INDIGENOUS INNOVATION FOR SUSTAINABLE FUTURE OF INDIA

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FOREWORD

"Education becomes meaningful when it bridges the wisdom of our ancestors with the aspirations of future generations."

It is with immense pride that SD College presents "Indigenous Innovation for Sustainable Future of India," a scholarly endeavor that exemplifies our institution's commitment to research excellence and national development. This publication represents the convergence of academic rigor with India's rich intellectual heritage, positioning traditional knowledge as a cornerstone for contemporary innovation.

Our college has always championed the philosophy that true education must be rooted in cultural values while embracing global perspectives. This comprehensive volume embodies that vision by demonstrating how indigenous wisdom can inform sustainable development strategies, technological innovation, and social transformation.

The research presented within these pages reflects our faculty's dedication to addressing critical national challenges through evidence-based solutions. From integrating Vedic principles in modern education to exploring digital inclusion strategies for rural communities, each contribution offers practical pathways toward India's sustainable future.

As we witness rapid technological advancement and environmental challenges, the importance of indigenous knowledge systems becomes increasingly apparent. This publication validates our belief that sustainable development cannot be achieved through imported solutions alone but requires deep understanding of local contexts, traditional practices, and community wisdom.

SD College takes pride in fostering research that serves national interests while maintaining global relevance. This book stands as evidence to our commitment to academic excellence and our responsibility toward building a sustainable, prosperous India that honours its heritage while embracing innovation.

We are confident this work will inspire policymakers, researchers, and practitioners to explore indigenous innovations as viable solutions for

contemporary challenges, ultimately contributing to India's emergence as a global leader in sustainable development.

I congratulate Dr. Savita Gupta, Chief Editor of the book and the Editors, Dr. Palwinder Kaur, Dr. Kanwardeep Singh Dhaliwal and Dr. Sachin Kumar for choosing a very relevant topic for publication. I extend my greetings for the successful publication of the book.

Sincerely Yours

Hema Sharma
President
New S. D. College Managing Committee
Hoshiarpur

MESSAGE

"Innovation rooted in wisdom creates solutions that are both transformative and timeless."

As India embarks on its journey toward becoming a developed nation by 2047, the integration of indigenous knowledge with contemporary innovation emerges as our most strategic advantage. This comprehensive volume, "Indigenous Innovation for Sustainable Future of India," presents a meticulously curated collection of research that demonstrates how traditional wisdom can address modern challenges while driving sustainable development.

The book encompasses critical dimensions of India's transformation journey. From reawakening modern education through Vedic insights to addressing unemployment challenges posed by artificial intelligence, each chapter offers evidence-based solutions that balance technological advancement with social equity. Our exploration of digital inclusion initiatives reveals how rural India can leapfrog developmental stages through innovative technology adoption, while studies on rural community empowerment showcase grassroots innovations that drive inclusive growth.

The agricultural sector, backbone of India's economy, receives particular attention through comprehensive analyses of agro-based industries and sustainability challenges. Cultural heritage preservation emerges as a central theme, demonstrating how indigenous practices can be systematically integrated into contemporary development models.

At SD College, Hoshiarpur, our vision resonates with the Prime Minister Sh Narinder Modi's emphasis on "Sabka Saath, Sabka Vikas" and his belief that India's solutions should be "for the world, from the world." This interdisciplinary approach reflects our institutional commitment to holistic development that honours India's rich heritage while embracing technological innovation. As an institution rooted in Punjab's fertile intellectual landscape, we recognize our responsibility to contribute meaningfully to national discourse on sustainable development. Each contribution has been rigorously peer-reviewed and presents practical applications which policymakers, researchers, and practitioners can implement immediately.

The timing of this publication is particularly significant as India assumes greater global leadership in climate action and sustainable development, embodying PM Modi's vision of India as a "Vishwa Guru." The solutions presented here offer alternatives to Western development models, providing pathways that are environmentally sound, economically viable, and culturally appropriate—perfectly aligned with the government's mission of "Atmanirbhar Bharat."

This volume serves as both scholarly resource and practical guide for stakeholders committed to India's sustainable transformation. Through SD College's dedication to research excellence and our unwavering commitment to national development, the papers presented here demonstrates that our path to prosperity need not compromise our values or environment, but can instead be strengthened by them.

Dr. Savita Gupta
Principal
Sanatan Dharma College
Hoshiarpur

PREFACE

The concept of indigenous innovation refers to the development and implementation of new ideas, products, and processes that are rooted in the cultural, social, and environmental context of local communities. In the context of India, a nation marked by a rich history of traditional knowledge and practices, indigenous innovation presents a compelling pathway for achieving sustainable development. As India grapples with challenges such as rapid urbanisation, environmental degradation, and social inequalities, leveraging indigenous innovation offers a viable strategy for fostering a sustainable future while honouring the country's diverse cultural heritage.

One of the most significant aspects of indigenous innovation is its alignment with sustainable practices. Traditionally, many indigenous communities in India have maintained a deep connection with nature, utilising locally available resources in ways that are environmentally sustainable. For example, practices such as organic farming, water conservation techniques like rainwater harvesting, and traditional herbal medicine have sustained rural livelihoods for generations. These age-old practices, rooted in the wisdom of local communities, can be reinvigorated and adapted to address contemporary challenges, thereby providing an environmentally friendly alternative to mainstream industrial practices.

Moreover, incorporating indigenous knowledge into modern education and research frameworks can catalyse innovation. Educational institutions in India are increasingly recognising the value of integrating traditional knowledge systems with contemporary scientific research. This hybrid approach not only respects the wisdom of ancestral practices but also empowers indigenous communities by validating their knowledge. By incorporating local wisdom into the curriculum, universities can encourage students to engage with their cultural heritage and seek innovative solutions that reflect the needs and aspirations of their communities.

Additionally, technology can play a crucial role in amplifying indigenous innovations. The advent of digital tools and platforms can facilitate the documentation, dissemination, and commercialisation of traditional knowledge and practices. For instance, mobile apps and online marketplaces can be

developed to help local artisans, farmers, and entrepreneurs reach broader markets while preserving their unique cultural identities. This not only helps in generating income but also empowers communities by giving them control over their intellectual property and the narratives surrounding their products.

Indigenous innovation also has the potential to enhance resilience against climate change, which poses a significant threat to India's ecological and socio-economic landscape. Many indigenous communities have developed adaptive strategies in response to environmental changes over centuries. For example, agro-ecological practices that maintain biodiversity and soil health can be leveraged to build climate-resilient agricultural systems. By integrating these practices into national agricultural policies, India can not only bolster food security but also mitigate the impacts of climate change.

Furthermore, promoting indigenous entrepreneurship is vital for a sustainable future. The rise of social entrepreneurship in India has highlighted the potential for businesses focused on social and environmental outcomes rather than solely profit. By supporting startups and enterprises that centre around indigenous practices, the government and private sector can create a robust ecosystem that nurtures local innovation. Initiatives such as incubation centres for traditional artisans and training programmes in sustainable business practices can empower communities to harness their skills and knowledge in the marketplace.

Policy frameworks also play a crucial role in supporting indigenous innovation. There is a pressing need for policies that recognise and protect indigenous knowledge systems while providing incentives for sustainable practices. The Government of India can establish platforms that facilitate collaboration between indigenous communities, researchers, and policymakers. Additionally, incorporating local voices in the decision-making process is essential to ensure that policies are reflective of the needs and perspectives of the communities they aim to serve.

The role of NGOs and civil society organisations is equally significant in promoting indigenous innovation. These organisations can bridge the gap between traditional knowledge and modern solutions by fostering partnerships, facilitating capacity-building workshops, and advocating for the rights of indigenous peoples. Their work can empower communities to transform their knowledge into innovative practices that contribute to sustainable development goals while preserving their cultural heritage.

In a nutshell, indigenous innovation holds immense potential for shaping a sustainable future for India. By valuing and integrating traditional knowledge

with modern practices, the nation can address pressing socio-economic and environmental challenges. Furthermore, by fostering an ecosystem that supports indigenous entrepreneurship and collaborative policy-making, India can empower its diverse communities to thrive. Ultimately, the path to sustainability lies not solely in technological advancements but in honouring and leveraging the rich tapestry of indigenous knowledge that has been cultivated over centuries. Such an approach not only honours the past but also paves the way for a resilient and sustainable future.

To understand the importance of indigenous innovation for sustainability comprehensively, the viewpoints of various academicians, scholars and thinkers have been collected in the form of articles and published in this book. We hope that the book will serve the purpose of encouraging readers to exert innovative sustainable practices in their lives to contribute to the sustainable future of India.

Editorial Board

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ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT GOALS: A REVIEW

Anjali Jolly*

Abstract

The integration of Artificial Intelligence (AI) in advancing the Sustainable Development Goals (SDGs) has gained significant attention in recent years. This paper offers a comprehensive review of AI's role in promoting global sustainability through innovative business models, sustainable development strategies, and its critical contributions during the COVID-19 pandemic. AI technologies are explored in the context of environmental sustainability, social development, and urbanization, demonstrating their transformative potential in addressing global challenges. The review emphasizes the importance of AI-driven solutions in fostering sustainability, while also acknowledging the ethical challenges and infrastructural requirements essential for effective implementation. By synthesizing recent studies, this paper provides an in-depth analysis of AI's applications, supported by detailed case studies and technological frameworks. It highlights how AI innovations are shaping the future of sustainable development, offering practical insights into their deployment across various sectors. Ultimately, the review underscores the necessity of establishing robust AI infrastructure and ethical guidelines to harness AI's full potential for achieving the SDGs, making a significant contribution to the discourse on technology and sustainability in the modern era.

