awareness

Parental illiteracy emerged as an important social constraint, with 72% of parents reporting limited or no formal education.

Social and Cultural Constraints

The mismatch between school culture and indigenous practices, along with limited use of the mother tongue in instruction, led to feelings of alienation among children. Such disengagement gradually weakens students' attachment to schooling.

Presence of Wild Animals (100%)

All students (100%) and all parents (100%) reported fear of wild animals while travelling to school. This fear discourages regular attendance, particularly among younger children, and reinforces prolonged absenteeism, thereby increasing the risk of dropout.

Holistic Interpretation of Findings

The triangulated analysis of responses from students, teachers, and parents clearly indicates that school dropout among tribal children in Edamalakudi is the outcome of interrelated geographical, institutional, social, and safety-related constraints.

Policy Implications and Development-Oriented Interventions

The findings indicate the need for flexible schooling models, improved infrastructure, better hostel facilities, provision of staff quarters, culturally responsive pedagogy, and enhanced community participation. Policies must be adapted to address the unique challenges of remote tribal regions.

Policy Analysis

While the Right of Children to Free and Compulsory Education Act, 2009 provides a strong legal framework, its implementation in remote tribal contexts remains limited. Standardised policy approaches fail to account for geographical isolation and social realities. Strengthening decentralised planning and inter-departmental coordination is essential.

Recommendations

- Improve school and hostel infrastructure
- Provide staff quarters to ensure teacher availability
- Introduce flexible and localised schooling models
- Promote culturally responsive pedagogy
- Strengthen community participation

Conclusion

School dropout among tribal children in Edamalakudi is a systemic issue rather than an individual failure. Addressing it requires comprehensive, culturally responsive, and development-oriented interventions. Ensuring regular attendance and retention is crucial for achieving educational equity among tribal communities.

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Locating Chinese Trade and Travel: Tracing the Fifteenth Century Voyages of Zheng He in South and South East Asia

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Abstract

Zheng He's seven voyages in the 15th century marked a significant milestone in world history, fostering trade and socio-cultural exchanges between China and South and Southeast Asia. Under Emperor Yongle's reign, the Ming dynasty promoted trade with India, Sri Lanka, Malaysia, and Indonesia, forming cultural networks and integration. Zheng He's voyages transformed the economies of visited regions, increasing wealth accumulation and a peaceful international order. China's commercial exchange involved silk, ceramics, and luxury goods, while Chinese merchants established an extensive trade network beyond Southeast Asia. The voyages facilitated cultural interactions, constructing buildings and promoting Islam, Buddhism, and Confucian ideals. Zheng, He popularized the Mazu cult, spreading it throughout Southeast Asia.

1. Introduction

During the reign of Ming Dynasty in China, various industries flourished, including the weaving and dyeing of silk, cotton, and other fabrics, and the production of porcelain and iron pans. Industrial production gradually led to the emergence of several large manufacturing industries. These Chinese goods were highly sought after by foreigners and were often shipped all over the world. At this time, the number of Chinese merchants travelling abroad increased. As a result, China's maritime activities gradually initiated. In this background the Chinese established a number of seaports throughout South and Southeast Asia. In the 15th century, Zheng He led seven oceanic voyages for the Ming emperor, and these voyages are considered as a remarkable milestone in world history. As a result, Chinese traders quickly formed strong relationships with the governments and people of Southeast Asia. Concerning the biography of Zheng He, he was born Ma He in the Yunnan province located at the South-West corner of China 1371 CE. After the fall of Yunnan to the Ming dynasty, it is observed that a good number of young boys (including the 10-year-old Ma He) were captured and castrated. Notably, the castrated men were known as eunuchs, who were a recognized group inside and outside China. As part of administration, the Chinese emperors, princes, and generals had appointed and employed them as staff members, and their figure was considered as a way to have male servants serve women without risking the genetic integrity of the ruling family. During the initial voyages Zheng He travelled all the way from China to Southeast Asia and South Asia and visited all the major trading ports. In his fourth voyage, he travelled to the Persian Gulf.

But for the three last voyages, Zheng He went even further, all the way to the east coast of Africa. Ultimately, Zheng He in his voyages have transacted many commodities and gifts to the South and South East Asian countries and also collected tributes from the different countries. In addition, the seven voyages of Zheng He reflected the maritime trade history before the arrival of Columbus and Vasco da Gama.

2.Ming China

In 1402, Zhu Di became the Yongle Emperor, a significant milestone in Chinese history. Despite facing challenges, he achieved enormous success, including importing weaponry and technology, gaining advanced shipbuilding and navigational skills, and leading major campaigns against Mongolian tribes. Yongle aimed to establish a tribute system, ensuring peace and trade for all involved parties. He protected China from threats from the north, particularly from the Mongols, and used advanced technology for ocean expeditions. After ascending to the throne, Yongle implemented a diplomacy of peace, conducting trade voyages with Zheng He, transferring the capital from Nanjing to Beijing, and investing in the city's wall.

3.Zheng He and voyages

Zheng He led seven maritime journeys from 1405 to 1433, sailing to Southeast Asia and the Indian Ocean, including East Africa. The first journey, initiated in 1405, took place in accordance with an edict issued by Ming China. The second journey, initiated in 1407-1409, was led by Zheng He and accompanied by 30,000 government troops. The third voyage, led by Zheng He, took place between January 16th, 1409 and February 14th, 1411. The fourth journey began in 1413-1415 and included visits to various locations in south and Southeast Asia. The sixth voyage, 1417-19, was intended to provide safe passage for ambassadors from nineteen kingdoms and present awards to their respective kings. The fleet visited various locations in South Asia, Southeast Asia, and Africa. In 1421, Zheng He led six voyages with a fleet of 41 ships and 1,000 crew members on a journey through Southeast Asia, India, and East Africa, receiving gifts such as spices, precious stones, and exotic animals. Zheng He's seventh journey (1431-33) was the most significant, with Zheng He and Wang Ching Hung as chief officers. The emperor appointed numerous assistant envoys and appointed a diverse group of individuals. The fleet departed from Dragon Bay in Nanking on January 19, 1431, and reached various locations in Indonesia, Malaysia, Sri Lanka, and India. Money to the officers and men of the treasure fleet in Beijing. Zheng He's death is a topic of debate among scholars.

4.Socio-Cultural Influence of the Voyages

Trade transactions not only commercial but also socio-cultural interactions were significant in the construction of buildings across South and Southeast Asia. Guan Chang, the most important building construction of the Zheng He era, served as strategic bases for ships awaiting favorable winds. Zheng He encouraged building of mosques in the Chinese architectural style, incorporating Islam, Buddhism, the Mazu cult, and Confucian ideals. He oversaw the construction of Nanjing's Da Baoen Temple, Jingjue Mosque, and Xian's Qingjing Mosque. Zheng He's voyages to the Western Ocean popularized the Mazu cult, leading to its spread throughout Southeast Asia. The worship of Mazu, the Goddess of the Sea, has expanded to

various locations, leading to the construction of temples dedicated to her across coastal provinces. People celebrate Zheng He's death anniversary at Chinadeth near Puthiyangadi in Kozhikode, Kerala, India, from the 18th to the 24th of the Zafar month in the Hijra year.

5. Conclusion

This thesis investigates not only the exchange of trade activities but also the interaction between different generations' cultural, religious, and trading practices. Seaborne trade links, particularly travel, population movements, economic exchange, climate, and historical factors, all help to promote cohesion. During the medieval period, trade economic links between China, South Asia, and Southeast Asia were at their zenith. This link was a drastic change in social life. As a result, it impacts several aspects of life, such as construction, art, and architecture.

China's trade with the great past is still ongoing today. China now opens a new trade port every year. In addition to other types of transportation, they pushed seaborne trade. For example, After India became independent, it didn't pay much attention to port towns in Bengal and Kerala, especially Calicut, Kollam, Kannur, Beypore. His voyage during the Ming Dynasty not only left a remarkable historical imprint on the places he visited, but also inspired the creation of hundreds of literary works, both fiction and non-fiction.

Now discussions are going on about the fact behind the development and growth of the Chinese trade in the world market. Historically we can see the policies and promotions of trade of different dynasties of China gradually developed. We can observe that Zheng He not only engaged in trade activities, but also implemented a tributary system for states around the Western Ocean. Following Zheng's death, trade missions rapidly declined. While history books are replete with the exploits of Columbus and Gama, not much is known about Zheng He, whose fleet was considered to be ten times bigger than his contemporaries. In fact, National Geographic Magazine described Zheng He's naval armada off Sri Lanka as a massive shadow on the horizon that moved like a 'floating city'.

Zheng He is a hero in China, where students learn about his adventures. The opening ceremony of the 2008 Beijing Olympic Games presented Zheng He's epic voyages as a theatrical representation of China's grand historical tradition. China honours Zheng He's voyage by commemorating Maritime Day. Initially, Kunming Changshui International Airport was to be named Zheng He International Airport. In 2015, Emotion Media Factory dedicated a special multimedia show "Zheng He is Coming" for Amusement Park Romon U-Park (Ningbo, **China**). The show was named a finalist in the International Association of Amusement Parks and Attractions (IAAPA)'s prestigious Brass Rings Awards. All these factors have driven China's remarkable growth and development in recent decades. However, a closer examination of the country's history reveals that maritime trade has played a pivotal role in shaping China's economic trajectory. China's maritime trade legacy, particularly during the Ming Dynasty, has played a profound role in shaping the country's modern growth and development. As China continues to navigate the complexities of the 21st-century global economy

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The Influence of Qadiri Sufi Order in the Socio-Cultural and Spiritual Life of Kerala Muslims

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Abstract

The Qadiri Sufi order, one of the earliest and most influential Sufi traditions in the Islamic world, has played a decisive role in shaping the socio-cultural and spiritual life of Muslims in Kerala. Founded by Abdul Qadir Jilani in the 12th century, the Qadiri Sufi order emerged as one of the most widespread Sufi orders globally and played a crucial role in shaping Islamic spirituality in South India. This paper examines the historical arrival, diffusion, and enduring influence of the Qadiri order in Kerala, focusing on its socio-cultural and spiritual contributions among Kerala Muslims. It argues that the Qadiri tradition significantly influenced religious practices, literature, education, social organisation, and inter-communal harmony. Qadiri rituals such as *Ratib*, *Mawlid*, and collective *dhikr* gatherings became integral to religious life in Kerala, strengthening communal spirituality and emotional bonds among believers. The presence of Qadiri *khanqahs*, mosques, and *dargahs* served not only as centres of worship but also as spaces for spiritual instruction, ethical guidance, and social cohesion. By analysing historical sources and cultural practices, this study highlights how the Qadiri order contributed to the formation of a distinctive Islamic identity in Kerala, harmonising local customs with universal Islamic values.

Keywords: Sufism, Qadiriyya, Jilani, dargah, khanqah, customs, dhikr, mawlid,

Introduction

The spread of Islam in Kerala is deeply intertwined with the influence of Sufi traditions. Kerala occupies a unique place in the history of Islam in India due to its early contact with Arab traders and its long-standing maritime links with West Asia. The Muslim community of Kerala, known as the *Mappilas*, developed a distinctive cultural and religious identity shaped by both Islamic teachings and local traditions. Among the various influences, Sufism-and particularly the Qadiri Sufi order-has played a pivotal role. The *Qadiriyya*, one of the oldest Sufi orders in Islam, originated in Baghdad under the leadership of Abdul Qadir Jilani and spread widely across Asia and Africa. Its arrival in Kerala marked a significant transformation in the religious and cultural life of Muslims in the region.

Origin and development of Qadiri Sufism in Kerala

The transmission of the Qadiri Sufi order to Kerala can be traced through the Coromandel Coast, particularly via prominent Muslim centres such as Kayalpattanam and Keelakarai, which had emerged as significant hubs of Islamic learning and trade by the 12th century. These regions hosted settlements of Arab merchants, especially from Yemen, who migrated for

commercial activities and religious propagation. Their presence played a crucial role in shaping the Islamic intellectual and spiritual landscape of South India. A pivotal figure in the dissemination of Islamic education in Kerala was Zainuddin Makhdoom I, who is believed to have arrived from Kayalpattanam. He initially reached and later settled in Ponnani, which subsequently developed into a renowned centre of Islamic scholarship. The Makhdoom family emerged as key leaders in religious instruction and preaching along the Malabar Coast, significantly influencing the socio-religious life of Kerala Muslims.

By the 12th and 13th centuries A.D., a period marked by the consolidation and expansion of organised Sufi orders across various regions of the Muslim world, the Muslim milieu of Kerala had likewise begun to absorb and reflect these spiritual developments. Historical indications suggest that the diffusion of Sufi thought and practice into Kerala was not an isolated phenomenon but part of a broader transregional movement linking the Indian Ocean world. It is said that Imam Abd al-Karim al-Jili, one of the descendants of Sheikh Muhyiddin Abdul Qadir Jilani, and the author of the well-known Sufi work *Al-Insanul al-Kamil*, had reached Cochin, one of the port cities in Kerala, intending to engage in Islamic missionary and spiritual activities.

