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Editorial

The *KISS International Journal of Entrepreneurship, Innovation and Sustainability (KIJEIS)*, a peer-reviewed and refereed journal of KISS Deemed to be University, is envisioned as a global platform for advancing research that is innovative, inclusive and grounded in sustainability. Aligned with KISS Deemed to be University's longstanding mission of promoting impactful and inclusive research, under the inspiring vision of Prof. Achyuta Samanta, Founder KISS and KIIT, KIJEIS aspires to become a vibrant platform for scholarly exchange across various disciplines. At a critical moment when societies seek equitable growth, responsible innovation and sustainable solutions, KIJEIS aims to amplify scholarly voices that connect knowledge with meaningful social impact. Anchored in the University's mission of inclusive and transformative education, the journal aspires to bridge theory and practice by integrating global academic perspectives with indigenous wisdom and community-driven innovations.

The contributions in this issue reflect the spirit and scope of KIJEIS. The papers engage with themes such as women's empowerment, indigenous knowledge systems, sustainable agriculture, digital transformation, ethical innovation and social inclusion. Together, they highlight how entrepreneurship and technology, when guided by sustainability and equity, can create pathways for empowerment especially for rural, tribal and marginalized communities.

This issue also foregrounds emerging concerns around AI, digital identities, surveillance ethics and policy-driven development, encouraging responsible and human-centric innovation. By bringing together diverse methodologies, disciplines and contexts, KIJEIS seeks to challenge conventional paradigms and inspire new ways of thinking about development and progress.

As KIJEIS begins this journey, we invite researchers, practitioners and change-makers worldwide to contribute to this evolving dialogue. Together, let us shape a future where entrepreneurship fuels inclusion, innovation serves humanity and sustainability guides every step forward.

Content

Indigenous Technology and
Economic Empowerment of Rural Woman

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Abstract

The paper systemically examines the role of indigenous technology in rural environment serving economic empowerment. A systematic Literature review of the past decades, reflecting the traditional practice in rural India. In which we see the application of Herbal Medicine, Agro-Processing and Craft Making contributing to Women Entrepreneurship. (Agarwal,2002, Kumar & Singh,2018). Empirical studies have indicated involvement with indigenous practices promotes decision-making capacity. It increases self-confidence. Further it promotes cultural identity. (Chambers & Conway, 2018). But there are certain barriers in this pathway, for example limited market access, inadequate policy support and inadequate infrastructure which restricts the market development. (Shiva, 2016). The study mentions the indigenous knowledge combined with advanced digital technologies. Use of renewable energy application along with hybrid approaches address the existing challenges. It helps to expand market and improve product quality. This lifts the sustainable local enterprises (Resnick et al., 2019; World Bank, 2021). These innovations of social upliftment goes beyond economic benefits, gender equality and social harmony. The findings indicate culturally sensitive policy, technological intervention and capacity-development. This helps in developing sustainable goals and promoting all round growth for rural women (United Nations, 2015). Addressing the research gaps especially in the long-term has impact assessments along with digital intervention. This further improve policies and women empowerment.

Keywords: Indigenous Technology, Women Empowerment, Rural Development, Sustainable Livelihoods, Cultural Preservation

1. Introduction

Agriculture and agriculture-related works have been corner stone of Indian Economy. Both in terms of Employability and Income Generation. Women's groups have been the backbone of rural India. Their contribution is notable but unnoticed. They have worked under the shadow of the male population. In Advanced Economies, Women are undertaking responsible activities in the farm and livestock management (World Bank,2021). Population pressure and gender disparity are obviously a few reasons that make the difference between the developed and developing economies. Although they are taking a key role, their significance is marked with enormous challenges. Access to quality Education, Availability of Finance, and quality health facilities are the key requirements that are missing. These factors significantly deters the promotion women entrepreneurs (UN Women,2020). In order to have a proper economic development, upliftment of women is necessary. Availability of quality education will not only increase literacy rate but would enable them to think, understand and take important decision.

In paper, the role of indigenous or application of Technology importance have been mentioned. The strategic role of it making economic development highlighting both opportunities and challenges faced. It mentions community-centered application utilizing the knowledge as a foundation for gender equality and sustainable development.

2. Literature Review

The potential of indigenous knowledge and technologies works as key factor for sustainable development. Although, it has been highly acclaimed in scholarly circles. It remains hardly used within policy frameworks. Research studies indicate indigenous technologies covers diverse domains. It ranges from traditional agricultural methods, home based industries such as pottery, herbal medicine, food processing and many others. For example, in African countries women involve in indigenous specialized craft. Craftsmanship of the highest quality in bead-making which has been a source of income. Further, an avenue for cultural expression. (Agyemang & Bayang, 2020). In South Asia, women are involved in organic spice grinding or herbal product preparation. Earning livelihoods which environmentally sustainable (Kumar & Singh, 2018).

In the context of environmental sustainability, indigenous knowledge systems play pivotal role in biodiversity. Further, it also helps towards conservation and climate adaptation strategies. For example, indigenous methods of seed-saving techniques. Practices such as sustainable harvesting practices, organic farming

method contribute to ecological balance (Shiva, 2016). Practices of such kind helps reinforcing women's role in the society as custodian of local ecosystems. (Chambers & Conway, 2018).

The existing literature introspects overcoming these barriers. It attempts to deliberate, culturally sensitive strategies respecting indigenous knowledge. Various models does advocate for community ownership, capacity building. Further intellectual property rights protection, capacity-building are also in this same arena. The market access facilitation helping indigenous practices (Leach et al., 2010). Evidence based study effectiveness remains limited. Many studies lack rigorous analysis and are predominately descriptive. There is a recognition of potential of indigenous technology in women's empowerment. This gap helps in understanding, especially in implementation and impact assessment.

3.   Absence of Longitudinal and Impact-Focused Studies

Although there is a need for policy interest towards indigenous technology for empowering rural women. There are several critical gaps restricting its potential. These gaps need to be addressed. This would create an environment for the inclusive, sustainable development of women's rural entrepreneurship.

Absence of Longitudinal and Impact-Focused Studies
Existing research studies on indigenous technologies and women's empowerment focus on cross-sectional study. This provides limited access to long-term socio-economic impacts. There is lack of longitudinal studies. Studies on women's income levels, decision-making capacity, and their social standing over extended periods are scarce. Data is required for understanding indigenous enterprises. This is required for understanding sustained empowerment over time (Leimona et al., 2018). Designing policies and programs without conducting a longitudinal study remains a challenge.

Insufficient Focus on Vulnerable and Marginalized Subgroups
Studies highlights the benefits of indigenous practices. They overlook the unique challenges faced for example women with disabilities, may be belonging to lower socio-economic group. They encounter stiff barriers like-social discrimination, cultural restriction in participation (O'Hara & Ali, 2021). Research data related to socio-economic status, caste, ethnicity, disability are important for targeted intervention which promote inclusivity.

Limited Exploration of Technological Integration
The indigenous knowledge with modern digital innovations is an under-explored frontier. Opportunities leading to more access to mobile phones, digital marketplaces,

and financial technology. Development of market access towards traditional crafts having immense potential. Online platforms promote women crafts to reach wider audiences. Digital payment systems facilitate transactions in remote areas (World Bank, 2021). Empirical studies into effective models, barriers, practices for digital integration in indigenous practices is rare.

Policy Frameworks and Institutional Support

A significant gap remains in understanding policy structures. It effectively supports the recognition, protection of indigenous technologies. There is a need for comprehensive policy frameworks. Need to address intellectual property rights and market development appropriately. (Kumar & Shankar, 2020). Understanding successful policy models, replicability in various contexts remains important for useful recommendations.

Impact of Indigenous Enterprises on Socio- Community Dynamics

Few studies have valuated the broader social fabrication of indigenous entrepreneurial commitment. The practices promoting gender equity, and family relationships overtime. The social dimensions are crucial. It empowers outcome holistic and leads to sustainable community resilience.

Scalability and Replicability of Best Practices

Few community-based projects demonstrate success in some specific contexts. The transformation of models to other regions remains uncertain. Clear indication in the context of adaptation, sustainability are lacking. It restricts the policymakers' and practitioners' capacity.

The paper provides a thorough review of literature as to role of indigenous technology and its role in the society. The research gaps identified through the literature review stresses the importance of more specific impact-oriented investigation. In order to have a sustainable development the gaps needs to be addressed. This will useful for economic development in the coming years.

4. Research Objectives

The scope of this review paper, primary aim is to integrateexisting literature to clarify the role of local technology in economic empowerment of rural women. The objectives guiding this are as follows:

To fundamentally understand the existing research on native technology. Its practical utilization contributing to income generation and livelihood (Agrawal, 2002). To study diverse case study reports for understanding the nature of native remote practices among women in different Socio- Culture.

To Understand the socio-economic impacts on technology utilization. Its impact on rural women's empowerment including aspects of income, community participation and social recognition (Chambers & Conway, 2018). This objective aims to find previous research which link traditional practice.

To identify the barriers enabling factors which influence the adoption and sustainability of technology. It is based one valuations and reviews (Leach et al., 2010). This relates to literature on Socio-Cultural, economic challenges and facilitators.

To identify the potential for integrating practices with modern technological innovations. This includes the application of digital platforms, renewable energy, and market linkage tools (World Bank, 2021). This objective relates to existing discussions combined tradition with innovation.

To develop policy implications on comprehensive research on developing sustainable and culture.The sensitive strategies empowering rural women with technology (Kabeer, 2015). The goal is data-based study for creation of policy for successful models and identified gaps.

5. Research Hypotheses

This is a review paper without original data collection. The following hypotheses are created to guide the critical analysis of the reviewed literature:

H1: Local technological practices are associated with increased income levels and livelihood sustainability.
Rationale: Multiple case studies suggest that traditional practices like craft-making, herbal medicine, and agro-processing contribute positively to women's economic independence (Agyemang & Bayang, 2020; Kumar & Singh, 2018). This hypothesis seeks to find the relationship based on existing evidence.

H2: Involvement with local technology improves women's empowerment, which includes decision-making and community participation (Chambers & Conway, 2018).
Rationale: The literature study mentions the participation in local business helping social status, although findings may vary.

H3: Barriers like limited market access, cultural stigmas and lack of institutional support negatively impact the extent of local technology adoption among rural women (Leach et al., 2010; Shiva, 2016).
Rationale: Existing reviews indicate persistent problems of impending sustainability.

H4: Integration of local practices and modern technologies. Applications of digital platforms and renewable energy solutions are improving the sustainability of enterprises (World Bank, 2021).
Rationale: The potential of various approaches of traditional knowledge in the modern markets is discussed.

H5: Supportive policy environments and frameworks that improve the preservation of technologies benefiting rural women (Kabeer, 2015).
Rationale: The importance of policy in safeguarding local knowledge developing economic outcomes based on study.

6. Methodology

This paper employs a methodology to clarify the existing research. Studies on native technology and economic empowerment of rural women. The primary objective is to evaluate the depth and quality of available literature that connects patterns, gaps, and emerging trends. The methodology further stresses and emphasises the dynamic relationship. The traditional practices, the application of indigenous technology and rural women empowerment are very closely linked.

6.1 Research Design and Approach

The research has been designed using a qualitative interpretative approach (Jesson et al., 2011). Analysis has been conducted to understand the indigenous technology working as a catalyst for socioeconomic development. A dep study study has been conducted on various reports, peer-reviewed articles and case studies of past years. Efforts have been undertaken to understand the unique indigenous models, the policy environment and its overall outcome.

6.2 Literature Search Strategy

A multi-database search was conducted. Platforms such as Google Scholar, JSTOR, Science Direct, Springer-Link, and Scopus was used. The search used specific keywords, including: "indigenous technology," "rural women," "economic empowerment," "craftsmanship," "women entrepreneurship," and "sustainable development." The search was from publications 2000 onwards to ensure a contemporary relevance.

6.3 Inclusion and Exclusion Criteria

Inclusion Criteria:
Peer-reviewed articles, case studies explicitly focused on local practices and women's livelihoods. Studies analysing socio-economic impacts, barriers, facilitators, policy implications related to indigenous technology use.

Exclusion Criteria:

Articles without qualitative/quantitative analysis. Publications focused on urban contexts. Non-scholarly opinion articles without methodology

From the selected literature, data was extracted. Rregarding the type of indigenous practices studied, geographic regions, methodological approaches. The key findings related to economic outcomes, empowerment, barriers, or enablers. A thematic approach (Thomas & Harden, 2008) was employed for recurring contradictions, and gaps.

6.4 Quality Assessment

In this study tools like Critical Appraisal Skill Programme (CASP), Checklist for validity and reliability (CASP,2018). Further, it needs to be noted that relevance of the research questions and its applicability was done critically to understand the significance.

6.5 Analysis and Interpretation of the Literature

After undertaking a thorough study of the literature, it was identified that local indigenous technology does play an important role in economic development. Entrepreneurship in women is markedly influenced by the application. Though there are high amount of scope for utilisation.

6.5.1 The Role of Indigenous Practices in Income Generation

Case studies have indicated of the fact places such as West Africa, South Asia, and South America, rural women have taken textile, weaving, and agro-processing as a source of income. Further, they are earning quite a significant amount. (Agyemang & Bayang, 2020; Kumar & Singh, 2018). The work they have undertaken is done for the age. It is deeply rooted in the tradition, custom and style. In our country, India, women involved in herbal medicine plantation and production have seen a significant increase in income. The literature report suggests that income has increased by around 40% level. This has affected their economic position and increased their significance in the household.

6.5.2 Impacts on women's empowerment in the socioeconomic environment

Women's entrepreneurship has long standing role in women empowerment. There skill, craftsmanship with indigenous technology helps to improve their social capital. Further, it provides them recognition and puts them in leadership roles (Chambers & Conway,2018). This development makes the possibility of gender equality. Further, the age-old class discrimination and gender bias in also challenged.

6.5.3 Challenges and Barriers to further development

There are inherent quite a few challenges which restricts the development. These problems are chronicle such as limited access to markets, lack of fund,age old thought process and many others. These problems are vicious in nature. They crumble the very foundation of development. (Shiva,2016). Further, availability proper infrastructure, lack of digital adaptation. It becomes difficult to expand market beyond certain area due to lack digital marketing. Support facilities in the form of capacity building and policy support are meagre.

6.5.4 Potential for Innovation and Integration

Case studies of African nation Kenya suggest have enabled women entrepreneurs to reach broader audiences with the use of mobile technology. This has provided a solution of restricted market. Further,it has shown was to increase income (World Bank,2021).The blend of indigenous technology and entrepreneurship have yielded good results specially were renewable sources such as Solar,Wind energy have been used to power generation. This led to lower cost, higher yield and revenue upliftment. These innovations using tradition with technology address existing barriers of market access and technological constraints.

6.5.5 Policy and Institutional Frameworks

The literature indices the importance of government policies and institutional support. Developing local practices among rural women. Models often involve policies for intellectual property rights, capacity-building programs which targeted specifically at women-oriented local enterprises. For instance, India's Geographical Indications (GI) registrations are for traditional crafts. It has helped to authenticate and market women's products globally. (Kumar & Shankar, 2020). Lack of policy coherence and insufficient institutional backing. It continues to hamper the growth of industry sectors, emphasizing the need for more, culturally sensitive policy interventions.

6.5.6 Key Gaps and Future Directions

The literature advocates for positive effect of indigenous technology. The existing studies have shown the work reflected short term projects for a very small window time. This makes quite difficult to assess the sustainability and feasibility. Limited use of Digital technology innovations have been a bottleneck for fast growth and access to bigger market. Studies lack specific projections meant for rural enterprise development.

6.5.7   Emerging Trends and Good Practices

There have been some positivity areas as well. Cooperative movement, Government involvement in the form of subsidy, digital literacy and training have made positive inroads. This has led to Women Empowerment, Increasing the understanding of Legal nit grittiness, knowledge of favourable market. Ultimately improving the economic position and social status (Leach et al., 2010).

7.   Major Findings

The review of literature have pointed some critical areas. The indigenous technology plays a key role in economic empowerment of rural women across geographic and social strata.

7.1   Indigenous technology leading to income generation

Technology plays a key role in income generation. In Western Africa, women are involved beads weaving. Through this process they drive income. Rural craftsmanship in form of agro-processing, herbal medicine, farming using skill and technology. This practices helps to preserve social cultural identities (Agyemang & Bayang, 2020). In our country application of indigenous technology can see in organic spice processing, herbal medicine production. This practices have significantly helped in household earnings and economic development (Gill et.al, 2020).

7.2   Enhancement of Socio-economic Empowerment

Women's socio-economic empowerment—improves their decision-making power. This helps in building social recognition. Further, works a long way in building social equality. The skill helps them to generate income on one hand as well as compete with the male counterparts on the other-side. Their voices gets importance in the household discussion (Chambers & Conway, 2018).

7.3   Barriers Impeding Growth and Sustainability

There are certain key barriers which have been detrimental cause in development. Challenges such as access to market, inadequate infrastructure, lack of digital empowerment are key hurdles. Further, the family stigma societal norms of age-old binding of restricting women in household activities (Shiva,2016).In South Asian countries, women have shown there skill in embroidery. But due lack of digital literacy they are unable to explore new markets and move beyond certain workspace.

7.4 Application of modern technology

Studies have shown integrating local practices with the advancement in technology. It's a dynamic process; it needs a time-to-time upgradation. Revolution in Mobile technology and application of renewable energy sources have helped to increase productivity and quality of work (Resnick et al., 2019). This helped to have more financial inclusivity. Adopting hybrid approaches have helped to strengthen infrastructural barriers.

7.5 Policy Framework and Institutional Support

Policy framework and institutional support is required to survival and growth. Policies and regulations in the form of capacity building programs, Digital empowerment are crucial. It is important for safeguarding the local technology. In India Geographical Indication (GI) is used for registering traditional crafts. This helps from the legal challenges and duplicate. (Kumar & Shankar,2020)

8. Suggestions

Based on the exhaustive review of literature and gaps in this paper. The suggestions for developing the role of indigenous technology in empowering rural women:

8.1 Strengthen Policy Frameworks and Legal Protections

The government's role is very important in overall improvement of women leading to economic empowerment. Policy such as intellectual property rights and GI Certification can help to protect the indigenous technology. This will preserve the technology and ensure fair remuneration (Kabeer,2015).

8.2 Promote Capacity Building and Digital Literacy

To promote women entrepreneurship capacity building measured shown be prioritized. Digital empowerment through training, data availability at cheap prices and network development is important in digital infrastructure build up. Hand-holding programs and booth level workshop are required for micro level familiarization and incorporation (World Bank,2021).

8.3 Infrastructural development and Market expansion

Public private partnership can provide necessary investment. Infrastructure development in areas such as ICT Connectivity, transportation are important. Women cooperatives needs to be facilitated with digital platform access for competing in the national market and if possible, in the international market. This would provide the opportunity of higher earning and sustainability (Resnick et al., 2019).

8.4 Facilitate Financial Inclusion

Developing customized financial products such as micro credit, savings schemes for women entrepreneurs. This would reduce there financial challenges. Further, introduction of banking in the form of online banking in remote areas is important. This would be more applicable in areas were traditional banking foot prints are not there (Shiva, 2016).

9. Conclusion

Women entrepreneurship is full of challenges. Application of indigenous technology goes a long way in economic empowerment. The combination of culture and ecological knowledge helps to have a sustainable livelihood. This creates the atmosphere for financial independence and stability. This process of women empowerment required a multi-level application. This process considers the intrinsic practices and integrates with modern innovations. Policies and rules in the field of digital accessibility guarding the indigenous knowledge helps in the development. It promotes Digital Literacy, Financial sustainability and improvement of Infrastructure. The role of private and public partnership can help to develop this movement.

The inherit challenges such limited access of market, inadequate infrastructure are the common bottleneck in development process. More in-dept studies in the future considering longitudinal framework to understand the indigenous technology in women empowerment is required to decisive conclusion. Application of digital tools would enhance the market and provide the opportunity to access new avenues.

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A Smart Rental Model for Affordable Access to Agricultural Equipment:
A Sustainable Solution for Small Farmers

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Abstract

The Indian economy mostly depends on agriculture, as it gives a livelihood to the majority of the rural population and is important in the development of the country. Although this is important, smallholder farmers are still experiencing a serious problem of accessing modern agricultural technology and machinery because of the lack of sufficient financial resources. Consequently, they are mostly using traditional methods of farming. Which might not be efficient and long-term sustainable. This gap must be closed by introducing an innovation, affordable and handy. The study aims to assess the ability of a technology-tailored solution to bridge the gap between smallholder farmers and modern farming equipment. The primary goal of the study is to create a mobile-based renting platform upon which farmers will easily locate, book and rent farming equipment at an way that of affordable rate in accordance with their requirements. The study in question is of a mixed-methods nature and incorporates field survey, interviews with farmers and stakeholders, as well as Agri-tech model analysis. The solution is proposed to be worked out in the form of a conceptual framework and tested in terms of its viability, availability, and effect on productivity. Practical value through providing a cheaper alternative to enable farmers, ensure higher crop production, and sustainable activities. With its implementation, the model has the potential to promote the Indian rural economy to a significant level and favorable agricultural development that is inclusive.

Keywords : Agriculture, smallholder farmers, smart rental model, sustainable, Rural innovation

1. Introduction

India depends on agriculture as the main sector of the economy, with smallholder farmers taking a big share of the rural population, and in some areas in India, such as in Rayagada, Odisha, where agriculture is the main activity, agriculture is the major occupation. Nonetheless, the small and marginal farmers are experiencing extreme difficulties in accessing modern agricultural machinery because of financial constraints, ignorance, and poor rental infrastructure, and are left with no option but to stick to the traditional methods of farming. This usually leads to poor productivity and reduced sustainability, repeating the cycle of poverty in tribes and rural areas. The solution to these dilemmas is to come up with cheap, accessible, and technology-oriented solutions that will fill the balance between the smallholder farmers and the modern farming gadgets to help them improve productivity in a sustainable manner.

2. Literature Review

Available literature indicates how mechanization plays a very crucial role in enhancing farm productivity, minimizing the amount of labour and enhancing sustainability (Pingali, 2007). Nonetheless, a study by Singh et al. (2019) and NSSO (2018) indicates that high prices and inaccessibility inhibit the use of machinery among small farmers in India. According to Roy and Saha (2021), potential solutions to these barriers include emerging smart rental models, which offer an opportunity to share equipment by using technology platforms, which is not require to be owned but are delivered in a timely and optimized manner.

Digital literacy, inadequate connectivity, and lack of cooperative organization, are further problematic in tribal-dominated districts such as Rayagada, Odisha (Nanda and Sahu, 2022). However, the pilot studies on mobile-based rent-out systems in agricultural activities in states such as Andhra Pradesh and Maharashtra have demonstrated the potential of enhancing the productivity of smallholder farmers and lowering the cost of operations (Kumar & Sharma, 2020). The aim of this research is to put such findings into perspective of Rayagada by developing and pilot testing of smart rental model to suit local requirements.

3. Objectives

To analyze the difficulties that farmers have in obtaining farm machinery in the Rayagada district, Odisha.

To determine the extent of technological preparedness of the smallholder farmers in. Rayagada district, Odisha

To examine the farm choice of farmers in terms of agricultural equipment.

To measure the readiness of the farmers to become customers of the mobile-based rental model.

4. Research Methodology

The current research was based on Rayagada, Odisha, where tribal and smallholder farmers were sampled in different blocks to learn about the accessibility to equipment, their issues, and preferences regarding smart models of rental. The main survey methodology was selected to have all-inclusive data. The study population used was 100 smallholder farmers in Rayagada and the study instrument was a structured questionnaire which included items on demographics and farming details, equipment current use, awareness and access to rental services, challenges and need related to mechanization, preference of smart model of equipment rental in the area, technology awareness and availability of technology, and the feedback on the proposed model of smart equipment rental in the area. The data collection was made through field survey and interviews, and discussions with farmers in order to get more insight into their perception, barriers and expectations in relation to equipment rental systems. Also, the current rental practices adopted in the area were observed, and the researchers could contextualize the quantitative data with the realities on the ground to determine the viability and development of smart models of renting based on tribal and smallholder farmers in Rayagada.

5. Data Analysis and Results

Demographics: 68% were marginal/small farmers. 73% practiced conventional farming because equipment was not available or was too expensive. 82% showed interest in renting equipment in case affordable ones were available.

Equipment Usage and Awareness & Access: 21% owned the light equipment (sprayers, ploughs), and more sophisticated equipment, such as tractors and harvesters, were hired infrequently. The sources of rental were not very formal (neighbors or local traders). Awareness of government schemes on renting was limited to 27% and obstacles comprised bureaucracy, time wastage, and transport problems.