Keywords: *Artificial Intelligence, Sustainable Development Goals, AI-driven innovation, Sustainable business models, AI in urbanization, AI in pandemic response, AI ethics, Smart cities, AI infrastructure, Environmental sustainability*

Introduction

The Sustainable Development Goals (SDGs) represent a global initiative

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aimed at fostering environmental sustainability, promoting social inclusion, and ensuring economic growth for all. Achieving these ambitious goals requires innovative solutions, and Artificial Intelligence (AI) has emerged as a transformative technology with immense potential to drive progress in these areas. AI's ability to streamline operations, improve decision-making, and foster innovation makes it an essential tool for addressing the complex challenges associated with sustainable development.

This paper explores the pivotal role of AI in advancing the SDGs by examining its applications across various sectors, including business models, technological frameworks, pandemic response, and sustainable urbanization. AI-powered solutions have demonstrated significant impact in enhancing efficiency and sustainability in multiple domains such as healthcare, education, environmental conservation, and urban management. For instance, AI-driven predictive analytics can improve healthcare delivery by enabling early diagnosis and personalized treatment, while intelligent systems in education can offer personalized learning experiences, thereby improving educational outcomes. Similarly, AI technologies are being leveraged to optimize resource management, reduce waste, and promote environmental sustainability through smart systems for energy management, climate monitoring, and conservation efforts.

The rapid evolution of AI technologies, including machine learning, natural language processing, and computer vision, has opened new possibilities for achieving sustainability targets. Machine learning algorithms, for example, can analyze vast amounts of data to identify patterns and make predictions, aiding in resource optimization and risk management. Natural language processing facilitates better communication and information dissemination, which is particularly valuable in promoting awareness and driving behavioral change towards sustainability. Computer vision technologies contribute to environmental monitoring and management by enabling automated surveillance and analysis of ecosystems, thereby aiding in the protection and preservation of natural resources.

In addition to its technical capabilities, AI has played a critical role during the COVID- 19 pandemic, where it has been used for tracking virus spread, optimizing healthcare resources, and supporting remote work and education. AI-driven tools have facilitated rapid data analysis, enabling policymakers and healthcare providers to make informed decisions in real-time. The pandemic has highlighted the importance of AI in crisis management and underscored its potential to support resilience and recovery in the face of global challenges.

Despite its transformative potential, the integration of AI into sustainable development is not without challenges. Issues such as data privacy, algorithmic bias, and the environmental impact of AI infrastructure pose significant hurdles. The collection and use of vast amounts of data raise concerns about privacy and security, while biases in AI algorithms can lead to unfair and discriminatory outcomes. Additionally, the energy consumption associated with AI systems, particularly in training large machine learning models, has an environmental footprint that must be mitigated to ensure that AI contributes positively to sustainability efforts.

To fully harness the potential of AI for achieving the SDGs, it is essential to address these challenges through robust governance frameworks, ethical guidelines, and sustainable infrastructure development. This paper emphasizes the need for collaborative efforts among stakeholders, including governments, businesses, and academia, to create an ecosystem that supports responsible AI innovation. By doing so, AI can become a powerful enabler of sustainable development, driving progress towards a more equitable, inclusive, and sustainable future for all.

Literature Review

AI and Business Models for Sustainable Development

Di Vaio et al. (2020) highlight AI's role in enhancing business efficiency and sustainability through resource optimization, innovation, and strategic decision-making. AI technologies foster circular economy models by promoting reuse and recycling. The integration of AI in business models enhances operational efficiency, reduces costs, and promotes sustainable practices. AI-driven tools such as predictive analytics, automated supply chain management, and intelligent resource allocation systems enable businesses to reduce waste, optimize energy consumption, and develop sustainable products. For instance, AI algorithms can predict demand patterns, allowing companies to adjust production schedules and minimize resource wastage.

Case Study: A multinational corporation implemented AI-based supply chain management to reduce its carbon footprint by optimizing transportation routes and minimizing fuel consumption. This initiative resulted in a 20% reduction in greenhouse gas emissions and significant cost savings.

AI-Driven Sustainable Development Approaches

Kulkov et al. (2024) discuss AI applications in governance, technical operations, and data processing. AI systems improve waste management,

energy optimization, and water conservation, contributing significantly to sustainable development. AI technologies such as machine learning algorithms, IoT devices, and big data analytics play a crucial role in monitoring and managing natural resources. AI-driven governance models enable policymakers to make data-informed decisions, track progress towards SDGs, and implement effective sustainability strategies. Technical operations such as smart grid management, automated water distribution systems, and waste sorting facilities benefit from AI integration.

Technological Framework:

- **Data Collection:** Sensors and IoT devices collect real-time data on resource usage.
- **Data Processing:** AI algorithms analyze the data to identify patterns and anomalies.
- **Decision-Making:** AI-driven dashboards provide actionable insights for policymakers and businesses.

AI's Role in 4IR and SDGs Amid COVID-19

Mhlanga (2022) examines AI applications in healthcare, education, and economic recovery during the COVID-19 pandemic, emphasizing AI's role in accelerating digital transformation and enhancing resilience. The pandemic highlighted AI's potential to address global challenges swiftly and efficiently. In healthcare, AI-driven diagnostic tools, virtual health assistants, and drug discovery platforms played a critical role in managing the pandemic. AI algorithms were used to predict virus spread, optimize resource allocation in hospitals, and develop vaccines at unprecedented speeds. In education, AI-enabled adaptive learning platforms ensured continued education during lockdowns by providing personalized learning experiences and remote access to educational resources. The pandemic demonstrated the importance of AI in crisis management and underscored the need for resilient digital infrastructure to support global health and education systems.

AI's Contributions to SDGs

Vinuesa et al. (2020) underscore AI's contributions to environmental sustainability, social inclusion, and economic growth, while addressing ethical challenges such as algorithmic bias and data privacy. AI models for climate prediction, renewable energy optimization, and biodiversity conservation contribute significantly to environmental sustainability. AI-powered platforms enhance access to education, healthcare, and financial services, particularly

in underserved regions. Economic growth is fostered through AI-driven entrepreneurship, enhanced productivity, and job creation in tech sectors. Addressing bias in AI algorithms, ensuring data privacy, and minimizing the environmental impact of AI infrastructure are critical for sustainable AI development.

AI and Sustainable Urbanization

Wang et al. (2024) explore AI's impact on urbanization through R&D innovation, infrastructure development, and market competitiveness, with examples from smart cities like Singapore and Amsterdam. AI technologies enhance urban infrastructure, optimize traffic management, and promote energy-efficient buildings.

Smart City Initiatives

- **Traffic Management:** AI algorithms optimize traffic flow, reduce congestion, and minimize emissions.
- **Energy Management:** AI systems manage energy consumption in buildings, reducing waste and promoting sustainability.
- **Waste Management:** AI-driven sorting and recycling systems enhance waste management efficiency.

Conclusion

Artificial Intelligence (AI) plays a vital role in advancing the Sustainable Development Goals (SDGs) by improving operational efficiency, driving innovation, and promoting sustainable practices across various sectors. Its diverse applications range from optimizing business processes and managing resources to advancing healthcare services and enabling smart urbanization. AI technologies, such as machine learning, predictive analytics, and automation, contribute significantly to enhancing productivity, reducing waste, and fostering environmentally friendly solutions. This paper underscores AI's transformative impact on sustainable development, highlighting its potential to address complex global challenges. AI- driven solutions are increasingly being integrated into sectors such as healthcare, where they improve diagnostics and patient care, and urban management, where they enhance infrastructure, transportation, and resource utilization. Moreover, AI supports environmental sustainability through smart energy systems, climate monitoring, and efficient resource allocation. However, the widespread adoption of AI in sustainable development is not without challenges. Ethical concerns, data privacy issues, and the environmental impact of AI

infrastructure need urgent attention. Addressing these challenges requires continuous research, robust policy frameworks, and substantial investments to ensure that AI technologies are deployed responsibly and sustainably. This extended review emphasizes that the future of sustainable development is closely linked to AI innovations. Leveraging AI's full potential requires collaborative efforts among stakeholders to build a sustainable, inclusive, and technologically advanced future.

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CHALLENGES AND OPPORTUNITIES IN HUMAN RESOURCE DEVELOPMENT FOR PERSONS WITH DISABILITIES: A REVIEW OF POLICIES AND PRACTICES

Mr. Patal Kumar Murasing*

Abstract

Inclusion of the persons with disabilities (PwDs) in employment remains a major challenge. Despite legislative and policy advancements, barriers persist. Human Resource Development (HRD) plays a key role in promoting equal employment opportunities. However, there are still barriers preventing PwDs from fully integrating into the workforce. This review examines the challenges and opportunities in HRD for PwDs through a systematic analysis of existing policies, literature, and case studies. It focuses on policy gaps, accessibility issues, discrimination, and limited skill development. The study also explores possible solutions, including better legislation, inclusive education, corporate social responsibility (CSR) initiatives, and emerging technologies to improve accessibility. To ensure a comprehensive analysis, the researcher has reviewed the latest related papers using the Google Scholar database to identify relevant and targeted articles. Findings reveal that despite policy frameworks, implementation remains inconsistent, and workplace accessibility remains a significant hurdle. Employer attitudes and limited training programs further restrict opportunities for PwDs. The review emphasizes the importance of a multi-stakeholder approach in fostering inclusive workplaces. Stronger policy implementation, corporate commitment, and technological innovation are crucial to bridging gaps and ensuring sustainable employment for PwDs.