Several descendants of Abdul Qadir Jilani are known to have migrated to different parts of the Islamic world even during his lifetime, contributing to the early spread of the Qadiri spiritual lineage. Among them was Fariduddin bin Abdul Qadir Khurasani, who is believed to have arrived in Kerala in the 12th century, approximately three centuries before the emergence of the Makhdoom tradition in the region. According to local traditions, Sheikh Fariduddin established a mosque in Ponnani and initiated efforts in religious preaching and spiritual instruction. However, Sheikh Farid's activities were confined to a few areas and did not take on an organised form.

The Qadiri order was deeply embedded in the thought and culture of Kerala Muslims during the three centuries from 1600 to 1900. Its widespread diffusion across the region is closely associated with the efforts of Makhdoom I and his scholarly lineage. Historical records indicate that the Kunjali Marakkar, who were followers of the Makhdooms, adopted the honorific title '*Qalandar*', symbolising their affiliation with Sufi ideals. The spiritual solidarity fostered through the Qadiri order also played a significant role in strengthening anti-colonial resistance in Kerala. In this context, Kunji Marakkar Shaheed of Veliyankod is remembered as a close follower of Makhdoom I. The lineage of the Makhdooms is traditionally traced back to Baghdad, through Kayalpattanam and Yemen, highlighting the transregional intellectual and spiritual networks that linked Kerala to the wider Islamic world. Furthermore, the majority of scholars who received their training in Ponnani were adherents of the Qadiri order, contributing to its sustained prominence in the religious life of Kerala Muslims.

The *Qadiriyya* gained further consolidation in Kerala during the period of Abdul Aziz Makhdoom, the son of Makhdoom I. A key figure in this phase was Qazi Muhammad of Kozhikode, whose efforts significantly contributed to the spread of the Qadiri path. He is widely known as the author of the celebrated devotional poem *Muhyiddin Mala*, which extols the spiritual greatness and contributions of Abdul Qadir Jilani.

The propagation of the Qadiri order continued through Muhyiddin I (d. 1856), the son of Qazi Muhammad, who played an important role in further popularizing the order among the Muslim community of Kerala. Another prominent figure associated with this tradition was Sadaqatullah al-Qahiri from Kayalpattanam, who visited Kozhikode during the tenure of his son Abdu Salam as the Qazi of the region. Sadaqatullah was renowned for his work '*Qutbiyyat*', which reflects on the spiritual stature of Sheikh Abdul Qadir Jilani. During his stay in Kerala, Sadaqatullah resided for an extended period at Muchundippally and in the Jama Masjid of Kozhikode.

Many of the Sufi orders that later took root in Kerala were either offshoots of or closely connected to the *Qadiriyya*. This reflects the foundational role played by the Qadiri tradition in shaping the broader Sufi landscape of the region. Sirajuddin Sheikh Qadiri Ailakkad, Sheikh Muhammad Salihul Maula Veliyancode, etc., were some of the later prominent figures in the Qadiri order.

The Ba 'Alawi Tariqa, which spread in Malabar through the efforts of Sheikh Jifri and his descendants who migrated from Hadramaut, is often regarded as being closely connected to, or an offshoot of, the *Qadiriyya*. Following Sheikh Jifri, figures such as Hasan Jifri, Sayyid Alawi Thangal of Mampuram, and Sayyid Fazal Thangal continued to lead and expand this spiritual lineage. The Ba-Alawi tradition gained significant influence in the interior regions of Malabar largely through the efforts of Sayyid Alawi Thangal of Mampuram, who emerged as a source of spiritual guidance and social support for the people of southern Malabar. His leadership contributed to the consolidation of Sufi practices and devotional life in the region. Sheikh Jifti's relative, Sayyid Abdurrahman Haidros, was also actively engaged with propagating the Qadiri and *Ba-Alawi Tariqats* in and around Ponnani.

The Qadiri scholars viewed the Portuguese and British incursions not just as territorial threats, but as moral and spiritual challenges to the Islamic social order. In response, prominent Sufi leaders such as Sayyid Alawi of Mampuram and Sayyid Fazal utilised their spiritual authority to mobilise the peasantry against oppressive landlords and colonial tax regimes.

Socio-cultural Engagements

The Sufis were successful in developing educational methods according to the socio-cultural traditions of their respective countries. That is also the reason why Islam took root in various countries. Rather than rejecting indigenous artistic and cultural expressions, Sufis often engaged with them creatively, reinterpreting and integrating local traditions within an Islamic framework.

Muhyiddin Mala composed by Qazi Muhammad, played a significant role in strengthening the Qadiri order in Kerala. The text emphasises the spiritual virtues, miraculous episodes, and personal excellence of Abdul Qadir Jilani in a narrative style that is accessible and appealing to the common people, rather than presenting abstract or complex Sufi metaphysical doctrines. The custom of attaining virtue by reciting *Malas* became widespread in society, and it was placed in the heart as part of religious studies. In particular, it became customary in many communities for girls of marriageable age to memorise the text by heart.

Although many Arabic-Malayalam poems about Sheikh Jilani have appeared in later years, *Muhyiddin Mala* remains in first place. *Mala* became famous even among non-Muslims who did not know Arabic. It helped in widespread changes in the fishermen's families in the coastal areas. *Mala* songs were sung by the fishermen instead of *Vanchipattu* songs.

The Arabic-Malayalam literature tradition is rich in references to the Sheikh Jilani. There are many Arabic and Arabic-Malayalam versions and translations of the Sheikh's renowned work, *Futuhul Ghaib*. In addition, prominent compositions such as *Kappapatt* and *Noolmadh* by Kunjayan Musliyar enriched the Arabic-Malayalam literary corpus while extolling the spiritual greatness of Sheikh Jilani. In Arabic, forms such as *Muhyiddin Bait*, *Muhyiddin Mawlid*, and *Muhyiddin Ratib* gained more prominence.

The Influence of Qadiri Order

Kerala is known for its pluralistic society, where Muslims, Hindus, and Christians have coexisted for centuries. The Qadiri Sufi order contributed significantly to this harmony. Sufi sheikhs often acted as community leaders, mediators, and moral guides. Their influence

extended beyond religious matters to social and economic issues. Many Sufi shrines in Kerala attract people from different religious backgrounds. These spaces function as symbols of communal harmony.

Devotional practices such as Qadiri *halras*, monthly *Mawlid* gatherings, and annual festivals (*urus*) held in the name of Sheikh Jilani continue to be observed in Kerala, reflecting the enduring vitality of Sufi traditions. The influence of this devotional culture is also evident in naming practices: among the descendants of Qazi Muhammad of Kozhikode, the name ‘Muhyiddin’ became prominent, despite its absence among earlier generations. Over time, the name gained widespread popularity among Kerala Muslims, often chosen by parents for their newborn sons. Furthermore, the landscape of Malabar bears testimony to this legacy, with numerous mosques dedicated to the Sheikh, commonly known as ‘*Muhyiddin Masjid*’ or ‘*Jilani Masjid*’.

The practice of sacrificing a goat or a chicken in the name of the Sheikh for the cure of chronic diseases and the fulfilment of desires still exists today. There is also the practice of reciting the *Qutbiyyat*, which chants the names of the Sheikh to ward off evil spirits and solve problems. The practice of reaching a state of ecstasy by chanting the name of the Sheikh loudly is very evident among the common people. All these depict a clear picture on the influence of Qadri Sufism in the day-to-day life of the Muslims of Malabar. In essence, the movement has become firmly rooted within the cultural and devotional fabric of Kerala’s Muslim society.

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The Socio-economic Status of Coastal Muslims in South Kerala: A Case Study of Thiruvananthapuram, Kollam and Alappuzha Districts

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Abstract

This study examines the socio-economic status of coastal Muslim communities in South Kerala with reference to Thiruvananthapuram, Kollam, and Alappuzha districts. Despite Kerala's strong development indicators, disparities persist within coastal regions. The fisheries sector remains the primary livelihood base, yet income instability, occupational vulnerability, and limited access to welfare schemes continue to affect these communities. The study is based on both secondary data and a modelled primary dataset derived from field observations and survey responses. Findings indicate that while educational attainment has improved over time, economic mobility remains constrained. Welfare schemes, largely fisheries-centric, do not adequately include allied occupational groups. Additionally, recent infrastructure developments, such as port expansion, have introduced new challenges related to displacement and compensation. The study argues for inclusive and context-sensitive policy interventions that address structural inequalities and promote sustainable development in coastal regions.

1. Introduction

Kerala has long been recognised as a model for human development, achieving high literacy rates, improved health indicators, and relatively low poverty levels compared to other Indian states. According to the Economic Review 2024, the state recorded a growth rate of 6.5 percent and a per capita income of ₹1,76,072, reflecting sustained economic progress. Despite these achievements, development outcomes are not uniformly distributed, and certain regions and communities continue to experience socio-economic marginality.

Coastal regions of South Kerala represent a significant case of such uneven development. These areas are home to large Muslim populations whose livelihoods are historically linked to fisheries and allied occupations. While the fisheries sector contributes substantially to Kerala's economy, producing 8.32 lakh metric tonnes of fish and generating exports worth ₹7,231.84 crores, the benefits of this sector are not equitably distributed among those directly dependent on it. Many coastal households continue to rely on informal, seasonal, and low-income employment, making them vulnerable to economic fluctuations and environmental risks.

Over the decades, the Government of Kerala has implemented a range of welfare schemes targeting coastal communities. These include savings-cum-relief schemes, housing assistance, insurance coverage, and educational concessions. However, evidence suggests that

these initiatives are largely designed for registered fishermen and do not sufficiently address the needs of allied occupational groups such as fish vendors, processing workers, and informal labourers.

In addition to structural limitations in welfare delivery, recent infrastructure developments such as the Vizhinjam International Seaport have introduced new socio-economic dynamics. While the project aims to enhance economic growth and connectivity, it has also raised concerns regarding displacement, livelihood disruption, and uneven compensation. Official records indicate that out of 2928 identified project-affected persons, compensation had been disbursed to 2697 beneficiaries as of December 2023, pointing to gaps in coverage and implementation. Subsequent updates on livelihood assistance as of April 2025 suggest the continuation of the same compensation framework without substantial structural revision, indicating persistent challenges in achieving comprehensive rehabilitation. This study seeks to analyse the socio-economic conditions of coastal Muslims in Thiruvananthapuram, Kollam, and Alappuzha districts by examining education, income patterns, welfare access, and development impacts. It aims to understand how structural inequalities persist within Kerala's broader development model and to suggest pathways for more inclusive growth.

2. Objectives and Methodology

The primary objective of this study is to examine the socio-economic status of coastal Muslim communities in South Kerala, with particular emphasis on livelihood patterns, education, and access to welfare schemes. The study also aims to identify structural gaps in policy implementation and to analyse the impact of development initiatives such as port infrastructure on local communities.

The research adopts a mixed analytical approach combining both secondary and primary data. Secondary data have been collected from official sources, including the Economic Review 2024, Fisheries Department reports, and policy documents related to coastal welfare and development. These sources provide insights into macroeconomic trends, fisheries output, and government interventions.

Primary data were collected through field observations and structured questionnaires conducted in selected coastal areas of Thiruvananthapuram, Kollam, and Alappuzha districts. The initial dataset consisted of 150 responses, focusing on key socio-economic indicators such as education, income, and access to welfare schemes. For comparative analysis, the data were proportionally expanded to a model sample of 300 respondents, with equal representation of 100 respondents from each district. This modelling approach is employed to facilitate analytical interpretation of emerging patterns and regional variations, and should be understood as indicative rather than as a basis for statistical generalisation.

3. Socio-economic Analysis

3.1 Education and Social Change

Educational attainment among coastal Muslim communities has improved significantly over the past decades. The expansion of public education, scholarship schemes, and increased awareness has contributed to higher levels of school enrolment and completion. A considerable proportion of respondents in the study have attained secondary education, and a smaller but notable segment has pursued higher education.

However, the relationship between education and economic mobility remains complex. Despite improved educational outcomes, many individuals continue to be engaged in low-income and informal occupations. This suggests that education alone is insufficient to



overcome structural barriers related to employment opportunities, skill development, and access to formal sectors.

3.2 Socio-economic Distribution

Educational and Income Distribution (Modelled Sample Based on Field Data, n=300)

Source: Primary Data, 2025

3.3 Income and Livelihood Patterns

The income distribution data reveal a concentration of households in the lower income categories. A majority of respondents report monthly incomes below ₹25,000, indicating limited economic stability. This is largely due to the seasonal and uncertain nature of fisheries-based livelihoods. Fishing activities are highly dependent on environmental conditions,

Table 1. The table demonstrates that while educational attainment has improved, income levels remain largely concentrated in lower categories. This reflects a disconnect between education and employment opportunities in coastal regions.