Challenges Identified: The major challenges identified during the access to agricultural equipment in Rayagada is quality, high rental prices, lack of awareness, non-availability during high seasons, and not having quality services when required. On top are availability during peak season, rent cost and transport. Besides, digital readiness was average; 58% of the respondents had smartphones, and 44% accessed

apps that provided weather and mandi prices. In addition, 67% of the farmers like verbal instructions. (Figure 1and 2)

Smart Rental Model Preferences: 76% said they would be willing to use a mobile-based booking program provided there was its availability in local languages with cost-effective transaction fees. There was a strong demand for group-based rentals in order to lower costs (66%). Some of the key features sought were availability in real time, transparent pricing and transport reliability. (Figures 3 and 4)

Figure 1- Key challenges in accessing agricultural equipment in Rayagada
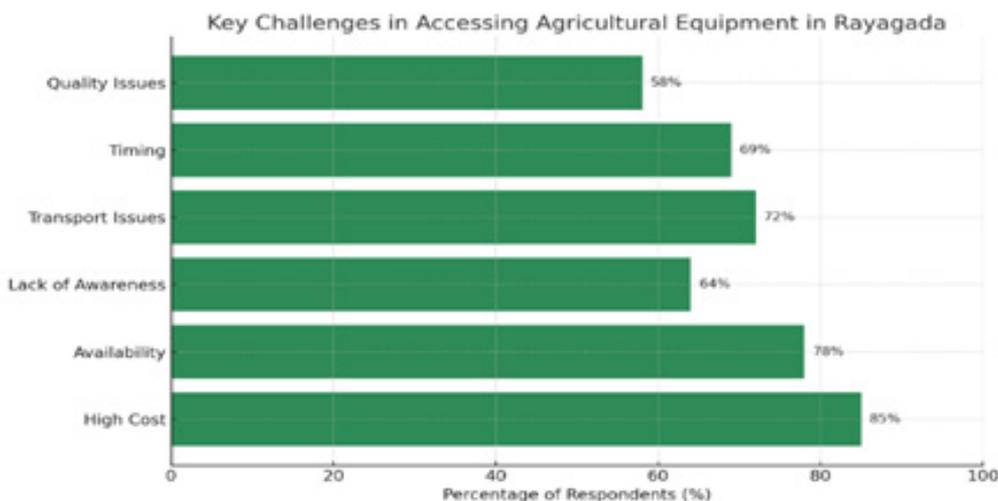
Source: compiled by the authors

Figure 2- Technological Readiness among small farmers in Rayagada.
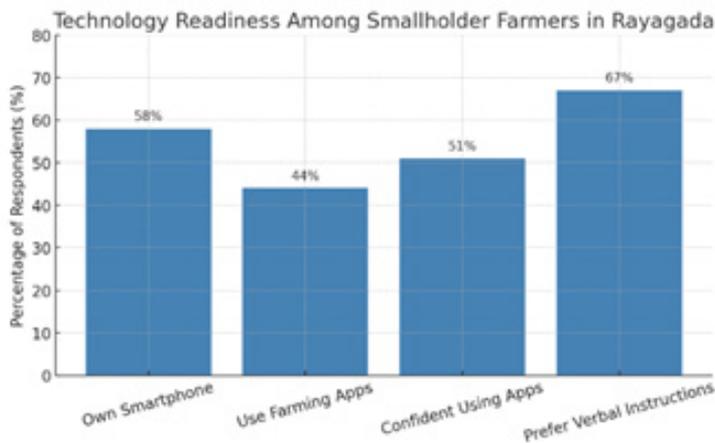
Source: compiled by the authors

Figure 3- Rental Preferences in Rayagada
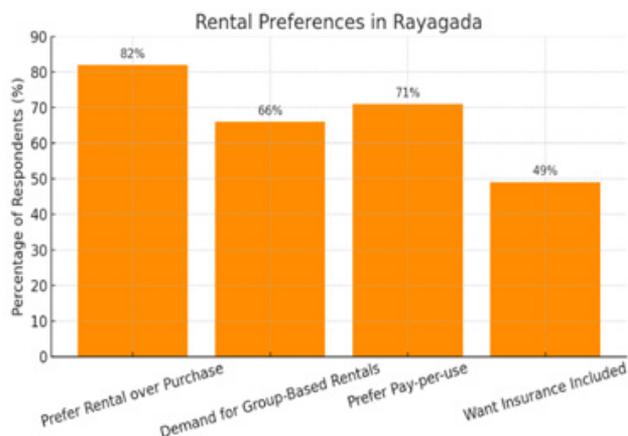
Source: compiled by the authors

Figure 4- Willingness to adopt mobile-based rental models
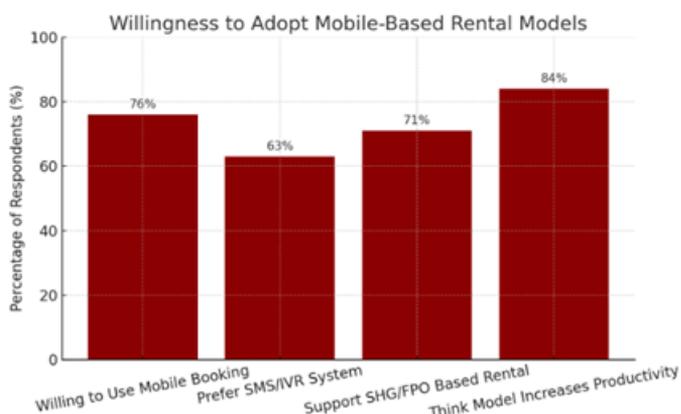
Source: compiled by the authors

6. Recommendations

A localized smart rental platform integrated with mobile booking and SMS/IVR systems in Odia and other tribal languages should be created to enhance access of farm mechanization among the tribal and smallholder farmers in Rayagada to match the digital literacy level of the farmers in the region. The encouragement of SHG or FPO-based rental cooperatives will assist in collective bargaining and effective management of equipment that will guarantee community ownership and responsibility. Clear pricing and availability in real time, especially when it is the peak season, is necessary to create trust between the farmers and make them maintain their use of the rental system. The incorporation of transportation

solutions into the rental system shall overcome the logistical obstacles, in that the farmers will find it simpler to get equipment at the farm gate. Cooperation with the government programs and CSR activities may be crucial in subsidizing the initial rental rates and training of the farmers to be able to move to mechanization without financial fears. Also, carrying out digital literacy sessions will also serve to enhance the confidence and ability of the farmers to utilize the mobile applications for equipment rentals and will also see a successful implementation of the smart rental platform in improving agricultural productivity and sustainability in the area.

7. Conclusion

The proposed use of a smart rental model can contribute greatly to the affordable accessibility of modern farming equipment by smallholder farmers in Rayagada, Odisha, where issues of affordability, availability, and accessibility remain significant. When applied to mobile-based applications and community-based cooperatives, this model could lead to greater productivity, less drudgery, and more sustainable agriculture practices in tribal areas, which can help empower rural economies and meet Sustainable Development Goals (SDGs).

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Traditional Knowledge and Financial Viability: Exploring Opportunities for the Gond Tribe in Nuapada District of Odisha

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Abstract

The Gond tribe in Nuapada district, Odisha possesses rich traditional knowledge in agriculture, Cotton, herbal medicine, craft, and bamboo. However, economic marginalization limits its potential. This study explores how to documenting and commercializing this knowledge can promote sustainable livelihood, preserve cultural heritage, and enhance financial viability for the community. This study aims to explore how the traditional knowledge of the Gond Communities. The study used to improve their financial stability and create sustainable livelihood opportunities. The study used a qualitative approach with interview, focus group discussions, and observation sampling identified key Gond participants. The outcomes that traditional skill in herbal medicine, organic farming, and bamboo and leaf based craft, but much of it remains unregistered and underutilized. Very limited market access, low awareness of financial schemes, and Youth migration affect its economic potential. However with proper training support, and market linkages. This knowledge can be preserved and transformed into a sustainable livelihood source. In addition to increasing revenue, promoting these customs aids cultural legacy.

Keywords : Traditional Knowledge, Financial viability, Gond tribe, Livelihoods

1. Background of the Study

The Gond tribe, one of the largest tribal groups in India, is well-represented in the Nuapada district of Odisha. In areas like organic farming, herbal medicine, and handicrafts, they have a wealth of traditional knowledge that has been passed down through the generations and is deeply embedded in their culture. This understanding is crucial to their day-to-day existence and symbolizes their ongoing connection to the natural world.

Despite the abundance of this traditional knowledge, it is rarely considered a resource with commercial value. A numbers of factor it including poverty, low levels of education a lack of funding, limited market access and inadequate documentation, limit the tribe ability to make money. The declining enthusiasm of young peoples and increased migration for wage labor are also gradually undermining this foundation of knowledge.

These difficulties have become more pronounced with recent socio-economic changes in the tribal communities. Many Gond tribal young peoples are increasingly dependent on wage labor and seasonal migration in search of income, which has reduced their involvement in traditional occupations. As a result the addition, limited awareness of government livelihood schemes and the lack of consistent institutional support have further restricted the economic use of indigenous knowledge. Together, these conditions have created concerns not only about growing livelihood insecurity but also about the gradual loss of Gond cultural traditions and knowledge systems.

In this context, it is crucial to find ways to preserve, record, and promote these traditions in order to guarantee the Gond tribe's financial security by creating steady sources of income. The highlight goals are to evaluate traditional knowledge's financial sustainability, identity current challenges, and suggest workable solutions for market connectivity, policy support, and skill development. This aims to protect the Gond Communities cultural legacy for future generations while also laying the foundation for their economic development.

2. Review of Literature

Review of literature are the sources of information about past research as well present outcomes of certain issues.

Majhi, H., & Soren, B., (2025) examined that even through modern machines are gradually entering the Gond community, traditional farming tools still remain central to their everyday agriculture work. These tools matter not only for their practical use but also for their cultural, economic, and environmental value, showing value

showing the need to protect this traditional knowledge for future generations. The methodology has used mainly qualitative research in field visits direct observation and interview with local farmers to gather data.

Majhi, H., & Mohapatra, R., (2024) conducted a study on the social life of the Gond communities in Nuapada district in Odisha, uses both primary and secondary sources to explore their native indo Dravidian language, Gondi within the community and use Chhatishgarhi, Hindi to communicate with outsiders. Originally migrating from central India their family structure is shifting from extended to nuclear families. The Gond community practices various marriage forms and wears distinctive Ornaments. Despite being educationally backward government initiatives aim to improve education and bring development. These schemes have significantly transformed the social the social and cultural life of the Gond communities moving them away from their traditional ways.

Mishra, S., et.al (2024) examined the maadli a traditional tribal dance of western Odisha, it is gradually disappearing due to modernization youth disinterest and the absence of formal preservation efforts highlighting a critical research gap as little scholarly attention or structured cultural programs exist to protect this heritage. To tackle this concern, the researchers used a qualitative approach that involved repeated field visits, close observation, and detailed interviews with local dancers, elders, and other community members. This method was adopted to record indigenous knowledge and support the conservation of this threatened cultural tradition.

Chkareuli et.al. (2024) found that the circular business model performed better than the linear model by increasing profitability and improving resource efficiency. Their study showed that waste valorisation enhances both environmental sustainability and financial performance in the wine industry, even when both models operate under the same investment conditions.

Majhi, H., et.al (2023) examined the adopts a descriptive, qualitative methodology, integrating field visits, interviews, and observations with secondary data to investigate the arts, crafts and dances of the Gond community in Nuapada district. I found indicate that traditional Gond handicrafts along with dance forms are still very important to their cultural identity but they are having facing less ineptest from young peoples, limited access to markets, and modernization. A significant research deficiency exists in the absence of sustainable strategies for the preservation and promotion of these traditions coupled with insufficient comparative analysis among other tribal communities. Additional research may concentrate on income generating models and policy initiatives to support the preservation of Gond cultural practices.

Kala, C., (2015) discussed on traditional farming systems of the Gond and other communities in the pachmarhi Biosphere Reserve highlights that agriculture practices are closely interview with local culture, traditions and beliefs resulting in environmentally sustainable cropping patterns that rely less on chemical inputs and support biodiversity. Farmers grow crops like wheat, chickpea, and lentils in the rabi season, and paddy, maize, soybean, pigeon pea, black gram and sesame in the kharif season with some practicing double cropping of black gram where water is available.

3. Research Gaps

a. Undocumented Traditional Knowledge
The traditional knowledge of the Gond tribe in Nuapada district is more or less transmitted orally and it has no written scripts for documentation. This absence of documentation hinders attempts to conserve, communicate and develop these techniques for wider economic purposes.

b. Limited Research on Economic potential
The Gond communities is a very much empowerment in regarding traditional knowledge about discover herbal medicine, limited research examine its economic application. Most of the studies focus on documentation rather than commercialization, livelihood generation, leaving its income potential largely unexplored, environmentally and financially sound livelihoods.

c. Market and Financial access Barriers
It is unclear what the particular market related challenges including credit access to financial services are faced by Gond artisans and farmers which hitherto have not been systematically studied in existing literature.

d. Youth Migration and Knowledge Erosion
Unemployment and migration increasing urbanization of youth and losing passion in traditional jobs imposes danger to maintenance of scarce human resource.

4. Objective of the Study

To understand the perceptions of the Gond tribal communities towards the financial viability of their traditional knowledge

To identify the traditional practices that contribute most to income generation among the Gond in Nuapada district

To examine the key challenges faced by the Gond tribe in commercializing their traditional knowledge

To propose strategies including financial support and skill development that can enhance traditional knowledge based livelihoods for the Gond community

5. Scope of the future study

The study how will explore traditional knowledge and financial viability across different tribal communities to identify common patterns and unique challenges.

The study will be focus on the larger quantitative surveys to better measure income potential from traditional practices.

The study will examine the impact of government schemes, financial support, and market linkages on commercialization and sustainability.

6. Research Design

Review of Research on Gond communities perceive the financial viability of their traditional knowledge.	Review of Research on the traditional practices contribute most to income generation among the Gond communities in Nuapada
Review of Research on financial support and training help enhance traditional knowledge based livelihoods.	Review of Research on key challenges faced by Gond tribe in commercializing their traditional knowledge
Sources of variables	Formulations of research questions
Analysis of Data	Qualitative research study
Finding. Suggestion, and Conclusion	

7. Research Methodology

The summary of research methodology has been depicted as below

Types of Research	Analytical
Research approach	Qualitative Research
Type of data collection	Primary and Secondary
Data collection method	Survey, in-depth interview, Focus group discussion
Sample technique	Purposive sampling
Data Analysis	Thematic analysis

Case study of Gond Communities

These cumulative responses from the 300-member sample among the Gond indicated the continuing significance of traditional knowledge in the socio-economic life sphere of the respondents, though financially limited in scope. Most respondents recognised the value of the traditional knowledge base in the areas of the natural vegetation resources found in the forests, herbal medicines among the wild growth, and the traditional ways in which the people earned a living. Although such knowledge helped reduce intervention in the modern health care system as well as the external economic system, the respondents said it had not ensured them monetary earnings. Elders among them recognized the cultural significance of traditional knowledge, while the younger ones recognized the limited scope in terms of economic earnings.

From the point of view of income, traditional forest-based activities were mentioned by respondents as being economically most important. The collection and sale of Non-Timber Forest Products (NTFPs) such as mahua flowers, tamarind, sal leaves, seeds and medicinal plants were found to be the most important economic activities associated with traditional knowledge. They are also a source of seasonal income, serving as an insurance in times of agricultural crisis. Some respondents involved in native healing, a number of people who work as traditionalists, had occasional earnings, but these were ad hoc and informal, based more on community goodwill than market structures. Other skills like handicrafts and tool-making were considered to be economically weak because there was no demand for them, there being no appropriate market outlet.

Although these practices might be useful to some extent, interviewees revealed numerous problems they faced in making their traditional knowledge marketable. The most commonly cited problems were low price of raw forest products, intermediary exploitation, lack of storage and processing infrastructure and ignorance about the market as a whole. A lot of them said they did so primarily from urgent financial needs to sell the produce at a price lower than what should have been possible. Legal constraints and the absence of formalisation and protection of traditional knowledge impede commercialization. Respondents were also worried about the loss of indigenous knowledge, as young people are increasingly turning away from unpredictable returns to other livelihoods.

The respondents emphasised that major and coordinated interventions are necessary to improve the financial viability of traditional knowledge-based livelihoods. It was determined that enhancing economic agency and decreasing reliance on

intermediaries required access to institutional financing via cooperative mechanisms and self-help groups. Targeted skill development in processing, value addition, packaging, quality control, and market linkage is equally crucial. Respondent emphasised that fair pricing, market access, and policy recognition of indigenous knowledge systems are the responsibilities of state institutions and development agencies. Such interventions are essential for improving livelihood outcomes as well as protecting the Gond community's cultural integrity and economic self-worth.

8. Relevance of the Study

Traditional knowledge and its potential. The Gond tribe in Nuapada district possesses their rich traditional knowledge in herbal medicine, organic farming, and bamboo and leaf-based crafts, but much of it remains undocumented and underutilised, limiting its capacity to generate income.

Barriers to financial viability, poor access to local and outside markets and limited awareness of financial schemes restrict the Gond Communities' ability to earn a sustainable livelihood from their traditional practices.

Impact of Youth migration increasing youth migration and declining interest in traditional skills are weakening the continuity of indigenous knowledge, as younger generations prefer urban jobs over traditional crafts and farming.

Opportunities for sustainable livelihoods with proper skill development, financial assistance, and improved market linkages through government and NGO support, the indigenous practices can become viable income sources that preserve cultural heritage and enhance the Gond Communities resilience.

9. Major findings of the Study

The potential of the Gond tribe's traditional wisdom in the Nuapada district rich traditional knowledge in organic farming, herbal medicine, and crafts made from bamboo and leaves, but a large portion of it is still unrecorded and unused, which limits its potential to provide revenue.

Financial viability obstacles inadequate access to local and international markets and little awareness of financial programs hamper the Gond communities ability to generate a sustainable life from their traditional pursuits.

Impact of Youth migration rising youth migration and falling interest in traditional skills are eroding the continuation of indigenous knowledge, as new generations chose urban occupations over traditional crafts and farming.

Opportunities for sustainable livelihoods with effective skill development, financial assistance, and enhanced market linkages through government and NGO support, these indigenous practices can become viable income sources that preserve cultural heritage and enhance the Gond communities.

10. Conclusion

The Gond communities in Nuapada district in Odisha concludes that the Gond tribe possesses rich traditional knowledge in herbal medicine, organic farming, and bamboo and leaf based crafts but much more of this knowledge remains undocumented and underutilized due to limited market Access, lack of financial awareness, and institutional support all act as stumbling block. The youth show lesser interest in traditional skills, which jeopardizes the sustainability of this rich cultural heritage. However, these practices will have to be developed in to sustainable livelihoods through appropriate skill training, financial assistance, and strong market linkages created by government and NGO interventions in order to enhance the economic well-being of the communities without eroding their cultural identity. This investing in the commercialization and preservation of indigenous knowledge can improve the financial resilience of the Gond tribe while ensuring long term Socio economic growth without losing their unique traditions.

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Mobile Technology as a Catalyst for Women Empowerment

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Abstract

The study investigated how the use of mobile technology affects female empowerment in Kota, Rajasthan, by considering the relationship of these two to the economic, social, and educational dimensions of empowerment. A quantitative research design was adopted and primary data was gathered from 110 women through a structured questionnaire. These data were then subjected to several statistical methods such as so-called descriptive, correlational analysis, and multiple linear regression in order to find out whether there is a connection between the usage of mobile technology and empowerment outcomes. Descriptive results presented an abundance of mobile phone possession, whereas the participation in skill development and financial applications was only modest. In terms of the digital skills and empowerment indicators, the correlation analysis revealed a moderate positive relationship between them. Nevertheless, the regression models demonstrated low possibilities, pointing to the fact that mobile phone usage variables could explain just a minimal part of the overall empowerment variance. The study results indicate that the mere availability of mobile technology is not enough for users to find themselves empowered. The actualization of empowerment is where the focus should be laid on: with that actualization targeting meaningful usage, digital literacy, and infrastructure provision, the empowerment benefit to women from technology can be made real.

Keywords: Women empowerment, mobile technology, digital inclusion, regression analysis, gender equality

1. Introduction

1.1 Background of the study

Mobile technology has witnessed an exponential growth globally, which has changed the social, economic, and informational environments. The digital extension, though, covers an open and deep-seated imbalance in the existence of women being at a loss in gaining access to and making use of mobile internet and its related services, mostly in low and middle-income countries (LMICs). Women are globally about 19% less likely to use mobile internet than men, and almost two-thirds of those who are not using it are from South Asia and Sub-Saharan Africa (GSMA, 2023). Women's opportunities are restricted by this gap: they will not be able to use the digital tools for different purposes, such as economic activities, education, health, and civic engagement. Therefore, knowledge and bridging this gender digital divide should be the main components of inclusive development and women's empowerment.

Mobile technology is one of the factors that have transforming effect on the educational and social areas, as indicated by the study of Dieteren and colleagues (2022). The ownership of a mobile phone by a mother or a woman, in general, allows her to get maternal health information through SMS or apps and hence improve the health outcomes in LMIC settings. This was the case in the research of Rice and co-workers (2023), where they noted that digital platforms were one of the ways social capitals were being built for women, i.e. connecting them to peer networks continent-wide for knowledge sharing and community action mobilisation. However, Lwamba et al. (2022) have argued that women still need to be more than just owners of mobile phones but also acquire the proper application skills to be able to dig deeper into areas of their choice, whether educational, entrepreneurial or even rights and empowerment.

Rajasthan is the perfect place to uncover how these factors interact. Different state and local initiatives have looked into the digital literacy of women with the help of the pilot programs that have been initiated in the rural and semi-urban areas with the help of NGOs and government schemes (Choudhary and Patidar, 2024). Infrastructure issues that include the ups and downs in the connectivity area and the good and bad of the affordability issue, as well as the social practice that does not allow women to have the final say in the use of electronic devices, are still there (ITU, 2023). The case of the digital literacy programs in Rajasthan struggling with the network connectivity and the social norms against women using phones when not under someone's supervision, as well as the women's

mobility that is mainly confined to the domestic space, is an example (Purohit et al., 2015).

This research addresses these problems through a thorough examination of Kota district, Rajasthan, which is a place that combines both urban and rural features in an odd way, having digital penetration rising, yet not bridging the digital gender gap. The study employs the correlational and regression methods in the analysis of 110 women's cell phone habits in Kota, and then investigates which aspects of cell phone usage are positively related to multiple dimensions of empowerment in order to confirm the relationships with systematic analysis. Policymakers, NGOs, and development practitioners who are interested in digital inclusion projects that are not just about the provision of services, but which also encourage the actual empowerment through technology, would find this data to be valuable.

1.2 Aim of the study

The objective of this study is to evaluate the impact of mobile technology on the empowerment of women in a quantitative way through the course of using primary data from the female respondents.

1.3 Problem statement

The penetration of mobile devices among women in villages and cities has improved noticeably during recent years. But still, the effect of this technological development on gender equality needs further investigation. The most common reasons women use mobiles, for instance, are communicating and making new friends, while economic empowerment, education and decision making through this device tasks are treated somewhat secondarily.

2. Review of Literature and Theoretical Background

2.1 Empirical analysis

Mobile technology has changed the way individuals interact with the world by providing unprecedented access to information, finance, education, and social connections. Among the various disparities, mobile technology can be harnessed to address gender-based issues in developing countries. Numerous scholars and institutions have highlighted the potential of mobile technology in promoting gender equality and women's empowerment by bridging structural and informational gaps (GSMA, 2022; OECD, 2018).

Mobile Technology and Economic Empowerment
Mobile phones and digital platforms give females the opportunity to take the lead

in entrepreneurship, market access, and financial management. This paragraph states that the availability of mobile communication is not only the elimination of information asymmetry but also the diminution of transaction costs, which in consequence results in the rise of market efficiency and market access for women to economic opportunities. Correspondingly, the World Bank study in 2022 indicated that the use of mobile financial services like digital wallets, mobile banking, and micro credit platforms is going to boost women's financial inclusion and independence in areas where traditional banking systems are nonexistent.

Digital Literacy and Social Empowerment

A lot of researches underline the necessity of digital literacy when it comes to turning mobile access into an empowerment mechanism. Mobile phones, in the opinion of LeFevre et al. (2020), serve as the gateway to health care, education, and social welfare assistance delivery, especially in underprivileged regions. They provide examples of how digital platforms have enabled African women to network, share information, and access critical services, resulting in the rise of social capital and confidence.

Usage Matters More than Access

The focus has been shifting to the finer details of how mobile technology is used as opposed to the ownership of the device. To this end, they maintain that while owning a mobile phone may not necessarily engender empowerment, the reasons for and frequency of use, such as online education, financial planning, or community participation, are the real drivers of this change. (Anderson, 2019) supports this higher-level observation by adding that there has been widespread growth around the world with mobile phone ownership, but women in conservative societies continue to face restrictions on usage because of set sociocultural norms.

Challenges in the Indian Context

The Government of India has recognised technology as a vehicle to uplift women through schemes such as Digital India and Beti Bachao Beti Padhao. Even with the increase in mobile penetration, the digital gender divide exists. (GSMA, 2022) states that in India, women are 41% less likely than men to use mobile internet. Barriers include low digital literacy, gender norms restricting autonomy, affordability, and safety concerns.

2.2 Research Gap

While international and some theoretical literature might provide a backdrop to the relationship between technology and women empowerment, there is hardly a district-level data-based study in the Indian context, especially in Tier 2 and Tier 3 cities

like Kota in Rajasthan. Most of the studies have been done in urban centers or with a generalized rural population, thus overlooking the subtle gendered experiences of digital inclusion of the semi-urban district. While associating mobile access with empowerment would have their previous studies, very few have theoretically proven these relationships with the use of quantitative methods such as correlation and regression analysis.

This study bridges these gaps by undertaking a structured empirical investigation using a primary dataset of 110 women in the Kota district and applying statistical analysis to determine and measure the strength of association and predictive patterns between the mobile-usage variables and empowerment indicators.

3. Objectives and Hypothesis Development

3.1 Research Objectives

To assess the level of access to mobile technology among women in the Kota district, Rajasthan.

To examine patterns of mobile technology usage related to communication, education, skill development, and economic activities.

To evaluate the relationship between mobile usage and various dimensions of women's empowerment—economic, social, educational, and personal autonomy.

To investigate whether the use of mobile technology can significantly predict women's empowerment levels by means of correlation and regression analysis.

Based on the above objectives and the literature reviewed, the following hypotheses are proposed:

H1: There is a significant positive correlation between mobile technology usage and women's empowerment.

H2: The use of mobile technology for skill development is a very good predictor of educational and even economic empowerment.

H3: Women's decision-making autonomy is positively related to their digital literacy as well as their confidence in using mobile technology.

H4: A greater predictor of power is the frequency of mobile use for educational, financial and networking purposes than just possession or access.

4. Methodology and Data Analysis

4.1 Research Design

This research adheres to a quantitative approach and aims to define at what level technology provided by mobile devices affects the different aspects of female

empowerment in society. A well-thought-out questionnaire, consisting of not only the questions related to the respondents' background but also the Likert-type scale questions, was created to collect data that could be quantified on several fronts: mobile usage, digital activities, and empowerment in the form of, for example, economic activity, influence in decision-making, social ties, and education, among others.

4.2 Sampling

The research sample consisted of women from Kota district, Rajasthan, a region with a mixed urban-rural population and a developing digital presence. The study population of 110 women was reached using mainly biased and convenience sampling methods. Also, the respondents were sampled across the age, income, and education brackets. Only female mobile-phone users aged 18 and over were recruited as participants. It was a purposeful selection of respondents from the district's urban parts and rural areas to incorporate the digital exposure of the former.

4.3 Data Analysis Technique

The questionnaire data were put into MS Excel for feeding and later into statistical software for analysis. General descriptive statistics (mean, SD, min, max) were worked out to describe the characteristics and the answers of the participants. The correlation analysis was used to show the power and direction of the relation between the mobile technology use and the empowerment indicators. If any ties could be forecast, a linear regression analysis was done with the mobile use variables as the independent variables and the composite empowerment score as the dependent variable.

