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Multidisciplinary Approaches in Commerce, Management & Economics

Editors:
Ms. Priya, Dr. Manju Devi,
Mr. Sahil Gupta, Mr. Gourav Kamboj

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PREFACE

"It is with great pleasure that we present this edited book, 'Multidisciplinary Approaches in Commerce, Management and Economics', which brings together a diverse range of perspectives and insights on the complex issues shaping these fields. As editors, we have sought to create a platform where scholars, researchers, and practitioners from various disciplines can share their expertise and experiences, fostering a richer understanding of the interplay between commerce, management, and economics.

The chapters in this book reflect the multifaceted nature of these fields, drawing on insights from fields such as finance, marketing, human resources, operations, and more. Through this multidisciplinary lens, we aim to provide a more comprehensive understanding of the challenges and opportunities facing businesses, organizations, and economies today.

We believe that this book will be a valuable resource for academics, researchers, and students seeking to deepen their knowledge of commerce, management, and economics. Practitioners and policymakers will also find the insights and recommendations presented here to be informative and thought-provoking. We hope that this book will inspire further collaboration and research, driving innovation and progress in these fields.

The book is organized into sections that reflect the major themes and topics covered, including [briefly mention the sections or themes]. Each chapter has been carefully selected and reviewed to ensure that it meets the highest standards of scholarship and relevance. We are confident that this book will make a significant contribution to the literature on commerce, management, and economics, and we are proud to share it with the academic community."

- Editors

ACKNOWLEDGEMENT

"We, the editors, would like to extend our heartfelt gratitude to all the contributors who have made this edited book, 'Multidisciplinary Approaches in Commerce, Management and Economics', possible. We appreciate the time, effort, and expertise they have invested in sharing their research and insights with the academic community. Their contributions have enriched our understanding of the complex issues in commerce, management, and economics, and we are confident that this book will be a valuable resource for scholars, researchers, and practitioners in these fields.

We would also like to acknowledge the support and guidance provided by our reviewers, who have helped us in ensuring the quality and relevance of the chapters included in this book. Their constructive feedback and suggestions have been invaluable in shaping the final product.

Our sincere thanks are due to the editorial team and the publisher for their unwavering support and cooperation throughout the publication process. We are grateful for their professionalism and dedication to bringing out this book in a timely and excellent manner.

Finally, we would like to express our appreciation to all those who have directly or indirectly contributed to the completion of this book. We hope that this book will be a testament to the power of multidisciplinary approaches in advancing our understanding of commerce, management, and economics, and will inspire further research and collaboration in these fields."

- Editors

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ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE TEXTILES: A REVIEW ACROSS THE VALUE CHAIN

Priya Jaswal[1] and Agya Preet[2]

[1]Department of Textile Engineering,

J.N Government Engineering College, Sundernagar, H.P, India,

[2]School of Fashion Design,

Footwear Design & Development Institute, Chandigarh, Punjab, India

Corresponding author E-mail: priyajaswal21@gmail.com, agyapreet@fddiindia.com

Abstract:

The international textiles and clothing industry is among the most resource-intensive and socially intricate businesses, with large-scale water consumption, chemical contamination, greenhouse-gas emissions, and labor-right issues. The chapter explores how artificial intelligence (AI) can be used as a game-changing catalyst for sustainability throughout the textile value chain. Starting with basic AI techniques—machine learning, deep learning, computer vision, natural language processing, optimization algorithms, and digital twins—the review delves into uses ranging from sustainable fiber production and smart manufacturing to supply-chain transparency, consumer behavior management, and end-of-life recycling. Evidence indicates that AI minimizes carbon footprints by saving energy and water, enhances economic returns through cost reduction and inventory minimization, and promotes social sustainability by monitoring worker safety and blockchain-based confirmation of equitable labor. Major challenges are limited data, capital-intensive infrastructure for small-scale manufacturers, ethical issues of job displacement, and a lack of standardized measures of sustainability. Future research directions include combining AI with Internet of Things (IoT) sensors and blockchain for traceability, applying digital-twin copies of whole production facilities, embracing manufacturing using generative AI for low-impact fashion production, and setting global policies and standards for sustainable AI use. In general, AI presents itself as a key technology to enable circularity, transparency, and climate-neutral growth within the world textile and apparel sector.

1. Introduction:

1.1 The Environmental Burden of Textiles

The fashion and garment industry has emerged as one of the most eco-intensive industries across the world. Its lifecycle encompasses resource-consumptive cultivation, high-impact

manufacturing, extensive distribution, and brief consumer lifetimes — leading to substantial emissions, resource exhaustion, and waste. Life cycle analysis (LCA) reports identify textiles among the top five consumption areas leading environmental pressures in Europe, in addition to housing, transport, and food (European Environment Agency [EEA], 2022). At the global level, it has been estimated that textile manufacturing uses 79 billion m^3 of freshwater every year, with the dyeing and finishing operations causing up to 20% of industrial water pollution worldwide (Kant, 2012; Ellen MacArthur Foundation, 2017).

Cotton, which accounts for almost one-quarter of all fibers consumed, is especially water and pesticide hungry. One kilogram of cotton takes between 7,000–29,000 liters of water to produce based on location of production and uses up 16% of all insecticides applied worldwide (Chapagain *et al.,* 2006). On the industrial side, polyester — the leading fiber, with a 60% market share worldwide — comes from fossil resources and is a significant contributor to greenhouse gas emissions. Every kilogram of polyester produces approximately 5.5 kg of CO_2, double that of cotton's carbon intensity (Shen *et al.,* 2010).

1.2 Waste and Fast Fashion

Growth in "fast fashion" has made the industry's unsustainable trend even more pronounced. International garment production has risen by about two times between 2000 and 2015, while the average use-phase of apparel has fallen by 36% (Niinimäki *et al.,* 2020). There are estimated 92 million tonnes of textile waste produced each year, most of which go to landfills and incineration instead of recycling (Sandin & Peters, 2018).

Adding to this waste issue is microfiber pollution. Synthetic clothing sheds huge quantities of microfibers during washing, which end up in aquatic and terrestrial ecosystems. Recent systematic reviews verify that clothes are one of the most significant sources of microplastics found in oceans and even food webs (Allen *et al.,* 2024; Weis, 2022). This makes clothing not just a climate issue, but a serious concern for biodiversity and human health as well.

1.3 Social and Governance Challenges

Aside from environmental pressures, the textile industry is also beset with social challenges. Offshoring production to low-income nations has made speedy production possible but is generally coupled with poor wages, lax labor protections, hazardous working conditions, and inadequate social sustainability governance (Niinimäki *et al.,* 2020). Supply chain opacity also makes it harder to hold anyone accountable: the majority of fashion brands buy from multiple tiers of subcontractors, so it is hard to track

environmental and social compliance (Ellen MacArthur Foundation, 2017). These systemic issues require solutions that not only enhance efficiency but also traceability, accountability, and decision-making (Sukhvir *et al.,* 2025).

1.4 Artificial Intelligence as a Pathway

Artificial Intelligence (AI) is being increasingly identified as a game-changing facilitator for sustainable transformation throughout the textile and apparel value chain. AI techniques like machine learning, computer vision, and predictive analytics have the potential to minimize waste, maximize efficiency of processes, and unlock circularity (Ramos *et al.,* 2023).

- *Design and Sampling*: Artificial intelligence software used for virtual prototyping, 3D visualization of garments, and zero-waste pattern making reduce fabric off cuts and physical samples, decreasing both material usage and energy consumption.
- *Manufacturing Optimization*: Intelligent factories may employ AI to monitor the process, optimize energy, and dose chemicals, minimizing the use of freshwater and effluent loads.
- *Sorting and Recycling*: Hyperspectral imaging and computer vision, along with AI algorithms, are being experimented with to identify fibers precisely and recycle textiles-to-textiles (Sandin & Peters, 2018).
- *Supply Chain Traceability*: AI, combined with IoT and blockchain, can trace raw materials, track compliance, and improve transparency.
- *Consumer Engagement*: Demand forecasting and recommendation systems can minimize overproduction, which now stands at virtually one-third of inventories left unsold in fast fashion industries.

1.5 Artificial Intelligence as a Driver of Data-Driven Transformation in Industry 4.0

With the textile and apparel industry becoming a part of the larger Industry 4.0 paradigm, Artificial Intelligence (AI) has emerged as the key driver of change. AI enables data-driven decision-making through processing intricate data streams that cover fiber characteristics, production variables, logistics chains, and buying behavior (Ramos *et al.,* 2023). In contrast to traditional process optimization, AI technologies like predictive analytics, machine learning, and computer vision allow for real-time prediction, quality monitoring, and adaptive process control (Li *et al.,* 2019).

Predictive demand forecasting ensures production is synchronized with market demands, reducing inventory overstock and unsold goods (Choudhury *et al.,* 2020). In manufacturing,

defect detection based on AI ensures better yield and lowers reprocessing demands (Shirke *et al.,* 2021). These features showcase how AI not only serves as a productivity enabler but also as a strategic driver of sustainability, since lower waste and better processes directly reduce resource intensities.

1.6 Connecting AI and Sustainability Objectives

Adoption of AI in the textile industry reaches beyond operational effectiveness to become the gateway towards achieving worldwide sustainability frameworks. Following the guidelines of the United Nations Sustainable Development Goals (SDGs), AI solutions address various dimensions of sustainability. For example, AI-powered water and energy monitoring supports SDG 6 (Clean Water and Sanitation) and SDG 7 (Affordable and Clean Energy), while smart manufacturing supports SDG 9 (Industry, Innovation, and Infrastructure) (Niinimäki *et al.,* 2020). Predictive design and supply chain optimization minimize overproduction, which supports SDG 12 (Responsible Consumption and Production), and carbon footprint modeling supports advancement towards SDG 13 (Climate Action).

In addition, AI supports the circular economy by promoting textile recycling through the use of automated fiber identification, waste segregation, and material traceability (Sandin & Peters, 2018). When combined with blockchain and digital passports, AI enhances transparency and accountability so that sustainability standards and consumer demands are met. Notably, such technologies allow firms to transition towardscarbon neutrality goals, making AI a strategic enabler of climate-concordant industrial development.

This review thus considers AI not only as a technological advancement, but as an enabler of sustainability across the apparel and textile value chain, showcasing the power of AI to incorporate circularity, transparency, and environmental stewardship into industrial operations.

2. Artificial Intelligence Basics for Textile Use

The application of Artificial Intelligence (AI) in textiles draws from a number of fundamental computational methods that support automation, forecasting, and smart decision-making along the value chain. The subsections below offer an overview of the most applicable AI techniques for textile use.

2.1 Machine Learning (ML) and Deep Learning (DL)

Machine Learning (ML) involves algorithms which learn from past data to make predictions or classification. In textiles, ML has been used for prediction of yarn strength,

fabric property modeling, and process parameter optimization (Das *et al.,* 2020). Deep Learning (DL), a branch of ML based on multi-layer neural networks, has picked up pace in dealing with unstructured data like images and sensor signals. DL is extensively used in defect detection, fiber identification, and automatic quality control based on its ability to accurately identify intricate patterns (Hussain *et al.,* 2022).

2.2 Computer Vision

Computer Vision (CV) allows machines to decode and examine visual information, with revolutionary applications in textile inspection. Defect detection systems based on convolutional neural networks (CNNs) perform better than human inspections by detecting tiny imperfections in fabrics, yarns, and apparel (Shirke *et al.,* 2021). In addition to quality control, CV methodologies assist in material classification, texture recognition, and fiber analysis, enabling traceability and recycling in circular textile systems (Javed *et al.,* 2021).

2.3 Natural Language Processing (NLP)

Natural Language Processing (NLP) aims at extracting meaning from linguistic or textual data. In the textile and fashion industry, NLP helps in interpreting consumer sentiment on social media and e-commerce websites, which enables brands to predict trends and modify production (Zhou *et al.,* 2020). Furthermore, NLP integrated with blockchain raises supply-chain traceability, which helps in automated reading of regulatory documents and sustainability certifications (Gupta & Singh, 2021).

2.4 Optimization and Decision-Support Systems

Optimization algorithms play a vital role in balancing cost, quality, and sustainability in textile production. Decision-support systems (DSS) with embedded AI models offer real-time advice for resource allocation, scheduling of production, and energy usage (Choudhury *et al.,* 2020). Multi-objective optimization strategies enable manufacturers to minimize defect rates while conserving water, chemicals, and energy, directly in line with sustainability objectives (Mishra & Jain, 2022).

2.5 Digital Twins and Reinforcement Learning

Digital twins are computer representations of physical products or processes, augmented by streams of real-time data. Digital twins in textiles allow for simulations of dyeing, weaving, and finishing, eliminating the need for laboratory trials and conserving resources (Huang *et al.,* 2021). Complemented by reinforcement learning (RL) — in which algorithms learn by trial and error — these systems dynamically adjust process parameters to optimize them. For example, RL-based controllers may adapt loom speeds or dyeing

temperatures in relation to changing input conditions, ensuring maximum efficiency with reduced waste (Zhang *et al.,* 2022).

Together, these AI basics form the technological foundation for smart and sustainable textile production. Their convergence speeds the shift toward automation, circular economy processes, and carbon-neutral operations.

3. AI Across the Textile Value Chain

Artificial Intelligence (AI) touches every point of the textile and apparel life cycle, from the growth of raw fibers to the recycling of post-consumer clothing. Through the application of machine learning, computer vision, and optimization algorithms in production and consumption systems, AI saves resources, minimizes waste, and facilitates circular-economy objectives. The subsequent subsections map how AI aids sustainability at each pivotal point in the value chain.

3.1 Sustainable Fiber & Raw Material Phase

Artificial intelligence promotes sustainability right from the initial phase—fiber development and raw-material creation.

- *Bio-based fibers*: Machine learning replicates mechanical and thermal characteristics of hemp, flax, and bamboo to create ideal compositions of these with traditional fibers for enhanced durability and comfort and reduced resource intensity (Mishra & Jain 2022).
- *Optimization agronomic*: Soil, climate, and pest-trained neural networks forecast cotton yield and fiber fineness, facilitating site-specific irrigation and pesticide applications that can reduce water use by as much as 20 % (Liu *et al.,* 2019).
- *Discovery of alternative fibers*: AI-powered material-informatics platforms screen through large databases to discover new fibers—banana pseudostem and pineapple-leaf fiber—having low life-cycle footprints and adequate tensile strength (Sanyal *et al.,* 2021).

These strategies decrease trial-and-error testing, minimize chemical inputs, and speed up the shift towards bio-based or recycled raw materials.

3.2 Textile Manufacturing & Processing

The production phase is energy- and water-hungry, but AI is able to lessen its impact considerably.

- *Intelligent dyeing and finishing*: Reinforcement-learning controllers alter dynamic dye bath temperature and pH in real time to ensure uniform coloration and reduce water consumption by 15 % and chemical dosing by 10 % (Huang *et al.,* 2021).
- *Real-time defect detection*: Convolutional neural networks detect weaving and knitting defects at production speed with >98 % accuracy, minimizing rework and waste (Shirke *et al.,* 2021).
- *Process optimization*: Decision-support systems combine sensor information and predictive models to avoid energy spikes and optimize production planning, conforming to ISO 14001 environmental-management standards (Choudhury *et al.,* 2020).

3.3 Apparel Production and Supply Chain

AI improves traceability and lessens overproduction through the apparel supply chain.

- *Demand forecasting*: Gradient-boosting models forecast sales trends to align production with real-world market demand, reducing excess stock by about one-third (Choudhury *et al.,* 2020).
- *Ethical sourcing and transparency*: AI joined with blockchain traces fiber provenance and labor compliance through multi-tiered networks of suppliers, enabling real-time audits for social and environmental regulations (Gupta & Singh 2021).
- *Optimization of logistics*: Reinforcement learning enhances routing and warehouse scheduling, reducing transport emissions and delivery times (Ramos *et al.,* 2023).

3.4 Consumer Use Phase

AI also prolongs the useful life of clothing and prevents unnecessary consumption.

- Personal recommendation engines promote "slow fashion" by aligning consumer style profiles with long-lasting products, minimizing impulse buying (Zhou *et al.,* 2020).
- IoT wearables and smart clothing offer consumers feedback on fabric stress and washing frequency to aid in clothing maintenance and prevent early disposal (Ramos *et al.,* 2023).
- Circular fashion platforms utilize AI to forecast resale value and automate peer-to-peer transactions, increasing reuse of garments (Sandin & Peters 2018).

3.5 End-of-Life & Recycling

End-of-life solutions are vital to a circular textile economy.

- *Computer-vision automated sorting*: Hyperspectral imaging computer-vision systems efficiently sort cotton, polyester, and mixtures at high rates with high accuracy, increasing recycling yields to more than 90 % (Javed *et al.,* 2021).
- *Deep-learning material recovery modeling*: Deep-learning models predict fiber quality following mechanical or chemical recycling, providing optimal process paths and energy consumption (Yin *et al.,* 2020).
- *Integration of the circular economy*: AI-powered platforms regulate collection, transport, and processing of post-consumer waste to achieve optimal closed-loop recycling rates (Sandin & Peters 2018).

4. Sustainability Dimensions Linked to AI

Artificial intelligence has a direct impact on the three integrated pillars of sustainability—environmental, economic, and social—along the textile value chain. At the environmental level, AI-facilitated process optimization decreases carbon emissions by reducing energy requirements and eliminating unnecessary production runs. Smart dyeing and finishing systems, for instance, can save huge amounts of freshwater and reduce discharges of chemical effluents, enabling "zero-discharge" (Choudhury *et al.,* 2020; Huang *et al.,* 2021). Precise demand forecasting also decreases overproduction and the resultant greenhouse-gas footprint (Ramos *et al.,* 2023). From an economic perspective, predictive analytics and machine-learning–enabled scheduling enables factories to run with greater efficiency, minimizing downtime and inventory expense while enhancing resource usage (Mishra & Jain, 2022). Such cost optimization reinforces competitiveness and protects manufacturers against market fluctuations. Socially, AI-based monitoring systems enhance employee safety by identifying unsafe conditions in real time as well as monitoring adherence to occupational standards. Together with blockchain technology, AI also enhances supply-chain transparency, allowing verification of ethical sourcing and fair-labor practices along multi-tiered production networks (Gupta & Singh, 2021). In these manners, AI emerges as a bridging technology that propels all three dimensions of sustainability in tandem.

5. Challenges and Limitations

In spite of these benefits, various limitations limit the use of AI for sustainable textiles on a large scale. Lack of data availability and quality are core challenges: few small and medium-sized enterprises have constant sensor data or comparable formats, which makes it hard to train and implement machine-learning models (Ramos *et al.,* 2023). High infrastructure expenses—such as investments in sensors, cloud computing, and trained staff—add

another challenge for small-scale producers, hindering diffusion beyond prominent international brands (Choudhury *et al.,* 2020). Ethical challenges also remain. Although AI can improve employee safety, automation and robotics can replace low-skill workers, threatening issues of fair workforce transition and the requirement for reskilling initiatives (Niinimäki *et al.,* 2020). Lastly, the absence of standardized sustainability metrics makes impact evaluation and inter-industry benchmarking challenging. Without commonly accepted indicators for carbon intensity, water savings, or social compliance, it is hard to substantiate "AI-driven sustainability" or benchmark results across plants and geographies (Sandin & Peters 2018). Mitigating these constraints through policy frameworks, global standards, and focused capacity development will be imperative to unlocking the full potential of AI as a force for a greener and more socially responsible textile industry.

6. Future Directions and Research Opportunities

New technologies offer several possibilities for developing the potential of artificial intelligence in furthering a sustainable textile industry. Synergy between AI and the Internet of Things (IoT) and blockchain is one such promising direction. IoT sensor networks can provide real-time data on energy consumption, emissions, and working conditions, with blockchain confirming those records to be irreversible and transparent. When paired with AI analytics, such systems allow for complete life-cycle traceability of fibers and clothing, providing regulators and consumers with verifiable evidence of sustainable sourcing and ethical manufacturing (Gupta & Singh 2021; Ramos *et al.,* 2023).