Indicator	Thiruvananthapuram	Kollam	Alappuzha	Total (%)
Primary Education	18	22	20	20%
Secondary Education	52	48	50	50%
Higher Education	30	30	30	30%
Income < ₹10,000	40	45	42	42%
₹10,000–₹25,000	45	40	43	43%
> ₹25,000	15	15	15	15%

regulatory restrictions such as fishing bans, and market fluctuations. As a result, income levels are inconsistent, leading to financial insecurity and limited savings. Allied occupations, including fish vending and processing, are equally vulnerable, often lacking institutional support and formal recognition.

3.4 Welfare Schemes and Institutional Gaps

The Government of Kerala has implemented several welfare schemes aimed at improving the socio-economic conditions of coastal communities. These include the Savings-cum-Relief Scheme, housing schemes, accident insurance, and educational concessions for fishermen’s children. Additionally, institutions such as Matsyafed provide microfinance support, interest-free loans, and marketing assistance. Despite the availability of these schemes, their effectiveness is limited by structural and procedural barriers. Most schemes are designed for registered fishermen, excluding a significant proportion of the population engaged in allied occupations. Furthermore, issues such as bureaucratic delays, documentation requirements, and lack of awareness hinder access to benefits.

Women, who play a crucial role in fish processing and marketing, are particularly affected by these limitations. Although programmes such as the Society for Assistance to Fisherwomen (SAF) exist, their reach remains restricted.

3.5 Development Projects and Livelihood Impact

The development of the Vizhinjam International Seaport represents a major infrastructural intervention in the coastal region. While the project aims to enhance economic growth and connectivity, its impact on local communities has been mixed.

4. Conclusion

The study concludes that coastal Muslim communities in South Kerala have experienced measurable improvements in education and basic living conditions over time.

However, these improvements remain uneven when compared to the broader development achievements of the state. Income insecurity, occupational vulnerability, and limited access to welfare schemes continue to shape the socio-economic realities of these communities.

The fisheries sector, despite its significant contribution to the state economy, does not ensure equitable livelihood outcomes. Welfare schemes, while extensive, are largely fisheries-centric and fail to address the needs of allied occupational groups. Additionally, development projects such as the Vizhinjam Port have introduced new challenges, including displacement and uneven compensation.

The study highlights the need for inclusive and context-sensitive policy interventions that go beyond traditional sectoral approaches. Expanding welfare coverage, improving institutional accessibility, and promoting livelihood diversification are essential for addressing structural inequalities.

The study also notes that large-scale infrastructure interventions such as the Vizhinjam International Seaport have introduced new livelihood uncertainties, with partial compensation and limited inclusion of allied workers, highlighting gaps in rehabilitation frameworks. These developments further reinforce existing structural inequalities, emphasising the need for more participatory and inclusive policy approaches in coastal development. Ultimately, achieving equitable development in Kerala requires recognising the specific challenges faced by coastal communities and integrating their needs into broader policy frameworks. A more participatory and inclusive approach to development can contribute to sustainable socio-economic transformation in coastal regions.

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Educational and Professional Position of Muslim Women in Kerala: A Case Study of Thiruvananthapuram District

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Abstract

This study investigates the educational backgrounds and employment patterns of Muslim women in selected coastal wards of Thiruvananthapuram district. Although Kerala is widely recognised for its educational achievements, disparities persist within specific communities and regions. Data were collected from 250 respondents across five coastal wards: Vizhinjam, Poovar, Perumathura, Poonthura, and Edava. The analysis examines the impact of local economic conditions, cultural expectations, and resource accessibility on women's educational advancement and workforce participation. The findings reveal that, while basic education among Muslim women has improved considerably, access to higher education and stable employment opportunities remains constrained. Many women are either outside the workforce or engaged in informal economic activities. The study highlights the need for context-specific strategies that combine educational support with employment opportunities to foster meaningful empowerment.

1. Introduction

Kerala's development model is frequently associated with widespread literacy and social progress; however, these achievements are not evenly distributed across all segments of society. In the coastal areas of Thiruvananthapuram, Muslim women face distinct challenges shaped by geographic location, occupational patterns, and prevailing social expectations. These regions rely primarily on fishing-related livelihoods, which are often unstable and seasonal. Such economic conditions directly affect educational continuity and employment opportunities for women

Historically, opportunities for formal education among Muslim women have been limited by financial constraints and prevailing social attitudes. Over time, participation at the school level has improved, supported by public policies and increased family awareness. However, this progress has not translated into similar advancement in higher education or professional careers. This study examines this gap by focusing on selected coastal wards where these challenges are especially pronounced.

1.1. Methodology

This research adopts a descriptive approach to examine the current status of Muslim women in coastal Thiruvananthapuram. Data were collected from five wards: Vizhinjam, Poovar, Perumathura, Poonthura, and Edava. The study included 250 respondents, with 50 individuals randomly selected from each ward.

Data collection involved structured questionnaires and informal discussions to capture both quantitative trends and qualitative experiences. In addition to primary data, supplementary information was sourced from official reports and previous studies. The analysis primarily uses percentage-based interpretation to identify patterns in education, employment, and income levels

2. Socio-Economic Context of the Study Area

The coastal wards selected for this study share several characteristics, particularly their reliance on fishing as the primary source of income. Vizhinjam is notable as an active fishing centre with recent infrastructure developments, while Poovar combines fishing with tourism-related activities. In contrast, Perumathura remains less developed and provides limited employment opportunities beyond traditional occupations.

Poonthura is marked by high population density and economic hardship, making it one of the more vulnerable wards in the study. Edava shows a relatively improved situation due to some occupational diversification, although significant challenges remain. Across all wards, income instability and limited access to advanced educational facilities continue to affect women's opportunities

2.1 Socio-economic condition of Muslims in the coastal areas of Kerala

The socio-economic status of Muslims in Kerala's coastal areas reflects both social progress and ongoing economic challenges. Literacy rates are relatively high compared to many other regions in India, but remain slightly below the state average. In these coastal areas, limited access to higher education and skill-based training restricts opportunities for improved employment. Many households depend on traditional occupations such as fishing, small-scale trade, and remittances from Gulf countries. Although remittances have improved living standards, they have also contributed to economic dependency and limited diversification of local employment. The seasonal nature of fishing and exposure to environmental risks further increase income instability. Additional social issues, including inadequate housing, limited healthcare, and infrastructural deficiencies, are widespread. While the Government of Kerala has implemented various welfare and development programs, their benefits are unevenly distributed, leaving many families in vulnerable situations.

2.1 Educational Status of Muslim Women in the Selected Wards

Figure :-1

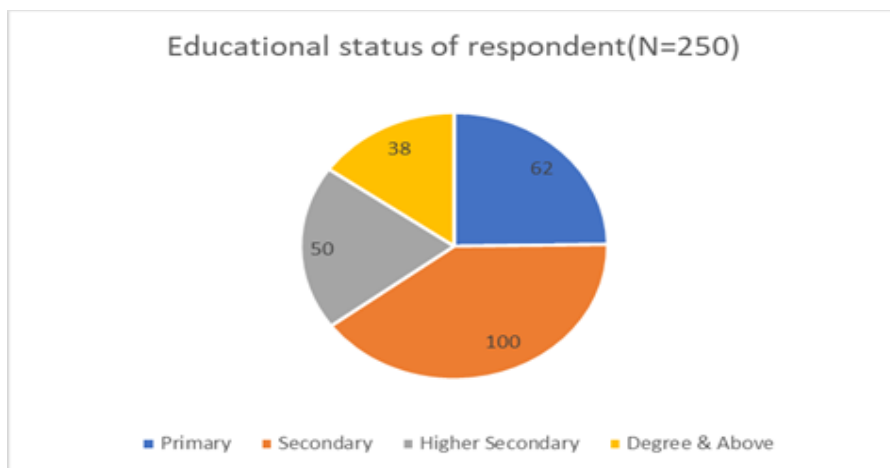


Figure 1 primary data (survey method)

The data collected indicate that access to basic education among Muslim women has improved significantly over the years. Most respondents have completed schooling up to the secondary level, suggesting that primary education is no longer a major barrier. Families increasingly view education as important, especially for younger generations.

Despite this improvement, continuation into higher education is still limited. Several respondents reported discontinuing studies after school due to financial difficulties, family responsibilities, or early marriage. In some cases, lack of nearby institutions and limited exposure to career options also contributed to this trend. As a result, a noticeable gap exists between basic literacy and advanced educational attainment.

2.2 Professional Position of Muslim Women in the Selected Wards

Figure:-2

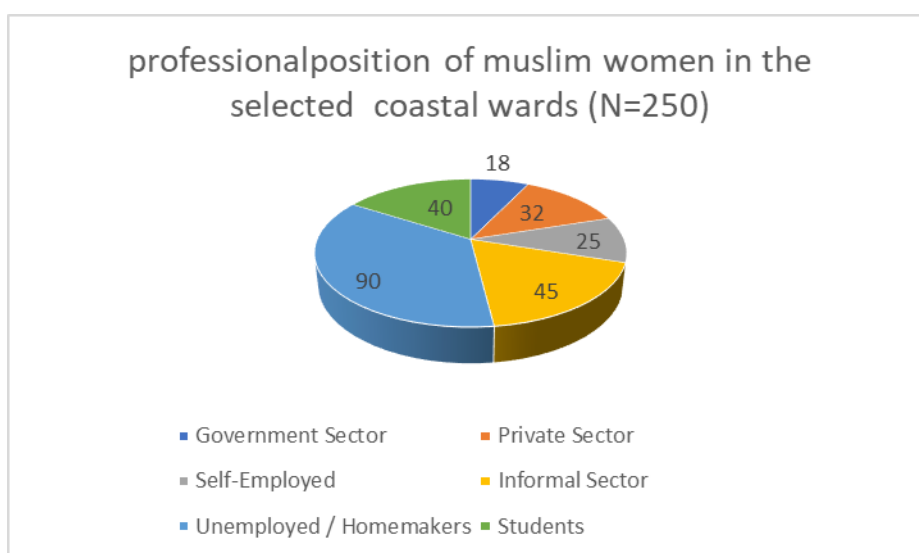


Figure 2 professional position of Muslim women in selected wards

The employment pattern of Muslim women in the study area reflects restricted participation in organized sectors. As presented in Table 2, only a small share of respondents are employed in

government or private sector jobs. A portion of women are involved in small-scale self-employment, often linked to local markets or household-based production.

A considerable number of respondents are engaged in informal work such as fish processing or tailoring, which provides income but lacks stability and formal recognition. At the same time, a large group remains outside paid employment, primarily involved in domestic responsibilities. The presence of students among the respondents indicates a potential for future change, but current employment levels remain low.

2.3 Socio-Economic Challenges

The study highlights that economic uncertainty remains a major concern for households in coastal areas. Since fishing income is highly dependent on environmental conditions, families often face financial instability. This directly affects decisions related to education and employment.

In addition to economic factors, living conditions in these regions present further challenges. Issues such as inadequate housing, limited infrastructure, and exposure to coastal hazards influence overall well-being. Social expectations also continue to shape women's roles, often prioritizing family responsibilities over career development. These combined factors create barriers that are not easily addressed through a single intervention.

Conclusion

The findings of this study suggest that Muslim women in the coastal wards of Thiruvananthapuram are experiencing gradual change, but progress remains uneven. While access to schooling has improved, movement into higher education and stable employment is still limited. The gap between education and employment highlights the influence of both economic and social factors.

At the same time, there are signs of positive transformation, particularly among younger women who are continuing their studies. Strengthening this trend requires focused efforts that address financial constraints, improve access to higher education, and expand employment opportunities. A balanced approach that considers both local realities and broader development goals is essential for improving the position of Muslim women in these communities

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The Impact of Maintenance and Welfare of Parents and Senior Citizens Act of 2007 and Islamic Elderly Care in Kerala : A Case Study of Thiruvananthapuram District

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Abstract

This study analyzes the impact and effectiveness of the Maintenance and Welfare of Parents and Senior Citizens Act, 2007 (MWPSA Act) in ensuring the maintenance and welfare of senior citizens in Kerala, with special reference to Thiruvananthapuram district. It explores how Islamic values influence elderly care practices within Muslim communities and examines challenges faced by families in fulfilling legal responsibilities. The study highlights the growing ageing population and the decline of traditional family support systems. By integrating legal and ethical perspectives, it argues that neither law nor morality alone is sufficient. A complementary relationship between the MWPSA Act and Islamic moral teachings is essential to promote effective and dignified elderly care.