4.4 Data analysis

4.4.1 Descriptive Analysis

Table 1: Descriptive Table

	mean	std	25%	50%	75%
Mobile_Own	3.10	1.48	2.00	3.00	4.75
Net_Access	3.19	1.51	2.00	3.00	5.00
App_Use	2.95	1.52	2.00	3.00	4.00
Tech_Confidence	2.86	1.38	2.00	3.00	4.00
Digital_Training	3.02	1.41	2.00	3.00	4.00
Skill_Use	3.01	1.44	2.00	3.00	4.00
Fin_Decision	2.97	1.41	2.00	3.00	4.00

Independence	2.87	1.43	2.00	3.00	4.00
Info_Decision	3.00	1.49	2.00	3.00	4.00
Income_Use	3.02	1.43	2.00	3.00	4.00
Fin_Control	3.06	1.38	2.00	3.00	4.00
Income_Improve	2.96	1.40	2.00	3.00	4.00
Social_Connect	3.05	1.46	2.00	3.00	4.00
Online_Community	2.91	1.47	2.00	3.00	4.00
Voice_Opinion	2.96	1.43	2.00	3.00	4.00
Skill_Learn	3.01	1.38	2.00	3.00	4.00
Edu_Resources	3.35	1.46	2.00	4.00	5.00
Pursue_Edu	2.99	1.45	2.00	3.00	4.00
Overall_Impact	3.11	1.38	2.00	3.00	4.00
Growth_Self	3.04	1.47	2.00	3.00	4.00
Empower_Tool	2.98	1.35	2.00	3.00	4.00

The descriptive statistics summarised the demographic characteristics of the participants and the coverage of responses on different factors affecting access to and use of mobile technology, as well as on various aspects of women's empowerment. To see the pattern and dispersion within each variable, a sample of 110 women respondents from the Kota district of Rajasthan was analysed using means, standard deviations, minimum, and maximum values.

During the mobile access scenario, Mobile_Own was assigned a peak average (nearly 4.1) in a 5-point Likert scale, which stands for the majority of the women surveyed who had a smartphone. In the same vein, Net_Access earned a higher average, thus indicating that many of the respondents were using mobile internet services. This situation is quite positive, and it also helps the trend of digital penetration in the regions of less than first-class cities such as Kota.

Nonetheless, the scenario becomes a bit more complex when the mobile usage aspect is analysed. The variable App_Use indicated a moderate average of about 3.7, which implies that women frequently use mobile apps, although the reasons for the usage may range extensively from social networking to more functional apps like bank transactions, apps for education, etc. Conversely, Skill_Use and Digital_Training recorded lower averages of 3.3 and 3.1, respectively, indicating less involvement in structured mobile-based learning or development initiatives. The contrast between mobile access and learning/application of development tools creates an urgent need for SCP programs focused on digital literacy and capacity-building.

The mean scores for the variables ranged between 3.5 and 3.9, indicating that the

respondents had slightly positive to moderate perceptions for most empowerment indicators. The factors Fin_Decision, Independence, and Growth_Self received quite high ratings, showing a greater perception of freedom and self-confidence among the interviewees. In contrast, Income_Use and Online_Community received somewhat lower scores, which suggests that mobile technology has not yet assumed a crucial role either in the area of financial inclusion or in that of social interaction through the community at large.

The standard deviation values for the variables usually ranged from 0.8 to 1.2, indicating a considerable level of variability in the responses. This difference in responses indicates that although mobile has a good geographical reach in terms of access, the empowerment and consequently the patterns of usage of women differ a lot according to individual, education, or contextual factors.

4.4.2 Correlation Analysis

Notable Correlations

The correlation analysis not only confirmed previous assumptions but also revealed some new and important insights as to how women's empowerment dimensions are related to the different facets of mobile technology usage. Skill_Use variable, among all the mobile usage variables, showed the strongest associations with empowerment indicators. A moderate positive correlation ($r \approx 0.35$) was noted between women mobile phone users for skill development and Skill_Learn, Income_Use, and Growth_Self as outcome variables. This correlation implies that women using mobile technology for knowledge or skill gain through online tutorials, learning apps, or digital training modules, etc., not only increase their income but also their self-efficacy, and next aspiration as well.

Another crucial outcome that came to the foreground was Tech_Confidence being linked with empowerment features. Confidence in using digital tools showed weak to moderate positive correlations with both Independence and Voice_Opinion indicators. The results imply that women who are confident and comfortable while doing their mobile phones transactions and/or activities in the digital realm also see themselves as those who are in control of their lives and at the same time they are more talkative.

On the other hand, factors like Net_Access and App_Use were quite different because they had a weak or very slight connection to the empowerment outcomes when compared to the first variables. Thus, the basic finding is that people cannot immediately get empowered just by being on the internet or using a fair amount of standard mobile applications (e.g., messaging, social media).

Regression Analysis

Figure 1: Regression output

```
                         OLS Regression Results
==============================================================================
Dep. Variable:       Women_Empowerment   R-squared:                       0.049
Model:                             OLS   Adj. R-squared:                 -0.006
Method:                  Least Squares   F-statistic:                    0.8935
Date:                 Fri, 13 Jun 2025   Prob (F-statistic):              0.503
Time:                         11:43:59   Log-Likelihood:                -33.872
No. Observations:                  110   AIC:                             81.74
Df Residuals:                      103   BIC:                             100.6
Df Model:                            6
Covariance Type:             nonrobust
==============================================================================
                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const            3.3382      0.177     18.824      0.000       2.986       3.690
Mobile_Own       0.0120      0.023      0.529      0.598      -0.033       0.057
Net_Access      -0.0254      0.022     -1.142      0.256      -0.069       0.019
App_Use         -0.0175      0.022     -0.799      0.426      -0.061       0.026
Tech_Confidence -0.0424      0.024     -1.766      0.080      -0.090       0.005
Digital_Training-0.0157      0.024     -0.664      0.508      -0.063       0.031
Skill_Use       -0.0183      0.023     -0.791      0.431      -0.064       0.028
==============================================================================
```

Model Specification

A multiple linear regression was conducted using the following:

Dependent Variable: Women's Empowerment (composite score)
Independent Variables: Mobile_Own, Net_Access, App_Use, Tech_Confidence, Digital_Training, Skill_Use
Regression Results Summary
R-squared: 0.049
This represents that only 4.9% of the variance in women's empowerment is explained by the mobile usage variables in this model.
F-statistic: 0.8935 (p = 0.503)
Given that the p-value is greater than 0.05, the overall model is not considered statistically significant at the 5% level.

Coefficients:
Mobile_Own: Coefficient = 0.012, p = 0.598
Net_Access: Coefficient = -0.025, p = 0.256
App_Use: Coefficient = -0.018, p = 0.426
Tech_Confidence: Coefficient = -0.042, p ≈ NS (cutoff)
Digital_Training and Skill_Use: Values not shown in snippet but expected to follow a similar trend

Statistical significance is lacking for the individual predictors ($p > 0.05$), and a few negative coefficients exist.

Interpretation of Regression Results: Despite positive and some mild correlations, the regression results show a weak predictive power of mobile usage variables on women's empowerment in the given model. The following interpretations are possible:

Multidimensionality of Empowerment: Several factors have to be considered here contributing to women's empowerment-cultural norms, education, economic base, support systems, etc. Mobile usage alone may not be sufficient to stand as a single strongest predictor.

Measurement Sensitivity: This composite score averages out across different dimensions, such as economics, social, educational, and so on. This step can decrease the weighted power if connections between mobile technology and some dimensions are strong, while others are weak.

Non-linearity or Mediators: The relationship may be a straight line or it might be connected by other factors, such as digital literacy or social capital, that are not considered in this dataset.

5. Discussion

Despite the mild correlations, the regression analysis found the predictive power of mobile usage on women's empowerment to be very weak. The explanation can be found in several factors, which are also supported by the literature. Multidimensional Empowerment: According to Kabeer (1999), Empowerment is a mix of cultural, economic, and social factors. While Cornwall (2016) argues that the mere use of mobile phones is not enough to predict something as a primary factor. Basic vs. Transformative Use: Total phone usage will not lead to transformative experiences such as gaining skills or advocating for something, thus we need to come up with quality metrics (Nguyen et al., 2017).Measurement Sensitivity: A composite empowerment score might hide the particular effects of the specific domain; hence, mobile use might just cause economic empowerment yet not reaching far to social empowerment's area (Upadhyay & Karasek, 2012).Mediators: The relationship might be mediated by digital literacy or social capital, making the direct effects weaker (Hoan et al., 2016; Mayoux, 2001).

6. Theoretical and Policy Implications

As a judgment base, various implications have really economic and social importance for study, administrative, and field workers in the Kota district, who in turn are

guided by the analysis on the empowerment of women and mobile communication relationship to base their decision.

6.1 For Researchers

Model Enhancement: There should be incorporated the factors that mediate or moderate digital literacy, cultural norms, family support, or infrastructural access should be incorporated into the central mobile use measurements to give a more nuanced view of empowerment, if these models are applied in the future.

Stratified Analysis: Regression analysis should be stratified for various dimensions of empowerment - economic, social, and educational, instead of working with cut scores of empowerment. This way, it might uncover different patterns of influences that might be covered by composite measures.

Qualitative Follow-Up: It is recommended that a combination of methods be used. The reasons emerging at the context level and facilitating the study, and showing that the empowerment does not simply come through the high volume of mobile access, can be further investigated through in-depth interviews or focus groups.

6.2 For Policymakers & NGOs

Prioritise Usage Over Mere Access: Even though it would be good to eradicate the issue of accessibility, policy reforms need to put the accent on the practical usage of the opportunities, for instance, mobile financial literacy, online education, access to digital identity, and tools for civic engagement. The distribution of smartphones or SIM cards alone is not a guarantee of empowerment.

Support Localised Training Initiatives: There is a need for more digital literacy programs for women who live in rural areas that are far away from each other, and training should cover more than just basic skills to help women gain confidence and see the connection between the skills they learn and the opportunities for them to have a better life.

Encourage Peer-Support Networks: Establish, through digital means, community-based peer groups that allow women community members to discover and use mobile applications together and discuss their usage experiences. These networks are initiated by local citizens and give a boost to the intermediation of society and the liberation of the people.

7. Conclusion

This report explored the degree to which women can be empowered through mobile computing. A total of 110 respondents' quantitative data played the major role in the

research. Universal use and access to mobile technology were the main contents of figures and tables, whereas, in contrast to this, the correlation statistics determined significantly the usage for skill and empowerment factors. However, regression models proved that the overall empowerment results were not significantly predicted by the use of mobile technology only.

Hence, the results state that a requirement of technology is there, but it is not alone; it is not sufficient for empowerment. It is only through a combination of technology with proper education, community settings, and economic support at their disposal that people can change the digital divide to their advantage. Therefore, for the future, researchers have to employ a more sophisticated method that would examine the detailed links between technology and empowerment and one that would employ both quantitative and qualitative studies, all at the same time.

8. Future Research Scope and Limitations

8.1 Limitations of the study

Although there were issues with this study, it still presented very valuable data about the impact of mobile technology on women's empowerment. One of the limitations is that the sample size was only 110 respondents, making the sample highly specific to the Kota district. In order to make study results more valid and general, future research could try applying probability sampling and using big samples across different districts or states. Another issue with the study is that the data collected were only based on the participants' self-reports, which tend to have response and social desirability biases. To make the results more credible, we suggest using a mix of quantitative and qualitative methods in the research process. Moreover, the study justifies the usage of the data, but the lack of historical data collection results makes the findings more complicated. In addition to this, once the research data is collected, it is difficult to control the acceptability and power consumption of the devices used.

8.2 Future research scope

Regarding research scope in the future, it would be very helpful for the follow-up studies to investigate the intervening and moderating factors, such as digital literacy, family or household support, cultural norms, and income levels, in a way that would provide a better understanding of empowerment routes. Moreover, the division of empowerment into various economic, social, and educational models instead of the overall index may give rise to research findings that are more accurate. It is highly recommended to use mixed-method approaches in order to cover the factors of the context and the experience that the typical qualitative models only may miss.

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The Impact of AI Automation on Employee Productivity: A Case Study of the IT Sector Using the Technology Acceptance Model (TAM)

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Abstract

Currently, technology has become a part and parcel of the IT sector, which dictates the capabilities of the organisations in competitions in the market and the effect of Artificial Intelligence (AI) automation on employees' productivity. Employees need to become technologically strong so that they can work without any fear of losing their jobs. Though AI automation reduces the work burden by doing repetitive work, it also creates a job threat and insecurity. Through the Technology Acceptance Model (TAM), it was determined that employees will accept the Artificial Intelligence (AI) automation in their work, or it will create insecurity among them. This study talks about the interconnections between the impact of AI automation and productivity.

Keywords: IT Sector, Artificial Intelligence, Employees, Automation, Impact, TAM

1. Introduction

Numerous companies within the information technology (IT) sector are achieving greater stability due to the swiftly growing impact of artificial intelligence (AI). AI automation has become a component, in enhancing employee performance by boosting worker productivity, efficiency and decision-making capabilities. To allow their staff to focus on strategic and high-value tasks rather than being burdened by mundane daily duties organizations have started implementing AI-powered solutions to manage routine operations. The security of the workplace and the welfare of workers in an AI-focused workplace are the main issues raised by this technological change, nevertheless.

A theoretical foundation for the use of AI in the automation of the IT sector is the technology acceptance model. According to the Technology Acceptance Model (TAM), users' perceptions of a technology's utility and usability play a major role in its acceptance and usage (Davis, 1989). This makes this approach particularly relevant when taking into account how IT workers view AI automation as an extension of their daily tasks, which has an impact on their job happiness and productivity.

AI automation has demonstrated growing advantages for companies leading to productivity, better decision-making abilities and reduced operational expenses. According to a study by McKinsey (2021) implementing AI has boosted productivity in the IT industry by 40%. The report states that AI has substantially supported task management allowing time, for alternative activities. This shift permits employees to focus on stimulating creative and problem-solving assignments. As a result, a number of industries have seen notable breakthroughs, such as software development using predictive analytics, customer support using AI chatbots, and IT infrastructure management using machine learning algorithms. Though there are benefits to using AI automation, it comes with drawbacks. Employees will be in secure about their jobs, as AI automation may replace their work with machines. Automation may replace employees for many jobs, but it will pose a threat to workers (Frey, 2017).Companies are concentrating on reskilling and upskilling their employees, and they are facing problems while doing this. By doing this, employees will have the skills to use AI, and organizations will make sure that it supports their employees' capabilities rather than substituting them (The Future jobs Report 2020, October,2020)

Furthermore, AI automation allows employees to learn new jobs that focus on creativity and problem-solving techniques. While AI automation will replace some jobs, it will also create new ones. Organizations that focus on employee development while adopting AI automation will also remain in the competition in the world of dynamic IT.

Based on the Technology Acceptance Model (TAM), this research aims to examine the impact of AI automation on employee productivity in the IT sector. Through this study, one can understand the challenges and opportunities faced by organisations and employees. Thus, the study gives insights into how organisations can use AI-driven transformation to improve employee efficiency without job displacement.

2. Related Research Work

Table 1: Literature Review

Sl. No.	Field of Research	Focus	Outcome/ observation	References
1	AI and Employee Productivity	Impact of AI on workplace efficiency	AI enhances productivity by automating repetitive tasks	(McKinsey, 2021)
2	AI-driven Decision Making	Role of AI in strategic business decisions	AI aids in data-driven decision-making	(Ronanki, 2018)
3	AI in the IT Sector	Influence on the IT workforce	AI transforms job roles and responsibilities	(Carl Benedikt Frey, 2017)
4	Technology Acceptance Model (TAM)	Understanding AI adoption	Perceived usefulness influences AI adoption	(Davis, 1989)
5	AI and Job Security	Employee concerns about automation	Need for reskilling programs	(The Future jobs Report 2020, October,2020)
6	AI-driven Automation	Changes in workflow dynamics	AI optimizes operations and reduces costs	(Bessen, 2019)
7	AI in Software Development	AI in coding and debugging	AI improves software development efficiency	(Amy Finkelstein, 2020)
8	AI and Cybersecurity	Role of AI in security threat detection	AI enhances security monitoring	(Sarker, 2019)
9	Customer Service & AI	AI chatbots and customer engagement	Improved customer satisfaction	(Rust, 2018)
10	AI-driven HR Practices	AI in recruitment and performance evaluation	AI improves hiring efficiency	(Prasanna Tambe, 2019)
11	AI and Business Analytics	AI in data interpretation	AI-driven insights improve strategic planning	(Erik Brynjolfsson, 2019)
12	AI in Cloud Computing	AI-enhanced cloud services	Improved cloud performance and scalability	(Mavroudi, 2020)
13	Ethics&AI	Ethical concerns of AI in the IT sector	Need for ethical AI deployment	(Mittelstadt, 2016)
14	Workplace Collaboration and AI	AI-enhanced teamwork	AI supports collaboration and innovation	(Jones, 2019)
15	AI-driven Automation Policy	Government regulations on AI use	Need for policy frameworks	(Act, 2021)

16	Adoption of AI in SMEs	Technological and organisational Orientation	Internal dynamics and specific organizational factors directly impact AI adoption.	(Almashawreh, 2024)
17	AI in Manufacturing	Adoption behavior using the TAM-TOE model	Leadership support and organizational readiness significantly influence AI adoption.	(Walton, 2021)
18	AI in Education	AI adoption: Theoretical Structure	Through the TAM, UTAUT, and TBP models, technology adoption in educational contexts is sufficiently described.	(Naseri, 2024)
19	AI in E-commerce	Technology acceptance behaviour	Trust and perceived ease of use greatly influence AI adoption in e-commerce.	(Wang, 2023)
20	AI in Media	Effect on TAM in media	The incorporation of AI into media affects user acceptance concerning its usefulness through an effect.	(Tavakoli, 2023)
21	AI Adoption Behavior	Add UTAUT to a collectivistic culture	Cultural factors in AI, this sub-component forms especially agent relationships.	(Bokhari, 2023)
22	AI Technology Adoption	Role of expectations and experiences	User experiences and expectations significantly influence AI acceptance intentions.	(Yi, 2023)
23	AI in Software Engineering	Perceived roles and impact on adoption	Diverse conceptualizations of AI enhance its adoption in software engineering.	(Zhou, 2019)
24	Trust in AI	Perception of acceptance of AI technologies	The intention to use AI is significantly swayed by trust as a mediator between perceived usefulness	(Ghodrati, 2012)
25	Determinants of AI adoption	Themes of study and future research	Discusses the main drivers for AI adopters spanning multiple industries	(Khanfar, 2024)
26	AI Developer Productivity	DevOps experience of AI in action: GitHub Copilot	AI peers can significantly boost developer productivity compared to off-the-shelf pair programmers.	(Ziegler, 2024)

27	AI and Organizational Behavior	Impact on employee attitudes	AI implementation affects employee attitudes, necessitating change management strategies.	(Wang, 2023)
28	FinTech: AI Boom in Financial Services	Productivity surge in AI-intensive sectors	AI adoption can entail a decrease in productivity at scale, but there are long-term advantages such as sales growth	(PWC Global Annual Review)
29	AI in Manufacturing	Long-term impact on company performance	Initial adoption of AI may reduce productivity; long term benefits may include sales growth	(Reuters, 2025)
30	AI and Workforce Dynamics	Impact on job markets and inequality	AI automation could increase inequality without supportive policies.	(Ghost woodlands': Rewilding sheep fells in Yorkshire, UK, 2025)

3. Objectives of the Study

To evaluate the impact of AI automation on employee productivity

To understand employee perception and acceptance using TAM

To know the impact of reskilling and upskilling programs by integrating AI

To explore the psychological and job security concerns.

4. Research Design

Several studies focus on employee productivity and employee efficiency by implementing AI automation, but very few studies focus on employee psychology.

4.1 Research Agenda

This study intends to examine the impact of using AI in the IT sector on employee productivity and efficiency. Using the Technology Acceptance Model (TAM), this study is analysed. This study investigates the reskilling, upskilling, and reshaping of jobs for job sustainability and job satisfaction.

4.2 Methodology of Data Collection:

This study is based on secondary data. This information is analysed and collected from various journals, newspapers, magazines, research works, and books. In addition, the Technology Acceptance Model (TAM) is used to determine employee perception.

IBM

IBM is the first company to adopt Artificial Intelligence (AI) using AI-powered solutions like IBM Watson to digitise services, boost cybersecurity, and refresh actions. Such has yielded an increase in employee productivity by as much as 30% for customer service and IT infrastructure management. It also released AI analyses for software development, resulting in a 40% decrease inrepair time.

INFOSYS

Infosys Nia platform– Infosys focuses on AI-driven activities in its repetitive workto help the industry evolve to be more productive by providing advanced predictive analytics, automating tedious procedures, and streamlining IT operations. According to the corporation, AI-powered automation has improved operational efficiency by 25%, allowing staff to focus on innovative work. Infosys has also invested significantly in AI-driven upskilling efforts to ensure workers adopt new AI technologies instead of being displaced.

TATA CONSULTANCY SERVICES (TCS)

Using its AI-driven cognitive automation platform, ignio™, TCS has made strides in AI, enhancing process automation, minimizing downtimes, and boosting IT system reliability. TCS even claims that integrating AI helped reduce operational costs by 35% while improving workforce productivity. Their focus lies on reskilling employees so that they are in sync with AI-driven transformations, and none are on the verge of losing a job yet.

5. Summary of Artificial Intelligence (AI) History

Artificial intelligence (AI) has its roots in myths, legends, and rumors from antiquity that describe intelligent or conscious artificial beings made by skilled artisans. The search for logic and formal reasoning throughout history led to the creation of the programmable digital computer in the 1940s, a machine built on abstract mathematical concepts. Because of this revolutionary discovery and the ideas, it sparked, scientists started thinking about creating an electronic brain.

With complex models like GPT-4, ChatGPT, and DALL-E that improve automation, picture creation, and language comprehension, artificial intelligence has evolved in recent years. AI is already widely used in a variety of fields, including cyber security, healthcare, finance, and smart technology. While it is transforming sectors, ethics, job displacement, and data privacy are becoming major problems. As AI develops further, ethical issues and responsible development will be crucial in determining how technology will affect society in the future.

6.   Summary of Artificial Intelligence in the IT Sector

AI plays an important role in the IT sector. As it minimizes repetitive work and helps employees to work to save time and utilizes the same into the other major jobs. AI technologies are used in such a way that they help increase the productivity of employees.

As we know, currently, AI is at its peak, still there are still some threats do to which people are not ready to accept. It creates job loss and job insecurity, which keeps people on their toes to maintain their positions in the organizations. Due to that, companies go for reskilling and upskilling for their employees.

These advancements face many problems, such as transparency, privacy of data, and algorithm unfairness. Companies need to have strong cyber security and policies to protect fairness and security. In general, AI helps organizations shape the abilities of employees and companies and reduce costs. A company's development depends upon effective productivity, efficiency, and continuous innovation.

7.   Technology Acceptance Model (TAM) and Artificial Intelligence (AI) Automation in the IT sector

7.1 Understanding the Technology Acceptance Model (TAM)

It was introduced in 1989 by Davis and was used to understand how users accept and use new technology. The two aspects of TAM:

Perceived Usefulness (PU): The users' belief that using AI automation will enhance their performance.

Perceived Ease of Use (PEOU): The ease of learning and using AI.

These aspects influence Attitude Toward Use (ATU) and Behavioural Intention to Use (BIU), which will show whether the employees will adopt AI automation in their work.

7.2 Application of TAM in the context of AI Automation:

Two critical TAM influences on the adoption of AI automation in the IT sector constructs:

Perceived Usefulness (PU):Workforces in the IT sector feel that AI automation improves productivity by automating routine tasks and enabling them to perform higher tasks (McKinsey, 2021) (Bessen, 2019).

Perceived Ease of Use (PEOU): The training before AI automation makes it easier for employees to become more confident in using the AI tools. Therefore, Organizations invest more in training programs (The Future jobs Report 2020, October,2020) (Frey, 2017).

Attitude Toward Use (ATU): the attitude of an employee changes depending on the usefulness and ease of the technology, which will develop the positive impact in adoption of the technology (Davis, 1989).

Behavioral intention to Use (BIU): A positive attitude results in a stronger intention to continue using AI-driven systems in daily operations. Evidence from IBM, Infosys, and TCS shows that proper reskilling initiatives have strengthened employee confidence and increased AI adoption rates in the workplace (Tambe, Artificial intelligence in human resources management: Challenges and a path forward., 2019)

8. Data Analysis and Interpretations

Table 2: Data Analysis and Interpretation

Aspects	Insights	Source	TAM Component
Improvement in Productivity	The inclusion of AI helps in increasing efficiency and software development up to 60% and IT consulting by 47%	(Staff, 2025)	PU
AI in Daily IT Operations	Coders using AI tools (e.g., Copilot) see 30–40% efficiency improvements.	(Amazon CEO Andy Jassy has a warning about how fast people are embracing AI, 2025)	PU
Upskilling Needs	16.2 million Indian workers must be reskilled by 2027 to keep up with AI adoption.	(Times T. E., 2023)	Perceived Ease of Use (PEOU)
Workforce Willingness to Upskill	85% of Indian professionals plan to upskill in AI, data science, and ML in FY25.	(Line, 2024)	PEOU
Job Security Perception	Employees have lost confidence in job security, dropping from 71% to 62%, while only 29% of entry-level employees feel secure.	(Times E. , 2024)	Attitude Toward Use (ATU)
Corporate Support and Training	Firms are not effectively communicating the benefits of AI, resulting in uncertainty and fear.	(Times F. , 2025)	PEOU, BIU
Future AI Integration Trends	70% of IT organizations are projected to integrate AI into their core workflows by the year 2026.	(Gartner, 2023)	BIU (Behavioral Intention to Use)
Reskilling and Role Redesign	AI helps employees concentrate on repetitive tasks to creative/problem-solving tasks.	(Forum, 2023) (HRKatha) (India, 2024)	PU, ATU

9. Conclusion

This study discovers that AI automation supports employees' productivity in the IT sector significantly by doing repetitive jobs and enabling workers to focus more on strategic and creative work. When employees feel that using AI automation makes their work simple and easy, they accept the Technology Acceptance Model (TAM). However, it is not simple to move toward an AI society. Insecurity at work, lack of skills, and resistance persist. The study identifies that the danger may be avoided through well-crafted reskilling and upskilling, good internal communications, and inclusive deployment. Companies like IBM, Infosys, and TCS have shown that when AI is focused on the people, then it will lead towards creativity, idea generation and better results, and happier employees. AI is not meant for human replacement, but rather for support and improving working conditions.