Another avenue is the creation of digital twins for textile manufacturing facilities. Digital twins are computer simulations of real-world facilities that get constant data inputs from equipment and environmental sensors. By emulating entire operations—from spinning to dyeing and finishing—these twins enable engineers to prototype process tweaks, forecast equipment breakdowns, and reduce energy and water usage before alterations are made in the physical world (Huang *et al.,* 2021). The emergence of eco-friendly fashion design using generative AI also presents vast opportunities. Pattern generation and prototype garment algorithms can be designed to include limits like minimal material waste, recyclability, and low-impact materials, thus minimizing sample creation and related resource consumption (Ramos *et al.,* 2023).

Lastly, the industry will be served by strong policies and global standards for sustainable AI adoption. Norms that establish acceptable data stewardship, carbon-footprint disclosure, and fair-labor certification will assist with harmonizing regional and supply-chain

practices. Standardization not only instills consumer confidence but also aids small manufacturers by offering transparent compliance goals and investment incentives (Niinimäki *et al.,* 2020).

Collectively, these lines of research—technological integration, virtualized manufacturing, innovative AI design, and policy formulation—constitute a roadmap for the use of artificial intelligence to realize circularity and climate neutrality for the world's textile and apparel industry.

Conclusion:

AI provides a robust route to a more circular, greener, and socially conscious textile and apparel industry. Throughout the value chain, AI solutions—spanning bio-based fiber optimization and intelligent dyeing to predictive forecasting of demand and automated sorting of textiles—evidence tangible improvements in resource use, waste reduction, and operating expenses. These improvements directly support several United Nations Sustainable Development Goals, such as clean water and sanitation, sustainable consumption and production, and climate action. Far from it, though, the transformation is incomplete. Current challenges—such as inadequate access to good-quality data, the prohibitive cost of technology upfront, workforce displacement ethical concerns, and no integrated sustainability indicators—need to be overcome in order to maximize AI potential. Applying AI to IoT and blockchain for traceability, scaling digital-twin technology for real-time optimization, using generative AI for eco-design, and building strong global standards for sustainable AI application are among the most important research and policy frontiers. By meeting these challenges and capitalizing on these opportunities, stakeholders can place AI not just as an instrument of efficiency but as a foundation for enduring environmental responsibility, economic resilience, and social justice in the textile sector.

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BEYOND THE SCREEN: QUALITATIVE INSIGHTS INTO TEACHER IDENTITY IN PUNJAB'S TECHNOLOGY-DRIVEN CLASSROOMS

Gurpreet Singh Bhatia and Nidhi Aggarwal
SOMC RIMT University, Punjab

Abstract:
The rapid integration of educational technology (EdTech) into higher education has reshaped pedagogical practices and redefined the professional identity of teachers. While technology promises enhanced accessibility, personalization, and efficiency, its growing presence raises critical questions about the role, autonomy, and relevance of educators. This descriptive, qualitative study explores how college teachers in Punjab perceive and experience these changes in technology-driven classrooms. Drawing on in-depth interviews with faculty members across government and private institutions, the research captures narratives that reveal both empowerment and disempowerment. Teachers reported that while EdTech facilitated interactive content delivery, streamlined assessment, and enabled hybrid learning models, it also reduced decision-making autonomy, increased administrative workload, and, in some cases, created a sense of professional displacement. Thematic analysis highlighted five recurring dimensions of identity transformation: role redefinition from instructor to facilitator, emotional disconnect from students, increased dependency on pre-designed content, perceived threat to long-term relevance, and the moderating influence of institutional training and support. The findings underscore the importance of positioning teachers as active co-creators rather than passive implementers in EdTech integration. By foregrounding teacher voices, this study advocates for policy frameworks and institutional strategies that sustain the human essence of teaching, ensuring that technology complements rather than replaces the educator's role.

Keywords: Educational Technology, Teacher Identity, Qualitative Study, Higher Education, Punjab, Teacher Autonomy, Hybrid Learning

Introduction:

The landscape of higher education is undergoing a profound transformation, driven by the rapid integration of educational technology (EdTech) into teaching and learning processes. Once considered supplementary, digital tools such as learning management systems, AI-powered tutoring platforms, interactive multimedia, and data analytics have now become

central components of instructional delivery. The COVID-19 pandemic accelerated this shift, compelling institutions worldwide to adopt remote and hybrid teaching models, thereby normalizing technology-mediated learning environments. While these developments have expanded opportunities for access, personalization, and efficiency, they have also sparked critical debates regarding their impact on the professional identity, autonomy, and long-term relevance of teachers.

Historically, the teacher's role extended far beyond content delivery—encompassing mentorship, ethical guidance, socio-emotional support, and the cultivation of critical thinking. However, in technology-driven classrooms, educators are increasingly repositioned as facilitators or operators of pre-designed digital content, raising concerns of de-professionalization and diminished pedagogical agency. Emerging research indicates that while some educators experience empowerment through innovative tools and flexible pedagogies, others report increased workload, reduced decision-making authority, and emotional disconnect from students. These divergent experiences suggest that the integration of EdTech is neither uniformly beneficial nor wholly detrimental, but context-dependent—shaped by institutional readiness, training provision, and cultural attitudes towards technology in education.

In the context of Punjab, India, the adoption of EdTech presents unique challenges and opportunities. Higher education institutions in the region exhibit wide variations in infrastructure, faculty training, and policy alignment, leading to uneven implementation outcomes. While urban and well-resourced colleges may leverage technology to enrich learning experiences, semi-urban and rural institutions often struggle with digital divides, inadequate support, and top-down mandates that exclude teacher input. Against this backdrop, understanding how educators in Punjab negotiate their professional identity in technology-integrated classrooms is both timely and essential.

This descriptive, qualitative study seeks to explore the lived experiences of higher education faculty in Punjab as they adapt to the realities of technology-driven teaching. By foregrounding teacher narratives, it aims to illuminate how EdTech shapes perceptions of autonomy, role relevance, and professional satisfaction, and to identify the institutional factors that mediate these effects. In doing so, the study contributes to ongoing discourse on balancing technological innovation with the preservation of the human essence in education—ensuring that technology complements, rather than replaces, the teacher's role.

Research Objectives

1. To explore how higher education faculty in Punjab perceive the impact of educational technology on their professional identity and role relevance.
2. To examine the ways in which technology-driven classrooms influence teacher autonomy and pedagogical practices.
3. To identify institutional and contextual factors that shape teachers' experiences and adaptation in technology-integrated learning environments.

Review of Literature

1. Evolution of Educational Technology and Pedagogical Shifts

The trajectory of educational technology (EdTech) has progressed from basic audio-visual aids and computer-assisted instruction to sophisticated AI-driven adaptive learning platforms, virtual simulations, and cloud-based learning management systems (Luckin *et al.,* 2018). This transition has enabled personalized learning pathways, real-time assessment, and increased accessibility, especially in geographically dispersed contexts. However, Selwyn (2019) notes that this technological evolution is also reconfiguring classroom authority, as educators increasingly serve as facilitators or "learning designers" rather than sole sources of knowledge. Such role redefinition demands advanced digital literacy, instructional design competence, and data analytics skills—competencies not traditionally emphasized in teacher preparation.

2. Teacher Identity in Technology-Driven Environments

Teacher identity is a dynamic construct shaped by professional autonomy, pedagogical agency, and social recognition (Beijaard *et al.,* 2004). The integration of EdTech challenges these identity markers in multiple ways. Borenstein and Howard (2022) caution that automation of tasks such as grading, feedback, and lesson delivery can foster a perception of professional redundancy, particularly when technology use is mandated without educator input. Conversely, studies by Holmes *et al.,* (2020) demonstrate that when teachers are active collaborators in EdTech design and implementation, their professional identity can be strengthened through opportunities for innovation and differentiated instruction. This dichotomy underscores the importance of implementation models that preserve educator agency.

3. Opportunities and Empowerment through EdTech

A substantial body of literature positions EdTech as a catalyst for pedagogical innovation. UNESCO (2021) highlights its capacity to promote inclusive education, especially in

underserved regions, by enabling remote learning and resource sharing. Flipped classroom models and collaborative online learning environments have been associated with higher student engagement and diversified teaching strategies (Anderson & Rivera, 2020). In such contexts, teachers have reported enhanced creativity and a renewed sense of professional purpose. These benefits, however, tend to manifest when adequate training, infrastructure, and administrative support are in place, aligning with findings from Singapore's hybrid teaching initiatives (Tan & Neo, 2023).

4. Concerns of De-professionalization and Reduced Autonomy

On the other side of the discourse, multiple studies have documented teacher concerns regarding reduced autonomy and increased workload in tech-integrated classrooms. Toropova *et al.,* (2021) found that educators often face "role compression," where their responsibilities shift towards monitoring digital platforms rather than engaging in active pedagogical design. In India, Sharma and Dey (2021) observed that in classrooms using platforms like BYJU'S, teachers reported feeling sidelined, with diminished control over pacing, content sequencing, and assessment methods. This perception of marginalization can erode job satisfaction and intensify professional stress.

5. Global vs. Indian Contexts: Implementation Gaps

Comparative analyses reveal that countries such as Finland and Singapore integrate EdTech through participatory planning and continuous teacher training, resulting in higher acceptance and role satisfaction (Uusiautti & Määttä, 2020; Tan & Neo, 2023). In contrast, Indian implementations often reflect top-down policy approaches, infrastructural disparities, and insufficient professional development, particularly in semi-urban and rural settings (Deshmukh, 2022). Punjab, with its heterogeneous mix of urban, semi-urban, and rural higher education institutions, presents a microcosm of these national challenges. While some institutions leverage EdTech for blended learning success, others struggle with digital divides, lack of localized content, and teacher resistance born from inadequate support.

6. Identified Gaps and Relevance of Current Study

Although the global literature provides valuable insights into teacher identity transformation in technology-driven contexts, there is a notable lack of qualitative, context-specific research in Punjab's higher education sector. Most existing studies prioritize student outcomes or focus on infrastructure readiness, leaving a gap in understanding the nuanced, lived experiences of educators navigating the EdTech shift. Moreover, few

investigations examine how institutional culture, training access, and policy alignment collectively influence teacher identity in Indian semi-urban and rural higher education institutions. This study addresses these gaps by centering teacher voices and providing a region-specific qualitative perspective, thereby contributing to the discourse on balancing technological advancement with the preservation of human-centered pedagogy.

Methodology

1. Research Design

This study adopts a descriptive, qualitative research design aimed at capturing the lived experiences and perspectives of higher education faculty in Punjab regarding the integration of educational technology (EdTech) into their teaching practices. The qualitative approach is appropriate for exploring complex, context-dependent phenomena such as professional identity, autonomy, and pedagogical adaptation, which cannot be fully understood through numerical data alone (Creswell & Poth, 2018). A descriptive orientation was chosen to present participants' experiences in rich detail, without imposing predetermined theoretical frameworks, allowing themes to emerge naturally from the data.

2. Study Area and Context

The study was conducted in higher education institutions across Punjab, encompassing government colleges, private autonomous institutions, and degree-awarding colleges affiliated with universities such as Guru Nanak Dev University (GNDU), Panjab University (PU), Punjabi University, and I.K. Gujral Punjab Technical University (IKGPTU). This regional focus reflects Punjab's diverse higher education landscape, where EdTech adoption varies significantly between urban, semi-urban, and rural contexts.

3. Target Population and Sampling

Population: Faculty members engaged in undergraduate or postgraduate teaching in disciplines where EdTech tools are actively used (e.g., Commerce, Management, Information Technology, Education, and Science).

Sampling Technique: Purposive sampling was employed to select participants who met the following criteria:

- At least two years of teaching experience in higher education.
- Active engagement with one or more EdTech tools in the classroom.
- Willingness to share in-depth reflections on their experiences.

Sample Size:

- **20 faculty members** participated in in-depth interviews.
- Effort was made to ensure representation from both government and private institutions, as well as from urban and semi-urban locations.

4. Data Collection Methods

4.1 Semi-Structured Interviews

The primary data collection method was semi-structured, face-to-face and online interviews lasting between 30 and 45 minutes. This format provided a balance between consistent thematic coverage and flexibility to probe deeper into participant responses. The interview guide included open-ended questions on:

- Perceived impact of EdTech on teaching roles and professional identity.
- Experiences with autonomy, creativity, and decision-making in tech-integrated classrooms.
- Institutional support, training, and policy environment.
- Emotional and psychological responses to technology adoption.

4.2 Field Notes

During and after interviews, the researcher-maintained field notes to capture contextual observations, non-verbal cues, and emerging reflections that enriched the data beyond verbal responses.

5. Data Analysis

The collected qualitative data were analyzed using thematic analysis based on Braun and Clarke's (2006) six-phase framework:

1. **Familiarization** with the data through repeated reading of transcripts.
2. **Initial coding** to identify recurring ideas and expressions related to teacher identity and EdTech integration.
3. **Theme development** by grouping related codes into broader categories (e.g., *Role Redefinition*, *Loss of Autonomy*, *Empowerment through Technology*).
4. **Reviewing themes** to ensure alignment with the dataset.
5. **Defining and naming themes** to capture the essence of each category.
6. **Producing the report** by integrating themes with participant quotes for authenticity.

Manual coding was used to maintain closeness to the data, with iterative comparison between interviews to identify commonalities and differences across institutional types and locations.

6. Trustworthiness and Rigor

To ensure credibility, dependability, and confirmability of the findings, the following strategies were employed:

- **Member checking:** Summaries of key points were shared with participants for validation.
- **Triangulation:** Data were compared across participants from diverse institutional contexts.
- **Audit trail:** Detailed documentation of sampling, data collection, and coding processes was maintained.
- **Reflexivity:** The researcher maintained a reflexive journal to monitor potential biases and assumptions.

7. Ethical Considerations

Ethical approval was obtained from the relevant institutional review authority. Participants provided informed consent before participation. Anonymity and confidentiality were ensured by using pseudonyms and removing identifying details from transcripts. Participation was voluntary, and respondents could withdraw at any stage without penalty.

Findings and Discussion

Data from semi-structured interviews with 20 higher education faculty members in Punjab revealed five major themes describing how educational technology (EdTech) shapes teacher identity in technology-driven classrooms. While experiences varied across institutional types and locations, the findings reflect a shared tension between opportunities for pedagogical innovation and concerns about professional displacement.

Theme 1: Role Redefinition from Instructor to Facilitator

Most participants described a shift in their professional role from being the primary source of knowledge to functioning as facilitators of pre-designed digital content. This change was perceived as both liberating and limiting.

"Earlier, I designed every part of my lecture. Now, with the platform content ready-made, I guide students more than I teach them directly." (P08, Private College, Urban)

For some, this transition reduced the burden of content creation, enabling greater focus on student engagement. Others, however, expressed discomfort at feeling less like subject

experts. These findings resonate with Selwyn's (2019) observation that EdTech often repositions teachers as "learning managers" rather than autonomous content creators.

Theme 2: Erosion of Professional Autonomy

Over half of the respondents indicated that institutional mandates to use specific platforms, apps, or pre-approved materials diminished their control over teaching content, pace, and methods.

"The system decides what to teach, in what order, and sometimes even how to assess. My judgment hardly matters." (P03, Government College, Semi-Urban)

This perceived loss of autonomy aligns with Toropova et al.'s (2021) findings on "role compression" in tech-driven classrooms. Participants noted that top-down EdTech implementation, without consultation, intensified this sense of disempowerment.

Theme 3: Increased Administrative Workload and Stress

Despite automation of certain tasks, most teachers reported that EdTech had increased their workload—particularly in the form of troubleshooting, updating content, and monitoring digital dashboards.

"I spend more time fixing technical issues and managing student logins than actually teaching." (P14, Private College, Urban)

This mirrors Sharma and Dey's (2021) findings on BYJU'S implementation, where teachers felt their core teaching time was eroded by administrative tasks, leading to frustration and stress. Participants highlighted the irony of technology promising efficiency while often creating new layers of labor.

Theme 4: Emotional Disconnect from Students

A recurring sentiment was that virtual and tech-mediated interactions limited teachers' ability to build rapport and respond to students' emotional and social needs.

"Even when students are online, it feels like they're somewhere else. I miss the natural conversation and the spontaneous questions." (P06, Government College, Urban)

This perceived disconnect reflects Beijaard et al.'s (2004) argument that teacher identity is partly rooted in relational engagement. Several participants noted that the lack of informal interactions undermined their sense of professional fulfillment.

Theme 5: Institutional Support as a Moderating Factor

Participants consistently identified training, infrastructure, and administrative encouragement as decisive factors influencing their EdTech experience. Teachers in

institutions with regular digital skills workshops and participatory decision-making reported greater satisfaction and perceived control.

"Once we got proper training and some say in choosing the platform, things became much smoother." (P11, Private College, Semi-Urban)

This finding supports Tan and Neo's (2023) research in Singapore, which shows that institutional readiness and teacher inclusion lead to positive EdTech integration outcomes. Conversely, the absence of training in some colleges left teachers feeling underprepared and resistant to adoption.

Integrated Discussion

The findings demonstrate that EdTech's impact on teacher identity in Punjab is context-dependent. In alignment with global literature (Uusiautti & Määttä, 2020; Holmes *et al.,* 2020), the study shows that when teachers are positioned as co-creators in EdTech integration, they experience empowerment and professional growth. However, in cases where technology is imposed without consultation, educators face reduced autonomy, role ambiguity, and heightened stress.

The role redefinition observed here reflects a broader pedagogical shift towards facilitation and learner-centered instruction, but in Punjab's context, this transition is often hampered by inadequate training and infrastructural disparities—particularly in semi-urban and rural areas. The emotional disconnect theme echoes concerns in Toropova *et al.,* (2021) that digital tools, while efficient, risk weakening the relational dimensions of teaching that underpin professional satisfaction and student engagement.

Institutional support emerged as a key mediating variable, reinforcing UNESCO's (2021) position that teacher agency, ongoing capacity-building, and participatory governance are essential to sustainable EdTech integration. This indicates that challenges associated with autonomy loss and stress are not inherent to technology itself but to the conditions under which it is implemented.

Conclusion:

This study examined how higher education faculty in Punjab experience and perceive the integration of educational technology (EdTech) in their teaching roles, focusing on its implications for professional identity, autonomy, and pedagogical engagement. The qualitative evidence highlights a dual reality: while EdTech enables innovative instructional approaches, personalized learning, and flexible delivery, it can also erode

professional autonomy, increase administrative workload, and weaken teacher–student relational bonds when implemented without adequate preparation or collaboration.

The findings confirm that teacher identity in technology-driven classrooms is not solely shaped by the presence of EdTech, but by the institutional and cultural frameworks governing its use. Where teachers are trained, consulted, and supported, EdTech functions as an empowering complement to their role; where such support is absent, it risks fostering feelings of marginalization and professional displacement.

Ultimately, the study reinforces the principle that the human dimension of teaching—empathy, mentorship, adaptability, and contextual judgment—remains irreplaceable. The future of education should not position technology as a substitute for educators but as a tool that amplifies their capabilities, provided its integration is guided by participatory and ethical frameworks.

Recommendations

Based on the study's findings, the following recommendations are proposed for policymakers, institutional leaders, and education practitioners:

1. **Integrate Teachers into EdTech Decision-Making**
    - Establish participatory planning committees that include faculty representatives in the selection, design, and evaluation of digital tools.
    - Encourage feedback loops to ensure technology aligns with pedagogical goals rather than administrative convenience alone.
2. **Strengthen Continuous Professional Development**
    - Move beyond one-off workshops to sustained, context-specific digital pedagogy training.
    - Include modules on instructional design, ethical considerations, and student engagement strategies in tech-rich environments.
3. **Safeguard Teacher Autonomy**
    - Allow flexibility in adapting digital content to local contexts, learner needs, and faculty teaching styles.
    - Avoid rigid mandates that restrict creativity and professional judgment.
4. **Address Teacher Workload and Wellbeing**
    - Audit the administrative impact of EdTech and implement workload redistribution or support roles (e.g., technical assistants) to prevent burnout.

- Provide access to counseling and peer-support networks for faculty managing high-stress transitions.