Key words:- Maintenance, Welfare, Senior Citizen, Elderly Care, MWPSA Act

1. Introduction

Population ageing is an inevitable outcome of demographic transition characterized by declining fertility rates and increasing life expectancy. Globally, the proportion of individuals aged sixty and above is increasing at an unprecedented rate. This demographic shift has transformed ageing from a family-centered issue into a major social, economic, and policy concern. According to international demographic projections, developing countries are expected to experience faster growth in elderly population compared to developed nations, placing additional pressure on social welfare systems that are still evolving (UN department of economic and social affairs, 2023).

India is undergoing significant demographic changes as the elderly population continues to increase. Traditionally, Indian society relied on joint family systems that ensured emotional, social, and financial support for elderly individuals. However, rapid urbanization, migration, and economic transformations have contributed to the gradual decline of joint family structures. Nuclear family arrangements have reduced the availability of family-based caregiving support, leaving many elderly individuals vulnerable to neglect, financial insecurity, and social isolation. As a result, the Indian government has introduced several welfare policies and legislative measures to address these challenges.

Among these initiatives, the Maintenance and Welfare of Parents and Senior Citizens Act, 2007 represents a significant step toward ensuring the rights and dignity of elderly individuals. The Act legally obligates children and relatives to provide maintenance and support to senior citizens who are unable to sustain themselves. It also establishes institutional mechanisms such as maintenance tribunals to address grievances related to elderly neglect and financial exploitation.

Kerala provides a unique case for examining elderly care due to its advanced demographic transition and high life expectancy rate. The state has one of the largest elderly populations in India and has developed comprehensive welfare schemes to support senior citizens. It also has a diverse cultural and religious landscape that influences social behavior and caregiving practices. Islamic teachings, which emphasize compassion, respect, and responsibility toward elderly individuals, play an important role in shaping caregiving attitudes within Muslim communities. This study examines the combined influence of legal frameworks and Islamic ethical values in promoting elderly care in Kerala, focusing specifically on Thiruvananthapuram district. By analyzing the interaction between legal obligations and religious teachings, the study contributes to understanding the development of sustainable elderly welfare systems.

2. Legal Framework of Elderly Care in India

2.1 Maintenance and Welfare of Parents and Senior Citizens Act, 2007

The Maintenance and Welfare of Parents and Senior Citizens Act, 2007 was enacted to address the growing need for legal protection and social security for elderly individuals in India. The Act recognizes the responsibility of children and relatives to provide financial maintenance and support for senior citizens who are unable to care for themselves. It ensures that elderly individuals have access to basic necessities such as food, shelter, healthcare, and emotional support.

One of the significant features of the Act is the establishment of Maintenance Tribunals at the subdivision level. These tribunals provide a simplified and accessible legal mechanism through which senior citizens can claim maintenance from their children or relatives. The Act also provides provisions for monthly maintenance allowances and empowers tribunals to ensure timely resolution of cases. This approach aims to reduce procedural delays and ensure effective legal protection for elderly individuals.

Another important aspect of the Act is its focus on protecting elderly individuals from property-related exploitation. The legislation allows for the cancellation of property transfers if it is proven that such transfers were made under coercion or if the caregiver fails to fulfill maintenance responsibilities. This provision serves as a safeguard against financial abuse and strengthens the security of elderly individuals. The Act also encourages the establishment of old-age homes and institutional care facilities for senior citizens who lack family support. These provisions highlight the government's commitment to developing comprehensive welfare mechanisms that combine family-based and institutional caregiving systems.

3. Implementation of the Act in Kerala

Kerala has played a proactive role in implementing the Maintenance and Welfare of Parents and Senior Citizens Act, 2007. The state government introduced the Kerala Maintenance and Welfare of Parents and Senior Citizens Rules, 2009 to facilitate the effective implementation of the Act. These rules established maintenance tribunals across subdivisions and appellate tribunals at the district level, ensuring accessibility of legal support for elderly citizens (Mathew & Nair, 2017).

The government also designated Social Justice Officers as Maintenance Officers responsible for assisting elderly individuals in filing maintenance claims and ensuring enforcement of tribunal orders. These institutional arrangements have significantly improved the accessibility and efficiency of elderly welfare mechanisms in Kerala (Mathew & Nair, 2017).

Kerala's implementation of the Act shows strong coordination between legal institutions and social welfare agencies, with maintenance tribunals effectively addressing issues like elderly neglect, financial insecurity, and property disputes through accessible procedures. However, challenges persist, including lack of awareness among senior citizens, social stigma in reporting family members, and financial limitations. Despite these barriers, Kerala remains one of the most effective models in India for implementing the Act.

4. Elderly Welfare Initiatives in Kerala

Kerala is widely recognized for its progressive social welfare policies and comprehensive healthcare system. The state has one of the highest life expectancy rates in India, resulting in a growing elderly population that requires specialized welfare programs. The government has introduced several initiatives aimed at improving the quality of life of senior citizens.

One of the major welfare measures in Kerala is the provision of social security pension schemes that provide financial support to elderly individuals belonging to economically disadvantaged groups. These pension schemes help reduce financial dependence on family members and enhance the economic security of senior citizens. Kerala has also developed extensive healthcare programs targeting elderly individuals. Community-based healthcare services, geriatric clinics, and mobile healthcare units provide medical support to senior citizens, particularly in rural and remote areas. The Vayomadhuram scheme, which provides glucometers and medical assistance to elderly individuals suffering from diabetes, represents an important initiative addressing age-related health issues.

The state has also promoted community-based elderly care programs that encourage social participation and emotional well-being. Old-age homes, day-care centers, and recreational facilities provide safe spaces for elderly individuals who lack family support. These initiatives reflect Kerala's holistic approach to elderly welfare, combining financial security, healthcare support, and social integration. Thus the increasing elderly population presents new challenges, including rising healthcare costs and changing family structures. The state continues to explore innovative welfare to address these challenges and ensure sustainable elderly care systems.

5. Islamic Ethical Perspective on Elderly Care

Islamic teachings provide a comprehensive ethical framework that emphasizes compassion, respect, and responsibility toward elderly individuals. The Quran repeatedly highlights the importance of kindness and gratitude toward parents, considering caregiving as both a moral obligation and an act of spiritual devotion (Quran, 29:8). These teachings encourage individuals to treat elderly family members with dignity and emotional support. Prophetic traditions further reinforce the importance of respecting elderly individuals as a fundamental aspect of social harmony. Islamic ethics emphasize intergenerational solidarity and encourage family members to prioritize the well-being of elderly relatives. These values contribute to the preservation of family-based caregiving systems within Muslim communities.

In Kerala, Islamic teachings play a significant role in shaping caregiving attitudes among Muslim families. Religious institutions and community organizations actively promote awareness regarding the moral responsibility of caring for elderly individuals. The integration of religious values into daily social practices strengthens emotional bonds between family members and reduces the risk of elderly neglect. Islamic charitable practices such as zakat and waqf also contribute to supporting vulnerable elderly individuals by providing financial assistance and welfare services. These practices demonstrate the role of religious institutions in supplementing government welfare programs.

The interaction between Islamic ethical teachings and legal frameworks such as the MWPC Act creates a complementary system that strengthens elderly care practices. While legal provisions establish enforceable obligations, religious values promote voluntary caregiving based on moral responsibility and social solidarity.

6. Conclusion

The increasing elderly population presents significant challenges for social welfare systems and family-based caregiving structures. The Maintenance and Welfare of Parents and Senior Citizens Act, 2007 provides a strong legal framework that ensures financial security and social protection for elderly individuals. Kerala's effective implementation of the Act demonstrates the importance of institutional mechanisms in safeguarding elderly rights. At the same time, Islamic ethical teachings play a vital role in strengthening caregiving responsibilities within Muslim communities. The integration of legal frameworks and religious values creates a holistic approach to elderly welfare that addresses both material and emotional needs. Policymakers should focus on enhancing awareness of elderly rights, strengthening community-based caregiving programs, and encouraging collaboration between legal institutions and religious organizations to promote sustainable elderly care systems.

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A Systematic Review of Mental Health Disorders and Their Influence on Career Decision Making Among Graduate Students in India

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Abstract

This systematic review examines the prevalence of mental health disorders specifically anxiety, depression, and burnout among graduate students in India and analyses their influence on career decision-making processes. Drawing on 38 empirical studies published between 2016 and 2025, the review synthesises prevalence rates across disciplines, identifies key psychosocial and academic stressors, and evaluates the implications of psychological distress on employability perceptions and career trajectories. The findings indicate consistently high prevalence levels, with anxiety and depression frequently affecting 30%-86% of students, particularly within medical and STEM disciplines. Burnout and associated symptoms, including suicidal ideation, are also notably prevalent. The review further reveals that mental health challenges significantly impair career self-efficacy, increase academic amotivation, and distort career related decision making through mechanisms of stress appraisal and uncertainty. The study highlights critical gaps in longitudinal and theory-driven research and underscores the urgent need for integrated institutional frameworks that link mental health support with career guidance in Indian higher education.

1. Introduction

The psychological well-being of graduate students in India has emerged as a critical issue, creates dire consequences in both individual academic success and national professional development. Over the past decade, a steady rise in psychological distress has been documented within Indian higher education, with anxiety, depression, and burnout identified as the most prominent conditions (Lt et al., 2021; Philip et al., 2021). National surveys and meta-analyses suggest that a significant portion of the Indian graduate population, between one-third and one-half, experiences clinically significant symptoms of depression and anxiety (Murali & Avudaiappan, 2024). The emergence of the COVID-19 pandemic served as a major catalyst, exacerbating pre-existing mental health challenges. Disruptions to academic routines, social isolation, and heightened uncertainty regarding the future led to intensified stress appraisals (Thomas et al., 2022; Verma et al., 2021). However, a critical gap remains in understanding how these psychological conditions specifically influence career decision-making and perceptions of employability (Shanmugam et al., 2025). The majority of existing studies remain confined to symptom-level assessments, offering limited integration of broader psychosocial contexts or career-related outcomes. As a result, the functional consequences of mental health distress during a pivotal career-transition phase remain insufficiently examined. Untreated mental health challenges extend beyond individual suffering, contributing to academic

attrition, diminished productivity, and long-term occupational difficulties (Lt et al., 2021). Against this backdrop, the present study aims to systematically synthesise existing research on mental health disorders among graduate students in India and examine their implications for career decision-making

2. Objectives of the Study

The primary objectives of this systematic review are:

1. To evaluate current knowledge on the prevalence of anxiety, depression, and burnout among graduate students in India.
2. To identify and synthesise the psychosocial and academic factors influencing mental health disorders in this demographic.
3. To benchmark the impact of mental health disorders on career decision-making processes.
4. To evaluate the effectiveness of existing coping strategies institutional support mechanisms.

3. Method Used for the study

This study adopts a systematic review approach to synthesise existing literature on mental health disorders and their impact on career decision-making among graduate students in India. The review process was guided by established systematic review principles, including structured search, screening, and selection procedures using PRISMA framework

A comprehensive literature search was conducted using relevant academic databases to identify studies published between 2016 and 2025. The search strategy incorporated combinations of keywords related to *mental health, anxiety, depression, burnout, graduate students, India, and career decision-making.*

Inclusion criteria were defined as: (i) empirical studies focusing on graduate or postgraduate students in India; (ii) studies examining mental health outcomes such as anxiety, depression, or burnout; and (iii) research addressing psychosocial, academic, or career-related variables. Studies not meeting these criteria, including those lacking empirical data or focusing on non-student populations, were excluded.

The initial screening of titles and abstracts yielded 108 relevant studies. To enhance coverage and ensure inclusion of influential works, backward and forward citation chaining was employed. This process resulted in an expanded pool of 198 studies. After detailed full-text evaluation and relevance assessment, 38 studies were identified as highly relevant and included in the final synthesis.

4. Results

The reviewed literature indicates a substantial mental health burden across various graduate disciplines, with medical students consistently reporting the highest morbidity. Table 1 shows the Prevalence of Mental Health Disorders and the corresponding studies reviewed for the study

Table 1: Prevalence of Mental Health Disorders by Student Subpopulation

Student Subpopulation	Disorder	Prevalence Rate	Source
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Medical Students	Depression	50%	Gore et al. (2025)
Medical Students	Anxiety	73.6%	Gore et al. (2025)
Medical Students	Burnout	80–86%	Philip et al. (2021)
Medical Students	Suicide Ideation	21%	Kaur et al. (2024)
Postgraduates (General)	Depression	34%	Alageel (2024)
Postgraduates (General)	Anxiety	41%	Alageel (2024)
PhD Students	Depression	27%	Lt et al. (2021)

4.1 Contributing Factors

Stressors contributing to these rates are multifactorial and can be categorized into four primary domains:

- **Academic Pressures:** Heavy workloads, competitive environments, and exam-related insecurities (Gore et al., 2025).
- **Financial Hardships:** Economic status and concerns regarding tuition fees and job market uncertainty (Cao et al., 2024; Lt et al., 2021).
- **Interpersonal Conflicts:** Strained relationships with supervisors and peer comparison (Alageel, 2024).
- **Gender-Specific Dynamics:** Female students consistently report higher symptom severity (Kaur et al., 2024); however, male engineering students report higher issues linked to parental pressure and social comparison (Maji et al., 2024).