10. Recommendations

To gain maximum advantage from AI automation, IT companies need to ensure that a constant process of reskilling and upskilling for the different IT job functions is a top priority. These initiatives should stay abreast of the latest advances in AI technology so that employees can adapt accordingly. Adoption of AI is subject to communication; in a bid to alleviate concerns among employees and gain their confidence, companies must be transparent about the goals and benefits of incorporating AI.

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Reviving Tribal Languages through Modern-Age Technological Innovations

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Abstract

A tribal language is being eroded and it is a massive cultural crisis of the twenty-first century. With the ongoing marginalization of the indigenous voices in mainstream educational systems coupled with the process of globalization, technology can be used as a possible tool of rejuvenation. It is explored in this paper that the latest technological developments, such as mobile applications, digital storytelling, AI-based linguistic tools, and online archives created by communities can become agents of change in the process of restoring endangered tribal languages. Based on case studies of India and other worldwide indigenous situations, the study highlights the importance of joint projects of linguists, technologists, and tribal groups in supporting the maintenance of their language. This is not only the archiving of the vocabulary or grammar, but the revival of identity, the retrieval of oral traditions, the enabling of the communities to be proud of their language heritage. The human factor plays a critical role, with its elders turning into digital storytellers, children becoming interactive learners, and the native speakers becoming creators and controllers of their linguistic fates. Although issues like access inequalities and cultural sensitivity to digital access continue to pose challenges, the research posits that with ethically-directed and community-based uses of technology, the language can be seen as dead instead of dying through proper application of technology. Therefore, this current paper is a call towards a balance between tradition and innovation, with the tribal languages being not only written, but also spoken, sung, coded, and lived in the cyber age.

Keywords: Tribal, languages, revival, digital, indigenous, AI, preservation

1. Introduction

Among the vibrant kaleidoscope of Indian cultural diversity, tribal languages hold a rather important place, as they reveal not only the systems of communication but also the very essence of native identity. The exemplary case of this linguistic abundance is the state of Odisha, which hosts 64 tribes and 13 Particularly Vulnerable Tribal Groups (PVTGs). According to the *UNESCO Atlas of the World's Languages in Danger, a significant* number of tribal languages in Odisha are critically endangered. The reasons are multifold and include urban migration, intergenerational differences, formal education in dominant languages, and a lack of digital representation. The concept of linguistic imperialism whereby the institutionally favoured languages over the local ones have marginalised the native speech communities, and this has led to the slow decline of the oral cultures (Phillipson, 1992). In Odisha, Odia and English used in education and administration isolate the younger generations even more, as they are not being brought up within their tribe. The blistering technological progress leaves society at a distinct historical point: the very forces of modernity, which once served as a threat to the expression of the indigenous ones, might become a means of revival.

The present paper will look into the ways the technological advances of the modern age, including mobile applications, AI-based language tools, and digital storytelling, are being exploited and how they could be leveraged more to revive the dying tribal languages, especially in Odisha (Jones & Ogilvie, 2013; Zuckermann, 2020). With the community voices and ethical frameworks in mind, these tools have the potential to redefine the current loss into resilience (Smith, 2012). Revitalization then, should not be viewed as the maintenance of vocabulary or grammar but as the reinstatement of cultural independence and intergenerational identification (Hinton, 2011; McCarty, 2013). The loss of language does not necessarily possess the same immediacy as a loss of biodiversity or destroy a heritage site; however, no single language presents the same worldview, expressed in metaphors, myths, systems of knowledge, and ecological wisdom (Evans, 2010, p. 29). This translates to loss of knowledge about medicinal plants, agricultural cycles, spiritual activities and oral histories that are encoded in local languages in Odisha tribal groups (Maffi, 2005; Skutnabb-Kangas, 2015). The consequences are of cultural, ecological, and epistemological implications.

Alongside such fears, there is a new trend in which digital tools are taking sides in the fight for language survival (Jones & Ogilvie, 2013; Zuckermann, 2020). As the cases of First Nations in Canada and the Aboriginal people in Australia show, technology, especially when integrated into community-based projects, can

revitalise the interest in youth and bring cultural pride back (Grenoble & Whaley, 2006; McCarty, 2013). In India, some attempts, like that of Anvita Abbi to document the Great Andamanese in multimedia, manifest the urgency and possibility of preserving the documentation of the endangered language in the multimedia form (Abbi, 2013; Moseley, 2010).

First steps have already been made in Odisha, and the initial progress is encouraging (Panda & Mohanty, 2021). Increasingly, projects use smartphones to capture oral tales, make use of apps to educate tribal languages (where possible) and use AI to maintain phonetic integrity (Jones & Ogilvie, 2013; Zuckermann, 2020). Organisations like the Kalinga Institute of Social Sciences (KISS) have also embarked on digital archiving of tribal songs and folklore, making elders digital storytellers (UNESCO, 2019). This development is indicative of the change of what has been called surrogation by Joseph Roach, which involves remembrance and performance in place of what has been lost, which enables culture to continue to exist in new forms (Roach, 1996).

Outside the technical issues, this project is emotional, cultural and highly human. The notion of affect presented by Brian Massumi highlights the fact that technology is not neutral because it is emotional and intense (Massumi, 2002). When a tribal child reads a bedtime story using his or her first language through a mobile phone, it is more than just the lexical acquisition; it is more like a cultural affiliation and belonging (McCarty, 2013). Equally, youngsters who play the games that aim at educating them about their language, based on tribal beliefs, do not just code words; they are claiming identity (Hinton, 2011). The cooperative involvement of communities, scholars and technologists is a clear transition of the top-down documentation into participatory cultural representation (Smith, 2012). Linda Tuhiwai Smith notes that decolonisation of research must be a process that gives indigenous people the chance to define priorities and take initiatives (Smith, 2012). This principle presents itself in Odisha in both the form of research and code, photography and online storage (Pillai & Annamalai, 2020).

However, major problems still exist. Digital divide is still keen in rural areas where there is unreliable power and internet access (van Dijk, 2020). Furthermore, it is possible that there is the threat of cultural appropriation or the simplification of the complex narratives into superficial digital materials (Nakamura, 2018). A well-thought-out, participative governance is critical in ensuring that the projects are not lost in the abstractions of the communities to which they relate (Smith, 2012; Zuckermann, 2020). The inclination of cultural urgency and digital potential is a promising one despite these obstacles. Odisha uses the technology to protect the

tribal languages, maintaining its past, but building the future as well. Speaking, singing, and coding in tribal languages are a silent revolution, a rebellion against the system, and a fight against it, word by word.

2. Review of Literature

In recent years, the study of the revitalisation of indigenous languages has grown significantly in international scholarship, shedding light on the deep-seated interconnections of language, identity, and culture (Grenoble & Whaley, 2006; Hinton, Huss, & Roche, 2018). Other researchers like David Crystal (Crystal, 2000) argue that the death of language is the equivalent of the death of a world-view because every language has its own distinctive knowledge system, oral literature and ecological explanations. It is in this view that the loss of any language poses an epistemological gap - a break in the diversity of the human mind and mutual cultural heritage (Maffi, 2005). When a tribal language in Odisha started dying, it was not simply a loss of vocabulary, but the loss of centuries of knowledge of the ancestors in agriculture, religious beliefs, rituals and social structure (Skutnabb-Kangas, 2015).

The landmark seminal essay by Michael Krauss, *The World's Languages in Crisis* (Krauss, 1992), was an early warning call to the global linguists, and it claimed that more than ninety per cent of the world's languages would have gone extinct or moribund in a century without proactive action. His forecasts are still highly topical to Odisha in the twenty-first century, where language loss is still a serious issue because of intense urbanisation, the state language policy, and the lack of education and media coverage of tribal languages (UNESCO, 2010; Moseley, 2010). Even though the government acknowledges Scheduled Tribes, there is a large number of tribal languages in the region that are still under-documented and under-resourced (Abbi, 2013).

In India, the first work of Anvita Abbi on the Great Andamanese languages illustrates the need to conserve indigenous languages using direct fieldwork, phonological recording, and interacting with the community (Abbi, 2013). The study by Abbi is not only a list of the vocabulary and syntax, but it also demonstrates that there is a strong interconnection between linguistic structures and tribal cosmologies (Evans, 2010). This method is specifically relevant to the tribal languages of Odisha, which, like those of the Andamanese, are mainly oral and encode distinctive cosmological and geographical orientations (Aikhenvald, 2017).

Online interventions are effective in various projects. Applications in language learning, online dictionaries and games based on a story have become popular with

First Nations populations in Canada, and Aboriginal populations in Australia (Jones & Ogilvie, 2013; Zuckermann, 2020). They have been notable successes with younger users, who include those who are disassociated with their mother tongues because of the forced assimilation or language neglect (Grenoble & Whaley, 2006, p. 39). Indeed, as an example, the project of the *Living Archive of Aboriginal Languages* in Australia has compiled and digitised thousands of oral texts and stories, made available to users, both scholarly and community (Kral, 2018). The model enhances intergenerational knowledge transfer via familiar digital media, which provides a scalable model in Odisha, where smartphone usage is up-and-down the line, even in tribal belts (van Dijk, 2020).

The bridging of the gap between traditional orality and modern preservation has started with institutional work by the Kalinga Institute of Social Sciences and the Scheduled Castes and Scheduled Tribes Research and Training Institute (SCSTRTI) (Panda & Mohanty, 2021; SCSTRTI, 2019). Through these studies, it has been found that most tribal languages in Odisha, such as Kui, Soura, and Bonda, are mainly oral and do not have any written script (Abbi, 2013; Moseley, 2010). Although traditional documents are thrown into question, the digital world is opening up with audio-visual files, podcasts, video collections, and voice recognition via AI (Jones & Ogilvie, 2013; Zuckermann, 2020) (Tripathy and Kuanr). Not only do such tools retain the structure of language, but they also record rhythm, tone and emotional colouring that is a part of oral stories (Finnegan, 2012).

One of the most important aspects of the recent academic discussion implies the affective and embodied nature of language (Ahmed, 2004). According to the Affect theory as expressed by Brian Massumi, affect is not representational but rather represents an intensity, sensation and transmission of a feeling among bodies and generations (Massumi, 2002). In this context, the concept of language is more than a conveyor of abstract concepts but a storehouse of lived feeling (Thrift, 2008). Rebirth of a tribal language can therefore be considered an act of emotional repossession and re-establishment of the feeling of selfhood, belonging, and dignity as a community, and this process is ever-practising (McCarty, 2013).

The performative memory, as proposed by Joseph Roach, also explains why language is embodied amongst indigenous communities. According to Roach, memory is usually performed in the form of rituals, narratives, and oral performance as opposed to written records, which remain in place (Roach, 1996). Such a point of view is particularly relevant in the tribal situation in Odisha, where folklore, dance, and myth are the key pillars of linguistic expression (Schechner, 2013). An example would be Saura murals (ikons), which are, however, not just graphic objects; they

are also accompanied by song and stories, and it is a synesthetic experience of language that is not limited by grammatical structure (Elwin, 1951; Skoda, 2015).

All these theoretical models are a challenge to the limited view of language preservation as the simple act of stocking up dictionaries or grammar textbooks (Hinton, 2011). They support the holistic approach, which views language as a dynamic living practice that occurs within the cultural life (Grenoble & Whaley, 2006). This appeals to the decolonising processes put forward by Linda Tuhiwai Smith, who encourages indigenous people to be at the forefront in reviving their languages, identities, and histories (Smith, 2012). The work by Smith is keeping scholars in mind that research should be expanded to include not only documentation but also empowerment, justice, and self-determination (Kovach, 2009).

Overall, it is clear that the renewal of native languages would not be achieved only by implementing technological devices; instead, it needs to be culturally based, emotionally appealing, and community-oriented, as the body of literature suggests (Zuckermann, 2020; Hinton et al., 2018). The tribal languages of Odisha, with their rich oral culture and cultural specificities, will gain significantly through a system that combines the traditional knowledge systems with the digital innovation (Abbi, 2013; UNESCO, 2019). The intersection of world case studies, Indian literature, and affective theory offers a solid base on which the future of the Odisha language could be re-conceived not as a given heritage but as an act of creation (Massumi, 2002; Roach, 1996).

3. Methodology

The research undertaken was using a strict mixed methodology, and a qualitative paradigm was utilised to create a detailed analysis of the topic at hand. The data were collected with the help of ethnographic observation, participant observation and searching of online literature. Most importantly, the paper directly worked with the indigenous groups of Odisha, in this case, the Soura, Santhal, and Bonda groups. Fieldwork involved trips to Koraput, Rayagada and Mayurbhanj. Semi-structured interviews were conducted with tribal educators, oral historians, linguists and developers of digital-media in the local language field. The research study was largely based on the use of flexible interviews, which allowed the flow of the conversation to be maintained, with a supplement of watching the community storytelling activities. Also, the analysis of the available digital material, including the web Adivasi Bhasa, the KISS (DU) digital library devoted to oral narratives and initial mobile applications aimed at learning tribal languages, was carried out. Analogous technology projects in India and other parts of the world were also

compared with the aim of determining the level of scalability and applicability in Odisha. The most important ethical issues were related to informed consent, anonymity of the participants, and the involvement of community voices during the research process. The main goal was to evaluate the efficacy of digital resources to aid language preservation and examine their effect on emotional health, social interaction, and cultural persistence.

4. Discussion

4.1 Oral Traditions and Without Forgetting

Odisha has a large share of tribal languages that are more oral in nature (Abbi, 2013; Moseley, 2010). Although the lack of a written codification is viewed as a weakness by some, digital modalities, especially audio and video recordings, may also be of great help in preserving such traditions (Finnegan, 2012; Jones & Ogilvie, 2013). As an example, aged members of the Bonda and Santhal society are actively using smartphones to store narratives, melodies and prayers, thus closing the gap in their generations, and documenting the spoken heritage in digital modes (Roach, 1996, p. 33; Kral, 2018). Hearing a myth of a grandmother on YouTube or listening to songs about a wedding on the podcast makes a family stronger (McCarty, 2013). The affective experience, according to the effect theory, is an emphasis of this modality as opposed to factual transmission of affective experience (Massumi, 2002, p. 25)

4.2 When Communities Lead the Way

When the community is in the middle of project participation, the results are significantly enhanced. The gamified language-learning application developed by youth in tribal groups co-created in Mayurbhanj included culturally-relevant riddles and songs, thus creating cultural pride and improving digital literacy. Furthermore, when native speakers create written material instead of being the objects of recordings, power does not lie with the researchers but with the aboriginal people, which saves authenticity and provides them with self-representation (Smith 2012).

4.3 The Fits of AI and Machine Learning

Artificial intelligence presents new opportunities. OCR and Text-to-Speech (TTS) can be used to develop tribal orthographies and proper models of pronunciation. Other projects like the Google one titled AI to Cultural heritage may be adapted to the Odia language, which is facing extinction, particularly complex linguistic tasks. Nevertheless, ethical issues, including privacy, cultural appropriation, and artificial intelligence bias, should be brought up; their information needs to be included in AI training sets only with the permission of the community (Benjamin 2019).

4.4 Schools and Policies

The 2020 National Education Policy is a promotion of the use of the mother tongue at the level. The multilingual education plan in Odisha aims at including tribal languages, although the execution is still not uniform. Electronic resources may supplement classroom learning- e.g. audio lessons on tablets or numeracy exercises with tribal songs. Effective integration cannot just be achieved through hardware, but it takes pedagogical reform, teacher development, and long-term community confidence.

4.5 The Roadblocks

Thought notwithstanding, a number of challenges exist: lack of trusted broadband connectivity, low level of technology among the older generation, cost issues, and adoption of new technologies. More so, digital platforms that are designed poorly are potential trivializers or falsifiers of complex oral traditions. Recording the language alone does not mean that it is alive; everyday use in the fields of education, family, and work is crucial, or the digital ones can be stored in archives (Fishman 1991).

5. Findings

Recalling the Tribal Tongues to Life

The restoration of the indigenous language is not confined to the preservation of the lexicons, but is a reclaim of the cultural identity of Odisha and its continuity. It is the digital storytelling that makes these linguistic habitats alive and keeps them going.

The Technology the Right Way

The overall strategic use of technology would help in reducing the generational gaps, as older people would be able to pass their knowledge and also as children become digital storytellers.

Working Together is a Must

Successful initiatives are most likely to be initiated through collaborative efforts, and at the very beginning of the process, the stakeholders in the community are involved; the by and for strategy is more authentic and has more traction.

School Integration Can Help

The integration of tribal languages into the curricular programs through the use of interactive applications can create a feeling of pride and inclusivity among students; this would necessitate a concerted action among the stakeholders to put the content into a proper perspective.

The Internet Problem

Poor and slow broadband connectivity in most tribal villages is also a setback to the implementation of the digital content, as potential gains are not achieved without a reliable connection.

AI – Friend or Foe?

Artificial intelligence is potentially useful in the study of linguistics, but it should be applied responsibly, without violating the rights and cultures of the affected communities.

6. Conclusion

Odisha, with its fantastic tribal variety, is at a language crossroads. It is not wishful thinking that its tribal languages will survive, but rather a shared and deliberate effort. The linguistic status burden in a state with 64 tribes and 13 Particularly Vulnerable Tribal Groups (PVTGs) is not limited to policy systems and institutions within the educational sector, but extends to community-based efforts and technological development. The intersection of ancestral memory and digital possibility brings a special chance to Odisha to influence the future when tribal languages are flourishing.

The digital era provides threats and tools. On the one hand, mainstream technologies promote the dominance of international languages like English and Hindi, hence pushing aside tribal languages. Conversely, these technologies, when used carefully and sensitively in the context of ethics and culture, can become potent tools of renaissance. As Crystal stresses, language death is a symptom of a larger cultural process of disenfranchisement; however, when languages are reanimated through digital means (i.e., voice recordings, storytelling apps, or AI-assisted learning tools), communities can gain control over their language and cultural narrative. Working together, community-based and ethically sound interventions have the potential to transform the erasure discourse into the discourse of renaissance, which we have already seen is shifting in Odisha (Crystal, 2000). Projects like digital storytelling organised by institutions such as KISS (DU) and SCSTRTI have provided elders with a voice that was once restricted to local communities (Tripathy & Kuanr, 2025). These projects do not merely record; they effect change, enabling tribal elders as mentors with the help of YouTube videos, podcasts, and mobile applications, creating a participatory ecosystem of cultural transmission.

The notion of affect, as suggested by Massumi, reminds us that language is not a container of cognitive meaning only but also of emotion and extreme significance.

This is especially correct in tribal Odisha, where languages are endowed with ritual, song, and oral performance. When a tribal child reads a bedtime story in their native language through a smartphone, they do not just hear words; they feel the past, being part of a group, and feeling pride (Massumi, 2002). Similarly, the idea of performative memory described by Roach confirms that language revival is a process of rediscovering an embodied tradition where language and identity are performed simultaneously (Roach, 1996).

The process of revitalising tribal languages with the help of technology involves recording sounds, protecting stories, healing history, and restoring intergenerational continuity. The aim is much more than digitalising languages; it aims at breathing them back to life so they can be spoken, sung, and lived. Krauss (Krauss,1992) advises that once a language is lost, it is usually impossible to revive it unless serious attempts are taken. Odisha should, therefore, follow a tailored, participatory, and futuristic route. Ethical aspects must be recognised in such efforts. Smith suggests that the preservation of language should be based on a decolonial approach, whereby the needs of the community, cultural ownership, and epistemic justice are central (Smith, 2012). Vernacular speakers need to collaboratively design how their languages are maintained, taught, and exchanged. Such transformation among stakeholders is necessary to revive languages sustainably and respectfully. The final representatives of dying languages will not only be the first teachers of their digital times but will also carry poetic justice and humanistic potential. This situation demands respect for the past and acceptance of the future; it sees tribal languages not only surviving but thriving.

Therefore, Odisha will spearhead such a transformative agenda with its abundant linguistic and cultural capital. The work can be monumental, but the prospect is great: a world where diversity is not just accepted but valued, not just stored but practised.

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Technological Utilization and Ethical Considerations: Surveillance, Consent, and Financial Aspects in Old Age Homes in West Bengal

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Abstract

The surveillance technology currently being used in nursing homes raises some serious ethical questions. In particular, the freedom, privacy and consent of the elderly are key issues. In West Bengal, where the elderly are increasingly dependent on nursing homes, this digital surveillance is raising serious issues of human dignity, power and commercialisation of services. The main objectives of this study are to execute the types of surveillance technologies employed in old age homes in West Bengal, to explore the experiences and comprehension of elderly residents regarding digital surveillance, to evaluate the ethical implications related to consent and privacy, and to examine the influence of capitalist principles on caregiving through technological interventions. A qualitative approach for this study is taken, where 50 elderly residents, 10 caregivers and 10 administrators from 10 nursing homes in Kolkata, Howrah and Hooghly were interviewed. The data was analysed using grounded theory. Research has shown that surveillance devices such as CCTV cameras, health monitoring apps, and digital health gadgets – while used in the name of safety and security often infringe on people's freedoms. Older adults are often not properly informed and feel uncomfortable being constantly monitored. As corporate investors turn the service into a business, surveillance has become a means of control rather than assistance. These policies are not being implemented properly, and there is little government oversight.

Keywords: Elderly monitoring, digital ethics, consent, senior living facilities, capitalist caregiving

1. Introduction

Like many other parts of India, West Bengal is also witnessing major changes in the way people live. For example, people are living longer, moving to cities and living in smaller households. This is leading to changing social and economic conditions, and as a result, the number of elderly people is also increasing. Many of them are now living in old-age homes or similar facilities. Many technologies are now being used in these facilities to provide safety, security, better work and better care for the elderly. However, the problem is that the use of these technologies, the complexity of their permissions and the differences in wealth - all these things together create a very difficult ethical situation, where great care needs to be taken. The rate of ageing of the population around the world is now at a rate that has never been seen before. As a result, there is a huge impact on the health system and society around the world. In the case of India, this demographic change is even more important because India will have a large elderly population in the next few decades. Experts say that by 2026, about 12.16 per cent of the total population of India will be elderly. And this number is expected to increase to an incredible 20 per cent by 2047 (Rajan & Mishra, 2015). This shift is a major shift from the previous "demographic dividend," where a large number of working people cared for fewer dependents. Now the opposite is happening: society is aging and the number of dependents is increasing. This demographic shift has made it imperative to find new caregiving solutions that go beyond the traditional family-based model.

New developments in information and communication technology (ICT) are revolutionising the way we care for the elderly. These new technologies are expected to help them receive better care, make better decisions, and keep track of everything faster. They will also help them make better use of money, time, and people. Many new technologies are changing the way we care for the elderly. For example, "Clinical Decision Support Systems (CDSS)", telemedicine, electronic vital signs monitoring systems, "Electronic Health Records (EHR)", the Internet of Medical Things (IoM) and smart wearable wristbands. The main purpose of these technologies is to help the elderly take better care of themselves, improve the quality of healthcare, and reduce the burden on those who care for the elderly and the healthcare system. Older people often face some problems, such as most older people do not know much about the new systems; Physical limitations make it difficult for them to use technological gadgets; and being unfamiliar with digital devices can make them feel isolated or have trouble connecting with others. In addition, privacy, accessibility, and a reluctance to use technology among some

older people, unless these major issues are well addressed, will make it difficult to make these technologies widely and equitably accessible to everyone.

Technology can certainly improve care for the elderly. It has been observed that if there is an excessive amount of technology and surveillance infrastructure in places like nursing homes, then an environment of moral and financial problems can be created, which becomes quite difficult for the common man to deal with. India is a diverse country, and in states like West Bengal, where people of different castes and religions live, the condition of the people and their problems in terms of cultural and economic background are much more multifaceted and present a complex picture of the society. Older people in India face many challenges, including financial hardship, digital literacy, and the inability to give informed consent. These challenges are compounded by the power and limitations of new technologies.

2. Effective Literature Review

Here is the brief literature review of the study:

2.1. Principles of Biomedical Ethics (2019) by Beauchamp & Childress

Beauchamp and Childress express about four significant ideas: 1. justice, 2. autonomy, 3. beneficence, and 4. non-maleficence. These are the most imperative things to discussed about when it comes to technology in elder care (Beauchamp & Childress, 2019). Surveillance-based technologies may be good for security and safety, but they may also hamper privacy and freedom if they are employed without permission. Their framework is significant for judging how ethical the procedures are in West Bengal's old age facilities.

2.2. Surveillance in Care Settings (2000) by Sixsmith

This research article focused on how surveillance technology may be used as a tool to stop crime. Sixsmith proclaims that even if technology makes things safer, it turns care into a clinical operation, which might make people feel less like themselves (Sixsmith, 2000). This has led to a strong debate in West Bengal among care workers and families over whether safety in institutions should come before personal freedom.

2.3. Digital Divide and Elderly Care in Eastern India (2019) by Banerjee, P. & Chakraborty, S.

This research article looks at how the technological infrastructure in Bihar and West Bengal's urban and rural old age homes is not properly distributed. It emphasises that elderly people who live over there don't know about their appropriate rights (Banerjee & Chakraborty, 2019). It is also explored that there are problems with

permission standards and that tech-based therapies in local households may not be financially viable.

2.4. Surveillance Capitalism and Vulnerable Populations (2021) by Bhattacharya, R.

Surveillance technologies are essential tools that are now which are regulating everything smoothly and systematically. Bhattacharya expresses that due to the rapid application of modern surveillance care in different fields, as well as in elderly care home sometimes it violates the rules and regulations of the ethical dimension. Though it is associated with the capitalistic profit mechanism (Bhattacharya, 2021). Violating privacy destroys the care ideology, trust and friendly environment.

2.5. Technology in Indian Elder Care (2021) by Kumar & Singh

As per the author's concern, in Indian private organization are more dependence on technological surveillance, and they are also applying into elderly care home also. Life of elderly people are getting easier and more secure with the use of technological gadgets. In West Bengal, families with a lot of money are using more modern instruments, while those with less money are falling behind, which creates inequality (Kumar, Opportunities and ethical dilemmas, 2021). Also, the growing expenses of technology frequently put a strain on inhabitants and their families.

3. Research Gap

Beauchamp and Childress talk about justice, autonomy, and ethics, but they place less importance on modern surveillance and more importance on elder care and safety. Sixsmith pays attention to uses of technology and surveillance for protection from crime. But his writing did not pay attention to how to protect people from crime. He did not systematically address how modern technology can be used to protect people from crime. Banerjee, P. & Chakraborty, S. proclaimed that one of the essential problems of elderly people in contemporary times is the digital divide. Digitally savvy family members spend more time in the digital world and neglect to maintain proper connections with elderly individuals. They prioritise other connections over helping elderly people connect with the digital world. In this research, I have tried to overcome these issues and wanted to find out about proper exploration.