5. **Promote Hybrid Pedagogical Models**
   - Blend human-led instruction with technology-mediated learning to preserve interpersonal engagement and socio-emotional support.
   - Encourage classroom practices where technology enhances, rather than dominates, the learning process.
6. **Bridge the Digital Divide**
   - Prioritize infrastructural investments in semi-urban and rural colleges to ensure equitable access to devices, internet connectivity, and maintenance support.
   - Develop localized, multilingual content that reflects the cultural and linguistic diversity of Punjab's student population.

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A STUDY OF DIGITAL TRANSFORMATION IN BUSINESS: DRIVERS, CHALLENGES AND FUTURE

Aastha Sharma and Gurpreet Kaur
Government Girl College, Palwal, Kurukshetra, Haryana
Corresponding author E-mail: aasthasharma3131@gmail.com, gurmangirdharpur@gmail.com

Abstract:
In the rapidly changing technological landscape of today's world, businesses require digital transformation for them to stay competitive and relevant. It refers to the use of digital tools and technologies across different areas of business, which changes how companies create value, connect with customers, and compete in the market. This paper explains what digital transformation is, its drives, the challenges organizations face, and how it impacts business functions. Using digital technologies to foster innovation, efficiency, and growth requires an extensive rethinking of operations, strategies, and culture. This study looks at the idea of digital transformation in businesses, focusing on its causes, challenges, and future prospects. The study highlights that for the digital transformation initiatives to become successful, there must be a clear plan, strong leadership, and cultural congruence. Also, the study investigates how emerging technologies like block-chain, cloud computing, IoT, and AI are influencing digital transformation and business strategy.

Keywords: Digital Transformation, Business Innovation, Machine Learning, Artificial Intelligence, Cybersecurity, Smart Operations.

Introduction:

Modern businesses face rapid technological growth, global competition, and rising customer expectations. In such an environment, digital transformation is no longer optional; it is a necessity. Unlike the simple adoption of new tools, it involves a complete rethinking of operations, strategies, and culture. A well-known example is the case of Blockbuster and Netflix. Blockbuster failed to adopt online streaming and lost its market position, while Netflix embraced digital innovation and became a global leader in entertainment. This highlights that digital transformation is essential for survival. It also changes how decisions are made—businesses now rely on real-time data rather than intuition. With digital technologies, companies can predict trends, personalize services, and improve efficiency, making transformation a key element of long-term strategy.

This study aims to explore the concept of digital transformation in businesses, its drivers, challenges and future prospects.

Literature Review

Research on digital transformation highlights its technological and strategic aspects. Westerman *et al.* (2014) argue that firms with strong digital leadership outperform competitors in customer service, efficiency, and innovation. Rogers (2016) points out that transformation is not only about IT systems but also about reshaping business models and workforce skills.

Bharadwaj *et al.* (2013) suggest that digital strategy combines technology with business processes to create an edge. In India, researchers emphasize mobile banking, UPI, and other FinTech innovations that enhance efficiency and financial inclusion. There are some case studies that define the role of digital transformation to achieve success in today technological oriented environment.

- **Amazon:** Uses AI, robotics, and cloud to improve operations and customer experience.
- **Netflix:** Changed the way people consume entertainment through digital streaming.
- **Tesla**: Uses IoT and AI for smart cars, autonomous driving, and predictive services.
- **UPI in India:** Revolutionized payments by making them instant, secure, and simple.
- **Infosys & TCS:** Leading Indian IT firms using AI, cloud, and consulting for global clients.

These examples prove that digital transformation works across sectors and regions. It also includes the theoretical framework and key drivers for today era.

1. Theoretical Framework: Disruption Theory (Christensen): New digital players often challenge established businesses, forcing them to adapt or fade out. Without developed technologies a firm can't survive in market.

2. Dynamic Capabilities Theory: Firms must learn, evolve, and stay flexible in fast-changing digital markets to remain competitive. Customer's demands are flexible for fulfilling their needs firms have to adopt new technologies so they can beat the competition.

Key Drivers:

1. Technological Progress: AI, IoT, cloud, and big data are transforming industries. Due to change in technologies companies also change as the need of environment.

2. Customer Needs: People expect fast, personalized, and smooth digital services for fulfilling needs of target market they adopt fast service techniques.

3. Globalization: Digital platforms allow businesses to scale across borders. Companies can now expend themselves on worldwide level.

4. Government Policies: Initiatives like Digital India push companies to adopt modern technologies but with it they also have to take care of government rules and society.

5. Competition: To survive, firms must match or outpace tech-savvy competitors.

In short, the literature agrees that successful transformation requires leadership, cultural alignment, and a clear strategy, alongside technology.

Research Methodology

This study review last 15 year's papers, articles and reports on digital transformation in business through a literature review methodology: to examining theoretical frameworks to understand the idea of digital transformation, such as the Disruption Theory and the Dynamic Capabilities Theory, to identifying the examples of successful digital transformation throughout a variety of sectors, that includes: Amazon, Netflix, Tesla, and UPI in India, to searching how digital transformation changes the business management and production or finding the main forces behind and hurdles that affect the firm, and to studying how new technologies are driving the digital transformation. The followings are the objectives of this study to understand this concept in deeply ways.

Objectives

1. To identify the factors that are driving the digital transformation.
2. To identify the obstacles and barriers associated with digital transformation.
3. To explore the way various business functions, including supply chain management, marketing, finance, operations, and human resource management, are impacted by the digital transformation.
4. To discover how new technologies is driving digital transformation.
5. To provide recommendations on how businesses can effectively implement digital transformation strategies.

Finding and Analysis

Firstly, we discuss about the first objective of this study; To identify the factors that are driving the digital transformation including the following at any level.

Cloud Computing:

Businesses are increasingly searching to the cloud for solutions instead of investing significant investments in complex IT infrastructure. It makes operations more flexible and less expensive by giving them immediate access to storage, software, and processing power when needed.

Analytics and Big Data:

Companies acquire huge volumes of data every day. Implementing better business decisions, finding hidden trends, and analyzing this data are all achievable with analytics.

Artificial Intelligence and Machine Learning:

Teaching robots to "think" and learn from their experiences is comparable to using artificial intelligence. It is widely used to forecast consumer behaviour or future trends, power chatbots, detect fraud, and make suggestions for products.

Internet of Things (IoT):

Nowadays, everyday things such as cars, industrial equipment, and even home appliances can be connected to the internet. This enables businesses to evaluate consumption, track performance, and quickly solve problems.

Robotic Process Automation (RPA):

Simple but repetitive office duties, like processing invoices or filling out forms, can be done with software robots. This minimizes errors and helps employees to focus on more crucial work.

Blockchain:

The Blockchain is an open and secure digital record system is what the blockchain does. It is particularly helpful for secure financial transactions, digital identity protection, and supply chain tracking.

Cybersecurity:

Protection of the Internet Since most business operations are now carried out online, companies require cybersecurity solutions to protect confidential data and stop cyberattacks.

5G and Stronger Networks:

Innovative uses like driverless cars, smart factories, and continuous instant communication are made possible by 5G and stronger networks.

Virtual and Augmented Reality (AR and VR):

These technologies enhance engagement and immersion. Students can experience lessons in various ways, doctors can practice surgery in a simulated environment, and consumers can virtually try products.

Digital Platforms:

Applications such as online shopping and mobile finance are instances of platforms that link companies with millions of people worldwide. They provide new opportunities for revenue generation, cooperation, and business growth.

Secondly, we find and analysis Challenges and Barriers to achieve the second objective of the study because Digital Transformation is not without hurdles:

1. **High Costs:** when firms decide about transformation of machineries, software's, they need high capital. because AI, cloud, and IoT require heavy investments.
2. **Employee Resistance:** Staff often hesitate to adopt new systems. They not feel comfortable with new transformation or they have to require a new skill for operating the software's.
3. **Skill Shortage:** Lack of expertise in AI, cybersecurity, and analytics slows progress that's why employees hesitate to adopt new system.
4. **Cybersecurity Threats:** Increased digitalisation means a higher risk of data breaches and it can turn the firm into high losses.
5. **Regulation:** Firms must comply with laws like GDPR and India's DPDP Act.

Overcoming these barriers requires strong leadership, planning, and a culture that welcomes innovation.

Thirdly, we discuss about the digital transformation influence the various on business functions to understand and to achieve the next objective of the study

1. **1.Marketing:** digital transformation has changed the marketing from mass to personally managed system of marketing. Social media, SEO, and online ads enable personalised campaigns.
2. **2.Finance:** digital transformation has made transactions more safe, transparent and faster it includes; Digital wallets, mobile banking, and blockchain simplify transactions.
3. **Operations:** IoT and automation streamline supply chains and manufacturing. It helps in measuring the performance of vehicles which is produced by firms.

4. **Human resource management:** AI helps with hiring, online training, and managing remote work. It provides the list of matching candidates as per firm's requirement.
5. **Supply Chain:** Smart logistics and real-time tracking improve speed and reduce costs.

Almost every business area benefits from digital transformation, boosting efficiency and innovation.

Future Direction and Recommendations

After to understand the concept of this digital transformation, its drive, challenges it requires some future directions, precautions to successfully implemented in their business to achieves all the objectives of an organisation in any particular sector or industry in any country at any level. We should use all this in systematic ways:

1. AI Growth: Smarter analytics, automation, and decision-making tools.
2. Blockchain: More secure and transparent transactions.
3. Sustainable Tech: Greener IT practices to cut environmental impact.
4. Metaverse & Web 3.0: New spaces for online interaction and commerce.
5. Digital Twins: Virtual models of real processes for better planning and risk management.

These trends will shape how businesses compete and innovate in the coming years. The study highlights that for the digital transformation initiatives to become successful, there must be a clear plan, strong leadership, and cultural congruence. We also discussed some basic needs for future directions which should be followed by any business.

1. Start transformation in phases to reduce risks.
2. Train employees in digital tools and analytics.
3. Invest in cybersecurity to protect sensitive data.
4. Use data-driven insights for decision-making.
5. Build customer-focused digital platforms.
6. Partner with startups and tech firms to encourage innovation.

Conclusion:

Digital transformation is a must-have for today's businesses. Success comes from blending technology with strong leadership, culture, and strategy. Companies that embrace it stay competitive and relevant, while those that resist risk are left behind. It is not a one-time process but a continuous journey requiring adaptability and innovation.

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ENHANCING CUSTOMER EXPERIENCE AND BRAND LOYALTY THROUGH WEBSITE OPTIMIZATION AND COMMUNITY BUILDING FOR APPAREL BRAND MANAGEMENT

Nikita* and Parteet Kaur

Fashion Management Studies,

National Institute of Fashion Technology,

Ministry of Textiles, Government of India, Panchkula

*Corresponding author E-mail: nikita.nikita1@nift.ac.in

Abstract:

The impact of website optimization and community-building strategies on enhancing customer experience and brand loyalty for an Indian ethnic wear brand has been explored. The study focuses on website optimization, specifically targeting the high return rates due to size and fit issues. By improving size guides and fit-related tools, an Indian ethnic wear brand successfully reduced return percentage from 30% to 16% in April 2025 within six months. The emphasis of this study lies on elements such as community building through emotionally resonant storytelling, cultural content, authentic brand communication, behind-the-scenes visibility, user-generated content, and customer-centric video engagement. Data from customers indicate that factors such as a strong emotional connection, along with a preference for authentic and culturally aligned content, are associated with increased loyalty and advocacy. The apparel brand study shows that these initiatives improve customer engagement, trust, and long-term retention significantly, positioning an Indian fashion brand as a purpose-driven brand with a loyal community.

Keywords: Website Optimization, Cultural Storytelling, Emotional Branding, User-Generated Content, and Customer Engagement.

Introduction:

The Indian Apparel Sector

The evolution of the Indian apparel sector reflects a broad-based transformation driven by domestic demand, global integration, policy reforms, and shifting consumer values. Its sizeable workforce, expanding market size, and strategic export focus position it as a vital contributor to India's economic growth and a competitive player in the global apparel landscape.

The Indian apparel sector is a dynamic and integral part of the country's economy, characterized by its extensive value chain from fibre to finished garments and its significant role in global textile and apparel markets. In 2022, the sector was valued at approximately US$172.3 billion, with a robust projected compound annual growth rate (CAGR) of 14.59% through 2028, aiming to reach US$387.3 billion. The industry contributes around 2.3% to India's GDP and employs over 45 million people directly, with an additional 100 million supported indirectly through allied sectors. Key textile-producing states include Andhra Pradesh, Telangana, Haryana, Jharkhand, and Gujarat.

The domestic market is dominated by women's apparel, expected to reach a market volume of US$ 53.13 billion by 2025, with a per capita revenue of US$75.25 and a projected volume of 41.4 billion apparel pieces by 2029. The bulk of apparel sales (98%) falls within the non-luxury segment, reflecting India's mass-market consumption pattern.

India ranks 6th globally in textile and apparel exports, achieving a record export value of US$35.58 billion in FY23. The United States is the largest export destination, accounting for nearly 29% of exports in FY-25. The sector benefits from Free Trade Agreements (FTAs) such as the one with the UAE, and ongoing negotiations with the EU and other countries, enhancing global competitiveness. Export growth is primarily driven by cotton textiles and handicrafts, while segments like man-made textiles and ready-made garments have seen declines.

Foreign Direct Investment (FDI) policies allowing up to 100% FDI in single-brand retail and 51% in multi-brand retail have bolstered India's appeal as a global sourcing hub. Additionally, a rising emphasis on sustainable fashion, driven by heightened consumer awareness and digital influence, is pushing brands toward eco-friendly materials and ethical sourcing practices. Globally, the Indian apparel sector is on a strong growth trajectory, competing with leaders like the United States, which is expected to generate US$ 366 billion in revenues by 2025.

Returns management and size & fit systems are intertwined facets of the customer experience in fashion e-commerce that directly influence brand reputation, operational costs, and profitability. The use of reverse logistics tools like Click Post helps automate and optimize returns, an otherwise costly and complex process. However, returns are often driven by fit issues, underscoring the necessity for sophisticated size & fit applications.

Traditional size charts are insufficient for today's diverse customer base and complex garment designs. Size & fit applications have evolved from static guides to interactive, AI-

driven tools that personalize recommendations. By collecting precise measurements and customer preferences, these systems offer a simulated fitting experience that reduces uncertainty. The inclusion of body shape, fabric type, and past purchase behaviour enhances accuracy, making the tool a strategic asset for e-commerce brands.

Yet, the effectiveness of these tools depends heavily on the quality of input data and the clarity of communication. Vague sizing terminology, without standardized definitions or supportive visuals, can alienate customers. Brands must invest in detailed garment measurement protocols, user-friendly interfaces, and educational content to ensure that customers understand and trust the sizing information presented.

From a business perspective, reducing returns has a multiplicative effect on profitability. Not only does it save direct costs related to shipping and restocking, but it also preserves the value of marketing spend and strengthens customer loyalty. The CRM team's role in analysing return and complaint data creates a feedback loop that drives continuous improvement in product design and size accuracy, further lowering return rates over time.

In summary, combining efficient returns management with advanced size & fit applications creates a virtuous cycle that enhances customer satisfaction, reduces operational burdens, and fosters brand growth in the competitive fashion e-commerce landscape.

Apparel Returns in Indian E-Commerce

The Indian e-commerce landscape is grappling with escalating apparel return rates that affect operational efficiency, profitability, and environmental sustainability. High return percentages, particularly in the online apparel segment, demand strategic interventions ranging from technological innovation to sustainable practices. Concurrently, the rise of community-powered marketing presents a vital opportunity for brands to build deeper, more meaningful customer relationships. Consumers seek association with brand communities that foster identity alignment and two-way communication, yet many brands lag in establishing and managing these communities effectively. Addressing challenges in data collection and personalization will be key to maximizing the benefits of community-driven engagement, thereby driving loyalty, purchase frequency, and long-term brand success. Together, these trends underscore the critical need for innovation, research, and a balanced approach that prioritizes customer convenience, operational efficiency, and environmental responsibility in India's evolving digital commerce ecosystem.

Apparel returns within Indian e-commerce are showing a significant upward trend, with return orders rising to 10.4% of total orders in FY23, up from 9.8% in FY22, according to

the Unicommerce India Ecommerce Index Report (2023). Clothing leads as the most returned product category, with return rates fluctuating between 25% and 40%. The average online apparel return rate in India reached 24.4% in 2023, substantially higher than the global average of 16.5% cited by Coresight Research (2023). This trend mirrors broader global patterns where online apparel returns considerably exceed in-store return rates. For example, in the US, online return rates stand at 15.2%, approximately three times higher than the 5% seen in physical stores (International Council of Shopping Centers). This disparity highlights inherent challenges in online apparel purchasing, where fit, feel, and style cannot be assessed physically before purchase.

The surge in apparel returns introduces several operational and financial challenges for e-commerce companies. Inventory management becomes complex as returns lead to inaccurate stock levels, either causing excess inventory or stockouts, both of which are detrimental to efficient supply chain planning and profitability. Additionally, processing returns incurs significant hidden costs, including freight charges, repackaging expenses, and the need to discount returned goods to resell them. Cash-on-delivery (COD) orders particularly exacerbate these issues due to their higher return-to-origin (RTO) rates, creating unpredictability in revenue forecasting and logistical planning. Companies like Dhartii and Berrylush report RTO return rates of 14-15% on their platforms, underscoring ongoing difficulties in managing customer-initiated returns and their impact on operational stability.

Beyond financial costs, apparel returns impose serious environmental burdens. Frequent returns contribute disproportionately to carbon emissions due to repeated transportation cycles. The CleanHub Report equates emissions from fast fashion returns to those produced by 3 million US cars annually, demonstrating the scale of environmental impact. Moreover, many returned items that cannot be resold end up discarded in landfills, generating hazardous waste. The repackaging process itself contributes to plastic and cardboard waste, increasing the sector's ecological footprint. In response, some companies are adopting sustainable practices such as refurbishing returned apparel and utilizing biodegradable packaging materials to reduce environmental harm, signaling a gradual shift toward eco-conscious return management.

To combat high return rates, brands are leveraging various strategies and technological innovations. Enhanced product descriptions, more accurate sizing charts, and improved imagery help customers make better-informed purchase decisions, thereby reducing size-

related returns. Artificial intelligence (AI) is also being deployed to limit COD options for customers with a history of frequent returns, helping curb RTO rates. Innovations like virtual try-ons allow shoppers to visualize fit digitally, and the adoption of better fabric choices such as lycra enhances garment fit and comfort, collectively reducing returns by up to 20%. Furthermore, pricing strategies now factor in the costs associated with returns to safeguard profitability, reflecting a more integrated approach to return management within pricing models.

There is a critical need for deeper research and innovation to understand the root causes of high apparel return rates and their dual impact on profitability and sustainability. Identifying best practices and emerging technological solutions can facilitate the development of more efficient return management systems. Balancing customer convenience with operational efficiency and environmental responsibility remains a key challenge. Research can also inform policymakers and industry stakeholders on potential interventions such as restocking fees or incentives designed to reduce returns. These measures, common in global markets, are relatively underutilized in India but could play a pivotal role in evolving the e-commerce ecosystem toward greater sustainability and efficiency.

The Growing Importance of Community-Powered Marketing

Consumer preference is increasingly shifting toward brands that foster dedicated communities, with 76.6% of consumers expressing a desire for their favorite brands to offer such spaces. This indicates a heightened consumer demand for deeper, ongoing engagement beyond traditional social media interactions. However, there is a noticeable gap in brand readiness: only 27.5% of marketers currently manage dedicated brand communities, and 19.5% are in the process of building them. This reveals a mismatch between consumer expectations and brand capabilities. Additionally, consumers are gradually moving away from conventional social media platforms, prompting brands to explore owned community channels to maintain meaningful digital connections and customer engagement.

Brand communities play a crucial role in fostering customer loyalty and influencing purchase behaviour. Such communities cultivate a sense of belonging and identity alignment, with 69.2% of consumers indicating that the brands they engage with reflect their personal identities. Participation in online brand communities is strongly linked to increased purchase frequency, with 73.6% of consumers reporting more frequent buying

behaviours as a result of community involvement. Despite high loyalty levels, where 77.5% of consumers consider themselves very loyal to brands, a significant 42.4% still indicate willingness to try competitors. This underscores the importance of leveraging brand communities to deepen emotional engagement and reduce customer churn.