4.2 Career Impact Assessment

Mental health disorders exert a profound negative influence on professional trajectories through several mechanisms. Applying a Sensemaking perspective, research shows that emotional strain linked to placement uncertainty impairs employability perceptions (Shanmugam et al., 2025). Network analysis reveals that career-related stress is central to the network of depressive and anxiety symptoms, acting as a core driver of psychological morbidity (N. et al., 2024). Furthermore, academic amotivation serves as a mediator between stress and mental health, leading to reduced productivity and increased risk of dropout (Maji et al., 2024).

5. Discussion

In the Indian context, sociocultural factors play a dual role. While family and peer pressure can intensify placement-related anxiety (Shanmugam et al., 2025), social structures can also act as buffers; for instance, marriage has been shown to buffer symptoms in some postgraduate cohorts (Madhan et al., 2012). Significant disparities exist between urban and rural populations, with rural youth reporting significantly higher rates of anxiety (58%) and depression (51%) due to limited access to formal resources (Bertorio & Theerka, 2025).

Graduate students employ a range of coping strategies. Adaptive mechanisms such as mindfulness, positive reframing, and peer mentoring show promise in reducing distress (Laequddin et al., 2024). Conversely, maladaptive behaviours, including substance use as self-medication and problematic internet engagement, are prevalent (Basri et al., 2022). Institutional

support is currently failing to meet demand. The literature highlights an alarming 82.9% treatment gap in the general population, which is reflected in the graduate context by a reluctance to seek care due to stigma and confidentiality concerns (Grover & Sahoo, 2023). According to the Conservation of Resources (COR) Theory, current institutional frameworks fail because they do not effectively replenish the personal and social resources depleted by chronic academic stress.

Research Gaps

1. Limited longitudinal studies tracking mental health trajectories across academic years restrict causal inferences.
2. A lack of direct empirical research examining the mechanisms through which psychological distress influences career decision-making and employability outcomes.
3. Minimal rigorous assessment of the effectiveness and reach of existing counseling, wellness, and support programs within higher education institutions.
4. Predominant emphasis on medical and STEM cohorts, with insufficient representation of arts, commerce, and other graduate streams.
5. Limited investigation into mental health prevalence among rural students and inequities in access to mental health resources.

Conclusion

This review confirms a mental health crisis among Indian graduate students, with prevalence rates for anxiety, depression, and burnout consistently exceeding 30%. These conditions are deeply entangled with academic workload, financial insecurity, and intense sociocultural pressures. Applying the Conservation of Resources Theory, it is evident that students are facing a depletion of psychological capital. Furthermore, from a Sensemaking perspective, the distress experienced during this transition period significantly impairs students' ability to construct a positive professional identity and navigate career decisions. There is an urgent need for the development and implementation of integrated mental health frameworks within Indian higher education that effectively bridge psychological support and career development services. Such frameworks must be culturally sensitive, confidential, and multi-tiered, addressing not only individual psychological needs but also the academic, institutional, and sociocultural factors that contribute to student distress. Embedding mental health support within educational governance and career guidance structures can enhance early identification, reduce stigma, and promote adaptive coping and informed career decision-making. Safeguarding student well-being is therefore not merely an ethical responsibility but a strategic investment in sustaining academic success, workforce readiness, and the long-term health of the Indian professional population.

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Construction of Gender in Early Language Education: A Study of SCERT Malayalam Textbooks For Class 1& 2

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Abstract

This study examines gender representations in the Malayalam primary school textbooks *Keralapadavali* for Classes I and II prepared by the State Council of Educational Research and Training in Keralam which is first published in 2014 which is reprinted in 2016 using qualitative content analysis. The study investigates how gender roles are represented, structured, and reproduced through textual narratives and visual illustrations in early educational materials. The findings reveal that these textbooks largely reinforce patriarchal ideologies by presenting male characters in dominant and public roles, while female characters are mostly associated with caregiving and domestic responsibilities. Such representations contribute to the early socialization of children into hierarchical gender roles, though emerging textbook revisions also indicate initial signs of more inclusive gender sensitivity.

Keywords: Patriarchy, Gender socialization, Textbook, Gender roles, Ideological apparatus

Introduction

Keralam is widely recognized for its achievements in literacy and social development; however, gender discrimination continues to persist within its social structure through deeply embedded patriarchal norms. Patriarchy in Keralam is not a sudden or isolated phenomenon but a socially constructed system reproduced through processes of socialization from early childhood. Through institutions such as family, education, media, peer groups, and religion, children internalize culturally defined expectations regarding gender roles, where men are often associated with authority and dominance, while women are positioned within nurturing and supportive roles. These processes contribute to the normalization and continuation of gender inequality across generations. Among the various agents of socialization, schools play a crucial role as formal institutions shaping children's social attitudes and values. In the Keralam context, where schooling is largely textbook-oriented, textbooks function as powerful instruments in transmitting cultural norms and social expectations. Particularly at the primary level, textbooks significantly influence children's understanding of identity, behavior, and gender roles through both textual narratives and visual representations. While textbooks have the potential to promote equality, they often reproduce dominant gender ideologies and reinforce traditional divisions of labor and responsibility. At this background, the present study examines gender representations in the Malayalam language textbooks *Keralapadavali*

prepared by SCERT for Classes I and II first published in 2014 which is reprinted in 2016 in Keralam. The study analyzes how these early educational materials contribute to the socialization of children into gendered roles and explores the extent to which they reinforce patriarchal assumptions within the schooling process.

Objectives Of The Study

1. To study how gender roles are represented in Malayalam language textbooks *Keralapadavali* prepared by SCERT for Classes I and II first published in 2014 which is reprinted in 2016.
2. To understand the role of textbooks as an ideological apparatus for establishing patriarchal Gender roles and expressions.

Research Methodology

This study adopts a qualitative research design to examine gender representations in primary school textbooks and their role in the socialization of patriarchal ideas. Qualitative research focuses on understanding social reality through the interpretation of meanings, experiences, and social processes within their contexts. In this study, qualitative content analysis is used to systematically examine how gender roles and expressions are represented in textbooks.

Drawing on Louis Althusser's concept of Ideological State Apparatuses, the study considers textbooks as important agents in transmitting dominant gender ideologies to children. The data consist of the Malayalam language textbooks *Keralapadavali* for Classes I and II which is first published in 2014 which is reprinted in 2016 prepared by the SCERT, Government of Keralam. Purposive sampling is employed to select these textbooks due to their significance in early-stage socialization. The collected material is thematically analyzed to identify recurring gender representations and to understand how early educational content contributes to the construction and reinforcement of patriarchal norms..

Discussion and Analysis

The data for this study were collected through qualitative content analysis and interpreted using thematic analysis in accordance with the objectives of the research. Content analysis enables the systematic identification of patterns, themes, and meanings within textual and visual materials and is particularly useful for examining how educational content communicates social norms and values. Through this method, the study analyzes gender representations in the SCERT Malayalam textbooks *Keralapadavali* for Classes I and II to understand how patriarchal ideas are embedded within early-stage educational materials.

The analysis reveals that gender roles presented in the textbooks largely reflect conventional social expectations prevalent in Keralam society. Women are predominantly portrayed within the domestic sphere as caregivers responsible for cooking, child-rearing, and household management, while men are represented as breadwinners and decision-makers engaged in activities outside the home. For instance, in the chapter "*Veedu Nalla Veedu*", (figure1&2) visual representations depict women and girls engaged in caregiving and household work, whereas boys are shown participating in outdoor activities such as playing cricket, and adult

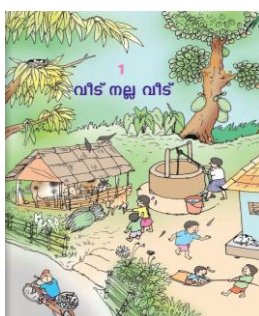
men appear as workers earning livelihoods. These representations implicitly communicate normative expectations about gender-appropriate behavior and responsibilities across different stages of life.

Similarly, in “*Angane Oru Avadhikkalathu*”, expressions such as “mother stacking clothes” and “father stopping the car” reinforce conventional divisions between domestic and public roles. In another section, fathers are shown cleaning a local pond, while women remain confined to household spaces such as kitchens. Likewise, in “*Arinju Kazhikkam*”(figure3), the visualization of a mother cooking and serving food to the family reinforces the idea that domestic labor is primarily women’s responsibility. In other hand male characters are engaged in jobs(figure 4). Such repeated depictions normalize gendered divisions of labor and subtly shape children’s perceptions regarding appropriate roles for men and women.

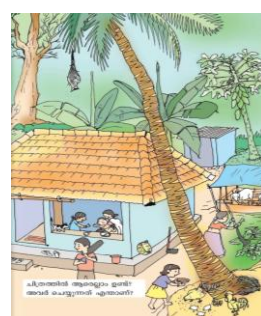
The textbooks also associate strength, authority, and leadership with masculinity through narrative symbolism. For example, powerful animal characters such as the elephant named “*Aanamooppan*” and the lion named “*Keshan Rajavu*” are presented using masculine identities, reinforcing the association between masculinity and power. These portrayals reflect broader cultural assumptions that align authority with male identity.

These findings can be understood in relation to Ann Oakley’s theory of the social construction of gender, which emphasizes that gender roles are shaped by cultural expectations and institutional practices rather than biological differences. The textbook narratives and images examined in this study support Oakley’s argument that gendered divisions of labor are socially produced and reproduced through everyday institutions such as education.

Furthermore, textbooks function as important ideological instruments within the schooling system. Drawing on Michel Foucault’s concept of power–knowledge, curriculum production can be understood as a process through which institutional authorities shape and circulate particular forms of knowledge. In this context, the SCERT textbooks reflect dominant social values that contribute to the reproduction of gender hierarchies. Similarly, Louis Althusser’s concept of Ideological State Apparatuses helps explain how schools and textbooks transmit dominant ideologies by presenting gender roles as natural and unquestioned. Through repeated textual and visual representations, these textbooks participate in the early socialization of children into accepting male-dominant gender norms, thereby contributing to the reproduction of patriarchal structures within society.



(Figure 1)



(Figure 2)



(Figure 3)



(Figure 4)

Major Observations

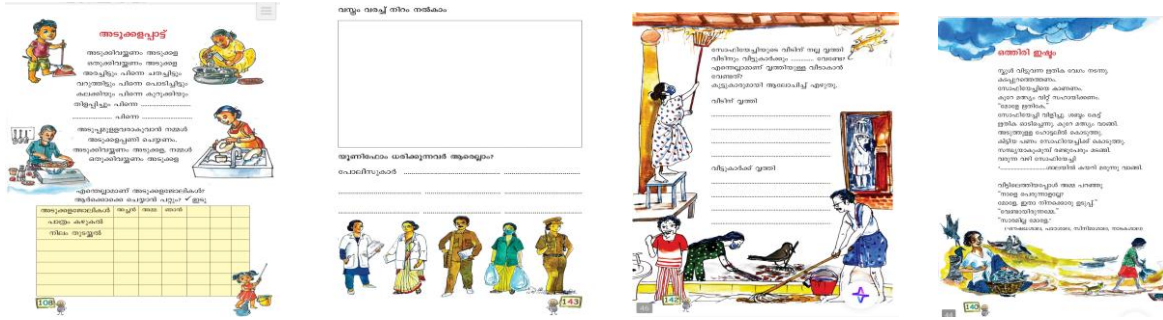
The analysis of the SCERT Malayalam textbooks *Keralapadavali* for Classes I and II reveals that gender representations are largely structured within a rigid binary framework, with only male and female identities being depicted. Across poems, stories, conversations, activities, and visual illustrations, gender is represented through clearly differentiated expressions, roles, and divisions of labour. These representations collectively construct a dominant narrative that normalizes traditional gender expectations among young learners.

The study finds that male characters appear more frequently and are often portrayed in positions associated with strength, authority, and public engagement, whereas female characters are largely confined to caregiving and domestic responsibilities. Such portrayals reinforce a gendered division between the public and private spheres and contribute to the reproduction of patriarchal assumptions within early educational contexts. The absence of representations beyond the gender binary further limits inclusive understandings of gender among children aged five and six.