4. Research Objectives

The main thematic objectives of this research are

To execute the types of surveillance technologies employed in old age homes in West Bengal

To explore the experiences and comprehension of elderly residents regarding digital surveillance

To evaluate the ethical inferences related to consent and privacy

To execute the influence of capitalist principles on caregiving through technological interventions

5. Research Methodology

In this research, a qualitative research design has been used. The research covered in-depth interviews with 50 senior citizens, 10 elderly caregivers, and 10 old age home administrators from 10 old age homes in Kolkata, Howrah, and Hooghly. Participant observation technique and document analysis were utilised to triangulate findings. The data were solely subjected to thematic analysis utilising grounded theory.

6. Major Findings of the Research

A look at some important technologies such as telemedicine, smart home devices, the Internet of Things (IoT), AI-driven robots, and assistive technologies. The use of new technology is quickly changing how elderly care is provided for older persons, giving them a range of options to improve their health and independence.

6.1. Technological Implementation in Old Age Homes for the Elderly Care

Telemedicine and telehealth have become a great thing, especially during times like the COVID-19 pandemic. There has been a significant change in the way older adults access healthcare. These can be used in almost any setting, be it managing chronic conditions like type 2 diabetes or virtual healthcare, where their use has increased. With the advancement of technology, it has become possible to provide appropriate advice on health issues to patients in remote areas through video calls and virtual communication (RHCF, 2021).

The Internet of Medical Things (IoMT) has completely changed our awareness and concept of taking care of health. The latest smart gadgets are not only presenting us with daily news or information but also keeping an eye on our body and providing us with body-related information every moment by keeping in front of various types of applications. Nowadays, people associated with medical science are easily exchanging health-related information by using the Internet. In this context, we can talk about devices like smart watches and fitness trackers that are constantly monitoring the health situation. They record various body activities based on specific times, such as heart rate and blood pressure. And in this context, it can be said that such real-time information also detects common problems like irregular

heartbeat, stroke, blood pressure, heart disease or falls in the elderly and makes it easier for doctors to treat them. Naturally, it is seen that all these devices are helping doctors and other health workers to make appropriate and correct decisions.

These types of healthcare gadgets have made daily life much easier, usually through voice commands, touch screens, or various types of mobile applications. Health apps have become much easier to operate. They are used in various ways to make the lives of the elderly easier. In this context, it can be said that specific alarms for falls or seizures, while services such as video calls, smart speakers, voice assistants, etc., are observed to make communication easier and faster. Such apps have made daily life much easier and are organising tasks. They usually help doctors to keep an eye on various types of urgent symptoms and specific health problems. Smart home gadgets are very useful for the idea of "ageing at home."

Nowadays, AI robots are offering new, specific, and great solutions to the growing problems of elderly care. These AI robots can help people communicate better with each other, help with daily tasks like cleaning, cooking, and self-care, and remind them to take their medications on time. When used together, they can greatly reduce the mental and physical stress on human caregivers, provide great emotional support, and give the elderly more independence. This research will explore new ways to keep older people healthy and safe. How are technology and caregiving evolving to provide new ways to care for older people? When new technologies, such as smart devices and modern home systems, work together with caregiving, older people can live independently, and their loved ones can feel secure. Assistive technology (AT) is a broad term that encompasses a wide range of devices and services that help people with disabilities (those with mental or physical disabilities). These include physical devices such as hearing aids, wheelchairs and prosthetic limbs, as well as digital devices such as speech recognition software, captioning services and time management apps. Assistive technology is essential for maintaining or enhancing a person's ability to do many things, such as speaking, listening, thinking, seeing, taking care of themselves and moving around.

6.2. Application of Technology

There are many benefits to using health and technology gadgets, such as more independence, better quality of care, and tasks being done better and faster. Using health-related technology for the elderly in nursing homes can yield many good results.

Good monitoring and good health are both essential. Telemedicine and health information systems are technologies that allow people to monitor their health at

all times, whenever they need it. This allows health workers to provide better care and make more informed decisions. A system called "remote patient monitoring (RPM)" is helping to improve the care of people who have been ill for a long time. This has resulted in fewer sudden major problems and fewer hospital admissions (Dobransky & Hargittai, 2006). One of the positive aspects of technology is that it improves the lives of the elderly and provides them with more convenience. It also provides long-term health care to the elderly, whether they live in their own homes or in nursing homes. Smart devices free the elderly from the tendency to become dependent on others and become a burden. The use of such smart gadgets in nursing homes and healthcare centres has a positive impact and increases their independence and confidence. They have not only increased the speed of work but also reduced the stress at work to a great extent. The application of technology and the application of robots in the healthcare sector is gaining more acceptance in the global market.

Technology has a lot of positive effects, especially when it comes to making a task easier and faster. However, it should be kept in mind that it is an important means of providing care to people, but it is not right to become too dependent on it. If we become too dependent on technology, then we will be deprived of the creative mindset of people and the responsibility and affection that they have to take care of them. It should not be forgotten that the emergence of new gadgets is designed to provide convenience to people, rather than being designed to replace people and occupy their place. It is necessary to ensure that the application of technology will make the relationship with the elderly more sincere and improve it, and not destroy it. Therefore, we need to remember that an important bond between technology and human care is needed to provide holistic care to the elderly.

There is no reason to think that it will be easy for everyone to control the use of technology. Along with the benefits of modern technology, there are also several complications associated with its use. Also, the old technologies that were used are quite different from the new technologies today. In many cases, it is seen in third-world countries like India that the elderly are not able to connect themselves with the new technologies in a simple way. As a result, in many cases, they are deprived of the benefits of such technologies. Although there are many reasons behind this, such as there are some elderly people who do not want to use technology, on the other hand, they do not show interest in using it for fear of failure. In many cases, they give more importance to the fact that they are 'old' for not being able to use them. In addition, various studies have shown that elderly people need the help of another person to use any new technical gadget (Bhattacharya, 2021). There are very few elderly people who can learn new technologies easily and comfortably.

In this context, it is important to remember that the digital divide is one of the biggest problems in third-world countries like India. As a result, access to technology and knowledge related to it among the elderly is considerably less than that of the so-called young people. Although this problem is not the same in all cases. All the factors associated with this problem are age, gender, educational qualification, income and environmental location. It is seen that the lack of interest towards technology is more observed among elderly women. The 'Agewell Foundation' has tried to show through a study that more than 85% of elderly adults in India cannot use a computer. On the other hand, the number of elderly women is 95 per cent (Sharma, 2017). Also, one of the victims of this digital divide is the elderly people in the villages. It is seen that compared to urban areas, people in rural areas are much more exposed to the digital divide; they do not get access to technology properly compared to the elderly people in the cities. However, apart from these, there are some physical problems that keep the elderly away from technology. In this regard, we can say that vision impairment, dementia, etc. Where physical disabilities hinder older people from carrying out their daily activities, they often become the reason behind their reluctance to embrace technology.

As society becomes more technologically advanced, an elderly class is being created in society who are deprived of the use of technology. In everyday essentials where technology is taking its place, such as ticketing, getting old age allowance, in all these areas where technology has taken its place, they have to depend on other people. Also, due to various problems like online fraud, withdrawing money from banks, etc., elderly people show aversion to technology. This isolation of elderly people from technology makes them lonely and creates a cultural lag between generations. Which often hurts the mind and body of elderly people. This shows that the digital divide is not just a technological problem, but also highlights a key message of how comfortable people can live in old age. Therefore, eliminating the digital divide in nursing homes is not just a technical issue but is one of the main aspects of social justice. It directly affects the quality of life and independence of the elderly residents there. It is not enough to just hand over gadgets to the elderly. Digital literacy programs must be introduced that are easy to use and tailored to their specific needs. The aim of these programs will be to show the practical benefits of technology to build confidence, eliminate loneliness and encourage independence.

6.3. Technological Surveillance

Their social, cultural, and medical checkups and activities are monitored through the process of digital surveillance. This research pays attention to those technological

surveillance processes that are associated with old-age homes. I have included a chart that explores the executions.

Figure 1: Application of Technological Surveillance
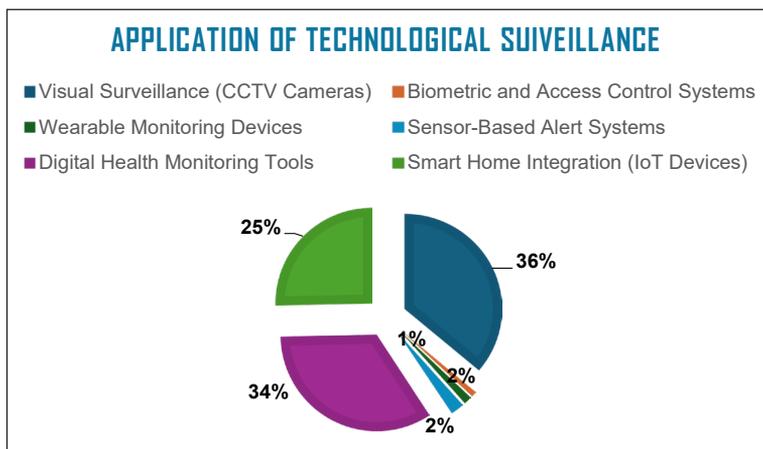
Source: Researcher field investigation (2025)

There are multiple healthcare gadgets available in society for care and health tracking. The pie chart above provides essential information about healthcare surveillance technology and its importance. At present, old age homes are using different health gadgets to monitor the daily health activities of elderly people. Those old age homes situated in urban areas are more familiar with these health gadgets, but rural old age homes are also using daily health monitoring gadgets and applications for better and more assured health services. The development of medical services and information and communication technology is responsible for the exponential growth of the elderly population in India. Conversely, the elderly are no longer receiving joint family care. In this regard, people are searching for alternatives to care for the elderly that offer long-term services.

Some of these include having a helper at home, access to home health care, and new technologies that allow older adults to live independently and get the help they need. Families can rest assured that their loved ones are receiving good care even when they are far away. Good care for the elderly is not only about meeting their physical needs, but also about keeping them involved in social activities and maintaining good mental health. In this case, families can be assured that their family members, including the elderly, are in a safe shelter. And by taking care of all these various things, not only does the interest of the elderly in their work increase, but their sense of kinship also becomes much richer, which makes their overall life better and more beautiful.

7. Conclusion and Future Research Scope

The use of technology and health-centric technology in nursing homes in West Bengal has completely changed the picture of health in the society. People's trust and confidence in nursing homes have increased a lot. The use of surveillance technology has not only provided security to the elderly but also improved their facilities and communication with their neighbours. In this context, it is important to remember that in nursing homes, there is a specific bond between these three things: surveillance, facilities and money. CCTV cameras, health monitors and AI-powered support systems are some examples of surveillance technologies that have improved the quality of care by monitoring people's health in real time and ensuring that they are well. However, there are some rules that should be followed while using such technologies to protect the privacy of residents and avoid unduly infringing on their freedom. The real challenge is to find a balance between security and dignity, where surveillance does not infringe on people's freedom.

Consent for the use of technology in senior care facilities is still crucial. The historical picture of care has completely changed with the advent of technology. Nowadays, adapting to technology has become one of the biggest challenges for the elderly. However, it is necessary to provide all the facilities to the elderly in nursing homes so that they can easily connect themselves with technology. Also, if necessary, the elderly need to be trained in the use of simple technology so that they can do small things themselves with the help of technology and do health awareness activities. However, it is also observed that advanced services mean spending a lot of money, which is often not possible for many people to spend that amount of money and receive services in many cases.

In this context, it can be said that if government policies, subsidies and various technology-centric IT companies take appropriate positive steps, it may be possible to provide services to the elderly at a low cost. Incidentally, maintaining ethical and financial standards is quite necessary to protect the elderly from financial exploitation. One of the major reasons for using technology in nursing homes is to make services more accessible and reduce the risks to the lives of the elderly. Making their lives easier by providing them with proper healthcare, providing security, facilitating communication with relatives, and providing all kinds of information are the positive aspects and uses of technology. Together, we can build a caring future for the elderly where technology is not just a material element but a caring partner and companion.

8. Future Research Scope

This Research needs to explore new ways to keep older adults healthy and safe. How are current technologies and surveillance infrastructures responding to new ways to care for older adults? The extent to which smart devices and modern family systems, together, affect the independence of older adults and the extent to which they shape their relationships with their loved ones is a matter of debate.

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Examining Non-Binary Gender Discussions Online: How Digital Platforms Reshape Youth Identity and Reinforce Inequality in India

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Abstract

Digital platforms intensify gender disparities to a much larger extent than in society. The study explores how gender binary stereotypes in digital space affect the Indian youth in navigating and forming their identities in the digital landscape by considering gender norms, gender-digital divide, segregation, and cyberbullying. The study uses a mixed approach. A qualitative analysis is employed, using secondary data collected from journal articles, research papers, books, and news reports. For the quantitative analysis, an online survey was conducted with closed-ended questions. The study found that while a percentage of teenagers question the status quo, some fall into discriminatory norms in society that algorithms have curated. This leads to the creation of fake social media accounts. The study reveals that technology not only perpetuates existing biases and injustices in society but also amplifies them through different means. This research examines the relationship between systemic violence facilitated by social media and algorithmic bias. Gender-based norms, through algorithms, silence non-binary voices from the digital space. The results reveal how gender-based discussions, prevalent in the online world, reinforce the orthodox societal norms.

Keywords: Youth identity, Digital Landscape, Gender non-binary, Gender-digital divide, Cyberbullying

1. Introduction

Digital spaces are becoming increasingly important for young people in India to shape their identity. India has one of the world's largest populations of digital users under the age of twenty-five. The Indian digital landscape symbolises a combination

of immense potential and persistent threats to its digital future. The use of digital technology among Youth from rural India is rapidly increasing, as revealed by the Comprehensive Annual Modular Survey(Press Information Bureau, 2024). The present study aims to investigate how gender binary stereotypes prevalent in society are embedded and perpetuated in digital architectures, online connections, and youth expression. Being the 131st among 148 countries in the Global Gender Gap Index, India's gender parity score has decreased since the previous year (World Economic Forum, 2025), signifying the entrenched disparities in health, education, politics, and the economy. Similar disparities are also evident in the digital arena, where digital access does not always translate into equity. Stereotypes entrenched in gender continue to influence how Indian youth live and engage with the digital space. This powers both their engagement and the formation of their identity. Even now, some individuals areligious the distinction between sex and gender. A group of individuals is prone to disagreeing with the existence of other genders aside from men and women, perpetuating the classical conception of the gender binary as the shapes of masculinity and femininity. 'Gender-continuum' is another way of understanding binary gender, and some examples, like dichotomous clothing, toys, or bathrooms, are the expression of gender stereotypes brought forth in the actual world (Kendall, 2023). Gender equality is defined as the ability to achieve equal rights, access, and participation for both genders in all aspects of society by ensuring equal value and opportunities(Thakur, 2019). Gender non-conforming youths are particularly vulnerable to offline and online violations.

2.   Literature Review

The literature review is organised thematically to provide an understanding of the existing literature in the field.

2.1 Identity and Youth Self-Expression in the Digital Landscape

Erikson's psychosocial theory explains how digital media influence young people's identity development during the emerging adulthood and adolescence phases, as they are identity-forming stages. He refers to the tension phase of 'identity synthesis' and 'identity confusion that the young people experience. He refers to it as the 'psychosocial moratorium,' a phase of life for experimentation without apprehension for long-term repercussions. The emergence of social networking sites, such as Facebook, has transformed the online world, where identities have become increasingly indistinguishable from those in real life. This emphasises recognizability and the avoidance of anonymous identities. Social media increasingly reflects offline relationships and social norms, with a significant amount of pressure being

placed on young people to project an idealised version of themselves online(Katie Davis, 2017). Šlerka and Merunková apply Erving Goffman's dramaturgical theory to scrutinise how young people construct and produce their identity on Facebook and other social media sites. Their principal objective is to know digital self-presentation as a structured performance shaped by the needs of technology and audience expectations. Dramaturgical theory refers to the propensity to construct themselves in behaviours desired by society(Peter Kivisto, 2007). Profile pictures, status updates, and selective visibility are used to alter their identity. This may be an unintended or intended portrayal of them. Social media users may purposely reveal only a part of themselves. It highlights the continuous struggle between legitimacy and authenticity. The design of social media sites has a significant impact on the identity formation of young people. It is fundamentally performative and context-dependent. Turkle argues that "identity play" in online environments serves as a rehearsal area, where both children and adults can try on various aspects of themselves without consequences in the physical world. During adolescence, this digital exploration facilitates identity construction(Turkle, 1999). Access is only one aspect of the digital divide, and other issues like usage patterns, skills, and mentorship are overlooked. Having the ability to use digital applications does not necessarily make individuals digitally fluent. A lack of awareness about privacy and ethical usage is a significant issue. Instruction in digital literacy is thus essential. Boyd concludes that adult anxiety, social pressures, and structural biases are far more accountable for the complexity of teen digital life than is technology. There is a need for adults to guide teens as they navigate the digital universe, rather than dreading digital youth culture (Boyd, 2014). Digital sites enhance creative identity formation and expression, leading to "digiphrenia," where managing multiple online channels and constantly switching between the offline and online worlds results in psychological and emotional tension(Rushkoff, n.d.).

2.2 The Gender Digital Divide: Access and Participation

Gender is a socially constructed set of expectations and role assigners, which are imposed on women and men, monitoring their roles and actions within society. Transgender, non-binary, agender, genderqueer, two-spirit, and other categories are all encompassed within the umbrella of gender identity, which extends beyond binary categories. Gender sensitization is described as a long-lasting informative development that promotes gender-neutral elements. Gender mainstreaming is employed to evaluate and integrate gender perspectives into organizational policies and practices. Due to the organization of the family, most family members have easy access to information technologies. Youth utilize numerous social media platforms,

and gender here does not limit mere access to informational resources, yet it does not ensure equity. Young people acknowledged that gender discrimination remains rampant in the workplace, at home, and in schools and universities, despite equal access to digital tools. Especially in educational and work environments, men are often preferred in decision-making and receive more opportunities. While attempting to achieve equal levels, most youth acknowledge that gender discrimination continues to affect daily life significantly. Youths often think that the word "gender" is a term that is applied to instigate prejudice. Students acknowledge that men often remain the favorites in the real world, even though they believe all genders should have equal opportunities. Although smartphone usage is increasing, it indicates that simply 40.3% of young rural women possess smartphones, and most employ shared phones under male control and only 40.3% of female participants had a smartphone, while 87% of males did, and most shared it, especially in rural Bihar and Uttar Pradesh, in the study conducted in India(Asiya Islam, 2023). Male relatives often mediate and control women's access, which reinforces patriarchal gatekeeping. Girls in traditional or rural families struggle to articulate themselves openly when they are restricted to limited and monitored access. They are defined by who manages their access as much as by what they can reach. They mentioned family constraints and lack of time, due to household duties, as the key obstacles to their lower and more scattered use of electronic devices. Self-efficacy in participating online, especially in public discourse, is affected by shorter usage time and parental monitoring, which limits perpetual interaction. The lower use of social media applications, such as Facebook and Instagram, by women indicates not just a lack of access but also a fear of losing their reputation and social status. Censorship by family members and misogynistic notions cause gendered silence and self-censorship in the internet world. Lower web presence debilitates the assertion of one's digital identity by consolidating marginalization and invisibility. Lower-caste and lower-income rural women experience the greatest exclusion from access, ownership, and agency. This intersection of disparities suggests that online identity construction is stratified. Yet another form of digital exclusion is perpetuated by the pervasiveness of cell phones as the sole point of entry. The absence of diversity in devices restricts exploratory and learning-based creativity and identity play to casual, entertainment-oriented content(Asiya Islam, 2023).In India, Dalit and tribal girls have more limitations in the form of family conservatism and a lack of support in society. Limited autonomy, time use inequality, and social monitoring hinder genuine online activity. They resort to pseudonymous use, or self-censorship. Structural inequalities such as caste and socio-economic status further fuel this online gender gap.

2.3   Online Gender Discussions: Stereotypes, Harassment, and Algorithmic Bias

The findings echo a disconnection between online and offline feminist activism and discussions. Though participants subvert gender norms in the world outside Instagram and call themselves feminists, Instagram use gives priority to picture curation over advocacy of real-world issues. Several girls self-censor out of fear. A 2020 Cyber Peace Foundation analysis discovered that offences like bullying, voyeurism, and stalking contribute to a significant percentage of cybercrimes in India (Gender.Study, 2024). Cyberspaces continue to remain hostile environments for women and queer users. Almost 73 % of female journalists have been victimized through online abuse, and these range from unwanted messages to threats of bodily harm (The Chilling: A Global Study On Online Violence Against Women Journalists, n.d.). Most users do not participate in digital discussions. It deprives individuals of the opportunity to express their identity freely. The psychological implications of online violence are anxiety, identity repression, and social anxiety. Sexualization of the female body, sexual harassment of other genders, and gendered censorship are issues of serious debate. Social media platforms perpetuate gender bias and reward sexualized images of women. Stereotypes in society take shape in social media in this way. They claim their right to physical autonomy and self-expression. Instagram makes visibility and representation possible. Meanwhile, it also perpetuates gender stereotypes. It poses a dilemma. Digital platforms offer striking, informative, and interactive opportunities. However, their benefits are reduced by prevailing gender norms. By studying gender and society, one can understand how social norms regulate behavior and provide men and women with their distinct roles and values, frequently resulting in discrimination. Indian socio-cultural context for the youth identity construction reveals how digital spaces both test and replicate gender norms. It complements Šlerka and Merunková's findings by incorporating how gender intersects with digital identity (Mrs. Padmasri, 2019).

Male-dominated online content design marginalizes other gender narratives. Socialization is gendered, restricting girls' and LGBTQ+ youth's full participation in the digital world. Some youth participate fully, while others participate with limited involvement, and some are wholly excluded. Youth navigating non-normative identities or social insecurity are more likely to experiment online, often in pseudonymous spaces. The "Hashtag Generation", a generation of individuals brought up with the digital boom of social media, defines Instagram as an important social media site today. The identity formation of these users is dynamic and relational. It is constantly being shaped by peer recognition and audience acceptance through likes, comments, views, and shares. 'Instagram' encourages youngsters

to blur the boundaries between their personal and public lives. It forces them to change their appearance for online viewers. This supports neoliberal standards of performativity, autonomy, and physical attractiveness. Cyberbullying instances and low self-esteem are addressed more in females than in males(Ms. Sanya Gupta, 2025). Social media platforms often use 'opaque inferential algorithms' to scan user gender preferences. This further strengthen the existing discriminatory gender norms(Eduard Fosch Villaronga, 2021). These systems rely on biased data and gender binary classification only to misgender non-binary individuals. It further disseminates gender stereotypes. Users will be labelled against their will. That lands them in restrictive identity expression and underlies exclusion. Safiya Umoja Noble demonstrates how sexist and racist sentiments embedded in society are reproduced through search engines and social media platform algorithms, which are often regarded as neutral systems. The online experiences of Indian youth in overcoming cyberspace marginalization based on caste, gender, and class are highly associated with her concept of "technological redlining", and based on this perspective, algorithmic curation through micro-targeting is a sociopolitical phenomenon and not a technical one (Noble).

3. Research Gap

The current literature addresses digital access and participation, but downplays the extent to which gender stereotypes through algorithmic moderation, overtly redefine identity construction among Indian youth. While the digital divide is often described in terms of access to devices and connectivity needs, a deeper analysis reveals that digital inclusion is a complex practice influenced by interconnecting aspects of marginalization. The research concentrates on how current binary and non-binary gender stereotypes are hindering equal participation on the digital platform, and investigates how these stereotypes continue to perpetuate gender inequality on digital platforms through algorithmic curation, impacting youth identity formation.

4. Research Objectives

To critically examine how binary gendered norms on digital platforms shape youth identity construction.

To consider how online community forums and platform algorithms support or subvert non-binary gender roles.

To look at social media platforms that promote or challenge non-binary gender through binary stereotypes.

To analyses instances of online abuse and how these influence the construction of gender-based identities among young people.

To propose policy frameworks for safer and equitable digital participation from non-binary genders and evaluate the effectiveness of current security measures.

5. Research Methodology

The study uses a mixed approach. A qualitative analysis is employed, using secondary data collected from journal articles, research papers, books, and news reports. For the quantitative analysis, an online survey was conducted in July 2025, using closed-ended questions, with a total of 60 respondents. It employed a combination of purposive sampling. Respondents were youth from the 15 to 30 age group. The study employed convenience sampling, where the online survey primarily targeted individuals within my social network as the primary respondents.

6. Analysis and Interpretation

6.1. Secondary Data Analysis

Even if young women have access to digital devices, only a small percentage of them feel liberated while using their smartphones. In rural homes, women are under observation while using mobile phones. So, empowerment needs to go beyond providing access to the digital world. Numerous non-binary and female users testified that they have access to ordinary digital tools under time-limited terms and tracking. Most male users received unrestricted access. This indicates gender stereotypes in society, limiting the fair utilization of the digital realm. Under these limitations, their liberty to express themselves is curbed. Teens who identify as LGBTQ+ usually have two online accounts. One for family visibility and another anonymously. This creates a fragmented sense of identity and psychological stress and suffer from digiphrenia(Rushkoff, n.d.). There is a broad binary conceptualization of gender, denying those not suited in the realm's 'male' and 'female', individuals who are non-binary were misgendered in every instance by Twitter's inference algorithm(Eduard Fosch Villaronga, 2021).

Posts related to mainstream entertainment receive significantly more engagement than those related to feminist or LGBT issues. There are cases where users expressed that their content was continually hidden or deleted. Meanwhile, binary gender assumptions were reinforced through algorithmically favoring posts that complied with heteronormative standards. Doxxing and slut-shaming are just two examples of gender-based trolling that most social media users have observed. They respond by self-censorship, not standing up to the gendered violence of the online space. Others create support networks for one another or employ counter-trolls or memes as forms of creative resistance. Some youths are taking their social media platforms to engage in activism. They highlight matters like caste discrimination, LGBTQ+

rights, and internet safety. Young activists who engage in feminist, anti-caste, or LGBTQ+ online activism in India are subjected to harassment or shadow-banning. This confirms Noble's observation that algorithms prioritise saleable content over justice, and that sites like YouTube and Instagram favor creative identities at the expense of political content(Noble).