Effective two-way communication is a cornerstone of successful community-powered marketing. A vast majority of consumers (88.1%) value the ability to share feedback and engage in dialogues with brands, and an even higher percentage (97.3%) are motivated to demonstrate loyalty when brands listen and respond to their inputs. However, 25% of marketers acknowledge that their efforts at maintaining two-way communication are weak, presenting a clear opportunity for improvement. Building robust feedback loops within brand communities enables companies to tailor products and marketing strategies better to consumer needs, thereby enhancing customer satisfaction and loyalty while improving overall brand experience.

While community-driven marketing holds promise for enabling more personalized consumer experiences (reported by 39.1% of brands), there remain significant challenges, particularly in data management. Brands find it difficult to collect zero-party data, which is the voluntarily shared information from consumers that enables personalization. Approximately 58.5% of marketers report hurdles in acquiring high-quality data, limiting their ability to deliver truly customized experiences. Overcoming these data challenges is essential for brands to unlock the full potential of community-powered marketing, enabling not only personalization but also more precise targeting and engagement strategies.

Methodology

This research employs a mixed-methods approach combining quantitative and qualitative techniques to address two critical aspects of enhancing the apparel brand- TrueBrowns e-commerce platform: (1) improving the Product Return Management system to enhance consumer experience, and (2) fostering Community Building to increase brand loyalty. The study is applied and strategic, focusing on refining both usability and emotional engagement for TrueBrowns' consumer base, primarily women aged 21-45 from Tier 1 and Tier 2 cities.

The research is divided into two interconnected modules. The first module targets website optimization to reduce product returns caused by sizing issues. Drawing on company return data and customer surveys, a revised sizing guide was developed featuring precise measurements, visual aids, and clearer instructions. This intervention was tested through

an in-store experiment and analyzed using descriptive statistics, comparative return rate analysis, and thematic coding of qualitative feedback. The results aimed to improve customer satisfaction, reduce returns, and build trust, thereby encouraging repeat purchase.

The second module explores community building as a strategic tool for strengthening brand loyalty and increasing Customer Lifetime Value (CLV). Through online surveys of existing customers, the study examines emotional attachment to the brand, willingness to engage in community activities, and the impact of cultural resonance on purchasing behavior. Data analysis focuses on understanding consumer motivation to participate in events and content sharing, positioning the community as a valuable brand asset. Together, these modules provide actionable insights for TrueBrowns to enhance the overall consumer journey and foster a stronger emotional connection with its customers.

Mixed-methods research combining surveys, experiments, and data analysis to tackle consumer experience and brand loyalty. Website optimization focused on reducing return rates by improving the sizing guide with precise measurements and visual aids. Purposive sampling targeted women aged 21-45 from Tier 1 and 2 cities with prior TrueBrowns' purchases. In-store experiments validated the revised sizing guide, contributing to clearer customer understanding of product fit. Community-building efforts explored emotional brand attachment and social engagement as drivers of loyalty. Data analysis included descriptive statistics, thematic analysis, and comparative return trends to ensure robust findings. Strategic focus on enhancing usability and emotional connection to improve repeat purchases and customer lifetime value.

Findings

Return Data as a Diagnostic Tool

The analysis of returns from October 2024 to January 2025 provides concrete evidence that sizing inconsistencies are a primary friction point for TrueBrowns customers. This data-driven approach grounds optimization efforts in real-world consumer behavior, avoiding assumptions, and ensures targeted improvements that can reduce return rates and associated costs. Accurate sizing information directly correlates with increased customer satisfaction and fewer operational inefficiencies.

Dual Questionnaire Strategy Enhances Understanding

By combining quantitative return data with qualitative customer feedback through two distinct questionnaires, the study captures a comprehensive view of both functional and

emotional factors influencing brand loyalty. This mixed-method approach enriches the analysis, revealing not only what the issues are (e.g., sizing problems) but also why they matter to customers and how brand engagement can be improved.

Experimental Validation of Sizing Guide

The offline trial with 50 participants interacting with the updated sizing guide demonstrates the practical effectiveness of the revised size chart. This step is crucial in bridging the gap between theoretical improvements and real customer experiences, ensuring that sizing information is both accurate and user-friendly, which can significantly reduce return rates and increase purchase confidence.

Website Optimization as a Competitive Necessity

In the crowded fashion e-commerce space, operational excellence—particularly regarding sizing accuracy and product information clarity—is vital. High return rates not only escalate costs but also damage brand credibility. Optimizing the website's sizing tools and product descriptions addresses a core pain point, directly improving the customer journey and encouraging repeat business.

Community Building Fosters Emotional Loyalty

Modern consumers value brands that resonate with their personal values and provide authentic narratives. The study's focus on community-building strategies—such as storytelling, UGC, cultural content, and exclusive brand experiences—highlights the importance of emotional connection in driving repeat purchases and brand advocacy. This emotional loyalty often translates into higher Customer Lifetime Value and organic growth through word-of-mouth.

Holistic Approach to Brand Loyalty

The integration of functional improvements (website optimization) with emotional engagement (community building) reflects the multifaceted nature of customer loyalty. Addressing only operational issues without fostering emotional ties can limit the potential for sustainable brand growth. Conversely, a focus solely on community without solving practical pain points like sizing can undermine trust. The dual approach ensures both immediate and long-term benefits.

Strategic Implications for E-commerce Brands TrueBrowns' approach serves as a model for fashion retailers aiming to balance cost control with brand differentiation. By leveraging data analytics, customer feedback, and community engagement, brands can reduce costly

returns while building meaningful relationships that enhance customer retention and reduce Customer Acquisition Costs (CAC).

This comprehensive strategy aligns with evolving consumer expectations in digital retail environments. This study demonstrates how a targeted approach to website optimization and community building can significantly enhance the customer experience and reduce operational inefficiencies like product returns for an e-commerce brand such as TrueBrowns. The initial challenge high return rates due to sizing and fit issues was strategically addressed by overhauling the size guide and eliminating the previously confusing size-and-fit tool. Instead, clear garment measurements (shoulder, waist, hip), fit types, and a visual "How to Measure" guide were implemented. These changes directly empowered customers to make more confident and informed purchasing decisions. As evidenced by both customer feedback and return data analysis, the return percentage dropped from 30.7% in October 2024 to 16% in April 2025, validating the effectiveness of these improvements.

In parallel, the community-building initiatives played a transformative role in strengthening emotional bonds with customers. Through storytelling that reflected cultural values, behind-the-scenes content, fashion shows, and user-generated content (UGC), TrueBrowns successfully established itself as more than a retail brand it became a cultural and emotional experience for its customers. Insights from the questionnaire clearly showed that customers are more likely to engage, remain loyal, and recommend a brand when they feel emotionally connected to it. For example, 72.6% of customers had already recommended TrueBrowns to others, and over 67% agreed that emotional or cultural connection enhances brand loyalty.

Together, these strategic initiatives have not only reduced product returns and improved decision-making at the point of purchase but have also cultivated a deeper, more meaningful relationship with the customer base. TrueBrowns now stands on stronger footing to scale further, backed by a loyal community that identifies with its values, trusts its product presentation, and actively contributes to its brand story. This project highlights the power of combining technical clarity with emotional resonance to build a sustainable, customer-centric e-commerce ecosystem.

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FINTECH AND DIGITAL COMMERCE:
DRIVERS OF BUSINESS MODEL INNOVATION IN INDIA

Hitika Yadav* and Archana Verma

Department of Commerce,

Institute of Economics and Finance, Bundelkhand University, Jhansi 284128

*Corresponding author E-mail: hitika26yadav@gmail.com

Abstract:

The synergy of financial technology (Fin-Tech) and digital commerce is catalyzing a fundamental transformation of business models across India's economy. This paper synthesizes recent academic and industry sources to examine how innovations in FinTech spanning digital payments, online lending, embedded finance, blockchain and the rapid growth of e-commerce (including platform marketplaces, quick commerce, and the Open Network for Digital Commerce) are reshaping how firms create and capture value. India is now a global FinTech leader, with projections of ten-fold growth in assets under management by 2030 (EY, 2022). Digital payments via the Unified Payments Interface (UPI) have reached extraordinary scale (over 185 billion transactions in FY2024–25, around 84% of retail digital payments) (MediaNama, 2025). Concurrently, India's e-commerce market is rapidly expanding into new channels (e.g. social commerce, quick commerce, hyperlocal delivery) and open platforms like ONDC (Islam *et al.,* 2024; Ranjekar & Roy, 2023). Key findings indicate that FinTech and digital commerce together are enabling more inclusive growth (by extending credit and markets to small businesses and rural consumers), fostering platform-based business models (aggregators, marketplaces, and API-driven services), and creating new partnerships between incumbents and startups. Challenges include regulatory and cybersecurity risks, digital infrastructure gaps, and the concentration of market power. The paper discusses policy implications (e.g. continued development of digital infrastructure, open networks, regulatory sandboxes) and future research directions. This study offers a comprehensive, up-to-date review of how FinTech and digital commerce jointly transform business models in India, highlighting emerging trends, opportunities, and hurdles for stakeholders.

Keywords: FinTech; Digital Commerce; Business Models; India; Financial Inclusion

Introduction:

The Indian economy is undergoing a rapid digital transformation, driven by FinTech innovations and the explosive growth of digital commerce. FinTech broadly defined as technology-enabled financial services now spans payments, lending, insurance, and wealth management, fundamentally altering how transactions are processed and value is created. India has emerged as a global FinTech leader. In 2021 it was the world's third-largest FinTech market (after the US and UK) and is projected to grow tenfold in assets and revenues by 2030 (EY, 2022). Digital payments are a cornerstone of this revolution: the Unified Payments Interface (UPI), a real-time mobile payment system, processed 186 billion transactions in FY2024–25 (a 42% annual jump) (MediaNama, 2025). These innovations have enabled unprecedented financial inclusion – for example, India's 2014 financial inclusion drive (Jan Dhan–Aadhaar–Mobile) helped raise adult bank account ownership to about 77% by 2024 (Jena, 2025).

Simultaneously, digital commerce (online retail and services) is booming. India's e-commerce gross merchandise value is projected to reach US $160–170 billion by 2028 as hundreds of millions of consumers adopt online shopping (Bain & Company, 2023). New commerce models are emerging: "quick commerce" (ultrafast delivery from local dark stores), direct-to-consumer (D2C) brands, social commerce via messaging apps, and collaborative platforms. In 2023, India's quick commerce sector was estimated to grow at nearly 28% per annum (FY2022–27) (Ranjekar & Roy, 2023). The government is also intervening: the Open Network for Digital Commerce (ONDC) initiative seeks to create an open, interoperable network for all sellers and buyers, countering the dominance of a few platforms and extending e-commerce to small retailers (Islam *et al.,* 2024).

This paper investigates how FinTech and digital commerce jointly reshape business models in India. We focus on recent developments (post-2018) and draw on academic studies, industry reports, and policy documents. Our aim is to identify key trends and outcomes – such as new ways of delivering financial services, new distribution and revenue models, and the integration of financial services into commerce – as well as the challenges and opportunities they present. The paper is structured as follows. The next section reviews prior research and context in FinTech and digital commerce in India. We then describe our methodology (a qualitative synthesis of literature). The Results section summarizes the main findings on how business models are evolving, and the Discussion interprets these

trends, addressing implications and future directions. The final Conclusion highlights the study's contributions and suggests policy considerations.

Literature Review

FinTech in India – Evolution and Impact

Globally, FinTech innovations have disrupted traditional financial services by embedding technologies (AI/ML, mobile computing, cloud) into payments, credit, and investment. In India, this trend has been especially dramatic. Since 2016, initiatives like demonetization, the Aadhaar biometric ID system, and the rollout of UPI have accelerated digital finance. By 2022, India supported over 7,000 FinTech startups (primarily in payments, lending, insurance, and wealth tech).

Growth of FinTech Startups in India

Table 1: Growth of FinTech Startups in India (2016–2025, projected)

Year	Number of FinTech Startups	Key Drivers
2016	~1,200	Demonetization, Aadhaar
2018	~3,000	UPI growth, mobile penetration
2022	~7,000+	Venture funding, BNPL, InsurTech
2025 (proj.)	~10,000+	Embedded finance, ONDC

According to EY (2022), payments-focused Fin-Techs attracted the largest share of funding in 2021 (44.4%), followed by lending Fin-Techs (15.7%), with InsurTech and neobanks each about 8–9%. These firms have brought financial services to underserved segments via mobile platforms, often offering lower costs and data-driven risk models (EY, 2022).

Prior studies note that the FinTech sector in India is still maturing, with evolving business models and a shifting regulatory landscape. Ramadass *et al.,* (2023) argue that new FinTech ventures are integrating technologies to reduce transaction costs and expand financial inclusion. For example, innovative lending platforms now harness alternative data (social media profiles, mobile usage) and API-based data-sharing (Account Aggregators) to serve borrowers who lack traditional credit histories (Ramadass *et al.,* 2023; Jena, 2025). Embedded finance and platform banking models are also emerging, where non-banks bundle financial services into their customer journeys. Academic reviews have classified multiple FinTech business models – such as digital wallets, peer-to-peer lending, crowdfunding, and digital insurance – noting shifts from single-product offerings to "super-app" ecosystems (Ramadass *et al.,* 2023).

Digital Commerce in India – Growth and Platforms

India's e-commerce sector is expanding rapidly. Major market studies report that Indian online retail grew many-fold since 2017 and is forecast to exceed US$160 billion by 2028 (Bain & Company, 2023).

E-commerce Market Size in India

Table 2: Growth of E-commerce Market in India (2020–2028, projected)

Year	Online Shoppers (millions)	Market Size (US$ billion)
2020	140	39
2022	180	55
2024	260	60
2028 (proj.)	350+	160–170

A recent Bain report estimates over 230–250 million online shoppers by 2023, driven by smartphone penetration and growth beyond major cities. Three-quarters of online shoppers now reside in Tier-2+ cities (Bain & Company, 2023). Beyond traditional e-tail, innovative models are rising. Quick commerce aims to deliver groceries and essentials within minutes; research from IIM Ahmedabad finds that this industry grew from essentially zero before 2019 to a multibillion-dollar sector, with projected CAGR of roughly 28% (FY2022–27) (Ranjekar & Roy, 2023). Major players (Zepto, Blinkit, Instamart/Swiggy) now process hundreds of thousands of orders per day by leveraging dense networks of small fulfillment centers (dark stores).

Other trends include D2C brands (manufacturers selling directly online), social commerce (transactions via messaging/social apps), and "hyper-value" commerce (low-cost assortment models). Globally-observed models like *Buy-Now-Pay-Later* (BNPL) have also taken hold in India's e-commerce payments, though penetration is still rising. The government's ONDC initiative, launched in 2022, is designed to "democratize digital commerce" by creating open standards for interoperability among e-commerce platforms (Islam *et al.,* 2024). Early analyses suggest ONDC could allow small retailers to plug into e-commerce without high platform fees, enabling competition and broader market access (Islam *et al.,* 2024).

Intersection of FinTech and Digital Commerce

FinTech advances have been a catalyst for digital commerce. For instance, UPI payments have become a near-universal online payment method, dramatically easing e-commerce transactions. Embedded finance models are blurring the line between commerce and

finance: ride-hailing and food delivery apps now offer loans or insurance to drivers and customers within their apps, and e-retailers often offer co-branded credit or insurance at checkout (Ramadass *et al.,* 2023; PwC, 2023). Conversely, e-commerce platforms serve as distribution channels for FinTech products: merchants use digital lending platforms to finance inventory, and online shops provide consumer financing at the point of sale. Prior literature on emerging markets emphasizes that such integrated ecosystems (combining commerce, payments, and credit) can create network effects and new value propositions (Ramadass *et al.,* 2023; PwC, 2023). However, challenges loom: business-model innovation can outpace regulation, and issues like fraud, digital illiteracy, and inequitable access persist.

Our review builds on these literatures to document how these broad forces are reshaping Indian business models. Overall, the literature suggests that FinTech infrastructure (like UPI) and innovative financial offerings are enabling commerce, while commerce platforms are expanding access to financial services. This interplay generates both opportunities (for inclusion and growth) and risks (for privacy, concentration, and regulation).

Methodology

This study employs a qualitative, descriptive research approach based on a systematic review of recent literature. We surveyed peer-reviewed journal articles, industry reports, and reputable sources (from 2018 onward) addressing Fin-Tech, e-commerce, and digital transformation in India. The analysis synthesizes quantitative data (e.g. market sizes, growth rates) and qualitative insights (e.g. case examples, regulatory developments) from these sources to identify key patterns. Given the interdisciplinary scope, sources include academic journals (e.g. *Journal of Risk and Financial Management*, *Finance India*), industry analyses (e.g. reports by EY and PwC), and policy documents. We critically evaluated these materials to construct an integrated narrative of how FinTech and digital commerce innovations are altering value creation and capture in Indian business. No primary data collection was undertaken; instead, findings result from triangulating evidence from multiple secondary sources. This methodology is appropriate for providing a comprehensive, up-to-date overview of trends in this rapidly evolving domain.

Results:

Fin-Tech-Driven Business Models

Our review shows that FinTech is enabling entirely new business models in finance and beyond. One major finding is the proliferation of platform-based financial services. UPI and wallet apps operate as multi-sided platforms connecting consumers, merchants, and banks.

According to EY (2022), payments Fin-Techs attracted a dominant share of investment, reflecting their broad merchant and consumer base. Digital lending models have also expanded: the overall loan book of FinTech lenders is projected to reach US$515 billion by 2030 (PwC, 2023). These platforms often leverage alternative credit scoring and automated underwriting (AI/ML) to serve borrowers who lacked traditional bank access (PwC, 2023).

Key FinTech Business Models in India

Table 3: Major FinTech Business Models in India and Their Value Propositions

Business Model	Key Features	Value Proposition	Examples
Payments & Wallets	Digital payments, UPI integration, mobile wallets	Fast, secure, cashless transactions	Paytm, PhonePe, Google Pay
Lending (Digital)	Peer-to-peer lending, digital credit scoring, instant loan disbursal	Quick credit access, lower interest rates, financial inclusion	Lendingkart, CASHe, Indifi
InsurTech	Online insurance platforms, AI-based underwriting	Simplified policy purchase, faster claim processing	PolicyBazaar, Acko, Digit Insurance
WealthTech	Robo-advisors, digital investment platforms, portfolio management tools	Personalized investment solutions, cost efficiency	Groww, Zerodha, Upstox
Embedded Finance	Financial services integrated into non-financial platforms	Seamless banking, improved customer experience	PhonePe Payouts, RazorpayX
Neo-banking	Digital-only banks with app-based interfaces	Convenience, lower fees, instant account management	Niyo, Jupiter, Fi
RegTech	Compliance automation, risk monitoring, KYC/AML solutions	Reduced compliance cost, faster regulatory reporting	Signzy, Fintellix

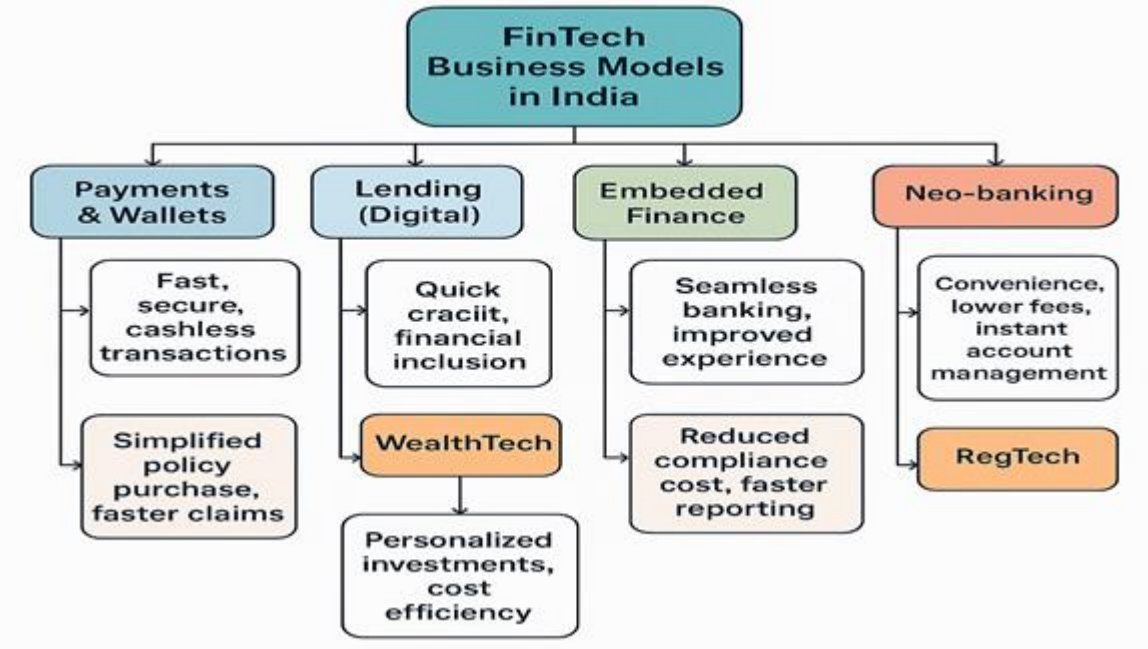

Figure 1: Major FinTech Business Models in India and Their Value Propositions

By mid-2024, leading mobile lending apps in India had been downloaded over 90 million times (MediaNama, 2025), underscoring broad consumer uptake. FinTech firms are also collaborating with traditional banks: hybrid models (bank–FinTech partnerships) allow banks to offer digital channels and tech firms to offer compliance capabilities.