These findings indicate that the textbooks play a significant role in shaping children's perceptions of gender by presenting male dominance as natural and socially desirable. The visual and narrative content collectively promotes stereotypical gender roles, thereby influencing children's early socialization into hierarchical gender relations. In this context, the representations identified in the textbooks support Ann Oakley's argument that divisions of household labour are socially constructed through institutional practices rather than biologically determined differences.-

Recent Improvements in Gender Representations in SCERT Malayalam textbooks

An examination of the revised 2026 Malayalam primary textbook prepared by the State Council of Educational Research and Training indicates the emergence of modest yet meaningful shifts in the representation of gender roles when viewed alongside earlier textbook versions. While traditional gendered portrayals have not disappeared entirely, several illustrations now depict boys and girls participating together in everyday activities such as play, cleaning, and shared responsibilities within the household environment. These visual and narrative elements suggest an increasing curricular sensitivity toward more balanced representations of gender at the primary level. Importantly, such changes should not be interpreted as a complete transformation of earlier patriarchal patterns; rather, they reflect the beginning of a gradual reorientation in textbook design. Considering the influential role of textbooks in shaping children's early perceptions of social roles, even these limited inclusions are significant. They signal a positive pedagogical shift toward more inclusive understandings of gender within early childhood education in Kerala and indicate the possibility of further progressive revisions in future curricular materials. (Some of the examples for the visual representation of gender roles from the new textbook published in 2024 are given below)



Conclusion

The study demonstrates that the Malayalam primary school textbooks Keralapadavali for Classes I and II prepared by the State Council of Educational Research and Training play a significant role in shaping children’s early understanding of gender roles within the schooling context of Kerala. Through qualitative content analysis, the research finds that textbook narratives and illustrations largely reproduce conventional gender divisions by associating men with authority and public participation and women with caregiving and domestic responsibilities. Such representations function as subtle ideological mechanisms that contribute to the normalization of patriarchal assumptions during early socialization. At the same time, recent textbook revisions indicate the beginning of emerging changes toward more balanced gender participation in everyday activities. Although these shifts are limited and not yet transformative, they represent a positive pedagogical direction. Strengthening such inclusive representations in future curricular materials is essential for promoting gender-sensitive socialization at the primary education level.

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Educational Extensions in Rural Development: Bridging Gaps and Cultivating Opportunities

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Abstract

Educational extensions play a crucial role in fostering rural development by addressing persistent gaps in access to quality education, skills, and knowledge resources. Rural areas, particularly in developing countries such as India, face challenges including inadequate infrastructure, limited institutional outreach, socio-economic constraints, and digital exclusion. Educational extension systems function as a bridge between formal knowledge institutions and rural communities by extending educational services through flexible, participatory, and context-specific approaches. This paper examines the concept, evolution, and educational dimensions of extension and their relevance to rural development. Drawing upon extension education theory, Indian government initiatives, and field-based case illustrations, the paper highlights how educational extensions contribute to behavioural change, livelihood enhancement, and community resilience. The study emphasizes the need for integrated and policy-supported extension systems to promote inclusive and sustainable rural development.

Keywords: Educational extension, rural development, extension education, behavioural change, India

1. Introduction

Rural development is central to the socio-economic progress of developing nations, particularly India, where nearly two-thirds of the population resides in rural areas. Despite sustained policy interventions and educational reforms, rural regions continue to experience limited access to quality education, skilled human resources, and institutional support. These constraints contribute to income inequality, low productivity, and restricted social mobility [1], [4].

Educational extensions have emerged as an effective strategy to overcome these challenges by extending education beyond formal institutional boundaries. Rooted in communication and participatory learning, educational extensions aim to empower rural populations through knowledge dissemination, skill development, and behavioural change [2], [3], [7]. This paper explores the role of educational extensions in rural development by integrating classical extension theory with contemporary Indian experiences [5], [6].

2. Objectives

The study aims to:

1. To examine the concept, evolution, and educational dimensions of extension in rural development.
2. To identify challenges in implementing educational extensions in India.
3. To highlight effective case studies of educational extension initiatives such as KVKs, Digital India, and Skill India programmes.
4. To analyse research gaps in areas including digital literacy, community-driven models, climate-resilient education, and financial inclusion.
5. To provide policy recommendations for strengthening educational extensions to promote inclusive rural development.

3. Methodology

This study adopts a descriptive and qualitative research approach. Data sources include a review of classical and contemporary literature on extension education [1–3, 7], government reports and policies (NEP 2020, Digital India, Skill India) [5, 6], and secondary case studies on rural education and development programs (KVKs, PMGDISHA). The analysis employs thematic review of literature to identify key contributions of educational extensions, comparative evaluation of case studies, and identification of research gaps and future policy directions. The scope is focused on rural development in India with emphasis on educational extension systems, covering infrastructure, digital literacy, vocational training, and community-driven interventions.

4. Concept and Evolution of Educational Extension

Extension is widely recognized as an effective strategy for rural development in economically weaker regions [1], [2], aiming to bring desirable behavioural change through systematic communication and learning. Esminger noted that it transforms attitudes and practices to promote adoption of improved innovations [1], while Dahama defined it as imparting knowledge and skills on new practices adaptable to local conditions [2]. Bhatnagar and Desai further described it as a mutual learning process that enhances knowledge, skills, attitudes, understanding, goals, and confidence [3]. Originating as an out-of-school system for rural populations [1], [2], extension has expanded beyond agriculture to include education, health, entrepreneurship, and digital literacy, and is now viewed as a process, method, system, and art for achieving sustainable behavioural change and improved livelihoods [7]. Derived from the Latin *ex* (out) and *tensio* (stretching), “extension” refers to reaching people beyond formal educational and research institutions [1], [3], [7].

5. Educational Dimension of Extension

A key contribution to extension education was made by D. C. Misra (1990), who identified ten dimensions of extension and emphasized the educational dimension as central, since extension fundamentally aims at behavioural change [7]. Education in extension operates across formal, informal, and non-formal systems, but mainly within non-formal education, which combines structured objectives with flexible content, timing, and methods [7]. This flexibility enables inclusion of people excluded from formal education due to economic, geographic, or social barriers [4]. The educational dimension focuses on improving knowledge, skills, and attitudes through participatory methods such as demonstrations, experiential learning, group discussions, and community engagement, thereby supporting empowerment, capacity building, and sustainable rural development [1], [2], [3], [7].

6. Literature Review

Educational extension is widely recognized as a key tool for rural development, bridging knowledge gaps and enabling behavioural change through participatory, context-specific learning. Esminger (1957) emphasized its role in transforming attitudes and practices for adopting innovations [1], Dahama (1973) defined it as imparting adaptable knowledge and skills [2], and Bhatnagar and Desai (1987) described it as a mutual learning process enhancing knowledge, skills, attitudes, goals, and confidence [3]. Misra (1990) further stressed its non-formal, flexible, and participatory nature [7]. However, challenges such as poor infrastructure, teacher shortages, high dropout rates, gender disparities, and limited digital access continue to limit rural education outcomes [4], [8]. Government initiatives like the National Education Policy 2020, Digital India, and Sarva Shiksha Abhiyan attempt to address these gaps through non-formal and technology-enabled approaches, including digital literacy, vocational training, and skill development [5], [6]. Practical models such as Krishi Vigyan Kendras (KVKs), PMGDISHA under Digital India, and programs under Skill India and the National Rural Livelihood Mission demonstrate how extension links education with livelihoods and socio-economic empowerment [1], [2], [4], [5], [6]. Despite progress, gaps remain in assessing long-term impacts of digital literacy, integrating climate-resilient strategies, understanding community-led success factors, and evaluating digital financial inclusion outcomes, highlighting the need for more evidence-based and inclusive extension policies [1], [3], [4], [5], [6], [7].

7. Role of Educational Extensions in Rural Development, Infrastructure Constraints, and India-Specific Initiatives

Educational extensions bridge gaps in formal education through distance learning, mobile classrooms, community learning centres, vocational training, and digital literacy programmes, improving locally relevant knowledge, decision-making, and livelihood opportunities, with integrated approaches linking education to agriculture, health, and infrastructure yielding stronger outcomes [1], [2], [7]. Their effectiveness is constrained by infrastructure deficits such as inadequate electricity, classrooms, water, and sanitation in rural schools, where only about 80% have electricity, reducing instructional quality, limiting digital tools, lowering participation, and increasing dropout rates, especially at secondary level [4], [8]. These gaps also restrict outreach mechanisms like mobile learning units, community libraries, and digital literacy programmes, reinforcing rural–urban inequality [1], [4]. In India, key extension models include Krishi Vigyan Kendras (KVKs), which provide training, demonstrations, and advisory services to improve agricultural productivity [1], [2], and the Digital India programme, which promotes digital access and literacy but faces challenges such as limited connectivity and uneven digital skills [4], [5]. Complementary initiatives like PMGDISHA, Skill India, and the National Rural Livelihood Mission link education with employability and empowerment [4], [5], [6]. However, extension systems continue to face constraints including poor infrastructure, funding gaps, digital divides, teacher shortages, socio-cultural barriers, and gender disparities, despite support from policies like Sarva Shiksha Abhiyan, ICT in Schools, and NEP 2020 [5], [6].

9. Future Directions, Research Gaps, and Policy Recommendations

Rural development requires continuous research and adaptive policies supported by stronger collaboration among researchers, policymakers, extension practitioners, private sector actors, and local stakeholders to align efforts with ground realities [1], [4], [7]. Greater emphasis is

needed on community-driven development, digital financial inclusion, and ecosystem-based approaches, as evidence on the long-term impacts of digital literacy, fintech inclusion, and climate-resilient interventions remains limited [4], [6]. Key gaps also persist in climate resilience, poverty alleviation, and teacher deployment, affecting the inclusiveness and effectiveness of extension systems [1], [7]. Strengthening educational extension demands integrated policy support linking education with agriculture, health, climate resilience, and digital infrastructure, with priorities including investment in rural infrastructure, expansion of non-formal and community-based learning, capacity building for educators and extension personnel, promotion of public-private partnerships, and active community participation in planning and implementation [1], [3], [4], [5], [6], [7], [8].

10. Conclusion

Educational extensions serve as a powerful mechanism for bridging educational gaps and promoting inclusive rural development. Rooted in behavioural change and non-formal education, extension systems have evolved to address contemporary rural challenges. In the Indian context, extension initiatives demonstrate significant potential to enhance education, livelihoods, and community resilience. Strengthening these systems through targeted policy interventions, infrastructure development, and participatory approaches is essential for achieving equitable and sustainable rural development [1], [4], [7].

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Rebuild Kerala from a Developmental Lens: Strength-Based Pathways to Adolescent Well-Being

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Abstract.

Rebuilding Kerala following recurrent ecological disruptions, public health crises, and social stressors requires strengthening psychological resources alongside physical infrastructure. Adolescents represent a critical developmental group whose well-being and strengths contribute to long-term social resilience. The present study examines the relationships between helping behaviour, gratitude, grit, and adolescent well-being using a quantitative, cross-sectional design. Data were collected from 400 adolescents in Kerala using standardized self-report measures. Normality testing using the Kolmogorov–Smirnov test supported the use of parametric analyses. Pearson correlation analysis showed significant positive associations among all study variables. General linear mediation analysis demonstrated that grit significantly mediated the relationship between helping behaviour and adolescent well-being. Gratitude also emerged as a significant mediator, mediating the relationship between helping behaviour and well-being as well as between grit and well-being. The findings highlight strength-based psychological pathways that support adolescent well-being and underscore their relevance for rebuilding Kerala through scalable, school-based mental health initiatives.

Index Terms-Adolescent well-being, developmental assets, positive psychology, Rebuild Kerala

1. Introduction

A sustainable recovery needs to consider human capital among adolescents because their development as youths will influence their future ability to strengthen community resilience, increase civic engagement, and create social cohesion. Adolescence is a time of significant emotional reactivity, expanding social roles and increased responsibility. While it provides a more significant degree of reactivity regarding stress and mental health issues, this period also offers a great opportunity to develop psychological attributes; therefore, this period should be an opportunity for the development of attributes that provide the ability to function adaptively [1] [2]. Current mental health frameworks increasingly view well-being as the presence of positive emotional, cognitive and social well-being rather than just a lack of distress [3]. The strength-based perspective, which is derived from positive psychology, describes positive attributes like helping behaviour, gratitude and grit as developmentally supportive resources of well-being and resilience [4]. The strength of helping behaviour, or the giving of oneself to others, will create social connections between individuals and encourage their involvement as citizens in their communities; gratitude will help to regulate emotion and appraise situations positively; and grit will support perseverance and the development of sustained effort, even

when facing difficulty [5] [6]. From the Rebuild Kerala perspective, these are building blocks of psychosocial resources that contribute to the collective recovery of a community. Although adolescent strengths have become increasingly interesting to researchers, little is known about how these attributes may be correlated and interactively associated with adolescent well-being within the context of Kerala. This study aims to address this void by examining the correlation and mediational pathways between helping behaviour and well-being in adolescents.

2. METHOD

2.1 Design and Participants

A cross-sectional quantitative research design was employed. The sample consisted of 400 adolescents recruited from secondary and higher secondary schools in Kerala. Ethical approval was obtained, and informed consent was secured from participants and relevant authorities.