Greater identity affirmation and resistance to gender bias are demonstrated by youth who belong to positive social media communities. While the portion of youth exposed to gender stereotypes on online platforms is having their identity reconstituted, it is congruent with their offline lives. The #DigitalHifazat campaign on various social media websites was initiated to oppose violence against women in India in the virtual sphere(FII team, 2016), enabling youth to challenge gender stereotypes and exercise agency. Some online LGBTQ+ support groups aim to challenge gender binary rules and enable youth to freely discuss their experiences, like the 'Humans of Queer'(Molshree, 2021). Positive or negative gender norms in digital platforms have the power to influence youth identity formation. The 'Bois Locker Room' in India revealed the misogynistic nature of the social media platforms, which have the potential to reinforce and reconstitute harmful youth identities (Taskin, 2023).

Both positive and harmful gender norms in online platforms can shape youth identity formation. Due to structural, familial, and societal barriers, gender minority youths are disproportionately denied active digital participation despite massive digital access. Studies by groups like Sahodaran in Tamil Nadu have identified that transgender youths in urban slums don't have personal smartphones and internet access because of rejection by their family and economic marginalization. Even when they get access, they are under surveillance and interventions by 'Sahodaran' are needed to conduct a training programme (Balasubramanian, 2024).

The identity development of young girls and gender minorities is negatively influenced by online bullying. This leads them to abandon the platform or join with pseudonyms only. Thenmozhi Soundararajan, a Dalit activist, faced online caste and gendered abuse following her advocacy on Twitter and was uninvited by Google after initially inviting her (Kannan, 2022). There are other cases where individuals have been compelled to abandon social media platforms. Algorithmic curation through microtargeting favours traditional gender representations and excludes non-binary gender expectations. The algorithm on Instagram favors hyper-feminine or hyper-masculine representations and excludes LGBTQ material. Non-binary users' materials are not microtargeted.

The internet exacerbates all the forms of discrimination, and the response a woman gets when she raises some concerns is adverse, whereas for men it is otherwise, and Cathy O'Neil discovered in his study that the social media websites' allotment to anti-harassment is lower, leading to the transmission of polarising content (Nandini Chami, 2021).

Several non-binary YouTubers also believed that their content was de-prioritised at some point. The lack of accountability in algorithmic curation primarily affects marginalised sections. Young individuals found that conforming to conventional gender behaviors was rewarded with visibility and validation, but deviance ended in policing and removal. This creates an internalized standard of expressing identity. Priyanshu Yadav, 16 years old, took his own life after being cyberbullied for applying makeup in India (Times of India, 2023). Rather than promoting varied gender expressions, online spaces reinforce current discriminatory norms. Scholars call for an inclusive, intersectional, and user-informed algorithmic structure that can transcend binary categories. Open, participatory processes are essential for creating respectful and just digital spaces that acknowledge gender as fluid and socially constructed.

6.2. Primary Data Analysis

The poll presents a paradoxical picture as the internet sites are both empowering and constraining. For the Indian youth, mainly those of non-conforming gender identities, the internet is a dominion of prospect and peril. Although access to technology is expanding, inclusion, security, and freedom of expression are not guaranteed. Harassment, censorship, and algorithmic discernment occur continuously. To transform these sites into inclusive spaces, educational institutions and digital firms must work together and address not only user behavior but also the unobserved arenas that perpetuate inequality.

Table 1: Personal data collected from the Respondents

Age Groups	Gender Identity	Educational Status	Location
15-18-13.3%	Female-45%	School student-8.3%	Urban – 60%
19-22- 30%	Male-30%	Undergraduate- 35%	Rural- 40%
23-26-25%	Non-binary-16.7%	Postgraduate-31.7%	
27-30-31.7%	Prefer not to say-8.3%	Working- 25%	

Source: The data is compiled by the author from a primary survey conducted online (2025)

The survey response rate of 25% (including non-binary and 'prefer not to say' respondents) is remarkable. It makes the information predominantly pertinent for learning gender expression and safety in the online space. An impartially balanced rural-urban combination places an emphasis on the topographical digital divide.

Table 2: The respondents' opinions on Gender Identity Expression, Online Safety, and Shadow Banning

| Access to a Personal device	Free to use true gender identity online	Have multiple social media accounts due to fear of Judgement or cyberbullying	Seen content that mocks non-binary identities	Experienced Shadow banning
Yes- 81.7%	Yes- 43.3%	Yes- 65%	Yes- 85%	Yes- 63.3 %
No -18.3%	No-56.7%	No- 35%	No- 15%	No -36.7%

Source: Compiled by author (2025)

Table 3: The respondents' opinions on Digital Access, Self-expression, and Inclusivity on Social Media Platforms

Freedom of Access	Social media usage frequency	Uses the real name/picture on their online platforms	Censor Oneself online	Family Restrictions on Online Activity	Supposed inclusivity in online spaces
Unrestricted- 56.7%	Daily-58.3%	Yes- 41.7%	Some-times- 46.7%	Yes- 31.7%	Partial-ly-61.7%
Moderately restricted- 26.7%	A few times /week- 28.3%	No-35%	Always- 35%	No -41.7%	Yes-20%
Restricted by Family- 16.7%	Rarely- 13.3%	Some-times-23.3%	Never- 18.3 %	Some-times-26.7%	No -18.3%

Source: Compiled by author (2025)

100% have access to digital devices and the internet, which was expected due to the online approach of the survey, yet control and surveillance are barriers. Digital platforms are not dispassionate spaces, wherein a noteworthy fraction of youth sense digitally regulated, leading to performative identities. Respondents witness platforms as biased, insecure, and organizationally unequal. Mockery and content restraint arbitrarily affect gender minorities and the feminist ability to speak.

Figure 1: Cyberbullying and Harassment Influencing Online Participation
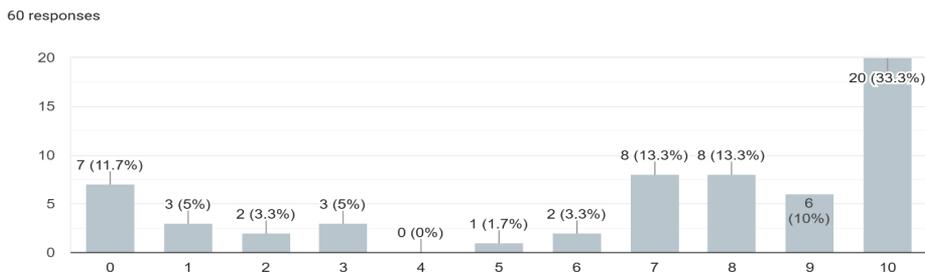
Source: Compiled by author

More than 43% of adolescents do not feel safe showing their real gender identity online. 35% confessed to having alternative accounts to guarantee they are not judged or cyberbullied. Even though technology empowers young people to connect and express themselves, it also subjects them to shadowing, which confines their freedom of expression.

Figure 2: Social Media Platforms:
(a) Reinforcing Gender Roles and (b) Promoting Binary Gender Stereotypes
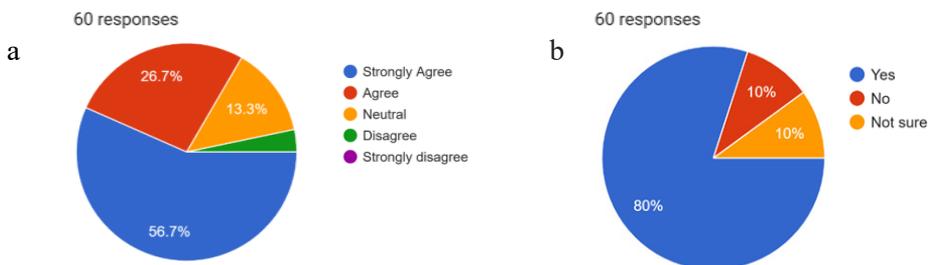
Source: Compiled by author

As shown in Figures 2(a) and 2(b), most young people believe that online platforms worsen gender inequalities. Social media platforms are democratizing, but the data indicate that, unless moderated, they could set existing societal hierarchies.

Figure 3: The respondents' negative experience while using social media Platforms
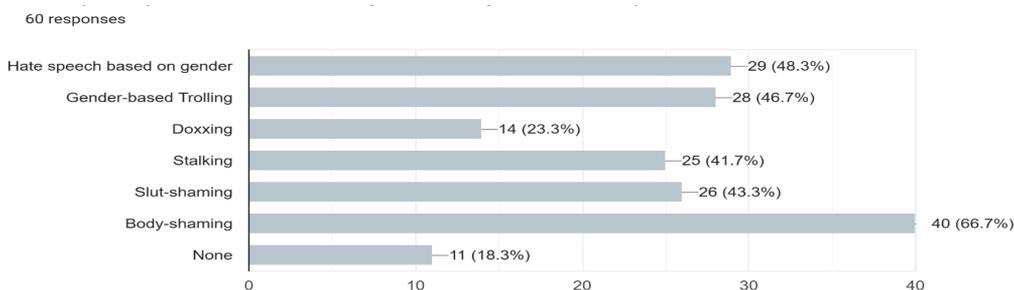
Source: Compiled by author

More than 4 out of 5 respondents experienced some online gender-based violence. This shows that these platforms are perilous spaces, primarily for non-conforming gender users. The sense of safety is further destabilized by fear of cyberbullying; more than 80% had witnessed posts encouraging gender stereotypes, and half said they had experienced body shaming, hate speech, or slut-shaming on the internet. The evidence that 46.7% of respondents occasionally self-censor online for fear of reprisals exemplifies how self-expression is muffled by cyber-aggression. Cyber-trolling based on gender, body shaming, and hate speech was disturbingly extensive. Almost half the respondents were victims.

Figure 4: Response to online harassment
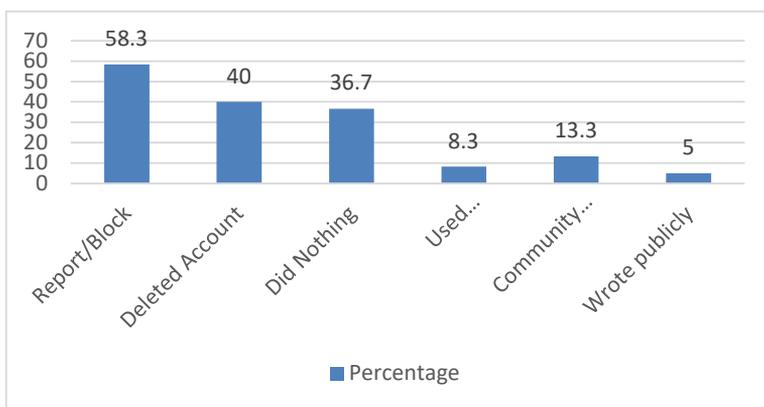
Source: Compiled by author

Much of this has no response in kind: 36.7% of harassed respondents took no action, and only 58.3% employed report and block functions. This passive or defensive reaction displays a distrust in platforms' ability to protect, and perhaps an acceptance of such abuse. Reporting is standard, but deleting accounts and hushing oneself is also common, signifying a fear-driven disconnection. A majority depend on distinct coping mechanisms, and peer support is nominal.

Figure 5: The respondents' opinions on treating all genders equally in the online space
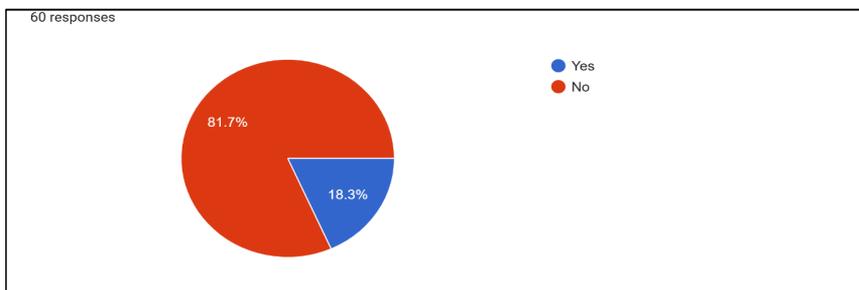
Source: Compiled by author

Over 60% of the contributors believed that online spaces are half as inclusive for all gender identities, and only 18.3% believed them to be completely inclusive. A very high percentage of people believe that social media platforms do not treat all genders equally. This disparity between the policies followed by social media and individual experiences is evident. It emphasizes the need for transparency and accountability in algorithm design.

Figure 6: The respondents' views on feminist or LGBTQ+ content getting blocked or deleted
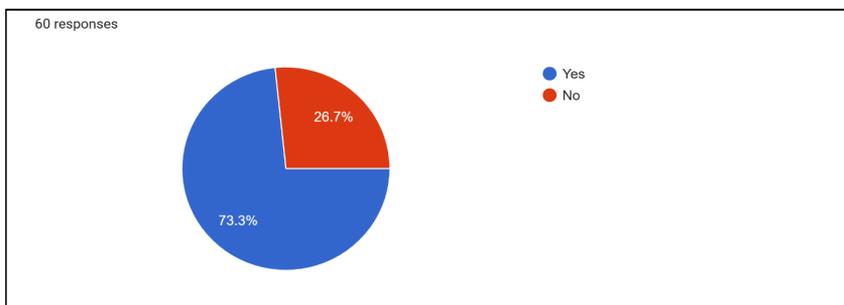
Source: Compiled by author

More than a third of participants saw algorithmic favoritism, with 26.7% stating that feminist or LGBTQ+ content had been deleted or blocked.36.7% reported experiencing shadow banning. It is a phenomenon in which their content was quietly suppressed. These decisions signal systemic biases within the social media platform's moderation, and the marginalized identities get disproportionately silenced.

Figure 7: The respondents' experience of online harassment affecting their participation
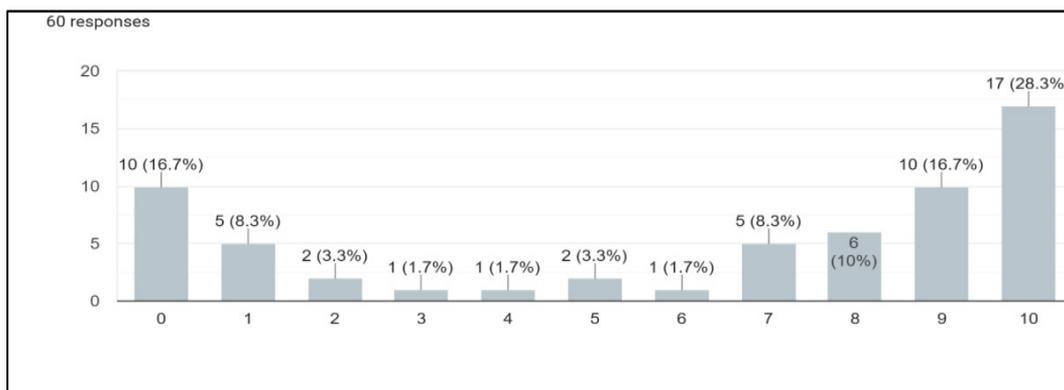
Source: Compiled by author

Figure 8: The respondents' experience of algorithmic favouritism online
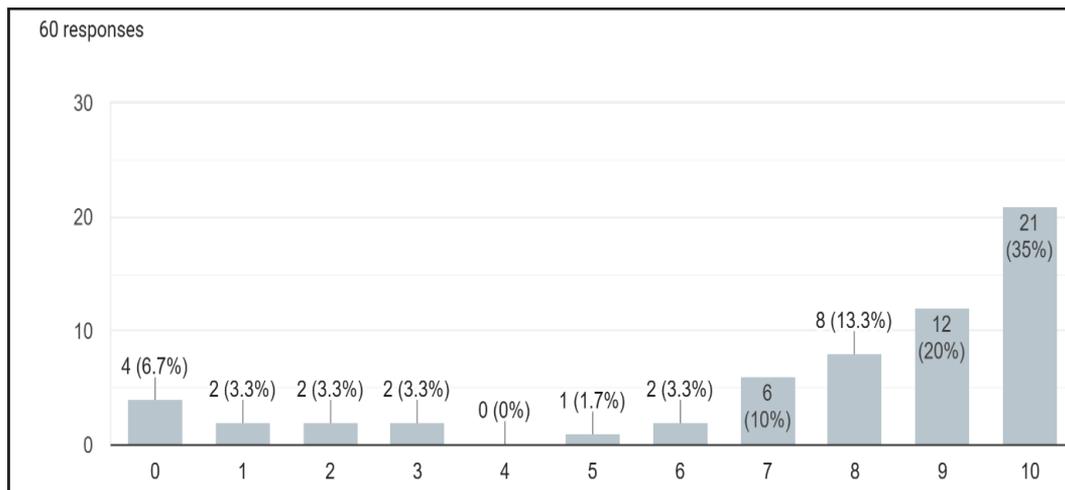
Source: Compiled by author

As shown in Figure 8, the respondents' experience of online harassment significantly disturbed their participation. Moreover, more than 60% experienced a significant level of algorithmic favoritism online.

Figure 9: The respondents' coping mechanisms to feel safe online
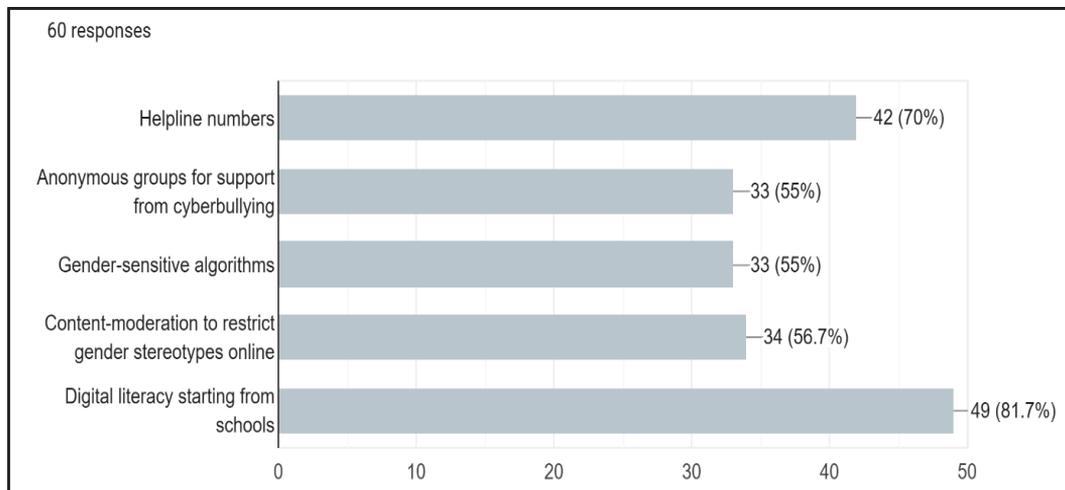
Source: Compiled by author

Participants required interventions. This included digital literacy classes from schools (81.7%), content moderation to censor gender stereotypes (56.7%), and the use of gender-sensitive algorithms (55%). Young people are not merely passive victims. They want structural changes to ensure that digital spaces are safer and more inclusive.

Figure 10: The respondents' opinion on increased gender disparity in digital platforms compared to society
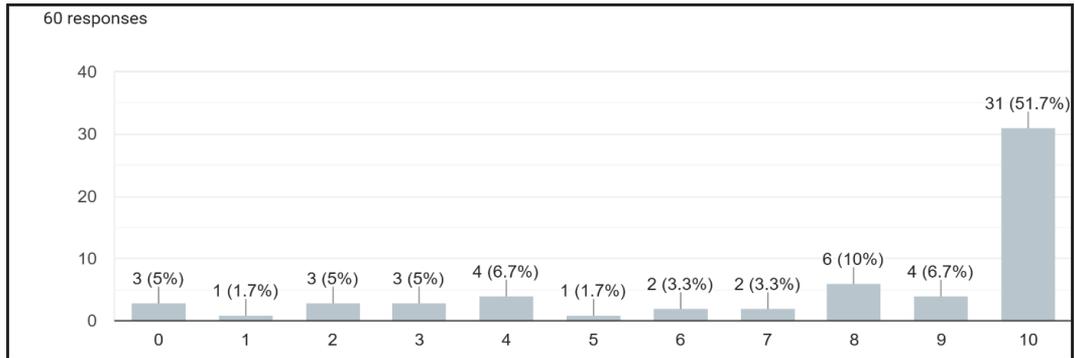
Source: Compiled by author

Youth opinion is that online platforms are amplifiers. They are not reductants of present patriarchal norms and gender hierarchies.

Figure 11: The respondents' awareness of anti-harassment policies on social media platforms
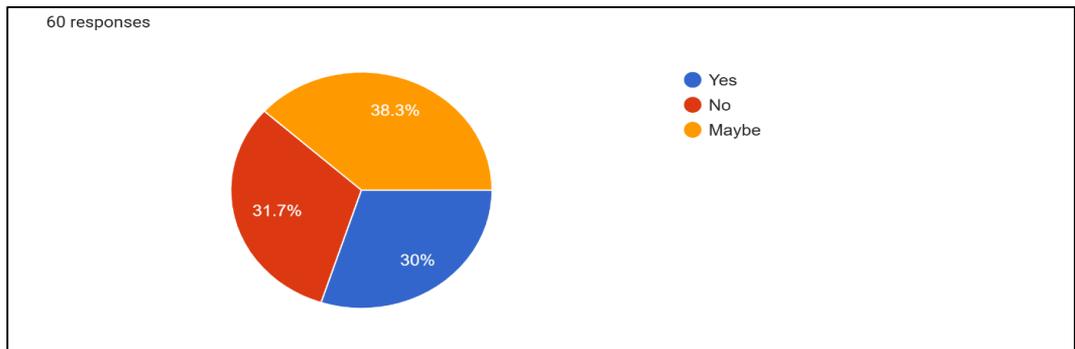
Source: Compiled by author

Figure 12: The respondents' views on Youth getting negatively influenced by gender-based stereotypes online
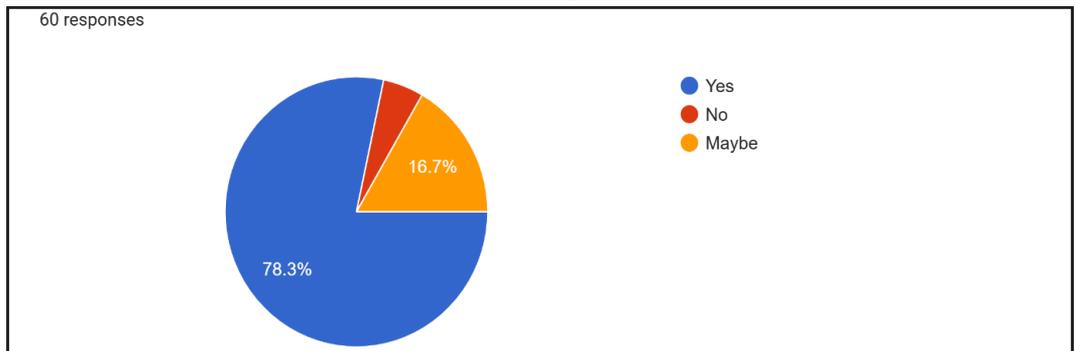
Source: Compiled by author

With 78.3% positive that stereotypes based on gender hurt the conduct of youth on the internet, there is an evident demand for both cultural and technological alteration to counter these stories.

Figure 13: The respondents' views on the importance of providing education on gender-sensitive online spaces in Schools/Colleges
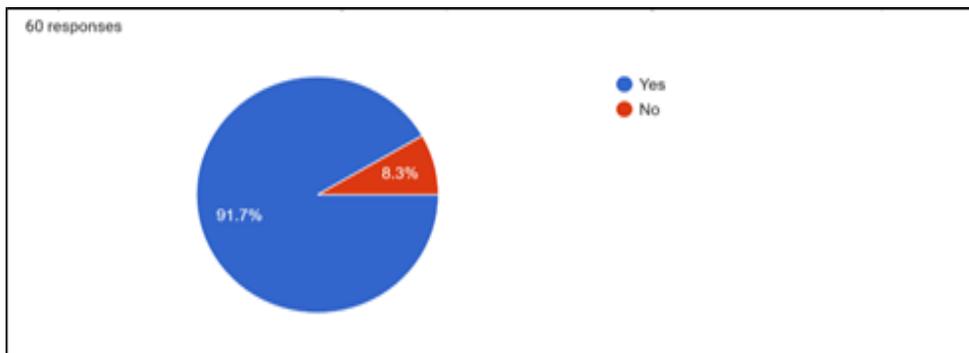
Source: Compiled by author

There was near-unanimity (91.7%) that schools and colleges need to offer education on gender-sensitive online behaviour.

7. Major Findings, Suggestions, and Conclusion

The design of social media websites primarily reinforces gender norms. Algorithms disdain activist or apt information that subverts gender norms. They prefer visually appealing, emotionally moving, and largely irrelevant content. Certain Youth with supportive online communities heavily generates stronger, more solid identities. They demonstrate a scuffle against prevalent gender bias and online bullying. While certain Youth, such as Girls and gender minorities, turn out to be disproportionately affected by digital disparity, apprehended as identity suppression.

Access is not the equivalent of inclusion. Girls and excluded genders often experience structural, cultural, and temporal limitations. Youth identities are fragmented due to the fear of being scrutinized and the limited prospects in society. Harassment makes individuals imperceptible in virtual space. Most among the youth pull out from online conversations because of the fear of cyberbullying. Social media websites only pay for appearance-based engagement. Ideological expression is not appreciated. Young people are dynamically sharing, provoking, and redefining digital gender norms despite the barriers. Context collapse is a significant problem in which digital expressions intended for one group inadvertently affect unintended witnesses, challenging the protective role of the psychosocial moratorium(Katie Davis, 2017).

States are supposed to apply reverse-engineer microtargeting tactics to counter the youth receiving similar information to the formerly held gender-biased content. Young women and gender minorities are often put in danger due to the psychological costs of the emotional labor of handling risky digital environments, as well as structural inequalities in access. Lessened spontaneous interactions and artistic expression are the effects of emotional vigilance as a managing strategy for dealing with platform hostility and surveillance. For instance, many participants spoke about withdrawing posts or comments in horror of being critiqued or misinterpreted. Emotional fatigue and identity repression are the consequences of complying with normative digital behavior. Forced to be politically neutral in sharing content or in sharing purely aesthetic content. The participants revealed multifaceted psychological effects. It ranges from anxiety and dissatisfaction to pliability and creativity.