Another key trend is the rise of embedded finance. Non-financial digital platforms increasingly incorporate credit, insurance, or payments into their service flows. For instance, major ride-hailing and e-commerce apps now let drivers or shoppers obtain instant micro-loans at the point of service (PwC, 2023). Embedded finance is projected to grow at a 30%-plus CAGR through 2029 (PwC, 2023). This model shifts credit provision toward a "Fin-Tech–commerce nexus" where financing is seamlessly offered during checkout, enhancing convenience and uptake. Similarly, BNPL has emerged as a popular offering for Indian online shoppers. The BNPL market's gross merchandise value is expected to grow at ~14% annually through 2028 (PwC, 2023), driven by mobile commerce trends. BNPL exemplifies a new revenue model for e-retailers (earnings from financing) and an installment payment option tailored to India, where only about 5% of consumers have credit cards (PwC, 2023).

FinTech also impacts traditional sectors. Microinsurance and digital health insurance models are scaling via online channels, with a large majority of consumers researching policies online (PwC, 2023). Digital wealth management (wealthtech) is democratizing investments, though detailed data on this are still emerging. Overall, the result is a financial

ecosystem offering more choices and competitive pricing. However, the literature also notes tensions: regulatory tightening (e.g. Reserve Bank of India actions against fraudulent lending apps) and risk aversion are tempering some FinTech growth (PwC, 2023; Ramadass *et al.,* 2023).

E-Commerce and Digital Commerce Trends

Digital commerce is similarly transforming traditional retail and service business models. Indian e-retail is segmenting into diverse "micro-models." Quick commerce platforms promise "10-minute" delivery on groceries and essentials. According to IIM Ahmedabad research, the quick commerce industry grew from essentially zero before 2019 to a multibillion-dollar sector, with projected CAGR ~28% (FY2022–27) (Ranjekar & Roy, 2023). These players operate dense networks of small fulfillment centers (dark stores) in cities. The result is a new last-mile distribution model that traditional retailers have begun to emulate.

Another trend is hyperlocal marketplace models, where existing e-commerce giants open their logistics (and even storefronts) to local merchants. For instance, Flipkart's Ekart joining ONDC allows small sellers nationwide to sell through Flipkart's logistics and access financial services (Islam *et al.,* 2024). The ONDC initiative itself is reshaping business models by creating a permissionless network: rather than selling through one app, vendors can integrate their inventory into any buyer app on the network. Islam *et al.,* (2024) suggest that ONDC aims to "democratize digital commerce" and diversify consumer choices by breaking platform monopolies. Early pilots indicate increased interoperability and opportunities for neighborhood shops to reach digital customers without paying high commissions (Islam *et al.,* 2024).

Social commerce is also emerging as a distinct model: sellers use chat apps and social media to transact directly. Though hard to quantify, this model blends e-commerce with peer networks (e.g. local WhatsApp groups for bulk purchases). A recent Bain report notes that nearly 40% of online shoppers in India are Gen Z and are highly active on social platforms, suggesting strong potential for trend-driven commerce (Bain & Company, 2024).

Key Statistics and Indicators

Several quantitative results highlight the scale of change. In payments, UPI volumes surged 41.7% year-on-year in FY2024–25 to 185.9 billion transactions (MediaNama, 2025), now accounting for 84% of India's retail payment volumes.

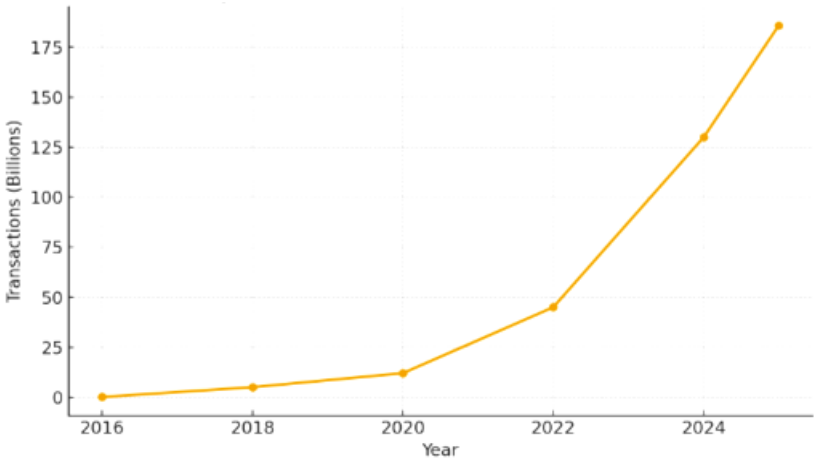

Figure 2: UPI Transaction Growth in India (2016–2025)

The share of adults with bank accounts rose from about 54% in 2014 to about 77% by 2024 (Jena, 2025), reflecting inclusion gains. Digital lending app downloads (90+ million) and year-on-year increases in MSME loan originations (20–28% YoY) signal FinTech credit growth (Ramadass *et al.,* 2023; MediaNama, 2025). On the commerce side, India's online shopper base grew from roughly 140 million in 2020 to about 260 million by 2024 (India Brand Equity Foundation, 2023), and is projected to exceed 300 million by 2030. The overall e-retail market is estimated at about US$60 billion in 2024 (India Brand Equity Foundation, 2023), with forecasts of 2–3× growth by 2030. These figures underscore the rapid expansion enabling new business models.

Discussion:

The results indicate a deep reshaping of business models across sectors.

Synergy of FinTech and Commerce:

FinTech infrastructure has become a backbone for digital commerce. For example, the ubiquity of UPI means retailers both online and offline can onboard customers easily, reducing cash handling and credit friction (PwC, 2023). E-commerce platforms and marketplaces often embed financial offers: consumer finance at checkout (BNPL or instant loans) and supply-chain financing for sellers. This integration blurs boundaries: many digital marketplaces are simultaneously becoming financial platforms (e.g. issuing co-branded credit products or FinTech tools for merchants). Such platformization accelerates value capture not just through product sales but also financial intermediation (interest, fees).

Emerging Models and Competitive Dynamics

The network effects of platforms are intensifying competition. ONDC's open-network model, for instance, could enable multiple apps to source from the same sellers, decoupling

discovery from logistics. If successful, small retailers could switch among channels and price competition may improve (Islam *et al.,* 2024). BNPL and embedded finance are also shifting market power: traditional banks may see lending migrate into e-commerce ecosystems, prompting partnerships or development of their own digital channels (PwC, 2023). FinTech startups continue to target niche markets (e.g. agri-FinTech for farmers, insure-tech for gig workers). The literature suggests these innovations make financial services more inclusive (e.g. reaching rural and semi-literate users via vernacular UPI apps) (Jena, 2025; PwC, 2023).

Challenges and Risks

However, the transition is not without hurdles. A persistent digital divide exists: as of 2022, about 43% of Indians remained unbanked, and many lack digital literacy (Jena, 2025). FinTech models often cater first to English/Hindi-literate urban users, risking exclusion of rural or disadvantaged groups (Ramadass *et al.,* 2023). Data privacy and cybersecurity are critical concerns: as user data flows across apps and networks, strong regulations are needed to maintain trust. The Reserve Bank of India has intervened to curb fraudulent lending apps and strengthen the regulatory sandbox for FinTech experimentation (PwC, 2023). FinTech literature warns that "risk levels will multiply" as new models scale rapidly (Ramadass *et al.,* 2023), requiring proactive regulation. Similarly, digital commerce brings risks of platform dominance; ONDC is partly a policy response to prevent monopolistic power by established e-commerce giants (Islam *et al.,* 2024).

Opportunities and Policy Implications

Despite these challenges, opportunities abound. Digital commerce offers vast new markets to small merchants: even traditional kirana stores can reach urban and rural customers online via ONDC or platform tie-ups. SMEs gain easier access to finance through supply-chain FinTech and digital lending, potentially filling the estimated US$400 billion MSME credit gap (PwC, 2023). From a policy perspective, authorities have incentives to nurture these trends. The government's push for open banking (Account Aggregators), digital public infrastructure (UPI, Aadhaar), and e-commerce democratization (ONDC) aligns with the need to create a level playing field (Islam *et al.,* 2024; EY, 2022). Regulators are also updating rules (for peer-to-peer lending, data protection, cryptocurrency, etc.) to mitigate risks while allowing innovation. Future directions may include enabling wider geographies (expanding UPI internationally as planned) and continued investment in rural digital infrastructure.

From a business standpoint, companies must adapt: incumbents should embrace API partnerships or incubate startups, while new ventures need to balance rapid growth with sustainable practices. For example, quick commerce firms are transitioning from VC-fueled expansion to more profitable models by optimizing supply chains (Ranjekar & Roy, 2023). Retailers may need multichannel strategies (online-offline integration, voice commerce) to capture different customer segments (Bain & Company, 2024; India Brand Equity Foundation, 2023). Ultimately, the amalgamation of FinTech and digital commerce is fostering a more platform-centric, data-driven, and customer-centric economy in India.

Conclusion:

In the conclusion of the study which involves FinTech and digital commerce are jointly catalyzing a transformation of business models across India's economy. By enabling seamless digital payments, extending credit and insurance to new users, and opening up online markets to a broader set of players, these innovations are redefining how value is created, delivered, and captured. Our review of recent data and studies shows that India's FinTech ecosystem is rapidly maturing (with thousands of startups and scaling platforms), and its digital commerce sector is diversifying into new modalities (e.g. quick commerce, open network marketplaces, social commerce). This evolution carries both promise and complexity: it holds potential for more inclusive growth, greater efficiency, and entrepreneurial dynamism, but also poses regulatory, infrastructural, and equity challenges.

Policy-wise, the interplay of FinTech and commerce suggests supporting open, interoperable systems (as exemplified by ONDC), strengthening digital infrastructure (rural internet, payment networks), and ensuring robust consumer protection and data governance. Future research should monitor how business models continue to adapt – for example, with AI-driven personalization, digital identity reforms, and cross-border digital trade – and evaluate their socio-economic impacts (on jobs, competition, and financial inclusion). In conclusion, India's experience illustrates how digital finance and commerce innovations can co-evolve to reshape business landscapes, offering lessons for other emerging economies. Stakeholders (firms, regulators, and civil society) will need to collaborate to sustain growth and mitigate risks as these transformations proceed.

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WOMEN ENTREPRENEURSHIP IN RURAL AREAS: A LITERATURE REVIEW

Sakshi Makhija

PIET NCR College, Samalkha, Haryana

Corresponding author E-mail: sakshi.ncr@pietgroup.co.in

Abstract:

This study examines the role of women in participation and management as an entrepreneur. The role of women in shaping the business activities is very significant. Gone are the days when tech-savvy industry is male-dominating, now women's contribution in operational evolution and continuing innovation is commendable. In rural areas, their role is more challenging and motivating. There are many influential businesses by women which can be seen on social media platform. Falguni Nayar, the founder of Nykaa is India's first beauty e-commerce unicorn. Upasana Taku, co-founder of Mobi Kwik was known as the first woman to launch payment startup in India. There are many more examples to show the women's prospective to create unique solutions for the challenging environment. Researches show that women make the majority of social media users on many platforms, making their crucial efforts for product development. However, the path of their success is very struggling and challenging. The notable barriers in rural areas are funding disparity, gender inequality and restrictive working environment like family issue household responsibilities. Challenges persist but despite of all the challenges they have proved themselves as a key player in emerging social media content creator to successful entrepreneur. Current study demonstrates the role of women economic development by understanding the opportunities and barriers special reference to rural area of India. This is a conceptual paper and secondary data through other research paper from the same domain have been used. The study provides the useful insights for the better understanding of significant contribution in digital entrepreneurship.

Keywords: Women, Entrepreneurship, Rural Area, Opportunities, Challenges.

Introduction:

Women, as an entrepreneur have played an important role in economic growth as well as in social development specially in developing country like India and Indonesia. From generation of employment opportunities to foster the innovation and economic security, women have created the benchmark (Orser & Elliott, 2015; Thomas, 2025). Although the path of making the benchmark and remembering history is full of challenges and barriers which they have faced and still facing is also considerable. The considerable berries are gender biasness, financial resources biasness and also the societal barriers like expectation

and domestic pressures (Trask, 2013; Coleman, 2000). In India, for instance, only 14% of total enterprises are owned by women, highlighting the need for targeted initiatives to empower them (Agarwal & Lenka, 2014).

The rise in digital technology has given numerous platforms where business can be developed with low cost. Social media is one of them leveraging the women to break their berries like time rigidity and domestic responsibilities (Gates, 2000; Chaker & Zouaoui, 2023). Initiatives such as the Digital India program and the Women Entrepreneurship Platform aim to enhance digital literacy and provide support for women entrepreneurs, thereby facilitating their participation in the economy (Jalan & Gupta, 2019; Podile, 2018). Furthermore, the rise of e-commerce has transformed traditional business practices, enabling women to leverage online platforms to overcome barriers and contribute to economic growth (PPRO Payments and E-commerce Report, 2018).

As the global community strives to achieve the Sustainable Development Goals (SDGs) by 2030, empowering women through entrepreneurship emerges as a critical strategy for fostering gender equality and promoting sustainable development (Danil & Fordian, 2022). This introduction sets the stage for a deeper exploration of the challenges and opportunities faced by women entrepreneurs in the context of digital entrepreneurship and the broader economic landscape.

Literature Review:

Women are showing their potential in every aspect of growth in India. Self Help Groups (SGH) are becoming very significant drivers to foster the economic independence among rural area women. SGH provides social support, financial hep and training to the women which help them to manage their business activities more efficiently. Although the working culture of women in rural is different from the urban area. They face more challenges such as limited finance, societal pressures and low financial literacy (Agarwal, S., & Lenka, U. 2018). Still, they are spark fulfilling the dual responsibilities of managing household chores and business as well. Their journey to entrepreneurship is definitely enlightening but at the same time due to challenges they face, it becomes more struggling also. Government should implement supporting policies to strengthen the women entrepreneurship. Financial awareness programs, special training and internship program may improve the conditions of working women in rural areas (Dhekale, 2016).

Foreign countries also face significant challenges in addressing unemployment, with approximately 7.61 million people unemployed, highlighting the need for job creation (BPS, 2012). The government aims to increase the number of entrepreneurs to 4.76 million, targeting women as a key demographic due to their potential to enhance the economy

(Antara News, 2012). Despite their significant role in micro, small, and medium enterprises, women encounter numerous obstacles, including traditional gender roles that often confine them to domestic responsibilities (Wood, cited in Griffin, 2003). Additionally, women face difficulties in accessing funding, as loans often require male approval, and they typically have lower educational attainment, limiting their entrepreneurial skills (Coleman, 2000; Cromie & Birley, 1992). However, the rise of social media presents new opportunities for women entrepreneurs in Indonesia. With a substantial number of women utilizing platforms like Facebook to establish businesses, social media offers flexibility and low startup costs, allowing women to balance work and family responsibilities (Gates, 2000). This trend shows that social media is the significant platform to boost the women entrepreneurship providing more financial independency, confidence and equality. (Nguyen, 2005; Cukier *et al.,* 1996). E-commerce has evolved significantly since its inception in the late 19th century, with the introduction of Electronic Data Interchange (EDI) as one of the earliest applications in business-to-business transactions. In India, the journey began with internet connectivity in 1989, leading to the regulation of e-commerce in 1998 (PPRO Payments and E-commerce Report, 2018). The Digital India program, launched in 2015, aimed to enhance digital infrastructure and literacy, particularly in rural areas, thereby creating job opportunities and fostering economic growth (Chatzistamoulou & Koundouri, 2020). Digital entrepreneurship encompasses the transformation of existing businesses and the creation of new ventures through technology, contributing to India's economic growth rate of 7.7% in 2018 (PPRO Payments and E-commerce Report, 2018). Despite the progress, women entrepreneurs in India face significant challenges, including limited access to education, financial resources, and societal expectations that often confine them to domestic roles (Trask, 2013). However, initiatives like the National Digital Literacy Mission and the Women Entrepreneurship Platform have been established to empower women through digital skills and entrepreneurship (Podile, 2018). Research indicates that social media plays a crucial role in expanding women's entrepreneurial networks and enhancing their business competitiveness (Cesaroni *et al.,* 2017; Omar *et al.,* 2017), highlighting the transformative potential of digital technologies in promoting gender equality in entrepreneurship (Jalan & Gupta, 2019).

Government has taken initiatives to strengthen the women entrepreneurship. Regularizing the policies and opportunities to grow financially and independently. There is more need to promote the women entrepreneurship in India to reduce the gender disparity (Cabrera & Mauricio, 2017).

Based on literature review, the opportunities and challenges for the women entrepreneurship are discussed below:

Opportunities for Women

1. **Local Impact and Market Development:** In rural areas, women can take advantage of local vendors by connecting directly with the vendors. It can enhance their profit and market efficiently.
2. **Social Inclusion and Gender Equality**: Through entrepreneurship, women take important decisions regarding their business and investment. This would lead to more social inclusion and gender equality in family as well as in business.
3. **Skills Enhancement:** To enhance the quality of decisions and operational activity, skills are acquired. This will make the women clearer about concepts, opportunistic and more enterprising in business.
4. **Digital literacy and Financial Inclusion:** Different digital tools like online banking, Mobile technologies, digital platforms, and e-commerce provide access to the women without going anywhere. Through financial inclusion, their participation in economy can be improved.
5. **Government Initiatives:** Government has announced several government policies to empower the women entrepreneurship. Policies such as financial inclusion, microfinance, concessional loans, training and development enhance the skills and opportunities.
6. **Social Networking and Influence:** social media provide the platform to the women to showcase their talent and skills. Sharing products, ideas and participating in collaborative activities has widen the perspective of entrepreneurship**.**

Challenges for Women

1. **Societal Pressure and Traditional Values:** The foremost challenge faced by women in rural area is the traditional values and belief which has restrict their potential. Early marriage, illiteracy and restricted connectivity to outside world become barrier in their path to success.
2. **Financial Challenge:** Limited access to money, external funding, no collateral securities restrict the women to execute their ideas. Moreover, high rate of interest and no independent decision are major weakness for women to access the funding.
3. **Deficit of Professional Skill:** Women particularly in rural area are less interesting in acquiring the professional skills due to social constraints and other factors. Lack of professional skills reduce the entrepreneurial decisions, hence leads to low productivity.