2.2 Measures

In the study, standardized self-report measures were utilized to measure adolescent well-being (Warwick-Edinburgh Mental Well-Being Scale, Tennant et al., 2007), helping behaviour (Helping Attitude Scale, Nickell, 1998), gratitude (Gratitude Questionnaire – 6 Item, McCullough, Emmons, & Tsang, 2002), and grit (Grit Scale, Duckworth, Peterson, Matthews, & Kelly, 2007). The WEMWBS is a measure of positive mental health and includes measures of emotional functioning, psychological functioning, and subjective well-being. The Helping Attitude Scale measures an individual's prosocial orientation and their willingness to engage in helping behaviours. The Gratitude Questionnaire – 6 Item is a measure of dispositional gratitude and an individual's tendency to acknowledge and appreciate positive aspects of life. The Grit Scale measures how much an individual exhibits persistence towards achieving a goal and consistency of interest in a goal over time. Each instrument has a history of use with adolescent populations and has been shown to have sufficient reliability and validity in previous studies.

2.3 Data Analysis

Normality of distributions was assessed using the Kolmogorov–Smirnov test, supporting the use of parametric statistics. Pearson correlation coefficients were computed to examine relationships among variables. General linear mediation analysis was conducted using helping behaviour as the predictor, grit and gratitude as parallel mediators, and adolescent well-being as the outcome. Indirect effects were evaluated using standard error estimates and confidence intervals.

3. Results

Correlation Analysis

Pearson correlation analysis revealed significant positive associations among all study variables, as presented in **Table I**. Helping behaviour was moderately correlated with adolescent well-being ($r = 0.290$, $p < .001$), grit ($r = 0.345$, $p < .001$), and gratitude ($r = 0.535$, $p < .001$). Gratitude was significantly correlated with grit ($r = 0.396$, $p < .001$) and adolescent well-being ($r = 0.276$, $p < .001$). Grit also showed a positive association with adolescent well-being ($r = 0.259$, $p < .001$).

Table I Pearson Correlation Matrix Among Study Variables (N = 393)

Variable	1	2	3	4
1. Adolescent well-being	—			
2. Grit	0.259***	—		
3. Gratitude	0.276***	0.396***	—	
4. Helping behaviour	0.290***	0.345***	0.535***	—

Note. *** $p < .001$

Mediation Analysis

Results can be found in Table 2. Supporting this relationship were two significant positive correlations with the helping behaviour score; grit ($\beta = .345, p < .001$), and gratitude ($\beta = .535, p < .001$). In terms of their independent connections to adolescents' well-being, both variable scores were also positively correlated: grit ($\beta = .150, p = .004$); gratitude ($\beta = .125, p = .031$). The indirect relationship between helping behaviour and adolescent well-being through grit was statistically significant (Est. = 1.422; $p = .007$). The same outcome was revealed through the gratitude variable (Est. = 1.835; $p = .034$). The direct relationship between helping behaviour and adolescent well-being remained statistically significant ($\beta = .171; p = .003$), indicating partial mediation. The total relationship between helping behaviour and adolescents' well-being was statistically significant ($\beta = .290; p < .001$).

Table II Direct, Indirect, And Total Effects of Helping Behaviour On Adolescent Well-Being (N = 393)

Pathway	Estimate	SE	95% CI Lower	95% CI Upper	β	p
Helping behaviour → Grit	0.340	0.047	0.248	0.431	0.345	< .001
Grit → Well-being	4.187	1.455	1.335	7.039	0.150	.004
Helping behaviour → Gratitude	6.400	0.510	5.401	7.399	0.535	< .001
Gratitude → Well-being	0.287	0.133	0.026	0.547	0.125	.031
Indirect: Helping → Grit → Well-being	1.422	0.531	0.381	2.463	0.052	.007
Indirect: Helping → Gratitude → Well-being	1.835	0.863	0.143	3.527	0.067	.034
Direct: Helping → Well-being	4.690	1.556	1.641	7.741	0.171	.003
Total Effect	7.947	1.325	5.350	10.544	0.290	< .001

4. Discussion

The findings showed that a strength-based developmental model can characterize adolescent well-being and will be crucial in rebuilding Kerala. Helping behaviour is the central psychosocial resource associated with adolescent well-being and positively influences well-

being both directly and indirectly through grit and gratitude. Helping behaviour facilitates social functioning, and social functioning also supports the development of positive psychological characteristics within adolescents. Grit mediates the relationship between helping behaviour and well-being, meaning that expressing helping behaviour through helping other people will support perseverance and, ultimately, support positive adaptation during adolescence through perseverance and sustained effort. With respect to helping behaviours, gratitude serves as the most one of the most salient pathways linking helping behaviours and grit with adolescent well-being. Gratitude facilitates positive emotion regulation, positive appraisal of self, and social connection with others. From a translational perspective, the results of this research could assist the implementation of strength-based mental health programming within schools. Promoting prosocial acts, along with promoting gratitude and grit, is a low-cost and scalable method of integrating these characteristics into Kerala's educational and public health systems. Defining adolescent well-being as psychosocial infrastructure supports the inclusion of promoting youth mental health as part of the foundation of sustainable recovery and long-term social resilience within Kerala.

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From Activities to Integration: An inquiry into Green Environment Practices in Secondary Schools of Kerala

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Abstract

Environmental concerns have repositioned schools as key sites for sustainability education. This study examines green environment practices in secondary schools of Kerala, with a focus on how such practices are organised and experienced within schools. It assesses student awareness and teacher perception, and examines the nature and scope of practices in relation to educational processes. A Mixed Method approach was adopted for the study. Quantitative data were collected using an Awareness Test for students and a Perception Scale for teachers, while qualitative data were generated through interviews, observations, and document analysis. The findings show that green practices are widely present but largely activity based and episodic, with limited integration into curriculum and pedagogy. Student awareness and teacher perception reflect variations linked to the extent of engagement within schools. The study highlights the need to move from isolated activities to integrated approaches that connect practice with teaching and learning.

Keywords: Green Environment Practices, Secondary Schools, Sustainability Education, Integration, Student Awareness, Teacher Perception

1. Introduction

Environmental concerns have placed new expectations on schools to move beyond awareness programmes and engage with sustainability as part of education. Policy frameworks recognise schools as spaces where understanding sustainability practices can be developed through teaching, participation, and institutional practices. However, the extent to which these expectations are realised in everyday school processes remains uneven.

In Kerala, secondary schools widely engage in green initiatives such as waste management, tree planting, and awareness campaigns. These practices are visible across school settings. Yet, they often function as isolated events rather than as part of a sustained educational process. Their connection with classroom teaching and student learning is not always clear. This raises an important concern. The presence of green practices does not necessarily indicate meaningful sustainability education. What matters is how these practices are organised, whether they are integrated into curriculum and pedagogy, and how they influence student understanding.



The present study examines Green Environment Practices in Secondary Schools of Kerala with a focus on this shift from activity-based approaches to integrated forms of engagement.

2. Objectives of the Study

The study was guided by the following objectives:

1. To examine the nature and scope of Green Environment Practices in secondary schools of Kerala.
2. To assess the awareness of Green Environment Practices among secondary school students.
3. To analyse teachers’ perception of Green Environment Practices in secondary schools of Kerala

3. Methodology

A mixed-methods approach was adopted to understand both the extent of practices and their educational meaning within schools. The study included secondary schools from different categories of administration. Quantitative data were collected from students and teachers using an Awareness Test and a Perception Scale. The tools were developed based on a review of literature and refined through expert validation. Qualitative data were generated through semi-structured interviews with school administrative staff, direct observations, and analysis of publicly available online documents. These provided insight into how Green Practices are organised and implemented within schools. Quantitative data were analysed using descriptive statistics, while qualitative data were analysed thematically. The findings were brought together at the interpretation stage.

4. Results and Findings

Green environment practices are present in most secondary schools. Activities such as waste management programmes, tree planting, and awareness campaigns are commonly reported. However, these are largely periodic and event-based. The nature of these practices shows limited integration with routine school processes. In many cases, they function as stand-alone activities rather than as part of ongoing teaching and learning. Institutional planning for sustainability is minimal, and continuity in practice is often lacking.

Student awareness is moderate and varies across school contexts. Students exposed to more consistent and structured practices demonstrate better understanding, while others show awareness linked mainly to specific events.

Table 4.1

Descriptive Statistics of the Scores of Awareness Test of Green Environment Practices for Total Sample

Awareness of Green Environment Practices	Mean	Median	Mode	SD	Skewness	Kurtosis
Total	15.86	15	10	6.01	0.32	-0.67

Components	Efficient Use of Resources	3.04	3	3	1.58	0.38	2.61
	Healthy Environment	3.58	4	4	1.73	-0.084	2.24
	Healthy Nutrition	3.44	3	2	1.80	0.17	2.16
	Sustainable Curriculum	2.82	3	3	1.50	0.04	2.29
	Sustainable Community Practices	2.96	3	3	1.67	0.26	2.54

Teachers generally express a positive perception towards green practices.

Table 4.2

Descriptive Statistics of the scores of Perception of Green Environment Practices for the Total Sample of Secondary School Teachers

Perception of Green Environment Practices	Mean	Median	Mode	S.D.	Skewness	Kurtosis
Total	152.01	156	155	22.39	-1.75	8.97
Efficient Use of Resources	18.82	19	19	3.20	-1.14	6.16
Healthy Environment	47.47	48	48	7.79	-1.79	8.43
Healthy Nutrition	23.65	24	26	4.22	-1.28	5.68
Sustainable Curriculum	43.38	44	49	7.50	-0.73	5.06
Sustainable Community Practices	18.67	19	20	3.46	-1.03	5.15

However, this does not consistently translate into classroom integration. Sustainability concepts are not regularly connected with subject teaching, and practices often remain outside formal pedagogy.

A clear pattern emerged through the thematic analysis of data collected from direct observation and documents available in the public domain online. While green practices are visible, their depth and educational relevance differ across schools. Some schools show signs of integration across activities, teaching, and institutional support, while many reflect a compliance-oriented approach. The findings indicate that most practices remain activity-based, with limited connection to curriculum and pedagogy. This reflects a gap between policy expectations and school-level enactment. Schools respond to environmental concerns through visible activities,

but these do not always translate into sustained learning experiences. Variations in student awareness and teacher perception suggest that the quality of engagement depends on how practices are organised within the school. Where practices are more consistent and connected to teaching, student understanding is stronger.

The study points towards the need for an integrated approach, where sustainability is embedded within curriculum, pedagogy, and institutional processes rather than treated as an additional activity.

6. Conclusion

Green environment practices are widely present in secondary schools of Kerala, but their implementation remains uneven. Most practices are episodic, with limited integration into educational processes. For sustainability education to be meaningful, these practices need to be connected with teaching, learning, and school functioning. The effectiveness of Green Environment Practices depends not on their visibility but on their integration within the educational process.

6. Suggestions

- Integrate sustainability concepts across subjects and classroom practices.
- Provide support for teachers to incorporate environmental themes into teaching.
- Develop school level structures to sustain green practices
- Ensure continuity in practices beyond one-time activities.
- Strengthen the connection between school practices and student learning.