Others actively withdrew from public spaces and opted for places that are encrypted and pseudonymous. While others reported feeling restricted. Pre-existing social boundaries are not erased by online engagement; instead, they are often armored. The type of information that is shaped and consumed remains largely determined by caste, economic status, and city of residence. Dalit and rural users risk marginalization or outright hostility, while urban, upper-caste youth may adopt activist rhetoric. The Indian digital environment is also a space of both possibility and risk for the construction of gendered youth identities. As digital spaces enable individuals to find and present things, these spaces also reproduce and reify the patriarchal and heteronormative standards present in society. The research focuses on a digital society where access prevails, even amidst the digital divide, yet there is no equality. Individuals are gaining visibility, and although it is empowering, it is also dangerous. Digital sites remake youth identities both voluntarily and through the exercise of control. For an entirely inclusive digital world, it is obligatory to transition from merely accessing to actively participating in making eloquent contributions. This necessitates an intersectional policy intervention. There is a requirement to reconstruct ethical online platforms with youth-focused online pedagogy.

It is only then that the digital world can expand from being an arena of observation to one of articulation and from alienation to empowerment. The social media post comments exhibit the common gender-based stereotypes that can shift the brain chemistry of youth in their perception of gender. Social media adoption and access inequalities are influenced not only by infrastructure but also by family control and gender roles. Performance is edited under terror, impacting the authenticity and development of an individual. Algorithmic biases favor normative selves and

set aside activism. Digital societies of youth are termed as the arenas of resistance and expression. When an individual has a fractured sense of identity, it is further compounded by algorithmic harassment, censorship, and the lack of safe online communities. However, changes are happening. The youth today are not solely victims but active agents, remaking online norms through art, humor, and solidarity. To best assist young people's identity formation in the digital environment, we must shift from merely granting digital access to facilitating digital equity, which entails:

Implementing policies to avert online harassment

Recommend school-level initiatives that emphasize digital safety and gender sensitivity.

Instruct educators and parents to support healthy digital engagement.

Impose gender-sensitive reporting procedures, content moderation teams, and harassment response processes for social media platforms.

Set up anonymous feedback and support networks for young people.

Offer device subsidies for young people who are marginalized.

Create community digital hubs with mentoring programs.

Support algorithmic transparency and third-party audits to track gender-based content suppression.

Support youth-led online platforms for free speech and creative engagement.

Invest in and support youth content creators from marginalized groups.

There ought to be Gender-Inclusive Digital Education through the integration of digital literacy and studies on gender into secondary school levels. They should also provide parents' workshops on ethical regulation and digital well-being. Digital platforms should be held accountable by providing transparency audits for their algorithmic choices. There should be a prerequisite gender-sensitive training for online content producers. There must be policy interventions that can facilitate device and data subsidies for marginalized youth and rural areas, and fund tech projects and open-source safety software. Support networks and studies need to be revitalized through funding allocation for youth-led digital rights movements, and increased emphasis on longitudinal research on digital identity, mental health, and resilience is necessary. To promote equal digital citizenship, a system change is necessary at the educational, technical, and policy levels. Only then can cyberspaces be inclusive, rather than tools of exclusion.

8. Ethical Declaration

For the online survey conducted as part of the study, participants provided their consent. Their responses remain anonymous.

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Ecosystem-Led Transformation of Indian Agriculture: Enhancing Sustainable Agribusiness and Policy Innovation for Viksit Bharat 2047

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Abstract

Unpredictable weather patterns, uneven agricultural policy, cultural diversity, and socioeconomic inequality continue to impede India's agrarian economy. However, India's agricultural sector can develop into a profitable and sustainable agribusiness with innovation, entrepreneurship, and effective policy support. This chapter will examine how an entrepreneurial ecosystem might support the expansion of agricultural farm earnings. Additionally, it will shed light on how domestic policy, globalization, and the evolving agricultural technology landscape affect agripreneurship. The dynamic character of the agricultural and allied industries' entrepreneurial environment has attracted and continues to attract attention in recent years. Using the Isenberg Model and pertinent policy viewpoints to examine the challenges and prospects faced by rural business owners, this chapter will outline how rural entrepreneurs face both possibilities and challenges due to the intersections of policy, access to finance, access to markets, infrastructure, and human capital. Even though programs like Startup India and RKVY-RAFTAAR have contributed to the development of a more startup-friendly institutional ecosystem in India, rural entrepreneurs still face a number of serious challenges, including a highly fragmented value chain, a lack of infrastructure, a scarcity of knowledge-based resources, and restricted access to funding sources. As business-oriented endeavors become more incorporated into traditional agriculture in collaboration with ecosystem stakeholders (universities, government programs and initiatives, and incubators), agri-startups are becoming more

common, according to evidence from case studies. The study's conclusion provides a comprehensive, ecosystem-integrated approach appropriate for the socioeconomic diversity of India. This would promote sustainable food systems, help local businesses, and sustain rural livelihoods. Consequently, it offers a way to change the entrepreneurial agrarian ecosystem and is consistent with India's Viksit Bharat 2047 goal.

Keywords : Agri-entrepreneurship, entrepreneurial ecosystem, rural innovation, agribusiness development

1. Introduction

In honour of the nation's centennial of independence in 2047, the Indian government unveiled Viksit Bharat 2047, a comprehensive vision plan. Under the direction of NITI Aayog, the nation's leading policy think tank, the program offers a 25-year development plan to make India a global leader in innovation and technology, a model for social welfare and human development, and an advocate for environmental sustainability. This idea holds that agriculture is essential to Amrit Kaal's inclusive growth, green development, and profitable employment.

India already has a big impact on the agricultural sector. It has the world's largest herd of buffalo and the largest area used for crops like wheat, cotton, and rice. In addition to being the world's leading producer of milk, pulses, and spices, the country ranks second in terms of wheat, cotton, sugarcane, tea, fruits, vegetables, farmed fish, and meat from sheep and goats. An essential component of India's economy has always been agriculture. Agriculture employs around half of India's labour force and accounts for about 17% of the country's GDP. (Mohankumar et al., 2025; Singh, Kademani, Nain, and Mishra, 2020).

However, a number of issues jeopardise the industry's sustainability and productivity, despite the fact that agriculture is a major source of income for many people and a foundation of the Indian economy. Long-standing agricultural cycles have been upset by unpredictable weather patterns brought on by climate change. Due to the agricultural sector's substantial reliance on the monsoon for rainfall, it is susceptible to droughts and floods, which can lead to irregular crop yields and unpredictable farmer incomes (Kumar et al., 2020; IPCC, 2022).

The country's social and economic conditions significantly worsen these vulnerabilities by limiting farm productivity through inheritance policies that cause land fragmentation and by preventing smallholder farmers from using formal credit

systems and technology to increase farm productivity and develop climate-resilient practices. Additionally, price fluctuations and insufficient market connections make farmers more susceptible to exploitation and uncertainty (Government of India, 2019).

Apart from these systemic problems, several structural problems continue to impede agricultural transformation.

Cropping patterns and agricultural output are greatly impacted by climate variability, and the recent rise in weather events is one factor contributing to this. Farmers are more vulnerable due to insufficient adaptation attempts (Tittonell, 2020). Furthermore, given the inefficiencies associated with smaller, dispersed plots of land, supply chains have an impact on farmers' scalability (Mohankumar et al., 2025). Due to their lack of official financial channels, farmers must rely on expensive alternatives for financing, which restricts their ability to pursue entrepreneurship (Cheng et al., 2024; Xu et al., 2024). According to Mohankumar et al. (2025) and Kademani et al. (2020), access to infrastructure for transportation, storage, and irrigation has a detrimental effect on both sustainability and competitiveness because it is insufficient for both. Finally, a lack of knowledge and awareness regarding technology, agriculture, and entrepreneurship also limits farmers' ability to innovate (Yoon et al., 2021; Soam et al., 2023).

To support food security, provide long-term sustainable rural development, and protect millions of people's livelihoods from instability and unpredictability, comprehensive policy frameworks specifically aimed at promoting adaptability and a sustainable farming system that embraces the socio-economic realities, climate change resilience, and sound governance associated with each aspect of adaptive/ sustainable farming must be developed. Such initiatives require collaboration between local communities, researchers, policymakers, and agricultural specialists in order to create an environment that supports a prosperous, sustainable, and profitable agricultural sector in keeping with India's goal for Viksit Bharat 2047. (FAO, 2021).

2.   Literature Review

2.1 Agri Startup Ecosystem

The agri-startup ecosystem is helping to create a revolutionary shift in agriculture through providing innovative, sustainable, and economically viable environments. Within this response, the agri-startup ecosystem will be thoroughly discussed, covering why it exists, what motivates agri-startups, how they function, how to

market themselves, what developments could take place in the future, and what challenges agri-startups face.

2.1.1 The Agri-Startup Ecosystem: Importance and Relevance

Innovation in Agriculture

Innovation is the primary purpose of agri-startups by incorporating modern technological advancements such as blockchain, artificial intelligence (AI), precision agriculture, Internet of Things (IoT), etc., thereby leading to improvements in productivity and efficiency and resource use (Shahab et al., 2024; Raj et al., 2024; Roy & Medhekar, 2025). In addition, through the application of technology and data analytics, agri-startups provide tools to enhance agricultural productivity and reduce post-harvest losses for the achievement of Sustainable Development Goals (SDGs) (Kumar et al., 2024).

Sustainability

The agri-ecosystem emphasizes sustainable ecological farming practices, water conservation measures, climate-resilient farming, and reduced chemical inputs via digital data (Kamyab et al. 2023; Roy et al. 2025). With the deteriorating environment, companies also contribute toward sustainable farming through organic farming methods and assisting with the development of future sustainable agribusiness opportunities for the global market (Kumar et al. 2024).

Economic Empowerment

Agri-startups create economic opportunities by promoting entrepreneurship in rural areas. The agri-startups provide value-added products and services that increase income, facilitate farmers' access to market, and create new jobs (Mishra et al. 2024; Hegde et al. 2025). They provide financial assistance, connect smallholder farmers to markets, and offer unique products and services to them. The success of agri-startup businesses is dependent on the type of crop and production system; however, agri-startups are critical to facilitating the integration of smallholder farmers into high-value supply chains (Prakash et al. 2023).

Food Security Focus

Food security is a critical focus for startups working on scalable solutions through enhanced supply chain efficiency, reduced post-harvest losses, and more effective crop management technologies (Zhao and others, 2024; da Silveira et al., 2023). By utilizing technology and strengthening supply chains, agri-tech start-ups are also contributing towards the availability and stability of food markets as well as improving rural livelihoods and environmental sustainability.

2.2 Ecosystem-Led Drivers of Change in India

Developing an inclusive ecosystem approach to India's agricultural transformation requires an integrative ecosystem framework that integrates digital, financial, institutional, policy, and cultural components. Each type of ecosystem has its own role in supporting agricultural development, and together they create synergies to create a more equitable, resilient, and sustainably productive agriculture sector.

Digital Ecosystem

At the heart of many digital technologies in agriculture, such as ICT, IoT, AI, and blockchain, is the provision of timely information, instruments/integration of precision agriculture equipment, and access to market connections, which have transformed the agricultural processes of farmers. Furthermore, the integration and inclusion of these technologies has addressed long-standing issues associated with agricultural production and distribution bottlenecks for smallholder farmers (Zhang & Florek-Paszkowska; Ujwary-Gil).

From the perspective of Zhang & Florek-Paszkowska (2022) and Ujwary-Gil, one of the main uses of digital technologies for farmers using precision agriculture is to assist farmers in optimizing their resource utilization and assist farmers in making more informed decisions about their sustainability practices through the use of tools such as geospatial analysis and ICT.

Blockchain and IoT Enable Transparency: Blockchain and IoT have improved transparency and increased financial and supply chain efficiencies, leading to an atmosphere of increased trust among all agricultural stakeholders (Florek-Paszkowska & Ujwary-Gil, 2022; Li et al., 2024).

Digital Platforms for Markets: As a result of exploiting the advantages of digital technologies and building digital marketplace platforms, farmers have a more direct relationship with their respective markets, and the pricing mechanisms for agricultural produce have been improved, reducing the need for reliance on middlemen (Florek-Paszkowska & Ujwary-Gil).

AI Advisory Services: The utilization of drone-based, real-time solutions and the ability to receive AI-supported advice in a farmer's native language allows farmers to more easily and effectively make adjustments as necessary (Florek-Paszkowska & Ujwary-Gil, 2022).

Financial Ecosystem

Within an agricultural framework, both scalability and long-term viability are firmly supported by a strong framework, including legislative support (i.e., the

emergence of agri-startups), and technological innovation will drive the evolution of the overall financial ecosystem (Karami et al., March 2023).

Mobile Technology: With digital mobile payments and mobile access, providing improved access to agricultural inputs/materials/equipment and a highly critical source (Krishnan et al., 2025; Ramos-González et al., 2019).

Incorporating Blockchain for Digital & Electronic Insurance Claims Collection— There is evidence from extensive research and analysis that blockchain can protect the collection of electronic insurance claims, subsidies, and loans (Laurent et al., 2024).

Intermediary Services of Fin-Tech Startups – Some startup companies provide farmers with financial products that help protect against extreme volatility in prices, as well as weather-indexed coverage, hedging, or similar products (Amar et al. 2019).

Financial Incentives through the Reform of the Subsidy System – Through the shift of subsidies for chemical fertilizers to subsidies for the use of bio-fertilizer for the support of smallholder farming, thus promoting sustainability (Hwang et al., 2021).

Institutional Ecosystem

Institutions are the building blocks of research, entrepreneurship, and farmer support, while strong institutional relationships lead towards the best sustainable and productive capacities.

Supportive policy frameworks: The National Agricultural Innovation Project (NAIP) promotes agricultural competitiveness (Karuppan-thetty et al., 2014).

Regulatory framework: Through the establishment of cooperatives, farmers can now access markets and have greater autonomy over their farms (Febrianti, 2024).

Access to inputs: The production aspect of agriculture can only benefit from increased financial investments and technological advancements utilized to facilitate production (Binswanger-Mkhize et al., 2012).

Human Capital Development: Investing in training will lower the chance of possible loss. Additionally, there will be more opportunities for you to earn money in other ways.

Farmers, suppliers, and markets will be able to access various resources, optimise their profits through their value chains, and establish networks with one another by cooperating. The process of working together as a group enterprise will encourage creativity and enhance the ability to develop sustainable livelihoods through developing a culture of collaboration (Sharma et al., 2011).

Policy Ecosystem

Improving environmental sustainability through reform of agricultural policies, as well as aligning them with international obligations.

Farmers build their resilience by gaining knowledge of organic farming, integrated pest management (IPM), and agroforestry through educational programs (Arumugam & Manida, 2023).

Increased funding for research and development will enable innovation with respect to creating new technology to support sustainable agricultural practices (Pradhan, 2022).

By redirecting government subsidies towards purchases of sustainable agricultural inputs, such as biofertilizers and sustainable farm equipment, the financial viability will be enhanced for smallholder farmers (Paul et al., 2023).

Assisting Farmer-Producer Organizations (FPOs) to grow their rural supply chains and develop better market infrastructure increases the bargaining power of FPOs (Mahesh et al., 2023; Philip et al., 2025).

The National Agri-Ecosystem Index will be used to assess the ecosystem preparedness of each state, while the use of policy innovation platforms, such as policy sandboxes, will allow for targeted experimentation with new policies.

2.3 Cultural Ecosystem

Cultural transformation regarding growing resilient and sustainable agricultural practices is essential for adaptation. Adaptive agricultural practices involve inclusive crop diversity and climate-resilient varietals and sustainable and effective ways to manage water, including using drip irrigation and rainwater harvesting methods (Rajesh et al. 2024; Bamniya et al., 2024; S. et al. 2024).According to Rajesh et al. (2024) and Kumar et al. (2024), technological developments like as precision agriculture, GIS, and information and communications technology (ICT) are facilitating improved player-based decision-making and enhancing resource management.

Opportunities for on-the-job training help communities, farmers, extension workers, and the general public swiftly adopt new and improved farming techniques (S. et al. 2024).

According to Rajesh et al. (2024), Couldrick (2024), and Angeon et al. (2024), collaborative partnerships between community organizations and the public and private sectors are increasing resources within their particular areas to promote sustainability-oriented practices and products. Creating frameworks for including

women's interests and concerns in agriculture will enable us to close current disparities, realize the full potential of all women-related companies, and create wider economic benefits that are achievable through women's participation.

Viksit Bharat Agri-Ecosystem Model (VBAEM)

Ecosystem-Led Transformation of Indian Agriculture for Sustainable Growth

CORE OUTCOMES (Vision 2047)
- Farmer Income & Productivity Growth
- Climate Resilience & Resource Efficiency
- Food & Nutrition Security
- Youth & Women Inclusion
- Global Export Competitiveness & ESG Leadership

Sustainability Regenerative, Climate-Smart, Circular Bio-economy

Innovation Technology, Finance, Institutions

Inclusiveness Youth, Women, Smallholders

Competitiveness Markets, Exports, Traceability

Policy & Governance Regulations, Incentives, Policy Sandbox, Convergence

Markets & Value Chains POs, Logistics, MSP+, Exports Carbon/ESG Markets

Digital & Data Infra AI/IoT, Satellites, Blockchain, Open Agri Stack

Finance & Risk Blended Finance, Insurance, Agri-Fintech, SDG Bonds

Institutions & Networks Extension 4.0, Incubators, PPP, Cooperatives

Knowledge & Skills NEP2020, R&D, IP, Entrepreneurial Culture

ENABLERS: Inter-ministerial Convergence • State Competitiveness • Public Digital Goods • Open Data • Standards & Quality Infra • Social Capital & Trust

FEEDBACK & MEASUREMENT: Agri-Ecosystem Competitiveness Index • Real-time Dashboards • Evaluation • Citizen Feedback Loops

2025 Quick Wins Policy Sandboxes • FPO Digitalization • Climate-Smart Clusters

2035 Scale PAN India Agri-Data Stack • Green Value Chains • Export Hubs

2047 Outcomes High-Income • Resilient • Inclusive • Net-Zero Agriculture

Model Logic: Enablers → Levers → Pillars → Core Outcomes, supported by continuous Feedback.
A time-bound roadmap (2025 → 2035 → 2047) aligns interventions with Viksit Bharat Vision.

Challenges Faced by the Agri Startup Ecosystem

Growth and innovation in the Indian agriculture sector are hampered by a number of issues. Lack of access to internet infrastructure in rural areas has a significant impact on digital agriculture. The main obstacle preventing farmers from utilizing precision farming technologies, connecting with other digital markets, and obtaining real-time data is the lack of access. Additionally, farmers suffer from a lack of training and understanding on how to use the digital instruments at their disposal. All this has also created some financial obstacles for agribusiness ventures: many farmers cannot find the needed funding to start an agribusiness. Furthermore, bureaucratic obstacles and bulky regulations stand as a barrier to investment and limit opportunities for innovation by the agribusinesses. Then there is technology, which also provides a barrier to broad-scale use: the high costs of

these technologies and a lack of adaptation to local conditions of many of these technologies. Furthermore, it will be hard to penetrate the market because of a lack of infrastructure, logistical issues, and cultural barriers. Resource-intensive processes give considerable environmental challenges to agribusiness startups at the same time as many agribusiness startups are committed to sustainability.

Thus, there also needs to be a rising trend and awareness regarding eco-friendly practices and climate-smart practices. Moreover, it is essential that partnerships between government institutions, agritech start-ups, and the corporate world exist to facilitate the development and scaling up of innovation within the context of agribusiness. (Chauhan, 2023; Kumar et al., 2024; Gangwar & Jadoun, 2023).

Cross-Cutting Innovations and Strategies for Promoting the Agri-Startup Ecosystem

A major role is being played by agri-startups in the transformation of the Indian agriculture sector. They help the integration of the digital, financial, institutional, policy, and cultural ecosystems. Factors leading to the development of agri-startups include:

Initiatives: With collaboration with international organisations, the 'Innovation and Agri-Entrepreneurship Development Initiative' in India promotes innovative agricultural entrepreneurship (Kumar et al., 2024).

Technological Innovations: The adoption of digital technologies, including blockchain, artificial intelligence, drone technology, and precision agriculture, has impacted the agricultural sector positively by maximizing the output and utilization of available resources (Gangwar and Jadoun, 2023). Furthermore, social innovators assist small-scale farmers through the adoption of community radio and artificial intelligence consulting in their local languages.

Market Demand: Producers who produce organic and sustainable products are benefiting from increasing consumer demand for such products, as well as having greater opportunities to develop scalable solutions to secure and enhance food quality (Sulillari, 2023).

Investment Flows: The agri-tech industry received significant capital investments, with $1.18 billion in 66 transactions recorded in 2021, including increasingly larger transactions over $5 million (Kumar et al., 2024).

Business Incubators and Accelerators: Business incubators and accelerators provide valuable financial and legal resources, along with mentorship, and positively impact the growth and success of agribusiness companies (Isher, 2024).

How youth agripreneurship can be enhanced through innovation competitions and hackathons as part of the National Education Policy (NEP) 2020's skill-education

ecosystem to create enthusiasm among youths towards agripreneurship and entrepreneurship.

The need for policy innovation to create a "technology-agriculture-entrepreneurship" (t-a-e) relationship to align start-up businesses with national developmental goals. The transition from input subsidy-centric approaches to ecosystem subsidy-based approaches and the creation of a benchmarking system, such as the National Agri-Ecosystem Index, for measuring state progress, as well as the development of AI-driven policy feedback loops to guide and facilitate smart governance.

Models of sustainable convergence through holistic and authentic integrative models based on the concept of One Health, One Farm, and One Future. These converging models will encourage, enable, and empower agriculturalists, entrepreneurs, and rural economic development stakeholders to work collaboratively to achieve sustainable development of the food and agricultural systems of India.

3. Strategies for Promoting the Agri-Startup Ecosystem

To maintain and scale up such innovations, the following approaches are key:

A supportive policy environment further furthers startups through priority access to lending, increased transparency of regulations, and reduced financial risks.

Training and skill development raise youths' and farmers' adoption of digital technologies and their entrepreneurial capacity.

Collaboration among the three stakeholders—enterprises, governments, and the local community—encourages the latter to organize for collective action, which in turn encourages the implementation of technology-driven business models.

Blended finance and digital credit offerings provide companies with increased access to funding.

Specific technology options, which are affordable, enable smallholders to bridge the gap in the absence of access to Internet facilities by providing solutions that are flexible and low-cost.

This will help in further enhancing and developing the digital marketplace and logistics that will, in turn, provide better market access and higher trading opportunities to poor rural communities.

There, one may find the entire set of logical proof techniques that can be used for mathematical reasoning.

The dynamic environment that is entrepreneurship is fueled by new developments in technology and industries that have been disrupted by global markets. Internationalization is encouraged by developments in technology as well as

communication. Entrepreneurs are encouraged to take risks and become innovative and learn from failure. It is better when knowledge and resources flow and when entrepreneurs, investors, mentors, and institutions of higher learning, as well as governments, work together. Entrepreneurs are starting to make sustainability and social responsibility an integral component of entrepreneurship, which is a reflection of society and an engine to drive innovation within sustainability.

4.   Conclusion

During the Amrit Kaal, a paradigm shift is required in the functioning and mindset of the agricultural sector in India for green, inclusive, and meaningful job creation. To enable this in the agriculture sector, science-based tech adoption is required; the agricultural sector has to become more liberalized, and the existing ancient legislation has to be made more up-to-date. Some crucial components for this transition include the promotion of the public sector, liberalization of the agricultural output market, development of a robust land leasing market, and seeking more support for greater efficiency. Though there exist numerous obstacles in the agri-startup ecosystem, the significance of the agri-startup ecosystem cannot be overlooked for innovation, sustainability, and effective growth. The challenges presented by the agri-start-up ecosystem have to be tackled through a strategic approach to enable the agri-start-up ecosystem to become a crucial aspect in the coming days of the agricultural sector for achieving the 'Viksit Bharat' vision for the country's future goals within the target timeframe of 2047.

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Bridging the Divide: Analysing the Correlation between Literacy and Crime against Scheduled Tribes in India

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Abstract

The article discusses the link between literacy rates and crime against Scheduled Tribes in India, which is complex and defies the simplistic assumption that education reduces victimization. The attempt here will be to understand how literacy impinges on the actual empowerment and safety of these historically oppressed communities. The study uses a mixed-methods approach. It combines a quantitative correlation of state-wise ST literacy data (Census) and crime statistics (NCRB) with a qualitative interpretation of the socio-political contexts to explain the statistical findings. The correlation is not a simple inverse one. The results support an "empowerment-reporting effect," in which higher literacy may lead to higher reported crime because aware individuals would be more likely to access the justice system. In other contexts, the protective effects of literacy are negated by deep-rooted structural violence and land conflicts. Effective policy needs to go further than basic literacy and ensure functional, legal, and political literacy. This educational empowerment needs to be linked with strong implementation of protective legislation and socio-economic support in order for ST communities to actually be safe and experience justice that bridges the gap between constitutional promise and lived reality.

Keywords: Scheduled Tribes, Literacy, Atrocities, Empowerment, Social Justice

1. Introduction

India is a country of immense diversity and rapid growth. However, the country continues to grapple with entrenched social inequalities. Among the most marginalized groups in the country are STs over 104 million people (8.6% of the population according to the 2011 Census) -(Ministry of Tribal Affairs, 2021), comprising more than 700 distinct communities with unique cultural and ecological ties. Inspite of constitutional safeguards under Article 15(4), 16(4), 46, 244, 330, and the Fifth and Sixth Schedules, and legal protection under the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989 (PoA Act), the reality remains grim. The National Crime Records Bureau recorded 8,802 crimes against STs in 2021, which saw a jump of 6.4% from 2020; even these figures tend to underestimate the actual incidence due to underreporting, police apathy, and victim intimidation during criminal investigation procedures (NCRB, 2022).

Alongside this, education has been promoted as a primary tool of empowerment through various initiatives like scholarships, hostels, and Eklavya Model Residential Schools. The underlying assumption is that literacy leads to reduced vulnerability because of growing awareness, contribution to economic functions, and access to justice. On the other hand, this paper challenges the linearity of that assumption, pointing out that the relationship between literacy and crime against STs is actually complex and context-dependent. The rise in literacy, especially legal and political consciousness, can lead to a greater reporting of crimes rather than their occurrence, an "empowerment-reporting effect." In areas with low levels of literacy, pervasive fear and systemic exclusion foster a "culture of silence."

The study attempts to examine the state-wise correlation between literacy and crimes against STs, based on quantitative data from the Census and NCRB, combined with a qualitative socio-political analysis. It tries to show how literacy acts not only as education but also as a possible instrument for justice, dignity, and structural empowerment of India's indigenous communities.

2. Literature Review

The connection between literacy and crime towards vulnerable populations, represents an example of an interdisciplinary area involving sociology, law, economics, and education. There are three main types of literature concerning Scheduled Tribes: (i) studies on their educational and socio-economic status, (ii) research on crimes against them and the effectiveness of protective laws, and (iii) analyses connecting education, empowerment, and social justice.