Keywords: *Human Resource Development, Persons with Disabilities, Inclusive*

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Employment, Workplace Accessibility, Disability Policies, Corporate Social Responsibility, Assistive Technology, Skill Development.

Introduction

Human Resource Development (HRD) is a critical driver in promoting an inclusive workforce, particularly for PwDs. As global societies strive toward greater inclusivity, the PwDs'integration into the labor market remains a persistent challenge. Effective HRD policies and practices play a pivotal role in addressing this challenge through focusing on enhancing the skills, accessibility, and workplace inclusion of PwDs. Despite significant advancements in legislation and policy, PwDs still encounter barriers that hinder them from fully participating in the workforce, particularly in terms of accessibility, skill development, and overcoming workplace discrimination (Myshbayeva et al., 2022)

Many governments and organizations have enacted legislative measures aimed at fostering disability inclusion. Notable among these are the "Americans with Disabilities Act" (ADA), that mandates accessible workplaces in the US (United States) (*Americans with Disabilities Act of 1990, As Amended*, n.d.), and the "United Nations Convention on the Rights of Persons with Disabilities" (CRPD), that provides a global context for protecting the rights of the PwDs(*United Nations. (2006). Convention on the Rights of Persons with Disabilities.*, 2006). These initiatives have been intended to create more equitable opportunities for PwDs, focusing on removing barriers to education, employment, along withseveral public services. However, the implementation of such policies has been inconsistent, with significant disparities across regions and industries. While some areas have made substantial progress in integrating PwDs into the workforce, others continue to struggle with limited accessibility, insufficient support for skill development, and prevalent discriminatory practices(Garg and Sehgal, 2024;Schloemer-Jarvis et al., 2022).

One of the most significant challenges in achieving workforce inclusion for PwDs is the persistent employment gap between PwDsalong with their non-disabled counterparts. As per the (*U.S. Bureau of Labor Statistics*, n.d.) employment-population ratio for the individuals with disabilities remains substantiallylower in contrast with individuals without disabilities. This gap is not only a reflection of societal attitudes towards PwDs but also an indicator of systemic barriers within the workplace. Despite legislative frameworks such as the ADA, these barriers continue to exist in the form of inadequate workplace accommodations, negative employer attitudes, and limited career

development opportunities (Baker et al., 2018)the 17.2% employment rate of people with disabilities stands in distressing contrast to the 65% rate of those without disabilities. This article summarizes the results of a comparative survey of representative academic literature and industry publications related to employer policies and practices that can affect workforce participation of individuals with disabilities. Emergent themes include variance in employer perspectives on hiring of individuals with disabilities, impact of perceived versus actual cost as a hiring barrier, and the perceived mismatch of education and/or skills to job qualifications among applicants with disabilities. These themes represent key areas to probe in subsequent research. The research objective is to identify focal points in the industry literature, representative of employer and industry (demand side).

The goal of this review study is to offer PwDs a thorough understanding of both opportunities and challenges in HRD. By examining the efficiency of the existing policies and practices, the review seeks to identify key barriers such as insufficient skill development, accessibility issues, and discriminatory practices in the workplace. Additionally, the review explores potential solutions and opportunities to enhance inclusion of thePwDs in workforce. These include improvements in legislative frameworks, promotion of inclusive education, CSR initiatives, and the application of emerging technologies to enhance workplace accessibility (Willingham et al., 2024)restoring function, and preserving quality of life in populations that face disparate health challenges related to disability. Despite the immense potential for rehabilitation and exercise to help people with disabilities live longer, healthier, and more independent lives, people with disabilities can experience physical, psychosocial, environmental, and economic barriers that limit their ability to participate in rehabilitation, exercise, and other physical activities. Together, these barriers contribute to health inequities in people with disabilities, by disproportionately limiting their ability to participate in health-promoting physical activities, relative to people without disabilities. Therefore, there is great need for research and innovation focusing on the development of strategies to expand accessibility and promote participation in rehabilitation and exercise programs for people with disabilities. Here, we discuss how cutting-edge technologies related to telecommunications, wearables, virtual and augmented reality, artificial intelligence, and cloud computing are providing new opportunities to improve accessibility in rehabilitation and exercise for people with disabilities. In addition, we highlight new frontiers in digital health technology and emerging lines of scientific research that

will shape the future of precision care strategies for people with disabilities. (https://pubmed.ncbi.nlm.nih.gov/38248542/) To provide organizations, educators, and policymakers with useful information to establish a more fair and inclusive work environment, this study focuses on these areas.

In conclusion, the PwDsintegration into the workforce remains a complex issue which requires a multifaceted approach. Despite some progress through global and national policies, many barriers remain. The employment gap shows the need for a stronger and lasting HRD framework. This review article explores disability inclusion by examining its challenges and opportunities. It also suggests ways to improve inclusive practices in HRD.

Literature Review

Human Resource Development (HRD) for PwDs encompasses a multifaceted field that intersects with disability studies, organizational behavior, employment policy, and technology. The existing literature delves into various dimensions, including legal frameworks, workplace practices, accessibility issues, and employers' role in creating inclusive environments. This section reviews key studies, policies, and practices related to HRD for PwDs, highlighting both the difficulties they face along with opportunities for improving their employment outcomes.

Schloemer-Jarvis et al., (2022) conducted a systematic literature review that examines human resource management practices regarding employing PwDs, identifying effective strategies and areas needing improvement.

Zhang et al. (2024) developed and validated the HRSPWD (Human Resources Scale for People with Disabilities), providing a tool to assess HR practices from the perspective of employees with disabilities.

A comprehensive review of eighty-eight empirical studies across rehabilitation, psychology, management, along with sociology has been conducted by Beatty et al. (2019)and practitioner's decisions should be guided by solid evidence-based research. We offer a systematic review of the empirical research on the treatment of persons with disabilities in organizations, using Stone and Colella's seminal theoretical model of the factors influencing the treatment of persons with disabilities in work organizations, to ask: What does the available research reveal about workplace treatment of persons with disabilities, and what remains understudied? Our review of 88 empirical studies from management, rehabilitation, psychology, and sociology research highlights seven gaps and limitations in extant research: (a, highlighting gaps

in research such as implicit definitions of the workplace treatment and neglect of individual differences.

A scoping review by (Aksnes and Ulstein, 2024) explores literature on positive employment outcomes for PwDs, emphasizing the importance of sustainable employment practices and stakeholder involvement.

To create truly inclusive workplaces, Thibedeau Boyd (2024) emphasizes the value of adopting a critical disability viewpoint as well as working toward transformative strategies that go beyond fundamental inclusion practices.

These studies emphasize collectively the significance of inclusive HR practices, the need for validated assessment tools, and the critical examination of existing policies to enhance employment outcomes for PwDs.

Disability Inclusion Policies and Legal Frameworks

Several studies highlight the value of legislative frameworks in promoting the inclusion of PwDs in the workforce. The ADA in the US requires appropriate accommodations in the workplace and prohibits disabilitybaseddiscrimination. An appropriate accommodation has been characterized as any modification to the application orelse hiring procedure, the job, execution of the job, or else the work environment which enables a qualified PwDs to fulfil the fundamental responsibilities of the position and access equal employment opportunities (*Reasonable Accommodations in the Workplace | ADA National Network*, n.d.).

Similarly, India's "Rights of Persons with Disabilities Act" (RPWD) of 2016 aims to offer equal opportunities to the PwDs, including access to education, employment, as well as public services. To enhance job opportunities for PwDs, the Act enhanced the reservation quota in government jobs from 3 percent to 4 percent (Kumar, 2017).

Nevertheless, a lack of thorough implementation techniques, inadequate monitoring, along with enforcement gaps can make these policies less successful. For instance, in the case of Reserve Bank of India vs. A. K. Nair and others, the Hon'ble Supreme Court of India held that the RPWD, 2016, expressly offers for reservation in promotion according to instructions issued by the Government from time to time (*Important Judgements for the Persons with Disabilities | NIEPVD Dehradun | India*, n.d.)

These examples illustrate that while legislative frameworks exist to encourage the inclusion of the PwDs in workforce; their effectiveness is contingent upon proper enforcement and implementation.

Barriers to Employment for Persons with Disabilities

A significant body of investigation has identified various barriers to the PwDs' employment. One key barrier is physical accessibility in workplaces. (Kim & Williams, 2012) highlight that inaccessible workplaces create numerous mobility barriers, leading to feelings of limitation or unfairness among employees with physical disabilities.

The digital divide also poses a substantial challenge. A report by the U.S. Department of Labor (ODEP, 2022) indicates that PwDsare less likely to use the internet for activities such as texting, emailing, shopping, and banking online, which can limit their access to job opportunities and workplace resources.

Negative stereotypes and biases further impede employment prospects for PwDs. A systematic review by (Lindsay & Fuentes, 2022) found that faculty along with staff with disabilities suffer high rates of discrimination, social exclusion, and marginalization within academic settings, suggesting that such biases may also be prevalent in other professional environments.