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APPENDIX

**NATIONAL RESEARCH CONFERENCE & KERALA HIGHER
EDUCATION EXPO 2026
PAPER PRESENTATIONS (ORAL PRESENTATION)
SELECTED LIST OF ORAL PRESENTATIONS FOR BEST PAPER AWARD**

1.Arts and Humanities

Sl. No.	Full Name	Title of Presentation
1	Arunima R	Anubhavathinte Raashtreyam:Adimmakkayum Aadivaasi Sthreyude bhumi-Svathva bhandangalum
2	Kaveri Babu	Embracing Touchwood: Condition of Higher Education Arts
3	Vasana R	Narrating Vulnerability and Illness Experience: A Study of Ananya Mukherjee's Tales from the Tale End
4	Karishma Suresh	From Region to Repository: Digitally Preserving Kerala's Traditional Clothing and Textile Knowledge
5	Deepthi CP	From Research to Resilience: Reimagining State-Owned OTT Platforms in Rebuilding Kerala
6	Parvathy Padmakumar	Translating the coast: Documentary Films as Translational Narratives of Trauma, Survival and Resilience
7	Shaini S S	Mohanlal Tripadhi ke upanyas mein manaveey sansakti.
8	Reshmi P	मालती जोशी के कहानी संग्रह 'औरत एक रात है' और सारा जोसेफ के कहानी संग्रह 'पाप भूमि' (पापत्रा) में स्त्री अस्मिता : एक तुलना
9	Dhanya Mol G	हिंदी और मलयालम सिनेमा में क्वीर अस्मिता : 'मूथोन'(2019) और 'अलीगढ'(2016) फिल्मों के विशेष सन्दर्भ में
10	Maya R	Ethical Kingship and Cultural Thought in Śukranīti: An Inquiry into Rāja Dharma
11	Akshai S	Artificial Intelligence in Higher Education: Pedagogical Possibilities and Ethical Challenges
12	Febin Mariam Jose	From Emergency to Ethics: Communitarian Statecraft in Rebuild Kerala
13	Praveena KK	The crisis of educational authenticity: A Philosophical reflection on contemporary Indian educational paradigm
14	Vandana Chandran	Environmental Sustainability Awareness among secondary School Students: Evidence for SDG -Oriented Teaching
15	Diya Vinod Kumar K	SWAT- Based Hydrological Modelling of the Andheri Watershed, Godavari Basin: Streamflow Simulation and Watershed Response Analysis

2. BIOLOGICAL SCIENCES

Sl. No.	Full Name	Title of Presentation
1	Puja Laxmanrao Shinde	Amalaki Rasayana inhibits deleterious effects of Galectin-3-C-Epitope Oligomers in Cardiac Hypertrophy.
2	Dhanya Krishnan	Exploring the role of TERT promoter mutation in Papillary Thyroid Carcinoma
3	Ramesan C K V	Omiganan, a potential antimicrobial peptide against carbapenemase producing Enterobacteria: an in silico and in vitro analysis
4	Faheem Qaid Abdullrahman AL-Mojahid	An in vitro approach to explore the Phytochemical Insights and Biological Activities of the Ethanolic fruit extract of Tribulus terrestris used in the treatment of UTI
5	Arya Muraleedharan	Evaluating Bioactivity of Evolvulus Nummularius Extract and its Green-Synthesized Zinc Oxide Nanoparticles for Advanced Wound Healing Applications
6	Lekshmi R	Comparative Elucidation of Thermal Stress Induced Metabolic Enzyme Modulation in Aedes aegypti and Aedes albopictus

3. CHEMICAL SCIENCES

Sl. No.	Full Name	Title of Presentation
1	Malavika K. G.	Aggregation-Induced Emission Enhancement in a -Tomatine for sensing of Cholesterol
2	Meera Kattoor	Electron Upconversion Enables C–P and C–S Bond Formation Under Mild Oxidative Conditions: A Theoretical Study
3	Gopika S	Synthesis of Tannic Acid- Stabilized Fluorescent Gold Nanoclusters: Application as Turn-on Sensing of Creatinine

4. COMMERCE AND MANAGEMENT

Sl. No.	Full Name	Title of Presentation
1	Chithra Vimal	The Interplay of Impostor Syndrome, Perfectionism, and Work-Life Balance among Higher Education Educators in the Nascent Career Stage
2	Ardra Mani	Insider Advantage or Positive Signal? Market Reactions to Share Warrant Issuances in India
3	Jeena Antony	A Study on sustainable investment practices among Genz students
4	Akhila Thomas	From Wardrobe Waste to Sustainable Value: Consumer Perception and Behaviour Towards Textile Re-Commerce Platforms in Kerala
5	Reeba Beegam F	Role of Recent GST Reforms on Financial Performance with Special Reference to the Services Sector in Kerala

5. ENGINEERING, SCIENCE AND TECHNOLOGY

Sl. No.	Full Name	Title of Presentation
1	Sumitha M S	Room-Temperature Electrochemical Detection of Formaldehyde Using MnO ₂ -Polymer Nanocomposite Sensors
2	Vinod V	Pressure build-up behind a perforated plate array due to the impact of a blast wave: Insights from experiments and simulations
3	Sreekala P	Sustainable Self-Powered Electrical Systems for Wearable Health Monitoring
4	Sivaprasad Athikkal	A Two Input SEPIC based DC-DC Converter for Renewable Energy Integration
5	Noorbina Razak	Process Optimization of Ultrasound-Assisted Oleoresin Extraction from Nutmeg Pericarp
6	Hannah Grace Philip	Smart Automation for Controlled-Environment Mushroom Production
7	Shreyas K	Sustainable Construction through Optimized Mix Design with Automated Nozzle Adjustment in 3d Printer
8	Nidhi M.B, Soumya A V, Asha S	A Comprehensive AI-Based Framework for Environmental Sustainability and SDG Acceleration in Academic Institutions
9	Franklin V Jose	AURA-Augmented Utility for Responsive Accessibility

6. HEALTH AND ALLIED SCIENCES

Sl. No.	Full Name	Title of Presentation
1	Jimna Mohamed Ameer	Ancient Wisdom Meets Modern Neuroprotection: Withanolide A Restores Mito-Lysosomal Homeostasis in Parkinson's Disease
2	Kavitha Chandran C	Phase I Cardiac Rehabilitation Following CABG Surgery: Evidence from a Tertiary Care Centre in Kerala
3	Lakshmi Gopalakrishnan Nair	Obesogenic Behaviors among Women in Kerala- A Trans generational Analysis

7. PHYSICAL SCIENCES

Sl. No.	Full Name	Title of Presentation
1	Shilpa R	Next generation HER electrocatalysts: Synergistic effects of MoS ₂ /CNT/MXene hybrids
2	Sophy Mariam Varghese	Engineering Multiwalled CNTs Modified Titanium Carbide MXene nanocomposites for Flexible Screen-Printed Micro-Supercapacitor Electrodes
3	Sreelekshmi A K	Probing the Near-Infrared Photophysical Emission Features of BaLaLiTeO ₆ :Cr ³⁺ Phosphors for Multifunctional Applications
4	Abishek P S	Ion Acoustic Solitary Waves in Magnetized Plasma of Venus Ionosphere
5	Rohit A	Photoresponsive Resistive Memory Devices Using Graphene Oxide-Phosphor Complex.
6	Anjitha V K	Molybdenum doped Bismuth ferrite Nanoparticles for sustainable catalytic, sensing, and optoelectronic technologies
7	Aswany V S	Comparative study of Cerium based Pyrochlore Ce ₂ X ₂ O ₇ (X= Ti, Sn) for Electrochemical Applications
8	Parvathy R J	Probing the electrical properties of Bi-Hf doped GDC system for electrochemical application
9	Suja Devi V	A theoretical study on the impact of position specific inclusion of pie conjugated donor substituent on Benzanthrone core- in its NLO properties.
10	Sangeeth M K	A Flexible Graphene-PVDF-Rubber Composite for Piezoresistive Pressure Sensing
11	Hridya Rajan	Molecular Design and Performance Assessment of 1,2,4- oxadiazolo for High Energy Density Materials

8. SOCIAL SCIENCES

Sl. No.	Full Name	Title of Presentation
1	Shameer Moozhiyan	The Economic impact of NH 66 road Infrastructure Project on the Displaced Community of Kerala
2	Arafa Beegum N S	A study on Factors Affecting School Dropout among Tribal Children in Edamalakkudi
3	Sharon Jose	Socioeconomic Impact of Market-Driven EdTech Services on Households in Kerala
4	Renjith R	Bridging the Charging Gap: A Spatial Analysis of the Electric Vehicle Charging Infrastructure in Kerala
5	Moideen C	Locating Chinese Trade and Trade: Tracing the Fifteenth Century Voyages of Zheng He in South and South East Asia
6	Abdul Naser U	Gendering Tribal Life: A Case Study of the Tribes in Nilambur
7	Bahir Abdu Raheem C	The Influence of Qadiri Sufi order in the socio-cultural and spiritual life of Kerala Muslims
8	Jagfarkhan S	The Socio-economic Status of Coastal Muslims in South Kerala: A Case Study of Thiruvananthapuram, Kollam and Alappuzha Districts
9	Sumayya Beevi. L	Educational and Professional Position of Muslim Women in the Coastal Areas of Kerala: A Case Study of Thiruvananthapuram district
10	Mubeena J	The Impact of Maintenance and Welfare of Parents and Senior Citizens Act of 2007 and Islamic Elderly Care in Kerala: A Case Study of Thiruvananthapuram District
11	Muhammed Mubaseer P K	Healing, Memory, and Translation: Arabi-Malayalam Medical Texts of Malabar
12	Anjitha Mary C J	Learned Helplessness and Turnover Intention: The Protective Role of Job Involvement
13	Naseeha Nazeer	Career Aspirations and Identity Formation among Higher Secondary Students during the School-to-Career Transition
14	Anulakshmi VS	Construction of Gender in Early Language Education: A Study of SCERT Malayalam Textbooks for Classes I and II
15	Muhammed Ali Rabeah	Educational Extensions in Rural Development: Bridging Gaps and Cultivating Opportunities
16	Gopika Krishnan	Effectiveness of E-content in Enhancing Menstruation Awareness among Secondary School Students.
17	Nikhil Zebukumar	Rebuild Kerala from a Developmental Lens: Strength-Based Pathways to Adolescent Well-Being

NATIONAL RESEARCH CONFERENCE & KERALA HIGHER EDUCATION EXPO 2026

POSTER PRESENTATIONS

SELECTED LIST OF ORAL PRESENTATIONS FOR BEST POSTER AWARD

Biological Sciences

Sl. No.	Name of the participants	Title of the presentation
1	Aparna G Kumar	An Amphiphilic Collagen-Based Hydrogel with Antimicrobial Activity for Enhanced Wound Repair
2	Unnikrishnan B, Aleetta Selestine, Keethedeth, Suman Sreedharan et. al.	Effectiveness of nano engineered varnish against Streptococcus mutans induced dental caries
3	Jacqueline Joe, Teena Merlin, Indu C Nair	Characterization of Exopolysaccharide from a Bacterial source

Chemical Sciences

Sl. No.	Name of the participants	Title of the presentation
1	Jithu Joseph, Mary Gladis J	Development of durable Zn-ion Hybrid capacitors through optimized electrode-electrolyte Synergy
2	Gopika S	Development of A Fluorescence- Based Non-Enzymatic Cholesterol Sensor Utilizing Tyrosine Gold Nano cluster
3	Vidhya KV, Simi Pushpan K	A Green and Scalable Aqueous Strategy for the Scramble-Free Synthesis of Un hinderedmeso-Aryltrans-A ₂ B ₂ Porphyrins
4	Arun John	Engineering of N-Doped Carbon Dots as a One-Drop Smart Nano material as Real- Time Dual-Mode pH Sensor for Industrial and Biomedical Applications
5	Atul, Chitra K R, N Gomathi	MOF based adsorbents for CO ₂ Mitigation and Dye removal from wastewater.

Commerce and Management

Sl. No.	Name of the participants	Title of the presentation
1	Harikrishnan A P, Shyni A	Towards a Sustainable Coastal Tourism Model: Lessons from Kerala
2	Jeffy James	Tourism-Led Development: Agri- Tourism's Contribution for Sustainable Tourism Development in Kerala Economy
3	Remya Ann Zachariah	Customer Awareness of Insurance Products
4	Devi krishnaK R	Financial Self-Efficacy of Women in Kerala: A Secondary Data Analysis

Engineering Sciences and Technology

Sl. No.	Name of the participants	Title of the presentation
1	Angel B John	Authorship Attribution of Malayalam Literary Works using Transformer Models and Transfer Learning
2	Manikandan H, Haris P A, Rajeesh R Pillai, Muhasin K M, MonhashT, Bijesh Paul	Beyond Compliance: Psychological Safety and Power Dynamics as Enablers of Inclusive, Liberty-Centric Behaviour-Based Safety Engineering
3	Ajin Reji, Alvin John, Varghese, Muhammed Anas S, Nikhitha Rajeev	Future of Charging for EV sand IoT Devices Without Cables
4	Jency Stanly	Hybrid Bivariate Beta-Based Models for Discrete Count Data with Applications
5	Gourinanda Sinoj, Irfana Rahim, Anaina Binoy, Jyothika P	Sign to Speak



Health and Allied Sciences

Sl. No.	Name of the participants	Title of the presentation
1	Meenakshi Jayan, Ashima Anil, Anna Mohan, Alin Mariya Saji	Hemosecure
2	Shyma S Mohan, Dr Jyothi H	The Invisible Transition: A Systematic Review of How Menopause Shapes the 3Modern Workforce
3	Savitha Jose	Determinants of Metabolic Syndrome Among Adults Attending Health Check Up Clinics in Two Sub Urban Medical Facilities of Southern Kerala

Physical Sciences

Sl. No.	Name of the participants	Title of the presentation
1	ChristeenaThomas, Reshmi R, Sreeja S	Hybrid IT/2HMOs2 nanostructures as an efficient platform for Dual- Analyte Electrochemical sensing
2	Geethika Santhosh	Probing star formation outside galaxies using UVIT on board AstroSat
3	Aswathy M, Mini Krishna K, Rachana R, ShamsiyaV N, Veena Gopalan E	A Comparative Study on the Structural and Optical Response of Synthetic and Green carbon Dots
4	Saranya Sasi	Enhanced photo degradation of methylene blue dye using Mn doped MoS, nanoflowers
5	Rachana R	Efficient Dye Degradation Using Sol- Gel Derived LaFeO3 Nanoperouskites

Social Sciences

Sl. No.	Name of the participants	Title of the presentation
1	Anu J Vengal	Green Environment Practices in Secondary Schools of Kerala: A Critical Study



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