2.1 The Socio-Economic and Educational Landscape of Scheduled Tribes

Ranging from sociology and economics to law and education, the connection between literacy and crime against weaker sections is thus an interdisciplinary area of study. A significant body of research explains the continuous marginalization of the STs. Works like that of Virginius (Xaxa, 2008), among others, have engaged in-depth with the question of "tribes into castes" and highlight how the processes of state formation and market integration have led to their dislocation and subordination. The alienation of the Scheduled Tribes from their traditional lands (Rajasenan et. al., 2019) and forests has been identified as the leading factor for their economic vulnerability and a major trigger of conflict (Shah, 2017).

This is always backed up by government reports. The Report of the High-Level Committee on Socio-Economic, Health and Educational Status of Tribal Communities of India (Xaxa Committee Report, 2014) give a full and honest picture. Even after decades of affirmative action, STs are still behind practically all other socioeconomic groups on important development indices including health, education, and poverty.

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2.2 Crime, Atrocities, and the Law

The literature on crime against STs is dominated by analyses of "the Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989". This Act has been greatly praised as a strong piece of legislation, but has been marred by difficulties in its implementation. Research has persistently indicated poor conviction rates, excessively lengthy delays in trials, and the routine abuse of the Act by the ruling communities to press counter-cases (Prakash, 2015).

Narayan and Vaddiraju (2019) contend that the PoA Act's success is significantly eroded by the police and judicial institutions' inclination. The police are not willing to file cases under the Act, try to water down the charges, or conduct half-hearted investigations. Victims are intimidated by offenders and not safeguarded by the state machinery, resulting in a majority of withdrawn or acquitted cases. The conviction rate under the PoA Act for ST crime was a paltry 25.5% in 2021, and more than 90% of cases remained pending trial at the year-end, summarizing the words of wisdom, "justice delayed is justice denied" (NCRB, 2022).

Researchers have also observed the changing nature of atrocities. In addition to open physical violence, they include more hidden forms of structural violence, such as taking tribal land for development projects (Borah, 2016), breaking the Forest Rights Act (2006), and going after Adivasis who oppose dispossession (Asher & Ramdas, 2018). These systemic issues are infrequently classified as "atrocities" under the PoA Act; consequently, they are absent from official crime statistics.

2.3 *The Nexus: Literacy, Empowerment, and Social Justice*

People in India generally think that being able to read and write is linked to lower crime rates, but this hasn't been proven. Amartya Sen (2000) and other economists have said that the basic idea is that education gives people more "capabilities" or freedoms. Literacy facilitates access to information, develops critical thinking, and makes political and legal participation much easier. An educated person is better acquainted with his or her rights, with red tape, and can defend against injustice.

Some micro-level studies confirm this hypothesis. For example, studies of the impact of female literacy find a clear correlation between increased literacy rates and lower incidence of domestic violence and increased ability to make decisions independently of male relatives (Jejeebhoy, 1998). It is therefore reasonable to assume that STs with higher literacy rates in their communities would be less vulnerable to being hoodwinked in business matters, more knowledgeable about legislation that protects them, such as the PoA Act and the Forest Rights Act, and better able to mobilize politically.

Nevertheless, several researchers have clarified some important nuances. In his seminal article, "Why the 'Haves' Come Out Ahead," Galanter (1974) argues that the courts inherently favor the rich and powerful. Basic literacy may not be adequate. People need to know the law and have the tools to utilize it well. Also, as people become educated and forceful, it can make dominating societies angry because they feel that their old hierarchies are being challenged (Mendelsohn & Vicziany, 1998). This might cause a short-term rise in violence and reports of atrocities as newly emboldened groups fight for their rights and resist being stopped.

3. Research Gap

The literature review reveals that while substantial research exists independently on ST education and crimes against STs, there is a significant gap in scholarship that systematically and empirically analyzes the correlation between them. Most studies either:

Theoretically assumes a positive link between education and empowerment without testing it against crime data.

Focus on legal analyses of the PoA Act's implementation failures, without correlating these failures with the educational status of the victim communities.

Conduct socio-economic analyses of ST communities where education is treated as one of many development indicators, but its specific role as a protective factor against crime is not isolated or deeply analyzed.

No major study has undertaken a state-wise statistical correlation of ST literacy rates with the corresponding rates of reported crime against STs (adjusted for population) and then interpreted these statistical findings through a qualitative lens that accounts for contextual factors such as reporting behavior, the political economy of a state, and the presence of social movements. This paper aims to fill this gap by providing a data-driven analysis that neither takes the protective power of literacy for granted nor dismisses it, but rather seeks to understand its complex, mediated, and often paradoxical role in the Adivasi struggle for justice and security in the following ways.

4. Research Objectives

To fill the research gap that has been found, this study has the following goals:

To chart and examine the disparities in literacy rates among Scheduled Tribes in India, encompassing the gender divide.

To look at the trends and how crimes against Scheduled Tribes are spread out across states under the Indian Penal Code (IPC) and the Protection of Atrocities Act (PoA).

To conduct a correlational analysis to investigate the statistical relationship between state-wise ST literacy rates and the rate of reported crime against STs (per lakh of ST population).

To qualitatively analyze the statistical results, the study examined the "empowerment-reporting hypothesis" and the impact of regional socio-political situations.

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5. Methodology

This study utilizes a mixed-methods research methodology, principally focusing on the analysis of secondary data, complemented with qualitative interpretation informed by the current literature. This was a descriptive and correlational investigation at the macro (state) level.

5.1 Data Sources

This study utilizes a mixed-methods research methodology, principally focusing on the analysis of secondary data, complemented with qualitative interpretation informed by the current literature. This was a descriptive and correlational investigation at the macro (state) level.

Literacy Data: The Census of India 2011 is the main source of state-wise Scheduled Tribe literacy rates, including rates for men and women. Even though these statistics are more than ten years old, they are still the most complete and detailed set of data for this particular group of people. The analysis recognized this restriction. More current, although not as direct, data from sources like the National Family Health Survey-5 (NFHS-5, 2019–21) will be utilized to help us understand how well people do in school.

Crime Data: The National Crime Records Bureau (NCRB) publishes annual reports called «Crime in India» that show how many crimes and atrocities have happened against Scheduled Tribes in each state. Recent years› data (such 2019, 2020, and 2021) will be utilized to look at present trends. The study would utilize the crime rate (the number of crimes per 100,000 or lakhs of the ST population) instead of the total number of instances for making the dataset normal and comparable.

Population Data: The Census of 2011 gives us the ST population numbers for each state, which we use to compute the crime rate.

5.1.1. Scope and Limitations

Scope: The study covers all major states and union territories of India for which comparable data on both ST literacy and crime against STs are available.

Limitations:

The research depends on official statistics, which have their own problems. The NCRB's crime data comes from First Information Reports (FIRs) that the police file, and it is known to be incomplete.

The literacy data from the 2011 Census is old. It's likely that literacy rates have gone up since then, but the order of states in terms of literacy is thought to have stayed mostly the same.

Correlation is not causation. A statistical correlation can never prove that it is the levels of literacy causing changes in crime rates. There are just too many other things that could impact on this relationship, including levels of poverty, patterns of land distribution, effectiveness of the police, political will, and the presence

or absence of civil society organizations. The qualitative interpretation looks to address this through an analysis of these mediating factors.

5.1.2. Method of Analysis

Descriptive Analysis: This involves the description of data on ST literacy and crime rates through the use of tables and charts to indicate trends and differences across states.

Correlation Analysis: The Pearson correlation coefficient (r) will be used to find the strength and direction of the linear relationship between the two main variables: state-wise ST literacy rate (%) and the number of crimes against STs, cases per lakh of ST population.

Qualitative Interpretation: The statistical results will be interpreted by categorizing states into different typologies, for example, High Literacy/High Reported Crime; Low Literacy/High Reported Crime; High Literacy/Low Reported Crime. This interpretation will use the literature review to explain the patterns observed, with particular emphasis on the empowerment-reporting hypothesis and the unique socio-political contexts of different states and regions, for instance, mainland states versus tribal-majority states in the Northeast.

5.1.3. Analysis and Interpretation

Using the methodology that was discussed before, this section demonstrates how the data was studied further. First, the study presents the trends in crime and literacy in a different manner. Next, the correlation analysis and its interpretation are presented. Finally, the analysis concludes with a conclusion.

5.2 State-wise Trends in Scheduled Tribe Literacy

The results of the Census taken in 2011 paint a clear picture of the educational disparities that STs are subjected to. There were significant disparities amongst the states, despite the fact that the national ST literacy rate was 59%.

Table 1: ST Literacy Rates in Major States (Census 2011)

State	Literacy Rate for all (%)	ST Literacy Rate (%)	ST Female Literacy (%)
High Literacy States			
Mizoram	91.3	91.5	89.4
Kerala	94.0	75.8	70.8
Sikkim	81.4	79.5	73.6

Moderate Literacy States			
Maharashtra	82.3	65.7	56.4
Gujarat	78.0	62.5	52.0
Jharkhand	66.4	57.1	46.2
Odisha	72.9	52.2	41.2
Low Literacy States			
Rajasthan	66.1	52.8	37.3
Madhya Pradesh	69.3	50.6	41.2
Telangana	66.5	49.5	39.4
National Average	73.0	59.0	49.4

Source: Census of India, 2011

Interpretation

Regional Disparities: Literacy rate data display extreme regional differences. The Northeast Indian States, mainly Mizoram, possess much higher literacy rates, some states exceed the national average. One contributing factor is the historic involvement of Christian missionaries in the spread of education in the tribal majority states where social structure is primarily homogeneous and empowers their communities.

High-Performing Mainland States: The state of Kerala possesses a much higher ST literacy rate than most states located on the mainland, due to a combination of the level of education in the state along with successful social development policies embraced by the state.

The "Heartland" Lag: Central India is represented by the "Heartland" Lag. States in Central India that have a high concentration of Scheduled Tribes (STs) including Madhya Pradesh, Rajasthan, Odisha, and the state of previously undivided Andhra Pradesh have shown significantly lower literacy rates. These Central Indian states also have the highest levels of caste integration among ST's and also continue to have an increasing amount of conflict over land and resources.

Gender Gap: The "Gender Gap" between the literacy of ST men and women in all states shows a disturbing trend with little evidence of abatement. In Rajasthan, for example, the female literacy rate is precariously low at 37.3%, with Adivasi women being doubly vulnerable due to their gender and tribal identity.

5.3 State-wise Trends in Crime Against Scheduled Tribes

The data from the NCRB illustrates the locations where atrocities are recorded the most frequently. We compare the crime rate (number of cases per lakh of ST population) for the year 2021 in order to ensure that the comparison is accurate.

Table 2: Crime Rate against Scheduled Tribes in Major States (2021)

State	Total Cases Reported	ST Population (in Lakhs, 2011)	Crime Rate (per Lakh)
High Crime Rate States			
Kerala	518	4.85	**106.8**
Rajasthan	2121	92.39	**23.0**
Madhya Pradesh	2627	153.17	**17.1**
Telangana	536	31.78	**16.9**
Moderate Crime Rate States			
Maharashtra	1342	105.10	**12.8**
Odisha	676	95.91	**7.0**
Gujarat	363	89.17	**4.1**
Low Crime Rate States			
Jharkhand	436	86.45	**5.0**
Mizoram	4	10.91	**0.4**
All-India Average Rate	**8802**	**1042.8**	**8.4**

Source: Calculated from NCRB "Crime in India 2021" and Census 2011 population data

Interpretation:

The Kerala Paradox**:** Despite gaining international recognition for its social progress and high ST literacy, Kerala tops the list with a very high crime rate against STs in the country by a huge margin of 106.8. This number is more than 12 times the average for the whole country.

The Central Indian Hub of Atrocities**:** Madhya Pradesh has the highest number of cases, though it reports a lower crime rate than Kerala or Rajasthan. It is part of the epicenter of documented atrocities against STs along with Rajasthan.

Low Reporting or Low Incidence: States like Jharkhand and Odisha, which have large ST populations and known problems with conflict and exploitation, have crime rates that are moderate to low. This brings up an important question: does this mean things are getting better, or is it just that people aren't reporting crimes because they can't get justice and are scared?

The Northeast Anomaly: Mizoram has the highest ST literacy rate and a very low crime rate. This makes sense because the PoA Act's power dynamics (minority vulnerability vs. dominant majority) don't work the same way in a state with a lot of tribes.

5.4 Correlation Analysis and Interpretation

Correlation analysis aims to ascertain the magnitude and characteristics of the relationship between two variables in the study. In a bivariate distribution, a significant correlation between two variables typically signifies the existence of a causal relationship. The "coefficient of correlation" is being denoted by "r".

Pearson's correlation analysis is used to see the association between two variables in a bivariate distribution for the following major states

Table 3: Crime Rates and Literacy Rates for Major States

State	Crime Rate against ST People (Per Lakh People)	Literacy Rate for all (%)	Literacy Rate for ST (%)	Literacy Rate Gap
Kerala	106.8	94.0	75.8	18.2
Rajasthan	23.0	66.1	52.8	13.3
Madhya Pradesh	17.1	69.3	50.6	18.7
Telangana	16.9	66.5	49.5	17.0
Maharashtra	12.8	82.3	65.7	16.6
Odisha	7.0	72.9	52.2	20.7
Gujarat	4.1	78.0	62.5	15.5
Jharkhand	5.0	66.4	57.1	9.3

Source: Calculated from NCRB "Crime in India 2021" and Census 2011 population data

A simple linear correlation analysis yielded a positive correlation coefficient ($r > 0$) [Crime against ST and Literacy Rate for all ($r = 0.74$); Crime against ST and Literacy Rate for ST ($r = 0.70$)]. This statistically suggests that as the literacy rate increases, the *reported crime rate* against ST Population also tends to increase. This finding directly contradicts the common-sense hypothesis that education is a purely protective factor that should lead to a *decrease* in crime. There is a moderate positive correlation between Crime against ST and Literacy Rate Gap ($r = 0.25$), meaning areas with higher gaps in literacy between Scheduled Tribes (ST) and the general population tend to report more crimes against STs. Visual representation (Table 4) illustrating the relationship between the literacy rate (from the 2011 Census) and the crime rate against STs (from NCRB 2021) for major Indian states.

Figure 1: Crime Rate vs. ST Literacy Rate
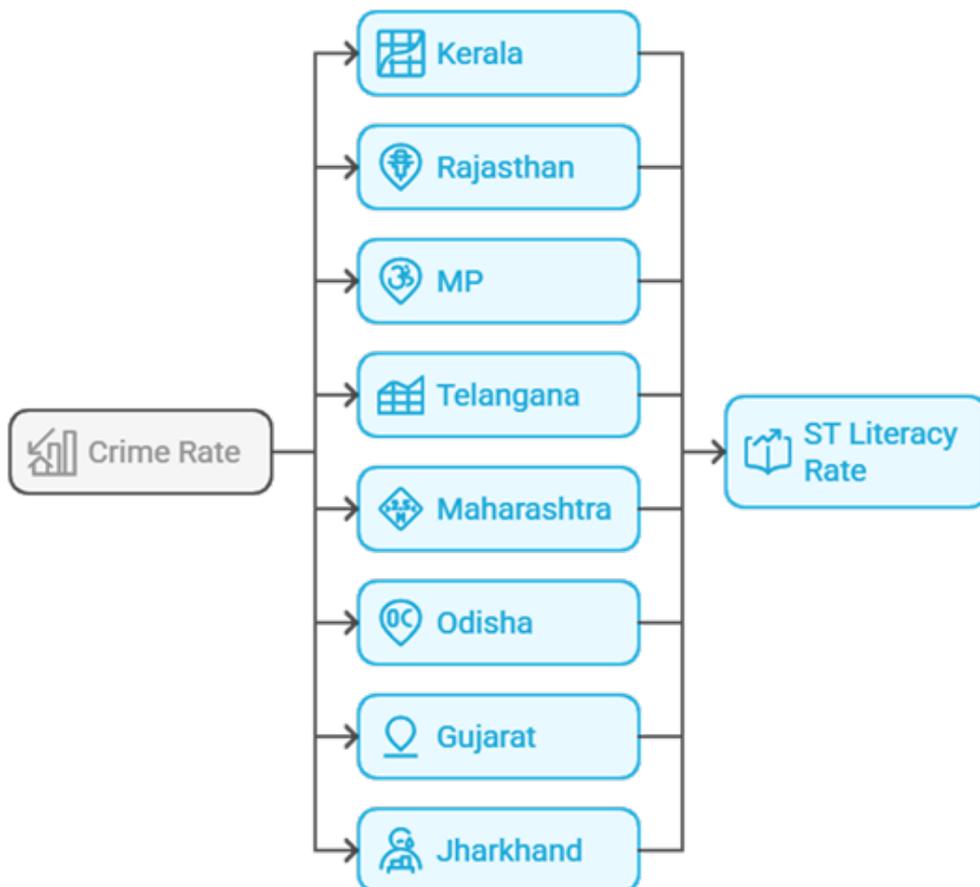
Table 4: Pearson's correlation analysis between two variables in a bivariate distribution

	Crime against ST	*Literacy Rate for all*	*Literacy rate for ST*	*Literacy rate gap*
Crime against ST	1.00			
Literacy Rate for all	0.74	1.00		
Literacy rate for ST	0.70	0.93	1.00	
Literacy rate gap	0.25	0.38	0.02	1.00

The correlation analysis across all states would be misleading due to the contextual differences. Instead, a qualitative grouping of states provides a more insightful interpretation.

Group 1: High Literacy and High Reported Crime Rate (e.g., Kerala)

The case of Kerala is the most compelling evidence for the empowerment-reporting hypothesis. The literacy rate for STs in Kerala is 75.8%, which means that tribal communities there are much better educated than those in most of India. Because of this level of education, along with the state's high political awareness and active civil society, ST people are more aware of their legal rights under the PoA Act and more comfortable talking to the police. The high crime rate is, therefore, less an indicator of exceptionally high levels of violence (though violence certainly exists) and more a reflection of a higher propensity to report crime. It signifies that the law is being used, which, paradoxically, is a positive sign of legal empowerment.

Group 2: Low/Moderate Literacy and High Crime Rate (e.g., Rajasthan, Madhya Pradesh)

These states represent the "classic" scenario of vulnerability. Rajasthan (ST literacy 52.8%, crime rate 23.0) and Madhya Pradesh (ST literacy 50.6%, crime rate 17.1) both have social structures that are very feudal and patriarchal. There is both increased reporting and increased frequency of crimes occurring here, with many going unpunished. Many times, the reasons for violence relate to land disputes, accusations regarding caste superiority, or sexual harassment. Consequently, a low level of literacy makes individuals especially vulnerable. Because they lack the ability to read complex land documents, apply for government assistance, and access the legal system properly as a result of their low literacy, ST people are particularly disadvantaged. A high crime rate indicates to us just how extreme the situation is for those caught in a system that oppresses them. The problem is compounded by the fact that ST people will continue to be disadvantaged, as increased literacy among them does little to change power structures.

Group 3: High Literacy and Low Crime Rate (e.g., Mizoram)

On the contrary, when we refer to Mizoram, as an example, where ST people have a 91.5% literacy rate and where the crime rate is only 0.4%. The social context in this state is not one of a small Adivasi minority fighting against a large non-tribal majority. Instead, over 94% of the population is tribal. The PoA Act, which was made for the latter situation, isn't very useful. Conflicts, when they arise, are typically intra-tribal and resolved through different social and legal mechanisms. This case demonstrates that the socio-political context is a critical mediating variable. High literacy in a tribal-majority state leads to overall development and well-being, naturally resulting in low crime rates.

Group 4: Low/Moderate Literacy and Low/Moderate Reported Crime Rate (e.g., Jharkhand, Odisha, Gujarat)

This is the most unclear group. Jharkhand (ST literacy 57.1%, crime rate 5.0) and Odisha (ST literacy 52.2%, crime rate 7.0) are two states where people are often forced to move, there is a lot of fighting between Naxalites, and mining companies and moneylenders take advantage of tribal communities. The low official crime rates are very suspicious and probably mean that a lot of crimes go unreported. In this case, the lack of reading and writing skills, along with extreme poverty, fear of retaliation from powerful vested interests (like the government and businesses), and a lack of trust in the police and courts, make a "culture of silence." There is a possibility that victims are unaware of their rights, or that they may believe that reporting a crime is either worthless or even harmful. There is a high probability that the statistical data in these states conceals more information than it discloses regarding the actual incidence of victimization.

6.   Findings and Discussion

Several significant findings arise from this analysis that contest oversimplified narratives:

No Direct Inverse Correlation: There is no straight-forward, universal inverse correlation between the literacy rates and crimes against STs. It's complicated and influenced by so many other things.

The Empowerment-Reporting Effect is Real: In highly socially developed states, in terms of literacy, for example, Kerala, higher levels of literacy and awareness translate to greater amounts of reported crimes, which reflects heightened utilization of the justice system rather than any increase in crime itself.

Structural Violence Overwhelms Literacy Gains: In those states where feudal hierarchies are strong and competition for resources is fierce, atrocities continue at a high rate even while literacy rises. The structural causes of crime are so powerful here that education alone cannot protect people from victimization.

Context is Paramount: The socio-political context is a key factor. Tribal-majority states like Mizoram are very different from mainland states where STs are a small, weak group. In tribal-majority states, STs have political and social power.

Underreporting Masks Reality: Low official crime rates in states with low literacy and known social conflicts - for example, Jharkhand and Odisha - probably reflect underreporting of crime and malfunctioning state machinery rather than the peacefulness of the social environment.

The Literacy-Justice Gap: The following analysis implicitly reflects a difference between basic literacy, or the ability to read and write, and functional/legal literacy, or the ability to understand and use information toward obtaining rights. The latter is what really equips people with the power to demand justice.

7. Conclusion

It is anticipated that a considerable period of time and effort will be required for the gap between the promised constitutional protection for Scheduled Tribes (ST) in India and the practical application of this protection to be sufficiently bridged. This article has focused on one element of this effort, namely the significance of both literacy and literacy development, in respect of Scheduled Tribes (ST). The relationship between literacy and other correlates of Scheduled Tribes (ST) has been statistically that there is a correlation between increased literacy levels and an increase in reported crimes. However, the relationship does not imply that increased literacy levels are "bad" for ST communities; rather, when properly interpreted, it strongly supports the assertion that literacy development creates empowerment to recognise crime, resulting in an increased likelihood that crimes will be reported. Therefore, literacy development will often be associated with an apparent increase in crime when, in reality, it is an indication of increased recognition of crime and subsequent reporting.

Given these challenges, policymakers, along with society, must consider two important tests concerning literacy among disadvantaged groups. First of all, literacy for Adivasis needs to be not only an accomplishment of technology but also a means of creating a consciousness about their role and position in power and society. Adivasis must be taught how to read - both the law and politics, as well as the operation of the justice system - so they can understand how to function within it and ultimately effect change in their own lives. Second, this type of education must be complemented by a sensitive and aware state that will put in place structures to protect and uphold individual rights to property and livelihoods, and endeavour to dismantle the systemic and entrenched prejudices that allow such atrocities to occur.

Lastly, to bridge the gap, we need to build a bridge on the two pillars of giving citizens power via education and holding institutions accountable through justice. We can't construct a society where India's indigenous people can live with the dignity, safety, and freedom that is their birthright unless we have both of these pillars in place.

8.   Suggestions and Policy Recommendations

Based on such facts, an interdisciplinary approach is required to leverage literacy for the protection of STs:

8.1. Reimagining Education for Empowerment

Curriculum of Rights**:**   Curricula at schools located in tribal areas have to be improved so that they go beyond literacy. Among the protective statutes that should be included are the PoA Act, the Forest Rights Act (FRA), and the Panchayats (Extension to Scheduled Areas) Act (PESA). Additionally, it should include modules on the Indian Constitution and the right to dignity. It is important that the information be broadcast in the indigenous languages of the tribes so that it may be comprehended.

Focus on Functional and Digital Literacy: An emphasis should be placed on functional literacy, which equips the populace with the skills necessary to enter the market, conduct banking transactions, and navigate government websites. For the purpose of avoiding fraud and gaining access to information in the modern day, digital literacy is also essential.

Empowering Adivasi Women: To bridge the gender gap, the most significant focus should be placed on education for young women. To combat the high rates of females dropping out of school, it is necessary to increase the number of residential schools of the EMRS type, as well as to implement economic incentives and local area mobilisation.

8.2. Strengthening the Justice Delivery System

Legal Aid and Awareness Clinics: Legal aid clinics should be established at the block level in regions that are controlled by tribal communities by the government, in collaboration with non-governmental organizations (NGOs). Not only should these clinics wait for victims, but they should also conduct informational efforts on the PoA Act to raise broad knowledge.

Sensitization of Law Enforcement: The need to provide police officers, administrative officials, and lower-level judges with regular and mandated training in sensitization cannot be overstated. For the purpose of overcoming institutional prejudice, they need to get training on the socio-cultural background of tribal societies as well as the spirit of the powers of attorney act.

Ensuring Accountability: There is a pressing need to remedy the appallingly low conviction rates under the PoA Act. It is vital to take the following actions in order to

complete this process: establishing exclusive special courts in situations where they are required, employing public prosecutors who are committed to their profession, and making certain that investigations and trials are carried out in a timely way. When this is done, there will be an increase in faith in the system, and there will be an encouragement to report.

8.3. Integrating Educational and Economic Empowerment

Effective Implementation of FRA and PESA: Land alienation is the root cause of many varied conflicts. Without authority over their resources, communities cannot benefit from education and awareness efforts. To ensure that tenure rights are secured and Gram Sabhas are granted more authority in decision-making, the government should ensure that FRA and PESA are effectively implemented. Consequently, the root source of vulnerability is reduced.

Livelihood Linkages: Education needs to be linked with livelihood opportunities that are culturally appropriate as well as economically and environmentally sustainable. Because of this, dependence and the risk of exploitation through bonded labor among other ways are minimized.

8.4. Nurturing a supportive social ecosystem

Support for Civil Society: The role of CSOs, or civil society organizations, and social movements taken up by the Adivasi groups is very significant in bridging the gap that exists between the community and the state. They are also watchful, besides providing legal assistance and mobilising people. These should not be perceived as an enemy by the government but rather perceived as a partner.

Public Dialogue and Combating Prejudice: Violence against STs reflects discrimination in society. The country needs a debate on the false ideas perpetuated about Adivasis, their culture, and their rights. Schools and the media need to push this.

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