These studies underscore the multifaceted difficulties that PwDsgo through in the employment sector, highlighting the need for comprehensive strategies to enhance workplace accessibility, bridge the digital divide, and combat discriminatory attitudes.

Vocational Training and Skill Development

Enhancing PwDs' employment prospects requires their access to skill development along with vocational training programs. However, many PwDs encounter difficulties in accessing these programs because of a lack of specialized offerings, funding limitations, and infrastructural barriers. The WHO (World Health Organization) emphasizes that PwDs face significant health inequities, which can impact their access to education and vocational training (WHO, n.d.).

Assistive technologies perform a vital role in allowingPwDs to perform tasks effectively in educational and workplace settings. A study by (Lancioni et al., 2023) discusses a smartphone-based program whichallows individuals with intellectual along with other disabilities to communicate, access leisure, as well as functional activities, highlighting the importance of integrating assistive technologies into training programs.

Inclusive educational practices that incorporate personalized learning, assistive technology, the universal design for learning are essential for

enhancing employability among PwDs. To promote equitable opportunities, the "World Programme of Action Concerning Disabled Persons" underscores the necessity of inclusive education and training programs that are tailored to satisfy the requirements of each individual (*World Programme of Action Concerning Disabled Persons | United Nations Enable*, n.d.).

These approaches not only improve employability for PwDs but also provide a foundation for lifelong learning, which is crucial in quickly evolving job market of today.

Corporate Social Responsibility and Disability Inclusion

CSR has emerged as a significant strategy for enhancing disability inclusion in the workplace. Many companies that prioritize CSR have incorporated disability inclusion into their HRD practices, offering mentorship programs, internships, along with career development services specifically for PwDs. (Schwartz and Robinson, 2018)we use a corporate social responsibility (CSR argue that CSR initiatives can perform a pivotal role in promoting diversity along with inclusion in workforce, noting that businesses committed to disability inclusion often outperform their competitors in terms of employee satisfaction, productivity, and retention. In addition to CSR initiatives, organizations are increasingly adopting policies such as affirmative action and reasonable accommodation, which ensure that PwDs are given equal opportunities in hiring, training, and career progression.

Schur et al., (2013) suggest that these inclusive HR policies are crucial for organizational culture creation which values diversity as well as promotes equality for PwDs.

The Role of Technology in Enhancing Inclusion

The technology's role in promoting inclusion of PwDs has garnered significant attention in recent years. Assistive technologies, that includeadaptive keyboards, screen readers, along with voice recognition software, have proven to be invaluable tools for enabling PwDs to participate more fully in the workforce (Al-Azawei et al., 2016). However, the literature highlights a major challenge in the widespread adoption of these technologies. Schur et al. (2013)argue that while assistive technologies can make a significant difference, their cost remains prohibitive for many organizations, particularly small and medium enterprises. Moreover, there is a need for greater awareness and training among employers about the availability and benefits of these technologies. Schur et al. (2013) suggest that technology can help create

more inclusive and accessible work environments—but only if employers are willing to invest in adaptive tools and ensure that employees receive the necessary training to use them effectively.

Results and Findings

The key outcomes from the literature and analysis of HRD practices for PwDs are represented in this section. These findings address both the challenges along with several opportunities within the current HRD landscape for the PwDs, with a focus on the effectiveness of policies, the role of technology, and the organizational practicesimpact.

Key Findings from Policy and Legislative Review

i. **Gaps in Policy Implementation**: Despite the existence of robust disability inclusion laws such as the ADA and India's RPWD, implementation gaps persist in many regions. Effective enforcement of policies remains inconsistent, particularly in developing countries or in smaller organizations whichmight not have the resources to comply fully with accessibility standards(Barnes and Mercer, 2005; Shakespeare, 2013).

ii. **Limited Effectiveness of Existing Training Programs**: Vocational training and skills development programs tailored for PwDs have been found to be limited in scope and accessibility. PwDs often face barriers in accessing training due to infrastructural constraints, insufficient support structures, as well as a lack of tailored programs designed to meet their specific learning requirements. While some initiatives are successful, the overall reach and impact remain insufficient to bridge the skills gap for PwDs in the labor market(WHO, 2011).

iii. **Workplace Accessibility Challenges**: While legislation mandates workplace accessibility, a significant proportion of employers still lack physical and digital accommodations for PwDs. Many workplaces remain inaccessible due to outdated infrastructure, lack of adaptive tools, or insufficient funding for modifications (Lindsay et al., 2020; WHO, 2011).

iv. **Employer Attitudes and Discrimination:**Bias and discrimination continue to hinder employment opportunities forPwDs. Despite anti-discrimination laws, research indicates that negative stereotypes about the abilities of PwDs persist among employers, often resulting in limited hiring, fewer career advancement opportunities, and lower wages compared to non-disabled peers (Kaye et al., 2011)

v. **Corporate Social Responsibility and Inclusivity:**Organizations that prioritize Corporate Social Responsibility (CSR) initiatives have been found to adopt more inclusive human resource development (HRD) practices. Businesses with active disability inclusion programs tend to demonstrate a greater commitment to integrating PwDs into the workforce (Aguinis and Glavas, 2012).

vi. **Technological Advancements in Inclusion:**The integration of technology into HRD practices has shown promising results in increasing the employability of PwDs. Although assistive technologies can significantly enhance workplace accessibility, their adoption remains low due to cost constraints and a lack of employer awareness or training (Morash-Macneil et al., 2018).

Discussion

Addressing the difficulties faced by PwDs in Human Resource Development (HRD) requires a multifaceted approach. The following key areas highlight the major obstacles as well as potential solutions for improving inclusion and accessibility in the workforce for PwDs:

- **Policy Implementation and Gaps:** One of the most significant challenges in HRD for PwDs is the inconsistency in policy implementation. While many countries have ratified international agreements promoting disability rights, enforcement remains weak due to bureaucratic inefficiencies and lack of accountability mechanisms.
- **Workplace Accessibility and Technological Integration:** Advancements in technology have the potential to transform the employment landscape for PwDs. Assistive technologies can significantly improve workplace accessibility. However, the high costs and lack of awareness among employers limit the widespread adoption of these technologies.
- **Addressing Bias and Promoting Inclusion:** Workplace discrimination and implicit biases remain major obstacles for PwDs seeking employment. Inclusive HRD strategies should focus on educating employers about the capabilities of PwDs and implementing diversity training programs to reduce biases.
- **Skill Development and Vocational Training:** A significant gap exists in skill development programs tailored to PwDs. Specialized vocational training programs, mentorship initiatives, and corporate training

partnerships can help bridge this gap and enhance the employability of PwDs.

- **Corporate Social Responsibility and Organizational Commitment:** Organizations that actively participate in CSR initiatives tend to exhibit higher levels of disability inclusion. Government incentives and industry collaborations can further encourage businesses to adopt more inclusive HRD practices.

Conclusion

Despite the challenges in HRD for PwDs, there are clear opportunities to improve inclusion through effective policies, technology, and corporate commitment to diversity. Policies that ensure equal access to jobs and workplace accommodations for PwDs can make a big difference. Technological tools, such as assistive devices, can help make workplaces more accessible. Furthermore, creating a culture of diversity and inclusion inside organizations may enhance the feeling of value and support for PwDs. A multi-stakeholder approach is key to creating lasting change. Governments can enforce laws and offer incentives to companies that promote disability inclusion. The private sector can improve workplace accessibility, offer training, and adopt inclusive hiring practices. Civil society groups can raise awareness and push for accountability.When organizations adopt inclusive HRD practices, they can tap into the full potential of the PwDs, benefiting from a more diverse along with fair workforce. This not only helps individuals with disabilities but also strengthens organizations and society as a whole. Collaboration among all stakeholders is essential to making workplaces truly inclusive for PwDs.

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3

A REVIEW OF CLIMATE CHANGE PATTERNS, ANALYZING ITS IMPACT ON AGRICULTURAL SECTOR AND HIGHLIGHTING FARMER'S PERCEPTIONS, MITIGATION AND ADAPTATION STRATEGIES WITH THE REFERENCES OF SOME OF THE CASE STUDIES CONDUCTED IN INDIA

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Abstract

This paper will enlighten the concept of climate change in detail with special reference to its impacts on agriculture sector, it also explore the farmers perceptions and adaptation strategies. It includes the references of some of the case studies of the geographical locations of India where farmers have changed their cropping pattern when they had adverse effects on their cultivated crops. This paper will address the causes, consequences and mitigation techniques towards the climate change patterns along with the policy initiatives taken by government of India to provide assistance and economic support to the farmers because majority of farmers are changing their occupation. It also highlighted the aquaculture which is the fast growing food producing sector in India with the annual average growth rate of 8.6% since late 1980s (FAO,2014). Aquaculture offers employment and reliable income opportunities to the farmer communities. Alterations in climate pattern have detrimental effects on Indian agriculture that lower down the productivity, lessen farmer's interest in agriculture, so there is an urgency to adapt mitigation policies for sustainable future.