Research Methodology

The research methodology applied in the study on women entrepreneurship, especially in the context of rural areas, involves a qualitative approach. The paper contains secondary data from different verified sources, including government policies, existing literature and reports with the particular domain on women entrepreneurship. Comprehensive literature review is conducted to identify opportunities and challenges faced by women entrepreneurs, particularly in rural area of India. Additionally, the study includes significant insights from examples and case studies of successful women entrepreneurs who have shown entrepreneurial potential to enhance their business operations. The objective of this paper to provide the overview of the challenges and opportunities in this domain. The paper also identifies the need for further empirical research to validate findings and explore the effectiveness of specific initiatives aimed at empowering women through digital entrepreneurship.

Conclusion

The development in women entrepreneurship in India and other country as well identify the critical roles of women play in economic growth and social change. However, the path of success is not easy for the women as they face the challenges like gender biasness, financial funding issues, family responsibility etc. Despite of multiple challenges their dedication and enthusiasm shift the challenges into opportunities and set the example of resilience and empowerment. Government has also supported the women entrepreneurship by initiating the program such as Digital India Program providing financial literacy and other essential support such as funding and venture. Using the digital technologies and e-platforms, women are not only financial independent but also the significant contributor in economic development. The popularity does not limit the boundaries; they have gained the popularity and spreading their business cross the boundaries also. The findings highlight the growing and glowing future of women entrepreneurship and underscore the need to continuing the efforts for more gender equality and financial independency essential for achieving the sustainable development goals.

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DIGITALISATION: IMPACT ON INDUSTRIES AND SOCIETIES IN 21ST CENTURY AND ITS CHALLENGES

Kawal preet Singh
Department of Physical Education,
Guru Nanak khalsa College, Yamunanagar
Corresponding author E-mail: kawalpreetgnkc@gmail.com

Abstract:
Digitalisation, the process of integrating digital technologies into various aspects of human life, is transforming industries and societies worldwide in the 21st century. This research paper explores the concept of digitalisation, its drivers, and its impact on different sectors of the economy and society. The paper reviews relevant literature and examines case studies to highlight the key changes brought about by digitalisation, including increased efficiency, innovation, and connectivity, as well as the challenges and risks associated with it. The paper also discusses the implications of digitalisation for businesses, governments, and individuals, and explores potential future developments and policy considerations in the era of digitalisation.

Keywords: Digitalisation, Technology, Industries, Society, Economy

Introduction:

Digitalisation, also known as digital transformation or digital revolution, refers to the use of digital technologies to change the way businesses, governments, and individuals operate and interact. It encompasses a wide range of technologies, such as artificial intelligence, big data analytics, cloud computing, Internet of Things (IoT), and block chain, among others, that are reshaping industries and societies across the globe. Digitalisation has become a pervasive force, driving changes in various sectors of the economy, including manufacturing, services, agriculture, healthcare, education, and finance, and impacting social, cultural, and political aspects of human life.

Drivers of Digitalisation:

Several drivers are contributing to the rapid pace of digitalisation in the 21st century. One of the key drivers is the increasing availability and affordability of digital technologies, such as smartphones, tablets, and high-speed internet, which have enabled greater connectivity and accessibility for people around the world. Another driver is the exponential growth of data, fuelled by the proliferation of digital devices and platforms, which has created

opportunities for data-driven decision-making and innovation. Additionally, changing consumer expectations and preferences, as well as the need for businesses and governments to enhance efficiency and effectiveness, are driving the adoption of digital technologies.

Objectives

The objectives of digitalisation can vary depending on the context and sector, but generally, they revolve around leveraging digital technologies to improve efficiency, effectiveness, and innovation. Some common objectives of digitalisation include:

1. Automation and Efficiency: Digitalisation aims to automate manual and repetitive tasks using digital technologies, such as artificial intelligence, machine learning, and robotic process automation. This can lead to increased efficiency and productivity in various industries, reducing costs, streamlining processes, and enabling faster decision-making.
2. Innovation and New Business Models: Digitalisation enables thenew business models and opportunities by leveraging digital technologies to develop new products, services, and processes. This can lead to the development of innovative business models, such as platformbased ecosystems, digital marketplaces, and subscription-based services, that disrupt traditional industries and create new markets.
3. Enhanced Communication and Collaboration: Digitalisation facilitates seamless communication and collaboration through digital channels, such as email, video conferencing, instant messaging, and collaborative platforms. This can enable organizations to connect and collaborate globally, leading to improve innovation, and knowledge sharing.
4. Improved Access to Information and Services: Digitalisation enables easy access to information and services through online platforms and digital channels. This can lead to increased accessibility to education, healthcare, government services, financial services, and other resources, particularly for underserved populations. Digitalisation can also democratize information and knowledge, empowering individuals and communities.
5. Enhanced Customer Experience: Digitalisation aims to improve customer experience by providing personalized and convenient digital services, such as online shopping, online banking, and customer self-service portals. This can lead to

increased customer satisfaction, loyalty, and engagement, as well as enhanced customer insights through data analytics.

Impact of Digitalisation on Industries

Digitalisation is transforming industries in fundamental ways, leading to changes in business models, operations, and customer interactions. In manufacturing, for example, digital technologies are being used to automate production processes, optimize supply chains, and enable mass customization. In services, digitalisation is leading to the development of new platforms, apps, and online marketplaces that are changing how services are delivered and consumed. In agriculture, digital technologies are being used for precision farming, crop monitoring, and supply chain management, among others. In healthcare, digitalisation is enabling telemedicine, remote patient monitoring, and personalized treatments. The finance industry is also undergoing significant digital transformation with the rise of fintech, digital payments, and block chain-based solutions.

The Impact of Digitalisation on Society and Industry

1. Socioeconomic Impact: Digitalisation can lead to significant socioeconomic impacts, both positive and negative. On the positive side, digitalisation can create new job opportunities, improve access to education and healthcare, and enable economic growth through increased productivity and innovation. However, it can also lead to job displacement, exacerbate inequalities, and widen the digital divide if not managed properly.
2. Industry Transformation: Digitalisation can disrupt traditional industries by enabling new business models, changing customer behaviour, and reshapingmarket dynamics. Industries such as retail, transportation, media, and finance have been significantly impacted by digitalisation, leading to changes in business processes, value chains, and competitive landscapes.
3. Innovation and Entrepreneurship: Digitalisation can foster innovation and entrepreneurship by lowering barriers to entry, enabling rapid prototyping, and facilitating global connectivity. Start-ups and small businesses can leverage digital technologies to disrupt established industries, create new markets, and drive economic growth.
4. Governance and Policy: Digitalisation presents new challenges and opportunities for governance and policy-making. It requiresrequires the development of regulations and policies that address issues such as data privacy, cybersecurity, intellectual

property, and ethics. Effective governance and policy frameworks are essential to ensure that digitalisation is managed responsibly, inclusively, and with consideration for societal impacts.

5. Social and Cultural Impact: Digitalisation can have social and cultural impacts, including changes in communication patterns, information consumption, and social interactions. It can also raise ethical and moral dilemmas related to issues such as privacy, surveillance, and digital ethics, which have implications for societal norms, values, and behaviours.

Challenges and Risks of Digitalisation:

While digitalisation presents numerous opportunities, it also comes with challenges and risks. One of the challenges is the digital divide, where disparities in access to digital technologies and skills persist, leading to inequalities in benefits from digitalisation. There are also concerns about data privacy, security, and ethics, as the increasing reliance on data and digital technologies raises issues related to data breaches, cyber attacks, surveillance, and bias. While digitalisation offers numerous opportunities and benefits, it also presents challenges and risks that need to be carefully addressed. Some of the key challenges and risks associated with digitalisation include:

- Workforce Displacement and Inequality: The increased automation and digitization of jobs can result in workforce displacement and job losses, particularly in industries where tasks can be automated. This can exacerbate inequalities, as some workers may lack the necessary skills to transition to new digital roles, leading to unemployment and wage disparities.
- Ethical and Privacy Concerns: Digitalisation raises ethical concerns related to data privacy, security, and usage. The collection, storage, and analysis of vast amounts of data can raise questions about privacy rights, consent, and potential misuse of data. There may also be ethical considerations surrounding the use of emerging technologies such as artificial intelligence and machine learning, including issues of bias, fairness, and accountability.
- Cybersecurity Risks: As digitalisation increases reliance on digital technologies, it also exposes organizations and individuals to cybersecurity risks. Cyber threats, such as data breaches, ransomware attacks, and identity theft, can result in financial losses, reputational damage, and disruption of critical services. Ensuring robust

cybersecurity measures and practices are in place is crucial to protect against these risks.

- Regulatory and Legal Challenges: The rapid pace of technological advancements often outpaces the development of regulatory frameworks and policies. This can result in legal and regulatory challenges related to issues such as data governance, intellectual property, liability, and accountability. Striking a balance between innovation and regulation is a complex task that requires careful consideration of the potential risks and impacts of digitalisation.
- Digital Divide and Inequities: Digitalisation has the potential to exacerbate existing inequalities, creating a digital divide between those who have access to digital technologies and those who do not. This can further marginalize vulnerable populations, limit access to information, services, and opportunities, and widen socioeconomic disparities. Ensuring digital inclusivity and addressing the digital divide is critical to ensure that the benefits of digitalisation are accessible to all.
- Misinformation and Disinformation: Digitalisation has also amplified the spread of misinformation and disinformation through online platforms and social media. This can have detrimental effects on society, including undermining trust, influencing public opinion, and creating social divisions. Addressing the spread of misinformation and disinformation is a significant challenge that requires media literacy, factchecking, and regulation of online content.
- Technological Dependence and Resilience: As societies become increasingly reliant on digital technologies, there is a risk of technological dependence, where disruptions to digital infrastructure can result in significant consequences. Ensuring the resilience of digital systems, including robust backup and recovery measures, is crucial to mitigate risks associated with technological dependence while digitalisation brings about numerous benefits, it also presents challenges and risks that need to be addressed proactively.

Navigating these challenges requires a holistic approach, including robust regulations, ethical considerations, cybersecurity measures, inclusivity efforts, and awareness of potential societal impacts.

Research Methodology:

A well-designed and executed research methodology is critical for conducting a rigorous and valid digitalisation research study. It should align with the research objectives, address

the research questions, and adhere to ethical principles. The data collection, data analysis, literature review, interpretation, and conclusion should be conducted meticulously to ensure the accuracy and reliability of the findings, and proper referencing should be followed to acknowledge the contributions

Conclusion:

In conclusion, digitalisation in the 21st century has brought about transformative changes with farreaching impacts on various aspects of society. It has revolutionized the way we live and work, creating new opportunities while posing challenges. It is crucial for policymakers, businesses, and society as a whole to navigate the opportunities and challenges of digitalisation in a responsible and inclusive manner, ensuring that the benefits are maximized while mitigating the risks. Continued research, collaboration, and innovation will be key in shaping the future of digitalisation

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EMPOWERING CHANGE:
WOMEN INNOVATORS DRIVING GREEN TECHNOLOGIES

Mangeet Kaur and Shilpi Manne
Department of Commerce,
Guru Nanak Khalsa College, Yamunanagar

Abstract:
Green technologies, aimed at promoting sustainability and mitigating environmental challenges, have become a focal point in the global fight against climate change. Women innovators are playing a transformative role in advancing these technologies, contributing to eco-friendly solutions across diverse sectors such as renewable energy, waste management, water conservation, and sustainable agriculture. This abstract explores the intersection of green technologies and women-led innovation, emphasizing how women bring unique perspectives and creativity to address pressing environmental issues. Despite facing challenges like gender bias, limited access to resources, and underrepresentation in science, technology, engineering, and mathematics (STEM) fields, women have emerged as trailblazers in developing sustainable solutions. Their efforts not only enhance technological advancements but also foster social inclusion and community resilience. Examples of women-led innovations in green technology include breakthroughs solar energy systems, biodegradable packaging, clean cooking solutions, and water purification technologies. Women entrepreneurs and researchers have also been instrumental in grassroots initiatives, empowering local communities to adopt sustainable practices. These contributions demonstrate the potential of gender diversity in driving sustainable development and achieving global environmental goals. Promoting gender equality and providing equitable opportunities in green technology sectors is crucial for fostering inclusive innovation. Policymakers, institutions, and industries must work collectively to address structural barriers, provide mentorship, and Create funding opportunities tailored to support women innovators. By encouraging more women to participate in green technology development, society can leverage diverse ideas and perspectives to accelerate the transition toward a sustainable future. This paper highlights the dual importance of green technologies in combating climate change and empowering women as key drivers of innovation. Recognizing and amplifying the role of women innovators not only supports

environmental sustainability but also aligns with broader goals of gender equality and social equity. Together, these efforts lay the foundation for a greener, more inclusive world.

Keywords: Green Technologies, Women Innovators, Sustainability, Renewable Energy, Environmental Innovation, Gender Equality, Eco-Friendly Solutions, Climate Action.

Introduction:

The world is facing a climate crisis, necessitating urgent action to transition toward sustainable technologies. Green technologies, which promote environmental sustainability while reducing carbon footprints, have become central to mitigating climate change. While traditionally male-dominated, the science, technology, engineering, and mathematics (STEM) sectors have seen an increasing number of women leading breakthroughs in green technology.

The purpose of this paper is to examine the difficulties faced by female green technology entrepreneurs as well as their contributions to sustainability. It also emphasises laws and programs that support women in the fields of green technology and STEM.

Objectives of the Paper

The primary objectives of this research paper are:

1. To examine the contributions of women innovators in green technologies.
2. To identify the challenges that women face in green technology sectors.
3. To analyse policies and initiatives that promote women's participation in sustainability-driven innovation.
4. To explore strategies for increasing gender inclusion in STEM and green technology.
5. To highlight case studies of successful women-led green technology initiatives.

Research Methodology

This research is conducted by using secondary data for research Using, various web sites, research articles, various reports through websites, online journals, news Articles, and other internet sources. In the present work, the study of green technologies and the role of women in driving this technology.

Women Innovators in Green Technologies

Women-led initiatives are driving green technology solutions across multiple sectors, including renewable energy, waste management, sustainable agriculture, and ecofriendly materials. Some notable women innovators include:

- Dr. Ellen MacArthur (UK) – Founder of the Ellen MacArthur Foundation, a leader in promoting the circular economy to reduce waste and environmental impact.

- Dr. Ayana Elizabeth Johnson (USA) – Marine biologist and co-founder of Urban Ocean Lab, focusing on ocean conservation and sustainable marine policies.
- Dr. Vandana Shiva (India) – Environmental activist and founder of Navdanya, advocating for organic farming and seed sovereignty.
- Katia Moritz (Brazil/USA) – Innovator in renewable energy solutions, developing decentralized solar energy models.

Contributions of Women in Key Green Sectors

1. Renewable Energy

Research and entrepreneurship in renewable energy have benefited greatly from the contributions of women. Women scientists and engineers have made important contributions to the creation of solar panels, wind farms, and bioenergy initiatives.

Case Study: Dr. Katharine Wilkinson

Co-author of Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming, Dr. Wilkinson is a climate strategist. Her advocacy for including gender equality into climate action has been rather strong.

2.Sustainable Agriculture

In order to combat the substantial contribution of agriculture to greenhouse gas emissions, female innovators are developing sustainable farming methods. Innovations led by women have benefitted regenerative agriculture, organic farming, and precision agriculture.

Case Study: Global sustainable food security has benefited from Dr. Molly Jahn's studies on soil health and robust crop varieties.

3. Circular Economy and Waste Management

Women have been trailblazers in waste reduction and recycling efforts. Thanks to organisations run by women, the idea of a circular economy—where things are reused and repurposed rather than discarded—is gaining hold.

Case Study: Miranda Wang, a co-founder of BioCellection, has created chemical methods to turn plastics that were previously unrecyclable into useful materials.

4 Green Chemistry and Sustainable Materials

The goal of green chemistry is to create goods and procedures that do the least amount of damage to the environment. Innovations in sustainable packaging, non-toxic colours, and bioplastics have all been spearheaded by women.

Case Study: Veena Sahajwalla, MD Dr. Sahajwalla, an Australian scientist, is credited with developing "green steel" technology, which drastically lowers carbon emissions by using recycled plastics in place of coal in the steel industry.

Factors Driving Women Entrepreneurship

1. Economic Factors

1.1 Growing Market for Green Technologies

The rising demand for sustainable products and services provides lucrative opportunities for women entrepreneurs. Green energy, waste management, and sustainable fashion are becoming billion-dollar industries.

1.2 Access to Impact Investment and Green Financing

The expansion of green bonds, venture capital, and government grants targeted at sustainability-focused businesses creates financial opportunities. Socially responsible investors are prioritizing women-led start-ups in environmental sectors.

1.3 Job Creation and Financial Independence

Entrepreneurship provides women with financial independence and the ability to create job opportunities for others. Women-led businesses often prioritize ethical employment practices, benefiting local communities.

2. Social and Cultural Factors

2.1 Increased Awareness of Environmental Issues

Women, particularly in developing countries, are often more directly affected by climate change (e.g., access to clean water, agriculture, and healthcare). This first-hand experience drives many women to develop sustainable solutions.

2.2 Support from Women's Entrepreneurial Networks

The rise of women-focused business networks, such as Women in Cleantech & Sustainability (WCS) and SheEO, provides mentorship and funding opportunities. Collaboration and peer support systems empower more women to enter green industries.

2.3 Changing Gender Norms and Societal Expectations

The growing push for gender equality has led to greater acceptance of women entrepreneurs. Women are increasingly encouraged to pursue leadership roles in business and technology.

3. Technological Factors

3.1 Digital Platforms and E-Commerce

Online marketplaces allow women entrepreneurs to promote and sell eco-friendly products globally. Digital marketing and social media provide cost-effective ways to build sustainable brands.

3.2 Advancements in Green Technologies

Innovations in renewable energy, biotechnology, and sustainable materials create new business opportunities. Women entrepreneurs are leveraging AI, blockchain, and IoT for smart sustainability solutions.

3.3 Remote Work and Digital Collaboration

The rise of virtual workspaces and cloud-based collaboration tools enables women to run businesses from anywhere. This flexibility particularly benefits women balancing entrepreneurship with family responsibilities.

4. Policy and Institutional Factors

4.1 Government Support and Incentives

Many governments offer tax breaks, subsidies, and grants for women-led green startups. Policies promoting gender diversity in STEM fields encourage more women to enter sustainability-driven industries.

4.2 International Sustainability and Gender Inclusion Goals

Global initiatives such as the United Nations Sustainable Development Goals (SDGs) and COP climate agreements emphasize gender inclusion in environmental innovation. Programs supporting women's entrepreneurship in green sectors receive backing from international organizations.

4.3 Corporate Social Responsibility (CSR) and Sustainability Commitments

Large corporations are increasingly partnering with women entrepreneurs to meet their sustainability goals. Corporate sustainability programs create funding and mentorship opportunities for female-led start-ups.

5. Personal and Psychological Factors

5.1 Passion for Environmental and Social Impact

Many women entrepreneurs in green technology are driven by a strong personal commitment to sustainability. The desire to leave a positive legacy for future generations is a key motivator.

5.2 Entrepreneurial Mind-set and Risk-Taking Ability

Growing confidence in leadership roles encourages women to start businesses. Women are increasingly taking risks in emerging green markets.

5.3 Desire for Work-Life Balance and Flexibility

Entrepreneurship provides women with the flexibility to manage professional and personal responsibilities. Green businesses often align with values of ethical business practices and work-life integration.

Challenge

Challenges Faced by Women in Green Technology

1. Gender Gap in STEM and Innovation

Despite their contributions, women still face significant barriers in STEM fields, including: Underrepresentation in leadership roles ,Limited access to funding and venture capital, Gender bias and stereotypes in technical industries

2. Access to Capital and Investment

Female entrepreneurs in green technology often struggle to secure investment. Studies show that women-led start-ups receive significantly less venture capital than their male counterparts.

3. Policy and Institutional Barriers

Many policies and institutional structures still do not support women's full participation in green technology sectors. The lack of gender-responsive policies in climate action plans further exacerbates the issue.