Keyword: *Adaptation strategies, Mitigation, Aquaculture, Sustainable future.*

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Introduction to the Concept

Global Climate Change has attracted the attentiveness of all the thinkers or researcher of all the fields as it has wide-ranging impacts on human communities and emerged as greatest threat with extreme level affects since last few decades. Climate Change refers to the alterations in a normal phenomena of an area or long-term shift in global or regional climatic conditions overtime; it is a significant and persistent distortion in weather patterns caused by natural processes or as a result of anthropogenic activities which results deterioration in environmental surroundings. It could be designated by increase in air and ocean temperature due to which earth temperature is rising, shrinking glacier covers causes sea level rise, modifications in atmospheric and ocean circulations results extreme events more frequent and intense. The paramount contributors to climate change in today's world are deforestation, burning of fossil fuels and release of greenhouse gases (such as carbon-dioxide, methane, nitrous oxide); these gases trap heat inside the atmosphere due to which gradual rise in global temperatures happened that is considered as greenhouse effect. The most dominant consequence of climate modification is global warming, it refers to the rising of average surface temperature of the planet. Greenhouse gases have already heated the global temperature of earth approximately by 1.1° C since the late 19th century by IPCC (Intergovernmental Panel on Climate Change); and it is estimated that by 2040 the average temperature would increased by 1.5°C and by 2100 it would rise by 1.8 to 4°C. Global Warming has increased drought frequency due to which food production disrupted in some of the tropical countries. Apart from global warming there are some other climate change impacts such as extreme events (forest fire, wildfire, heatwave), droughts, cyclones, floods, unexpected seasonal rises in temperatures, changing patterns of precipitation etc. which not only impacts encircling environment but also have impacts on human activities, human health and social systems, reduce agriculture productivity, decrease crop growth and development, increase unsuitability of certain crops in certain regions, threaten resource dependent human livelihood specifically in Asian Nations. Asian tropical to sub-tropical and arid regions are more prone to climate change as these are the population explosion zones of the world. Climate change held with yield reduction in some of the essential crops and South Asia had severe impacts (IFPRT, 2008).

Profile of Agriculture in India

Agriculture Sector lies to the center of Indian Economy; it shares 18% to national GDP however 50% of its population depends on agriculture as their principal source of income. It contributes major proportion (approx. 54.6%) of country's workforce. Agriculture and associated activities act as growth engine to the nation by not only assuring the food and nutritional security to the massive population but also supply raw materials to the agro-based industries.

Climate Change and Agricultural Vulnerability

Climate change and agriculture are interrelated concepts; former is the direct input to the productivity of the later one. According to a report of ICAR (Indian Council of Agricultural Research) out of 573 rural district 109 are extremely at risk and 201 are classified as risk-prone districts which shows the vulnerability scenario of Indian Agriculture to Climate Change. Research showed that without adaptation climate would have more adverse impacts on agriculture and vulnerability could be largely reduced with adaptation strategies. Climate variability leads to reduction in crop yield, cereals production especially in developing countries. A nation like India whose 60% livelihood is dependent on agricultural activities is more vulnerable to climate changing patterns because the highly populated nation with high rate of population growth, its food consumption patterns are needed to rise at least by 70% to meet the demand by 2050 (FAO 2005). For every one degree temperature rise, Indian agriculture will adversely effected by 3-7% reduction in the production of wheat, mustard, groundnut, soyabean and potato etc. To reduce vulnerability adaptation assessment initiatives should be enhanced particularly in most vulnerable regions. The IPCC AR3 reports introduced two type of adaptation strategies: autonomous and planned adaptations, first one refers to individual level and second one occurs to societal level through policies. Climate change plays vital role in farmer's life not just because crop planning depends on climatic conditions, soil type, availability of irrigational facilities etc. but also because the food and income from harvesting is the core source of his livelihood which makes him more vulnerable to climate change and it is revealed from various studies that farmers are aware about climate variability. An illustration, in Maharashtra (central India) and in North-East Karnataka drought become challenging for farmers to cope up with, especially the later one region is always prone to dry spells and droughts. With this water scarcity has also become the major issue to agriculture productivity

primarily in arid and semi-arid regions of India because dependency on summer monsoon raised and its unpredictability and inefficient irrigation developments decreased the production. In addition to it, coast of Tamil Nadu experienced 26% of cyclones formed in Bay of Bengal mostly during October to November due to which flood, water logging, unmanaged drainage system kind of problems occurred which make the region more insecure. Thus, the soil resources of this region are characterized with soluble salt concentration and pH level of the soil make cultivation a complicated task. Tamid Nadu has witnessed decline trends in net area sown of cereals crops.

Climate Change and its impacts on Agriculture

Rise in temperature affects the growth, development and productivity of crop, decrease yields and make some regions unsuitable for some crops as temperature increase is beyond the optimum requirements, deterioration in soil moisture content, changing trends in rainfall cause more and frequent floods and droughts, lessen water availability for irrigation, destroy fertility of soil which ultimately disturb agricultural activities. Both rainfall and temperature changes also leads to pest and plant diseases. Extreme weather events such as cyclones, heat waves, hurricanes etc. damage the physical environment of crops, disrupt pollination that leads to low yield and poor quality of crop. Climate Change accelerate the social inequalities, poverty, water scarcity, food security, salinization, economic loss and ocean acidification which poses risk to marine ecosystem.

References of case studies which showed the adaptation trends in farmers

It is the need of an hour to understand the perceptions of farmers regarding climatic variability and what are their responses, how they act towards adaptation strategies; are they aware about the alterations in cropping patterns in order to promote successful adaptation techniques. Here, a case study conducted in Kancheepuram situated in north-eastern agro-ecological zone in Tamil Nadu; experiencing hot and humid climate and enjoying both north-east and south-west monsoon; the surveyed farmer's responses which were taken through personal interview, group discussions and questionnaires (both in English and local dialect) with the help of department of Socio and Agro Forestry, District Kancheepuram and Government of Tamil Nadu, South India showed us that the region is rich in the production of rice, groundnut, sugarcane, pulses, cereals, millets as commercial crops and jowar and bajra etc as food crops and nearly half of its population indulge in agricultural

activities but due to the cyclonic depressions formed in bay of Bengal the region is more vulnerable. The results showed that during last two decades the temperature is increasing and rainfall is decreasing; unpredictable dry spells resultant change in cropping patterns, change in onset, duration and intensity of precipitation causes detrimental effects on growth and maturing of paddy crops therefore now farmers have changed their cropping patterns to support their livelihood. Another illustration can be taken of Kendrapara district of Odisha, as Odisha is the state of India which is situated at the coast of bay of Bengal is more prone to climatic change, here the district Kendrapara is designated with cyclonic depressions, floods sometimes droughts, high water deficiency, frequent rain failure; in this survey, data was collected with the help of personal interview and questionnaire in which 150 farmers were participated, the results revealed that annual average temperature have shown increasing trends and half of the participants noticed the decreasing trends in rainfall, and now farmers are adapting various strategies such as double seed crops, mixing crops, differentiate planting dates to overcome climatic problems. Adaptation techniques are also influenced by farmers age and educational background, family income and family size; more aged are experienced farmers and probability of adopting new technologies is more in educated farmers. It is found in the study area that average age of the farmer is 52 and young generation is now losing their interest in farming due to uncertainty and low productivity, even some of the population migrated to the outside. Therefore, essential initiatives should be taken to facilitate and encourage them to change their passive behaviour towards agriculture. Furthermore, affordable credit schemes, increase irrigational facilities, water harvesting schemes could be launched to support farmers. Last but not the least, one more example of aquaculture in Sundarban delta (largest mangrove zone on earth situated on Ganga-Brahmaputra Confluence, UNESCO declared as world heritage site and comprises of 100 above low- lying islands from which 54 are inhabited) region could be taken as climatically vulnerable as fisheries are integral part of the population of Sundarban, here it is the main component of economy. Coastal aquaculture is severely threaten by climate change patterns due to which fishery based livelihood is extremely vulnerable. According to one report of Intergovernmental Panel on Climate Change (IPCC, 2014), the raised regularity of extreme events such as cyclones, floods and storm surges have become common in the region due to which temperature, rainfall, salinity, sea-level modifications and erosion happened. Air temperature in Bay of Bengal showed rising trends at the rate

of 0.019ºC per year which is expected to raise 1ºC by 2050. Bay of Bengal experienced 18 out of 25 top severe cyclones of the world (World Bank, 2014), pre and post monsoonal depressions are more violent. This study was conducted in Basanti and Sagar Island, data was collected with the help of personal interview in which questionnaire was prepared in both English and local language to understand the complications of the local communities; findings showed that aquaculture operations are male oriented, traditionally these fish farmers are involved in number of aquaculture practices such as carp polyculture, prawn and shrimp farming etc. Respondent's conclusion expressed that they are fully aware about climate change patterns (cyclone and flooding specifically) and now they are concerned about the alter conditions of their ponds as these are filled with huge debris, dead organisms, toxic substances, pollutants and plastic which have adverse effects on pond's ecosystem. Whenever this situations occurred salinity and ph level of water depleted, quality and production decreased. Now farmers are adopting these strategies: they avoid over dependence on specific species rather than they supports species diversification, salt tolerant species added and planting of fruit trees and vegetables on the slopes and on the dykes of the ponds to reduce the risks of extreme events, government provide early information about the extreme events, subsidy and credits are provided to create infrastructure to save farmer communities and their livelihood. The climatic data of all the above three studies have collected from Meteorological Department of India, Pune.

Mitigation Strategies and Policy Initiatives in India

The 6th assessment report of IPCC 2021 has warned the world about extreme events and associated challenges. The year 2015 was a milestone year in which Paris Agreement not only took actions against climate change but also initiated Sustainable Development Goals agenda 2030 which comprises positive changes in all aspects of life without any harm to Mother Earth that represents to meet the demands of the present generations without compromising the future generations. According to the agenda, those socioeconomic and scientific approaches should be adopted which are peaceful and environment friendly. A collaborative plan to shield human health and well-being, ecosystem, agriculture etc. is needed to perform at local, national and international level. In India, the Ministry of Environment, Forest and Climate Change (MoEFCC) is the focal body for the formulation, promotion, coordination and monitoring of climate (except drought).

Therefore, a country like India, which has been working on poverty from longer period of time and still its large proportion of population remains below poverty line, climate change threats have high potential to disrupt the national economy and causes obstacle to achieve Sustainable Development Goals, as India ranks at 101th position from 116 nations at global hunger index in 2021 and identified among the countries where hunger is serious because climate change damaged food grains which ultimately intensify food security, so the positive participation of economist and researchers can play crucial role to examine the climate vulnerability, adaptation and mitigation specifically in the context of India where economy is agro-based. Also, the recent losses caused by cyclone Amphan (2020) and cyclone Yaas (2021) to Indian economy $ 8 billion and $ 14 billion respectively has warned us that if nothing is done to climate change then India would reduce 5.5% average loss per year to its economic potential in upcoming 50 years. So, the urgent need of the time is a comprehensive approach includes policies, investments, technologies and infrastructure should be initiated. As India initiated in 2015, before Paris Summit, "Science Express Climate Action Special" train that was the world's first and largest massive educational program on the concern of climate change. Early warnings about climate abnormalities should be provided to the farmers so that they timely get helped.

- Crop planning should be developed with the assistance of modern space technologies, it could also help to monitor pest movements. Utilization of artificial intelligence, mobile app-based services, machine learning enhance farmers abilities for decision making.
- Farmers should be aware about stress handling crops such as CR Dhan 209, CR Dhan 210 and Sahbhagi Dhan etc. which are suitable for drought conditions. Similarly HD 2987 and DBW73 etc. variety of wheat are also suitable in drought.
- To maintain soil health, better soil management strategies such as afforestation, mini-irrigational facilities, water harvesting techniques, terrace gardening etc. should be followed.
- To enhance the resilience of agriculture crop type and timing should be diversified, it will also help in ecosystem services like erosion control, GHGs reduction, nutrient cycling etc. Diversification in crops is more resilience to climate change than monocropping patterns. Short duration crops should be cultivated. In addition to it, inter cropping, mixed cropping organic farming should be used.
- Policies such as Pradhan Mantri Krishi Sinchayee Yojana, Paramparagat

Krishi Vikas Yojana, Soil Health Card Scheme, National Mission on Sustainable Agriculture, Crop Insurance Program based on Weather, Pardhan Mantri Fasal Bima Yojana are some of the initiatives taken by government of India.

Conclusion

To conclude the paper it is necessary to understand that climate change and adaptation strategies are essential to not for agriculture sector only but also to protect the survival of human. It is revealed from various case studies given above that farmers are aware about the climate change, adaptation strategies and mitigation processes but sometime due to the lack of early information they get effected badly due to which now they are not interested in agriculture as occupation which ultimately decreases the productivity and leads the nation to food security issues. Therefore, it is mandatory to enhance mitigation policies and government initiative among farmers, although they are aware but not all of them are ready to adjust their farming activities. And the factor that influenced them mainly is their income, access to irrigation and credit facilities, age and educational background. So, essential steps should be taken to encourage and facilitate them towards adaptation strategies to reduce their vulnerability.

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4

CORPORATE RESPONSIBILITY AS A CATALYST FOR SOCIAL SUSTAINABLE GROWTH

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Abstract

Corporate Social Responsibility (CSR) has transitioned from a voluntary business initiative to a strategic imperative that drives sustainable growth. This study explores the role of CSR as a catalyst for long-term economic, social, and environmental sustainability, providing empirical evidence and case studies from global and Indian corporations. Using a multidisciplinary approach, the research examines how CSR enhances corporate reputation, operational efficiency, and stakeholder trust while mitigating financial and regulatory risks. Additionally, the study discusses challenges in CSR implementation, such as green washing and regulatory disparities, and proposes strategies for maximizing CSR's impact. Findings suggest that companies integrating CSR into their core business strategy achieve superior financial performance, competitive advantages, and long-term value creation, reinforcing CSR's role as a fundamental driver of sustainable growth.

Keywords: *Corporate Social Responsibility, Sustainable Growth, Business Strategy, Corporate Governance, Ethical Business Practices.*

Introduction

Corporate Social Responsibility (CSR) refers to the ethical obligation of businesses to contribute positively to society by integrating social, environmental, and economic considerations into their operations. CSR encompasses a range of activities, including philanthropy, ethical labor practices, environmental sustainability, and community engagement.

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In India, CSR has been legally mandated under Section 135 of the Companies Act, 2013. The law applies to companies meeting any of the following financial criteria: (i) a net worth of ₹500 crore or more, (ii) a turnover of ₹1,000 crore or more, or (iii) a net profit of ₹5 crore or more during any financial year. Such companies are required to spend at least 2% of their average net profits of the preceding three years on CSR initiatives. This regulatory framework ensures corporate accountability and promotes sustainable development through structured social responsibility programs. A notable example is Infosys, which has consistently aligned its CSR spending with the legal requirements, investing ₹342 crore in FY2022-23 towards education, digital literacy, and environmental sustainability initiatives.

Sustainable growth, on the other hand, refers to economic development that meets present needs without compromising the ability of future generations to meet their own needs. It involves balancing financial performance with environmental and social responsibilities to create long-term value. For example, ITC Limited has adopted a sustainability-focused approach through its afforestation and water conservation programs, ensuring its agricultural supply chain remains resilient while promoting rural development. ITC's e-Choupal initiative has empowered over 4 million farmers, leading to enhanced productivity and stable incomes, thereby contributing to sustainable economic growth.

CSR and sustainable growth are deeply interconnected. By investing in CSR, businesses contribute to sustainable development by reducing environmental impact, enhancing social equity, and fostering economic stability. Companies that prioritize CSR practices not only fulfill legal and ethical obligations but also drive innovation, reduce operational risks, and improve market competitiveness. Unilever's Sustainable Living Plan illustrates this relationship, as the company has successfully integrated sustainability into its business model, leading to increased sales and brand loyalty. Unilever's sustainable brands, such as Dove and Hellmann's, grew 69% faster than the rest of its business in 2022, proving that responsible business practices drive financial success.

This paper explores how CSR serves as a catalyst for sustainable growth, using empirical evidence and case studies to illustrate its impact on corporate performance and stakeholder engagement.

Literature Review

The relationship between CSR and sustainable growth has been widely

studied. According to Carroll's (1991) CSR Pyramid, businesses must balance economic, legal, ethical, and philanthropic responsibilities. Porter and Kramer's (2011) Shared Value Framework highlights how companies can create economic value while addressing societal challenges.

Empirical research by Eccles, Ioannou, and Serafeim (2014) suggests that companies with strong CSR policies outperform competitors in long-term financial performance. A study by the United Nations Global Compact (2021) reveals that 84% of executives believe CSR initiatives enhance long-term business success. Additionally, the European Commission (2020) highlights that firms integrating CSR experience 20% higher profitability due to increased consumer trust and operational efficiencies.

Recent studies indicate that firms implementing structured CSR programs see an increase in investor confidence and regulatory benefits. KPMG (2022) highlights that businesses investing in CSR experience 40% higher employee retention rates compared to those without such programs. CSR also plays a significant role in mitigating financial and regulatory risks, as businesses adhering to sustainability standards face fewer legal challenges and benefit from incentives like tax reductions and government grants. For instance, Tata Steel's responsible waste management initiatives have significantly reduced compliance-related risks while enhancing operational efficiency. In 2022, Tata Steel reported a 16% reduction in environmental penalties due to its adherence to sustainable waste management practices.

Mechanisms of CSR in Sustainable Growth

Enhancing Corporate Reputation

CSR initiatives improve brand perception, fostering consumer loyalty and trust. According to a Nielsen (2021) survey, 77% of consumers prefer purchasing from socially responsible companies. Firms that proactively disclose sustainability efforts build stronger reputations, leading to competitive advantages in global markets. A prime example is Patagonia, which has cultivated a loyal customer base by committing to environmental sustainability, leading to strong financial performance. Patagonia's revenue grew by 30% after it pledged to donate its entire $3 billion company value to environmental causes in 2022.

Operational Efficiency and Cost Reduction

Companies implementing CSR focus on reducing carbon footprints, waste management, and sustainable sourcing. According to a report by

the Carbon Disclosure Project (2022), firms that actively reduce emissions experience a 10% increase in market valuation. Additionally, green initiatives, such as renewable energy adoption, can result in a 25% reduction in operational costs over a decade. Infosys has leveraged green buildings and renewable energy to cut down on energy consumption, improving cost efficiency while reinforcing its sustainability goals. Infosys reduced its per capita energy consumption by 55% between 2008 and 2022, leading to operational cost savings of ₹1,300 crore.

Strengthening Stakeholder Trust

CSR fosters workplace diversity, fair wages, and employee well-being. A study by McKinsey (2021) found that organizations investing in social responsibility see a 15% increase in employee productivity and retention. Moreover, CSR programs that support employee well-being reduce absenteeism by 30% and enhance workplace morale. For example, Google's focus on employee wellness through CSR initiatives has led to higher productivity and innovation. Google's parental leave policy improvements resulted in a 50% decrease in female attrition rates, strengthening workforce stability.