Government Initiatives

1. Financial Support and Credit Access

- Pradhan Mantri Mudra Yojana (PMMY): Provides collateral-free microfinance loans up to ₹10 lakh, benefiting women-led eco-friendly start-ups.
- Stand-Up India Scheme: Offers loans between ₹10 lakh and ₹1 crore for women entrepreneurs, encouraging investments in sustainable businesses
- Credit Guarantee Fund Scheme (CGTMSE): Supports women entrepreneurs in accessing loans without collateral for green technology ventures.
- Mahila Coir Yojana: Provides financial assistance for women in the coir industry, promoting eco-friendly and biodegradable products.

2. Capacity Building and Skill Development

- Green Skill Development Programme (GSDP): Conducted by the Ministry of Environment, Forest & Climate Change (MoEFCC) to train women in green skills like waste management, solar energy, and biodiversity conservation.
- Skill India Mission: Offers technical training in solar panel installation, energyefficient appliances, and environmental engineering.
- Women Entrepreneurship Platform (WEP) – NITI Aayog: Provides mentorship, networking, and skill development for women-led green startups.

3. Startup and Innovation Support

- Start-ups India Scheme: Encourages women-led green start-ups through tax exemptions, incubation centres, and funding support.
- Atal Innovation Mission (AIM): Provides funding and incubation for women innovators in sustainable technologies.
- BIRAC (Biotechnology Industry Research Assistance Council) Grants: Offers financial support to women entrepreneurs in biotech-based environmental solutions.

4. Market Access and Digital Platforms

- Udyam Sakhi Portal: A government initiative connecting women entrepreneurs with resources, mentors, and funding opportunities.
- Government e-Marketplace (GeM): Mandates a portion of procurement for women-led businesses, including those offering green technologies.
- Trade Fairs and Exhibitions: Women entrepreneurs are sponsored to showcase their eco-friendly products at national and international events.

5. Policy and Regulatory Frameworks

- National Policy on Women Entrepreneurship (Proposed): Aims to enhance access to finance, technology, and training for women in green industries.
- Renewable Energy Subsidies and Incentives (MNRE): Encourages women-led start-ups in solar, wind, and bioenergy sectors through financial and policy support.
- Faster Environmental Clearances for Women-led Green Enterprises: Simplifies regulatory approvals for eco-friendly.

6. Gender-Specific Climate Action & Sustainability Programs

- UNDP & Indian Government Collaboration: Implements climate resilience programs that empower women entrepreneurs in renewable energy and sustainable agriculture.
- Sustainable Development Goals (SDG) 5 & 13 Integration: Government policies align gender equality with climate action, supporting women-led sustainability ventures.

The Future of Women in Green Innovation

Women's role in green technology is expected to grow as gender-inclusive policies and funding initiatives gain traction. Emerging trend necessary:

- The rise of women-led climate-tech start-ups.
- Gender-focused climate financing models.
- Greater integration of gender equity into global sustainability policies.

By addressing existing challenges and providing the necessary support, women will continue to drive impactful green innovations.

Conclusion:

Women are revolutionising green technology by advancing eco-friendly materials, sustainable agriculture, renewable energy, and circular economies. Their entire potential in the sector is, however, limited by the persistence of gender imbalances. Society can unleash women's full potential in sustainability by creating an inclusive innovation environment through networking, funding, policy support, and education. In addition to promoting gender equality, empowering women in green technology is crucial to building a resilient and sustainable future.

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AUTOMATION AND ROBOTIC PROCESS AUTOMATION (RPA) IN BUSINESS INTELLIGENCE

Gurpreet Kaur[1], Jyoti Bala[1], Tajinder Kaur[2] and Gagandeep Singh[3]

[1]Department of Computer Science Engineering,
Faculty of Engineering Technology and Computing, Desh Bhagat University, Punjab
[2]Department of Applied Science,
Faculty of Engineering Technology and Computing, Desh Bhagat University, Punjab
[3]Department of Medical Lab Sciences,
Faculty of Allied and Healthcare Sciences, Desh Bhagat University, Punjab

Abstract:

Business Intelligence (BI) has evolved beyond dashboards and static reporting into a domain where automation and Robotic Process Automation (RPA) play pivotal roles. Automation enhances BI by streamlining data preparation, analysis, and reporting, while RPA extends this by mimicking human interactions with software systems to automate repetitive BI-related tasks. Together, they bridge the gap between data collection, analytics, and decision execution. This paper examines how automation and RPA integrate into BI systems, explores their benefits and challenges, and highlights their role in enabling data-driven, real-time, and self-service analytics for organizations.

Keywords: Business Intelligence, Artificial Intelligence, Robotic Process Automation (RPA).

1. Introduction:

In today's digital economy, organizations are increasingly dependent on Business Intelligence (BI) to transform raw data into actionable insights that drive competitive advantage. BI encompasses a broad set of methodologies, processes, and tools for collecting, integrating, analyzing, and visualizing organizational data to support both strategic and operational decisions (Wixom & Watson, 2010). Traditionally, BI has been characterized by descriptive and diagnostic analytics, where dashboards, static reports, and query systems provide answers to *what happened* and *why it happened*. While valuable, these approaches are often limited in scope, reactive in nature, and highly dependent on manual processes for data preparation, report generation, and distribution (Chen *et al.,* 2012).

As data volumes grow exponentially and organizations demand faster, more agile insights, the limitations of conventional BI become apparent. Modern enterprises require real-time intelligence that can integrate seamlessly with operational workflows, enable predictive capabilities, and reduce human dependency in repetitive processes. To address these needs, automation and Robotic Process Automation (RPA) have emerged as critical technologies enhancing BI systems.

Automation in BI refers to the use of rule-based scripts, workflows, and AI-driven methods to streamline BI tasks such as data collection, cleansing, transformation, anomaly detection, and report scheduling (Davenport, 2018). For example, automated ETL (Extract, Transform, Load) pipelines can ingest data from multiple sources, transform it into usable formats, and load it into BI platforms without requiring manual intervention. Similarly, automated alerting systems can notify stakeholders when KPIs deviate from expected thresholds. By minimizing manual workload, automation enhances accuracy, scalability, and timeliness across the BI lifecycle.

RPA extends the scope of automation by employing software "bots" that mimic human interactions with digital systems (Aguirre & Rodriguez, 2017). Unlike traditional automation, which depends on structured APIs or predefined workflows, RPA can interact with user interfaces (UI) much like a human operator, making it particularly useful for organizations with heterogeneous IT landscapes and legacy systems. Within BI, RPA bots can log into ERP or CRM systems, extract transactional records, populate dashboards, and distribute personalized reports across communication channels such as email, Slack, or Microsoft Teams. In more advanced implementations, RPA can even initiate corrective actions — for instance, placing an automated purchase order when BI systems detect low inventory.

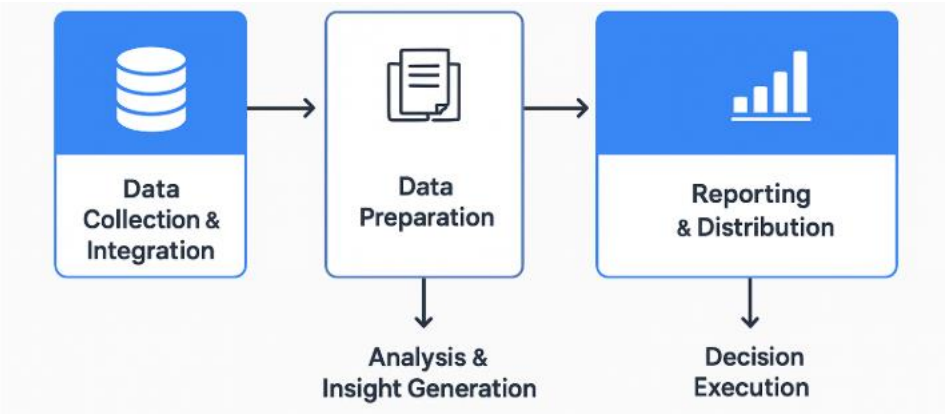
The integration of automation and RPA into BI marks a significant evolution toward end-to-end intelligent analytics pipelines. Instead of BI being restricted to passive reporting, organizations can now achieve proactive and continuous intelligence delivery. This shift aligns with the emerging paradigm of "lights-out analytics", where BI systems run with minimal human intervention (Gartner, 2021). Related industry trends, such as *hyperautomation* and *augmented analytics*, further highlight this transformation. Hyperautomation combines RPA with artificial intelligence (AI), machine learning (ML), and process mining to create adaptive workflows capable of handling complex decision-making scenarios (van der Aalst, 2021). Augmented analytics leverages AI to automatically

generate insights, narratives, and recommendations, thereby democratizing BI and reducing reliance on skilled analysts (Davenport & Bean, 2018). Together, these developments point toward the emergence of self-driving analytics systems that not only analyze but also act on insights.

Despite the growing adoption of automation and RPA in BI, several challenges remain. Key issues include data quality and governance, as automated pipelines can propagate errors at scale; system interoperability, given the diversity of enterprise IT landscapes; and organizational resistance, as employees may fear job displacement or loss of control (Syed *et al.,* 2020). Ethical and regulatory concerns also arise, particularly in ensuring transparency, accountability, and compliance when automated bots perform BI-related tasks. Furthermore, while automation reduces human dependency, it introduces a need for new governance frameworks, monitoring mechanisms, and skillsets to manage and optimize these systems effectively.

This paper explores the transformative role of automation and RPA in BI. It examines their core concepts, integration into data and analytics pipelines, benefits, challenges, and practical applications across industries such as finance, healthcare, manufacturing, and retail. The paper also highlights emerging trends such as hyperautomation, conversational BI, and generative AI integration. By doing so, it provides a comprehensive perspective on how automation and RPA are reshaping BI, enabling real-time decision-making, operational agility, and ultimately paving the way for autonomous, intelligent analytics systems.

2. Understanding Automation and RPA in BI



2.1 Automation in BI

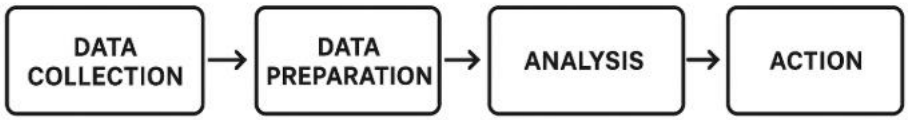
- Refers to the use of scripts, workflows, and AI/ML-driven processes to automate tasks like:

- Data extraction and cleansing
- ETL pipelines
- Automated anomaly detection
- Scheduled reporting and alerting

2.2 Robotic Process Automation (RPA)

- RPA uses software "bots" that replicate human interactions with digital systems.
- In BI, bots can:
  - Log into ERP/CRM systems to collect data
  - Populate BI dashboards with new data
  - Trigger reports for distribution (email, Slack, Teams)
  - Update KPIs across different platforms

3. Integration of Automation and RPA in BI Pipelines



i. Data Collection & Integration

- RPA bots fetch data from legacy systems, APIs, or even web scraping, feeding into BI platforms.

ii. Data Preparation

- Automated workflows clean, transform, and merge data, reducing manual errors.

iii. Analysis & Insight Generation

- ML-powered automation detects anomalies, predicts trends, and surfaces insights.

iv. Reporting & Distribution

- RPA delivers personalized reports to stakeholders at scheduled times.

v. Decision Execution

- Advanced integration allows BI → RPA workflows to trigger actions, e.g., automatically reordering stock when thresholds are crossed.

4. Benefits of Automation and RPA in BI

- **Speed and Efficiency**: Reduces manual reporting cycles.
- **Accuracy**: Minimizes human error in repetitive tasks.
- **Scalability**: Can handle large datasets and multiple processes simultaneously.

- **Accessibility**: Democratizes analytics by automating complex technical tasks.
- **Cost Savings**: Reduces labor costs in reporting and monitoring.

5. Challenges and Risks

- **Data Quality Dependence**: Automation may amplify poor data quality issues.
- **Change Management**: Employees may resist RPA adoption due to job displacement fears.
- **Complexity of Processes**: Not all BI workflows are easily automated.
- **Governance & Compliance**: Automated bots must comply with data security and privacy regulations.
- **Maintenance Overhead**: Bots and automation pipelines require monitoring and updates.

6. Industry Applications

- **Finance**: RPA bots reconcile transactions and push updated reports into BI systems.
- **Retail**: Automated dashboards track inventory levels and trigger replenishment.
- **Healthcare**: Bots extract patient data across systems for BI dashboards.
- **Telecom**: Automated network monitoring dashboards highlight outages in real time.
- **Manufacturing**: RPA integrated with BI forecasts machine failures and generates maintenance tickets.

7. Future of Automation and RPA in BI

- **Hyperautomation**: Combining RPA, AI, ML, and process mining for end-to-end BI automation.
- **Self-Service BI + RPA**: Empowering non-technical users to trigger BI tasks via natural language.
- **Integration with Generative AI**: Intelligent bots capable of not only retrieving data but also generating narrative reports.
- **Autonomous Decision Systems**: BI insights automatically triggering business workflows without human intervention (e.g., self-driving analytics).

Conclusion:

Automation and RPA are transforming BI from reactive reporting systems into proactive, intelligent decision-support ecosystems. By automating repetitive tasks and integrating insights directly into business workflows, organizations can achieve real-time agility and reduce operational overhead. However, successful adoption requires addressing challenges

of data quality, governance, and workforce transformation. As automation converges with AI, the future of BI is poised to become increasingly autonomous, efficient, and accessible.

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ROLE OF GREEN TECHNOLOGY AND ECO-INNOVATION IN MITIGATION OF ENVIRONMENT DEGRADATION

Sachin Kumar
Akal IAS Academy,
Baba Jujhar Singh Gurmat Trust, Karnal
Corresponding author E-mail: kumar.smathur@gmail.com

Abstract:
Green technology and eco-innovation are emerging fields focused on addressing environmental challenges through the development and implementation of sustainable solutions. Green technology, also known as clean technology, emphasizes innovations that reduce environmental impacts, promote energy efficiency, and conserve natural resources. Eco-innovation goes beyond technology by incorporating new processes, services, and business models aimed at sustainable development. The rising demand for cleaner energy sources, waste management, and pollution reduction has accelerated investments in green technologies such as renewable energy, electric vehicles, energy-efficient appliances, and sustainable agriculture. Innovations like solar panels, wind turbines, and biofuels illustrate the shift towards reducing carbon footprints. Similarly, eco-innovation fosters a systemic change in production and consumption patterns by integrating environmental considerations into every aspect of the supply chain. Challenges persist in scaling these innovations due to costs, regulatory barriers, and the need for significant behavioural shifts among consumers and industries. However, the growing global commitment to combating climate change, as demonstrated by international agreements like the Paris Accord, underscores the critical role of green technology and eco-innovation in achieving a low-carbon economy. In conclusion, green technology and eco-innovation are vital for fostering long-term environmental sustainability. They represent not only technological advancements but also a paradigm shifts towards greener, more resilient economies. Continued research, investment, and policy support will be essential to realizing their full potential in mitigating environmental degradation and promoting sustainable growth.

Keywords; Green Technology, Renewable Energy, Eco Innovation, Environment Sustainability, Energy Efficient Appliance.

Introduction:

Environmental degradation, caused primarily by industrial activities, deforestation, and

unsustainable agricultural practices, poses a serious threat to global ecosystems. It has led to severe consequences such as loss of biodiversity, climate change, and depletion of natural resources. Green technology, which involves the use of sustainable methods and products, and eco-innovation, referring to the development of new or improved solutions that reduce environmental harm, offer promising avenues to counter these issues. This research explores how the integration of these approaches can help mitigate environmental damage while supporting economic and social growth.

Environmental degradation, defined as the deterioration of the natural environment due to human activities, poses a significant threat to ecosystems and human well-being. Activities such as excessive carbon emissions, deforestation, and pollution are leading to adverse consequences like global warming, loss of biodiversity, and depletion of natural resources. To address these challenges, green technology and eco-innovation have emerged as solutions that combine economic growth with environmental protection. These innovations aim to reduce the negative impacts of human activities on the environment while promoting sustainable development.

1. **Green Technology: Definition and Importance**

   Green Technology: Overview and Significance

   Utilising eco-friendly technologies that minimise pollution, save resources, and lower greenhouse gas emissions is known as "green technology." Energy-efficient appliances, electric cars, waste management systems, and renewable energy sources including solar, wind, and hydropower are some examples of these technologies. Since green technologies provide alternatives to fossil fuels and conventional industrial processes, their development and application are crucial to reducing the environmental effect of human activity.

   Early Use of Green Technologies

   Humans have been using sustainable solutions for everyday needs for thousands of years. For example, early humans used geothermal heating by bathing in hot springs and building homes from lava. They also used wind energy to move boats down the Nile and pump water and grind grains.

   Green Technology Evolution

   Green technology has evolved to include renewable energy sources, waste management, and recycling systems.

The Fundamentals of Green Technology

- Renewable Energy: Using energy from natural resources such as sunshine, wind, and water is a common goal of green technology. These ideas are illustrated by hydroelectric systems, wind turbines, and solar panels.
- Energy-Efficient Infrastructure: In order to cut waste, green technology places a high priority on energy efficiency. This involves designing and constructing buildings, transportation systems, and appliances that use less energy.
- Waste Reduction: While promoting recycling and upcycling, sustainable practices seek to lessen the production of waste. In order to turn garbage into a resource rather than a burden, green technology looks at creative ways to manage it.

1.1 Renewable Energy

Renewable energy is one of the most prominent aspects of green technology. Unlike fossil fuels, renewable energy sources such as solar, wind, and geothermal do not produce harmful emissions or deplete natural resources. Transitioning to renewable energy reduces greenhouse gas emissions, which are the primary drivers of climate change. The widespread adoption of renewable energy technologies has the potential to decouple economic growth from environmental degradation, ensuring that energy demands are met sustainably.

1.2 Energy Efficiency

Energy efficiency technologies, such as LED lighting, energy-efficient appliances, and building insulation, reduce the amount of energy required to perform various tasks. Improving energy efficiency can significantly reduce energy consumption, lower carbon emissions, and decrease dependence on non-renewable energy sources. For example, smart grids and energy management systems optimize energy distribution and consumption, helping to reduce waste and ensure a more sustainable energy system.

The idea of eco-innovation is fairly recent. One of the first appearances in the literature was in a 1996 book by Claude Fussler and Peter James. In a subsequent article in 1997, Peter James defined eco-innovation as "new products and processes which provide customer and business value but significantly decrease environmental impacts". Klaus Rennings Employs the term eco-innovation to describe three kinds of changes related to sustainable development: technological, social, and institutional innovation.

2. Eco-Innovation: Concept and Impact

The creation of novel goods, procedures, or services that lessen their negative effects on the environment and advance sustainability is referred to as eco-innovation. Green

products composed of recyclable materials and innovative production techniques that lower waste and emissions are examples of eco-innovations. Achieving a circular economy depends heavily on the idea of eco-innovation, which spans several industries including waste management, manufacturing, transportation, and agriculture.

2.1 Sustainable Agriculture

Agricultural practices contribute significantly to environmental degradation through deforestation, soil degradation, and excessive water use. Eco-innovations in agriculture, such as precision farming, organic farming, and agroforestry, promote sustainable land use and reduce the environmental footprint of food production. By optimizing the use of water, fertilizers, and pesticides, eco-innovations help to reduce pollution and conserve biodiversity while maintaining food security.

2.2 Circular Economy

The circular economy is a model that focuses on minimizing waste and maximizing the value of resources by keeping them in use for as long as possible. Eco-innovations that support the circular economy include recycling technologies, waste-to-energy systems, and sustainable packaging solutions. These innovations reduce the environmental impact of production and consumption by closing the loop on resource use and minimizing the extraction of new raw materials.

3. The Role of Policy and Regulation

The adoption of green technology and eco-innovation depends on supportive policies and regulations. Governments play a critical role in promoting sustainable development through incentives, subsidies, and regulations that encourage the use of green technologies. Carbon pricing, renewable energy mandates, and pollution control measures are examples of policies that can drive the transition to a low-carbon, sustainable economy. Moreover, international agreements such as the Paris Agreement emphasize the need for collective action to reduce greenhouse gas emissions and limit global warming to 1.5°C above pre-industrial levels.