Mitigating Financial and Regulatory Risks

Businesses with robust CSR programs are better positioned to manage regulatory changes and financial risks. Firms with sustainable governance models face fewer legal penalties and attract long-term investors. A report by PwC (2022) found that companies committed to strong CSR policies saw a 25% reduction in compliance costs and regulatory fines. Nestlé's responsible water stewardship programs have helped the company avoid regulatory scrutiny while securing long-term access to essential resources. Nestlé invested $200 million in water conservation projects, reducing water consumption by 32% over the past decade.

Case Studies: CSR-Driven Sustainable Growth

Unilever: Sustainable Living Plan

Unilever's CSR initiatives, such as sustainable sourcing and eco-friendly packaging, have led to a 69% increase in sales of its sustainable brands. The company also achieved a 60% reduction in carbon emissions since 2010. Unilever's financial reports indicate that brands aligned with its sustainability strategy have grown at a rate 50% faster than non-sustainable brands.

Tata Group: CSR for Community Development

Tata Group has invested over $200 million in CSR initiatives, including education, healthcare, and rural development. The company's focus on ethical business practices has resulted in a 30% rise in investor confidence. Tata Steel, for instance, has implemented water conservation measures that have saved over 3 million liters of water annually.

Infosys: Green IT and CSR

Infosys has pledged carbon neutrality by 2030, reducing energy consumption by 44% in the past decade. The company's CSR programs have improved employee satisfaction and retention rates. Infosys Foundation has supported education and skill development for over 10 million individuals across India.

ITC Limited: Rural and Agricultural Development

ITC's e-Choupal initiative has empowered over 4 million farmers by improving market access and reducing supply chain inefficiencies. The company's CSR efforts have strengthened its market position and contributed to rural economic growth. ITC's sustainability reports indicate that their afforestation programs have resulted in a 50% increase in green cover across operational regions.

Reliance Industries: Education and Healthcare CSR Initiatives

Reliance Industries has invested heavily in education and healthcare CSR programs. The Reliance Foundation has provided healthcare services to over 10 million individuals and supports over 50,000 students annually through scholarships. These initiatives have enhanced Reliance's brand reputation and customer loyalty, resulting in a 15% increase in overall business revenue.

Challenges in CSR Implementation

Despite its advantages, CSR implementation faces significant challenges, including:

- **Greenwashing:** Companies may engage in superficial CSR efforts to enhance public image without meaningful impact.
- **Regulatory Disparities:** Different countries and industries have varying CSR standards, making compliance complex.
- **High Initial Costs:** Investing in sustainability initiatives requires substantial financial resources, which may deter small businesses.
- **Measuring CSR Impact:** Quantifying the actual benefits of CSR

initiatives remains challenging, making it difficult to justify investments to shareholders.

- **Stakeholder Skepticism:** Some stakeholders perceive CSR as a marketing gimmick rather than a genuine commitment to social responsibility.

Strategies for Maximizing CSR Impact

To address these challenges, businesses can adopt the following strategies:

- **Integration into Core Business Strategy:** Embedding CSR into business models ensures long-term commitment rather than ad-hoc initiatives.
- **Transparent Reporting and Metrics:** Using standardized frameworks like GRI and SASB enhances credibility and impact measurement.
- **Public-Private Partnerships:** Collaborating with governments and NGOs amplifies CSR efforts and reduces implementation barriers.
- **Employee Engagement:** Encouraging employee participation in CSR initiatives fosters internal support and improves workplace morale.
- **Leveraging Technology:** Utilizing AI and big data analytics can improve CSR efficiency and effectiveness.

Conclusion

Corporate Social Responsibility (CSR) has evolved from being a discretionary corporate initiative to a fundamental strategy driving sustainable growth. The findings of this study reinforce that businesses integrating CSR into their core operations achieve superior financial performance, enhanced brand reputation, and long-term stakeholder trust. Through case studies of companies such as Unilever, Tata Group, Infosys, ITC Limited, and Reliance Industries, it is evident that CSR fosters economic resilience, social inclusivity, and environmental sustainability. These organizations exemplify how structured CSR initiatives contribute to long-term value creation by mitigating financial risks, enhancing operational efficiencies, and fostering community development.

Furthermore, CSR's role in sustainable growth extends beyond compliance to strategic advantage. Companies committed to ethical business practices and environmental stewardship not only attracts investors but also experience higher employee retention, increased consumer loyalty, and regulatory benefits. However, challenges such as greenwashing, high implementation costs, and regulatory disparities persist, necessitating

transparent reporting, stakeholder engagement, and innovative strategies to maximize CSR effectiveness.

As businesses navigate an increasingly complex global economy, CSR must be viewed not as a cost but as an investment in future growth and stability. Organizations that proactively integrate CSR into their governance structures will not only contribute to societal well-being but also secure long-term competitive advantages in an evolving market landscape. By leveraging technology, fostering cross-sector partnerships, and embedding sustainability into their strategic frameworks, businesses can transform CSR into a powerful catalyst for enduring progress.

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5

BRIDGING THE DIGITAL DIVIDE: DIGITAL LITERACY AS A PATHWAY TO SOCIAL INCLUSION

Amandeep Kaur*

Abstract

Now days, Digital literacy has become a fundamental requirement of every individual for participation in modern society. In today's world, where so much of our lives are conducted online, it has become a mandate to use digital technologies effectively. It has a profound impact on social inclusion. Particularly in developing nations like India, where the digital divide exacerbates already-existing social inequities, digital literacy has emerged as a crucial ability for meaningful engagement in contemporary society. This paper examines the relationship between digital literacy and social inclusion by exploring how digital skills impact individuals' ability to engage in social, economic, and political activities. It also analyzes case studies, and discusses policy implications to highlight the role of digital literacy in reducing social exclusion.

Keywords: *Digital Literacy, Social Inclusion, Digital Divide, ICT, Education, Economic Participation*

Introduction

Like reading and writing in earlier times, digital literacy has become a fundamental ability in the twenty-first century. Digital literacy includes more than just the ability to utilize digital tools; it also includes the ability to securely and effectively access, assess, communicate, and produce information using digital technology. It refers to the skills required to access, evaluate, and communicate information using digital platforms. Digital literacy facilitates social inclusion by improving access to education, employment, healthcare, and civic engagement. India's inventive and technological methods have

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allowed it to reach new heights despite its rapid growth. It becomes crucial to improve one's digital literacy as we are digital natives. In order to survive and prosper in this digital age, people now need to be digitally literate.

Definition

Digital literacy is a capacity to efficiently locate, assess, produce, and share information through digital tools, social media, and the internet. It includes abilities like digital communication, online safety, critical thinking, and knowing how to utilize technologies and software sensibly.

Scope

Digital literacy encompasses a broad range of competencies, including:

- Use of digital devices (smartphones, tablets, etc.)
- Basic digital skills (e.g., using the internet, email, and social media)
- Information literacy (e.g., evaluating online information credibility)
- Critical thinking in digital spaces
- Online communication and collaboration
- Searching, selecting, and organizing digital content

The Role of Digital Literacy in Social Inclusion

1. **Economic Inclusion:** People without digital skills may find it difficult to find jobs, access education and training, or participate in online commerce. Digital literacy enhances employment opportunities by helping and enabling individuals to acquire new skills, access job markets, and engage in remote work. It also supports entrepreneurship and digital commerce, allowing individuals to participate in the global economy by providing equal opportunities.
2. **Educational Access:** E-learning platforms and digital resources enable lifelong learning, bridging gaps in traditional education systems. Digital literacy ensures that students and educators can effectively use technology to improve learning outcomes.where E-learning has played a vital role during COVID pandemic.

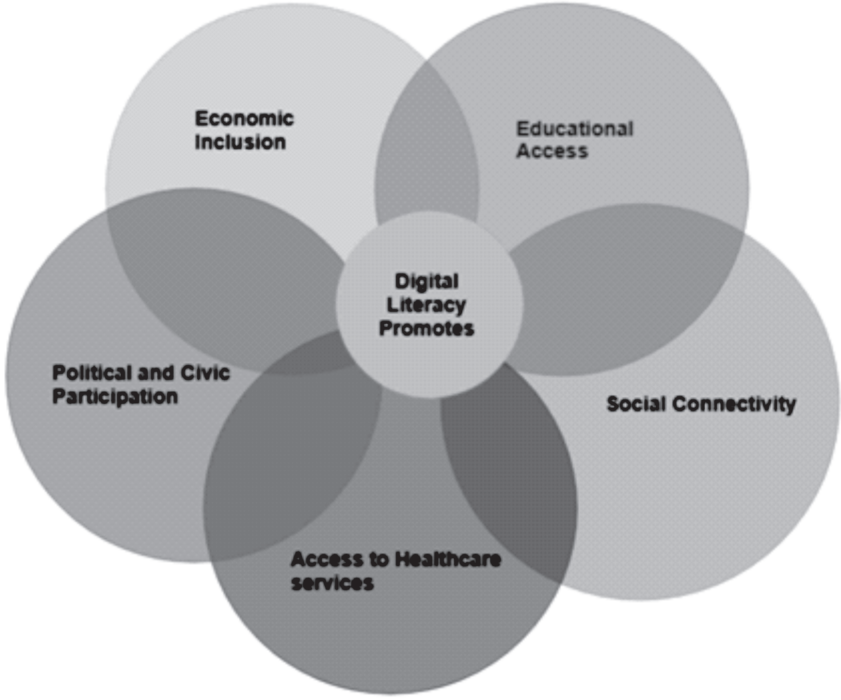

Figure 1: Role of Digital Literacy in Social Inclusion

3. **Political and Civic Participation:** Access to digital platforms allows individuals to engage in democratic processes, such as voting, advocacy, and online activism. Digital literacy fosters informed citizenship and participation in governance where people can keep on watching government activities and can give their reviews by assessing the performance of government.
4. **Healthcare and Well-being:** People who are digitally literate can look for trustworthy health information online and raise their level of health awareness. As telemedicine apps have grown in popularity, digital literacy has made it possible for patients to schedule virtual consultations, share medical records online, and receive online mental health counseling and therapy.
5. **Social connection:** The inability to use technology can lead to feelings of isolation and loneliness, as people miss out on opportunities to connect with others online.The internet and social media platforms can help people to connect with others who share their interests, build communities, and maintain relationships. This is especially important for people who may be isolated or marginalized in other ways.