4. Challenges in Implementing Green Technology and Eco-Innovation

While green technology and eco-innovation offer significant potential to mitigate environmental degradation, their implementation faces several challenges. These include high initial costs, technological barriers, and resistance from industries reliant on traditional technologies. Furthermore, the uneven distribution of resources and technological capabilities across regions can hinder the widespread adoption of green solutions.

4.1 Cost and Access

The high upfront cost of green technologies, such as solar panels or electric vehicles, can be a barrier to adoption, especially in developing countries. While long-term cost savings are often realized through energy efficiency and reduced resource consumption, the initial investment may be prohibitive for many businesses and households. Additionally, access to green technologies is often limited in rural or underdeveloped areas, exacerbating existing inequalities in environmental impact and climate vulnerability.

4.2 Technological Limitations

Despite advancements in green technology, certain limitations remain. For instance, energy storage technologies like batteries have not yet reached the level of efficiency needed to fully support the intermittent nature of renewable energy sources. Furthermore, many green technologies require rare or expensive materials, which can limit their scalability and environmental benefits. Continuous innovation is needed to overcome these technological barriers and enhance the effectiveness of green solutions.

4.3 Policy Gaps: In many regions, inadequate policy frameworks and regulatory support can slow the transition to a green economy.

The Adverse Effects of Green Technologies

Governments, corporations, and individuals must work together in a deliberate and coordinated effort to address these concerns. In order to fully utilise green technology and guarantee a sustainable future for the earth, these challenges must be overcome. Other examples of how green technology have a detrimental influence include:

Waste Electronic (E-Waste): Green technologies add to electronic trash and make proper disposal and recycling more difficult. Examples of these technologies include solar panels, wind turbines, and batteries for electric vehicles.

Geopolitical Tensions: Because a small number of nations control most of the world's reserves, the reliance on rare and essential resources for green technology may give rise to trade conflicts and supply chain vulnerabilities.

Infrastructure Recycling's Obstacles: For some green technologies, inadequate recycling infrastructure can impede appropriate electronic.

Several green technologies and eco-innovations have been brought to light by the G20 meeting, including:

- **Fund for Green Climate**

  For the years 2024–2027, the G20 demanded a significant replenishment of the Green Climate Fund.

- Industry Coalition for Resource Efficiency and Circular Economy (RECEIC)

This alliance was formed by the G20 to encourage circular economy and resource-efficient business practices.

- **Alliance for Global Biofuels**

This partnership was formed by the G20 to hasten the use of biofuels worldwide.

- **The Green Hydrogen Innovation Centre**

This centre was founded by the G20 to encourage the use of green hydrogen as a major force behind the shift to a low-carbon economy.

- **Gathering of the Research and Innovation Initiative (RIIG)**

The G20 gave the Research and Innovation Working Group (RIIG) official Working Group status (RIWG).

The Ethical Difficulties of Developing Green Technology

Human rights

In mining zones, the extraction of rare minerals and metals for green technology may result in violations of human rights. Openness ethical questions may arise from a lack of transparency or measures to minimise detrimental effects on the environment.

Fairness in Society

It is crucial to make sure that everyone can profit from green technology and that nobody is left out of the process.

Green Technology and the Economy's Challenges

There are obstacles in the way of green technology's economic integration. Among these is opposition from well-established industries. Moreover, legislative and policy barriers appear. International cooperation is essential. The goal of this partnership is to address environmental problems as a group.

Industry Resistance: The implementation of green technologies may face resistance from established sectors. This opposition stems from worries about expenses, interruptions, and ambiguous advantages. It is imperative to need proactive engagement and incentives. This serves to highlight the benefits of green technology.

Policy and Regulatory Barriers: Conventional techniques are frequently favoured by intricate legislation. Green projects are hampered by these practices. Frameworks for support are required. Simplified procedures and uniform enforcement are also necessary.

Financial Restraints: Businesses are discouraged by high upfront costs. Avoid investing on green solutions, especially for SMEs. This emphasises how crucial it is to have accessible

Environmental and Social Impact

In mining zones, these green technologies cause environmental harm, habitat devastation, and violations of human rights. When there is a lack of openness or an effort to minimise detrimental effects on the environment, ethical issues come up.

5. Future Prospects and Opportunities

The future of green technology and eco-innovation is promising, as global awareness of environmental challenges continues to grow. Advances in fields such as artificial intelligence, biotechnology, and nanotechnology offer new opportunities for developing more efficient and sustainable technologies. Additionally, as the cost of renewable energy continues to fall, the transition to a low-carbon economy becomes more feasible. Collaboration between governments, industries, and research institutions will be key to accelerating the development and adoption of green technologies.

Conclusion:

Green technology and eco-innovation, which offer long-term substitutes for conventional methods, are vital in reducing environmental damage. Numerous inventions can aid in lowering pollution, conserving resources, and safeguarding ecosystems. These include energy efficiency, sustainable agriculture, renewable energy, and circular economy models. But overcoming obstacles like cost, accessibility, and technology constraints will call for concerted efforts from communities, businesses, and policymakers. Green technology and eco-innovation have the power to propel a more sustainable future by striking a balance between environmental preservation and economic growth, provided they receive the proper backing. Green development requires eco-innovation since it is a fresh and valuable approach to accomplishing resource conservation or environmental improvement.

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THE FUTURE OF WORK AND WORKFORCE TRANSFORMATION IN A DIGITALLY CONNECTED WORLD

Kiran, Divya Malhan, Simran Sehgal and Tamanna
Maharshi Dayanand Umiversity (MDU),
Rohtak, Haryana

Abstract:
The future of work is being reshaped by intertwined forces, accelerated digital connectivity; Artificial intelligence (AI). Work is changing quickly because of AI, automation, better internet access, climate goals, shifting demographics and global uncertainty. These forces are changing what jobs exits, how work is done, what skills are valuable and how people and organization succeed. It shows why hybrid work is here to stay, which skills are rising in value, how AI can help people instead of replacing them and what leaders can do to make work both productive and fair. It ends with a practical roadmap for building human-centered, AI enabled, flexible and inclusive workplaces.

Introduction:
Work used to be organized around fixed jobs, fixed workplaces and fixed career paths. That model is fading. Today much work is digitally, team based and done across locations.AI tools can draft, summarize, analyze and automate routine steps. The internet connects teams across cities and countries (Sidhu *et al.,* 2024). At the same time, companies are retooling for cleaner energy and populations are aging in many countries while youth populations grow in others. These changes create both pressure and opportunity. Some roles shrink new roles grow and many roles changes in their daily tasks. This chapter offers a clear guide to these shifts (Sehrawat *et al.,* 2025). First, it explains the big forces that drive change. Next it shows how jobs and tasks are being redesigned. Then it covers skills, hybrid work, technology foundation, new many organizations operate and issues of fairness and policy. It includes examples, risks and a step by step roadmap leaders can use now.

1. Big Forces Reshaping Work

- AI and automation: AI is now practical, affordable and embedded in everyday tools. It can speed up writing, analysis, customer support and many repetitive tasks. Automation in factories and services reduces error and time, freeing people for high value work (Schatten and Aires, 2025).

- Connectivity and platforms: Reliable internet, cloud tools and collaboration platforms let people work from anywhere. This increase flexibility expands hiring pools, and enables 24/7 operations, if teams coordinate well (Ramesh, 2025).
- Green transition: Companies are moving toward cleaner energy and more efficient operations. This creates "green" roles and new skills in energy, materials, logistics and reporting. It also pushes firms to retrain existing staff (Samuel and Moagi, 2022).
- Demographics and geopolitics: Aging pollution in advanced economies raises demand for healthcare and care roles. Younger populations elsewhere create talent pools for digital and service work (Ramaul *et al.,* 2025). Geopolitics shifts influence where companies place teams and chains (Rahim *et al.,* 2022).
- Economic uncertainty: Frequent shocks make adaptability essential. Firms need flexible teams, skills-based staffing, and the ability to reconfigure work fast.

2. From Jobs to Tasks: How Work is Redesigned

- Tasks to automate: repetitive data entry, basic scheduling, simple reconcilations, template-based drafting (Özkul and Bayram, 2023).
- Tasks to augment with AI: Research, analysis, first drafts, summarizations, classifications, recommendations (Poleg, 2019a).
- Tasks to keep human: Judgment, ethics, negotiation, empathy, complex problem solving, creative strategy (Prabhakar, 2025).

Good redesign does not just "add tools". It rewrites workflows: who does what, in what order, with which checks.

3. Skills for Next Decade

- Rising technical skills: data literacy, data analysis, prompt redesign, AI supervision, cyber security, cloud basics, process improvement, and green literacy (Nzama *et al.,* 2024).
- Rising human skills: Communication, collaboration, adaptability, critical thinking, ethical judgment, stakeholder influence and learning agility (Negrete *et al.,* 2024).

- Skills-based talent systems: Employers increasingly assess and reward skills, not just titles or degrees. Internal marketplaces match people to projects. Micro credentials and short practice-based courses speed up reskilling (Ndhlovu *et al.,* 2025).

The best path is "T-shaped" skills: one strong specialty (e.g. finance, supply chain nursing, and sales) plus broad digital data and human skills.

4. Hybrid Work That Actually Works

Hybrid work- some days on site, some remote-has stabilized in many organizations. Studies show it can improve satisfaction and retention without hurting performance when does intentionally. The keys are-

- Clarity: Team level agreement for cadence, core hours, response times, documentation and decision making (Maslon-Orac *et al.,* 2025).
- Purposeful in – person time: use office days foe trust, creativity and complex collaborations-not just status meetings (Mehta and Singh, 2024).
- Outcome-based management: Judge Work by results, not presence. Use clear goals and shared dashboards (Macdonald, 2021).
- Equity: Ensure access to devices, bandwidth and learning. Make visibility and growth opportunities fair for remote and on site staff alike (Loganathan and Pidani, 2025).
- Manager enablement: Train managers in distributed leadership, feedback, and workload balance and conflict resolution (Nam, 2019).

Review of Literature:

Research on the future work has expanded rapidly, yet its emphases have been uneven across technological, social, economic, and institutional dimensions. A seminal science mapping analysis by Santana and Cobo (2020) reviewed 2,286 articles published between 1959 and 2019 across management, business and industrial labor relations. Complementing this macro level mapping, Glikson and Wooley (2020) synthesized 150 empirical studies. They show that trust hinges on AI's representation (robotics, virtual, embedded) and perceived intelligence, with tangibility, transparency, reliability and immediacy driving cognitive trust shaping emotional trust. Turning from trust to governance, Parent-rocheleau (2022) identify six, managerial functions increasingly automated-monitoring, goal setting, performance management, scheduling, compensation, and termination and map their implications for job resources and job demands. Broadening

the scope across disciplines, Subramony *et al.* (2024) distinguish between app work, crowd work and capital platforms. At the micro level Bankins *et al.,* (2024) delineate five themes- Human AI collaboration, perceptions of AI capabilities, workers attitude to aI, AI as control to platforms work and labor market. Wajcman (2006) argues that technical and social are inseparable when studying work and ICT's, challenging teachnologicsl determination and urging analysis that treat technologies and social arrangements as co- consititutive. Mackenzie (2018), traces how high frequency trading evolved from human to algorithmic actors, demonstrating that marketers themselves become computational systems, this shifts reframes labor, control and expertise in financial work.

5. Technology Foundations Behind the Scenes

High performing organizations are moving from scattered tools to connected platforms:

- Data foundations: Clean data, clear ownership, privacy and security by design.
- Integrated systems: AI connected to core systems (e.g. CRM, ERP, HR) so insights flow into daily works (Krishnamoorthy and Keating, 2021).
- Smart Automation: Process mining to chose the right workflows, human-in-the-loop quality checks and practical metrics like cycle times, error rates and customer satisfaction (Kumar, 2023).
- Responsible AI: Bias testing, transparent usage policies, audit trails and human oversight where decisions affect people's lives (Lang, 2021).
- Connectivity: Secure cloud, reliable devices and collaborations tools so distributed teams can deliver without friction (Kougiannou and Mendonça, 2024).

6. New Ways Organizations Operate

- From roles to skills: maintain a living skills map; use it for staffing, learning, and pay decisions (Kenon and Bartlett, 2025).
- Networked teams: Cross-Functional squads from around outcomes (e.g., a product launch or a process fix) and disband when done (Kapoor, 2025).
- Product operating models: Durable teams own end-to-end outcomes (like customer on boarding), blending business and tech.
- Internal mobility: Talent flows to priority work through internal marketplaces; people learn by doing.

- Continuous change: Leaders practice sense-making, experimentation and coaching. Change is not a one-off project but a steady capability (Hopf *et al.,* 2025).

7. Productivity and Well-Being: Getting Both Right

AI and hybrid can improve productivity, quality, and retention when work is redesigned. But benefits are not automatic:

- Redesign first, tools second: map workflows, fix handoffs and set clear quality checks (Holbeche, 2022).
- Measure what matters: outcomes, cycle time, error rates, customer impact, internal mobility and learning velocity.
- Prevent burnout: Set reasonable workloads, right-to-disconnect norms, and fair performance standards for distributed teams (Holzmann *et al.,* 2022).
- Fairness and Inclusion: Give equal access to tools, learning and visibility; watch for proximity bias.

8. Sectors and Roles: What Likely to Grow or Change

- Growing roles: AI and data roles; cyber security, product management Process owners, green economy roles, healthcare and care works, education and training (Castaneda *et al.,* 2025).
- Transformational roles: Finance, HR, marketing, sales, procurement, and customer support-now AI- augmented with higher expectations for analysis, communication and stakeholder influence (Dey, 2025).
- Shrinking tasks: Routine clerical work, basic reporting, simple processing, with reskilling people in these roles can move into analysis, customer-facing work, or process improvement (Galipeau, 2023).

9. Policy, Fairness and Social Impact

Three big policy themes matter:

- Lifelong learning: make short, affordable, recognized learning pathways available to all. Link credentials to employers needs (Carr *et al.,* 2023).
- Portable protections: as careers become more fluid, benefits and protections should travel with workers across jobs and platforms.
- Digital inclusion: ensure access to devices, broadband and safe digital identities for all regions and groups, without this inequality widen (Boone *et al.,* 2025).

- Public-private partnership helps align education with jobs, expands apprenticeships, support regional "talent hubs" and accelerate green and AI skills. This is essential for both economic competitiveness and social cohesion.

10. Practical Examples

- Hybrid done right: A company sets two teams days in office each week, keeps shared core hours, uses written decisions and track outcomes. Attrition falls, teams report clearer focus and less meeting overload.
- Smart automation in finance: The AP team uses process mining to target invoice matching. AI flags likely matches; human reviews exceptions (Bankins *et al.,* 2024). Cycle time drops, errors fall and analysts spend time on supplier strategy instead of manual checks.
- Skills-first staffing: Internal market places list short projects (e.g. data clean up customer journey mapping). Employees apply based on skills. This fills urgent needs and gives staff real-world learning without external hires (Allam and Takun, 2022).
- Responsible AI in HR: Recruiters use AI to screen resumes, but humans define the criteria, monitor bias and review shortlists. Clear documentation explains decisions to candidates.

11. Common Risks and How to Handle Them

- Inequality: Provide devices, connectivity and learning access to underserved groups and regions, monitor mobility and pay gaps (Arman *et al.,* 2024).
- Job displacement: Start reskilling early, create clear internal paths, offer carrer coaching, align incentives so managers move people, not just hire new.
- Low trust in AI: Use explainable models where possible, include humans in high stakes decisions, publish usage rules, audit regularly (Awad, 2024).
- Hybrid confusion: Replace vague rules with simple team agreements, lead with outcomes, document decisions.
- Change fatigue: Pace programs, communicate trade-offs, celebrate wins, and build manager capacity.

12. Roadmap for Leaders

- Set a"human + AI Vision: Decide where AI will help people do better work. Focus on quality, safety and value –not only cost.

- Stand up a skills engine: Create a skills map; tie pay and promotion to skills; offer short learning paths; use projects as classrooms (Adobor *et al.,* 2023).
- Make hybrid intentional: Team level agreements, purpose-driven office time and manager training for distributed leadership.
- Modernize the backbone: Clean data, connect systems, apply process mining and add humans-in-the-loop checks.
- Measure what matters: Outcomes, learning velocity, internal mobility, inclusion, and well being reported transparently.
- Partner for Impact: Team up with educators, industry persons, groups and government to grow AI data and green skills at regional scale (Alfes *et al.,* 2022).

Conclusion:

The future of work is not about choosing humans or machines. It is about combining human strengths with AI and smart systems to create better jobs, stronger organizations, and fairer opportunities Al Mokdad, M. (2024). The most successful employers will redesign work around human value, teach human new skills continuously and make hybrid work clear, fair and outcome focused.AI responsible, connected platforms, and a skills-first mindset, work can be more productive and more humane at the same time. The choices leaders make now about inclusion, learning, and design will shape whether the digitally connected world spreads opportunities or concentrates it. Tools are here; the path is clear; the task is built with care.

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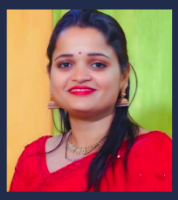
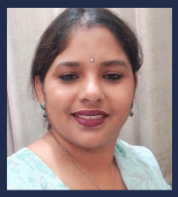


Ms. Priya is an Assistant Professor at Amity University, Patna, Bihar, with over eight years of teaching and research experience. She is pursuing her Ph.D. from Birla Institute of Technology, Mesra, Ranchi, and holds an MBA with dual specialization in Marketing and Human Resource Management from L. N. Mishra Institute, Patna. With 1.5 years of corporate experience, she blends academic rigor with practical insights. As a certified trainer with the National Skill Development Council, she contributes to professional skill enhancement. Ms. Priya has published research papers in ABDC-listed journals, authored book chapters, and presented papers at national and international conferences. Passionate about teaching, research, and holistic education, she continues to inspire students and strengthen the academic and professional learning environment.



Dr. Manju Devi is an Assistant Professor of Commerce at Government College for Women (GCW), Karnal. She holds a Ph.D. in Human Resource Management from GJU S&T, Hisar, an M.Com from Kurukshetra University, and an M.A. in Economics. A NET/JRF-qualified scholar, she brings deep expertise in worker participation, organizational behavior, and economic analysis. With a strong academic and research background, Dr. Devi effectively integrates theory with practical insights, encouraging critical thinking and innovation among students. Her teaching style emphasizes collaboration, analytical skills, and application-based learning. She has a proven record of excellence in commerce and human resource management, along with a passion for research and curriculum development. Dedicated to academic growth and leadership, she continues to inspire students through innovative teaching and scholarly engagement.

Mr. Sahil Gupta is an Assistant Professor and Coordinator in the Department of Laws at Universal Law College, Lalru, Mohali, Punjab. He holds a B.Com (Hons) from Himachal Pradesh University, an LL.B from Bahra University, Shimla Hills, and an LL.M in Business Law from the University of Petroleum and Energy Studies, Dehradun. Currently pursuing his Ph.D. at Maharishi Markandeshwar (Deemed to be University), he actively participates in faculty development programs, conferences, webinars, and workshops. His research focuses on Business Law, emphasizing the integration of contemporary legal issues into teaching and research. Known for his innovative pedagogy and dedication to academic excellence, Mr. Gupta fosters analytical thinking and a practical understanding of law among students. He has received recognition and awards for his contributions to legal education and research.

Gourav Kamboj is an accomplished academician and researcher with expertise in Commerce and Business Management. A Gold Medalist in B.Com, he holds an M.Com (Finance and Marketing), DCAA, and MBA from Kurukshetra University, Kurukshetra. He is currently an Assistant Professor and Ph.D. scholar at LM Thapar School of Management, Thapar University, Patiala. Mr. Kamboj has presented over 30 research papers at national and international conferences and published extensively in reputed journals. He has also authored several book chapters and serves as a reviewer for multiple international journals. Actively engaged in FDPs, webinars, and workshops, he demonstrates a strong commitment to lifelong learning and academic excellence. With his innovative teaching and research acumen, he continues to inspire students and contribute significantly to the field of management education.

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