Barriers to Digital Inclusion

Despite its benefits, digital literacy is not universally accessible due to:

- Socioeconomic disparities limiting access to digital devices and the internet
- Lack of digital education in marginalized communities
- Gender and age-related gaps in digital adoption
- Misinformation and cyber security threats

Case Studies and Empirical Evidence

This section showcases case studies of successful digital literacy initiatives, encompassing government programs, non-profit interventions, and corporate social responsibility efforts that have advanced digital inclusion in diverse ways.

1. Case Study: Digital Literacy in Rural India (Digital Empowerment Foundation)

In rural areas of India, the lack of access to technology and digital literacy limits many communities' ability to benefit from government services, education, and participation in various activities. **The Digital Empowerment Foundation** (DEF), a non-profit organization, identified this gap and sought to bridge it by offering digital literacy training to rural communities.

DEF launched a program named "**Digital Literacy for Rural India**" initiative. The program focused on:

- Setting up Digital Literacy Centres in villages to provide hands-on training in using digital devices like smart phones and computers.
- Teaching basic skills such as internet surfing, using email, and accessing government services online.
- Creating educational content in local languages to ensure inclusivity.
- Training community leaders to become "digital ambassadors" who could teach others in their villages.

Results

- Over 2.5 million people were benefited and have been trained across various rural regions in India.
- Participants became more confident in using digital services such as mobile banking, government e-services, and online education platforms.
- Enhanced involvement of women and marginalized communities in digital activities, aiding empowerment and economic development.

2. Case Study: Digital Literacy for Women (Nari Shakti: Digital Literacy Program)

Women in both urban and rural regions of India frequently encounter difficulties in accessing digital resources because of societal and cultural obstacles. The initiative **Nari Shakti (Women Empowerment through Digital Literacy)** sought to enhance women's digital literacy and facilitate their access to services such as education, healthcare, and entrepreneurial opportunities in order to empower them. Launched by the **Ministry of Women and Child Development**, the initiative included:

- A digital literacy curriculum tailored specifically to women, focusing on topics such as basic smart phone usage, online banking, digital safety, and e-commerce.
- Online and offline workshops across multiple regions, including both rural and urban areas.
- Collaboration with local NGOs and community organizations to reach a wider audience.

Results

- Over 500,000 women have participated in digital literacy workshops.
- Empowered women gained access to online government schemes, health services, and financial tools.
- Increased participation of women in digital entrepreneurship, leading to financial independence and economic empowerment.
- Many women reported feeling more confident navigating online platforms for social networking and educational purposes.

3. Case Study: Digital Literacy for Students (Pradhan Mantri Gramin Digital Saksharta Abhiyan - PMGDISHA)

The Indian government acknowledged the necessity of enhancing digital literacy, especially among students, in order to equip the next generation for the digital age. The objective of the **Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA**) was to provide rural inhabitants, especially students, with training in digital skills. PMGDISHA concentrated on:

- Establishing digital literacy centres in villages, equipped with computers and internet access.
- Providing basic digital literacy training to over 6 crore rural households by teaching skills like basic computer usage, internet browsing, digital payments, and email communication.

- Incorporating the initiative into schools and educational institutions to reach young learners.

Results

- More than 4 crore rural citizens have been trained, with a significant number of students.
- Increased use of digital platforms in rural education, including online learning platforms,e -journals and e-books.
- Enabled students to access scholarships, government schemes, and skill development programs through digital platforms.
- Improved digital inclusion for rural students, helping bridge the education divide.

4. Case Study: Digital Literacy in Healthcare (Telemedicine and eHealth Services)

In India, healthcare delivery in rural and remote areas often faces challenges due to a lack of infrastructure and medical personnel. The **eHealth** initiative, launched by the Ministry of Health and Family Welfare, focused on improving digital literacy among healthcare professionals and the public to promote telemedicine and digital health services. The eHealth initiative included:

- Training healthcare providers in the use of telemedicine platforms and electronic health records (EHR).
- Offering digital health literacy workshops to rural populations, teaching them how to access healthcare services online.
- Partnering with telemedicine companies to offer virtual consultations in underserved regions.

Results

- Increased adoption of telemedicine services, allowing patients in rural areas to consult doctors remotely.
- Healthcare professionals reported improved efficiency in managing patient records and accessing medical resources online.
- Patients, especially in remote areas, were able to benefit from online health consultations, reducing the need for travel and improving access to healthcare.

5. Case Study: Digital Literacy for Farmers (eNAM – National Agriculture Market)

India's farmers, particularly those in rural areas, have limited access to

digital tools and platforms that could enhance their productivity and connect them with markets. The **National Agriculture Market (eNAM)** initiative aimed to digitally empower farmers, helping them access better prices and services for their agricultural produce. The initiative focused on:

- Providing farmers with digital literacy training on how to use the eNAM platform to sell their produce.
- Teaching farmers how to use mobile phones and the internet to connect with buyers, track market prices, and access government agricultural schemes.
- Setting up training centers in rural areas to teach farmers how to use digital platforms for agriculture-related tasks.

Results

- Over 1.7 crore farmers have registered on the eNAM platform, increasing their market access and income.
- Farmers gained a better understanding of market prices, reducing the impact of middlemen and improving their bargaining power.
- Increased adoption of mobile phones and digital tools in farming, including apps for weather forecasting, crop management, and pesticide use.
- Empowered farmers with knowledge about digital payment systems, improving financial inclusion.

These case studies demonstrate the diverse applications of digital literacy programs in India, from empowering rural communities and farmers to enhancing healthcare access and creating economic opportunities for women and students. Digital literacy remains crucial to bridging the gap between India's urban and rural populations, ensuring greater inclusion in the country's digital transformation.

Digital Literacy Progression 2019-2024

Table 1: Digital Literacy Progression in India

Year	Digitally Literate Individuals (in crores)
2019–20	1.20
2020–21	0.80
2021–22	0.90
2022–23	0.70
2023–24	1.38

Policy Recommendations

To promote digital literacy and social inclusion, policymakers should:

- Expand access to affordable internet and digital infrastructure
- Integrate digital literacy programs into formal and informal education
- Promote public-private partnerships to enhance digital skills training
- Address cyber security and misinformation challenges through awareness campaigns

Conclusion

While India has made significant strides in enhancing digital literacy, especially through various initiatives, the overall computer literacy rate remains low, and gender disparities continue to be a concern. Efforts to improve infrastructure, such as increasing internet access in schools, are steps in the right direction It is essential for social inclusion in the 21st century to enable people to access opportunities, and connect with others, reducing inequalities and empowering individuals to participate fully in society. While challenges remain, targeted efforts in policy, education, and technology access can bridge the digital divide and promote equitable social development. it is important to ensure that everyone has the opportunity to develop the digital skills they need to thrive in the digital age.

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6

AGRICULTURAL INNOVATIONS IN PUNJAB: A PATH TO SUSTAINABLE RURAL DEVELOPMENT

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Abstract

Punjab, the "Granary of India," plays a vital role in India's agricultural output, yet faces severe challenges in sustainable rural development. Issues such as water scarcity, soil degradation, market access limitations, and the impacts of climate change jeopardize its agricultural viability. Over-reliance on water-intensive crops, chemical fertilizers, and monocropping has strained natural resources, while socio-economic challenges, including rural unemployment and migration, further hinder development. Agricultural innovations, including precision farming, crop diversification, and advanced irrigation systems, offer solutions to these pressing issues. A multifaceted strategy focusing on soil health, water management, rural infrastructure, and capacity building is essential for achieving sustainability. By promoting climate-resilient practices, enhancing market linkages, and fostering rural entrepreneurship, Punjab can ensure long-term productivity and socio-economic progress. These innovations hold transformative potential, empowering farmers, preserving resources, and fostering equitable rural development. Punjab's path toward sustainable agriculture serves as a model for regions facing similar challenges globally.

Introduction

Agricultural development in Punjab represents a pivotal aspect of sustainable rural development, offering a pathway to economic stability, environmental sustainability, and social progress. Punjab, known as the "Granary of India," has long been a cornerstone of India's agricultural sector, contributing significantly to the country's food security and economic growth.

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However, the region faces pressing challenges related to resource depletion, environmental degradation, and evolving climatic conditions. Agricultural innovations in Punjab have emerged as a critical pathway to achieving sustainable rural development, addressing these challenges while enhancing productivity and improving the quality of life in rural communities.

Historically, Punjab's agricultural success can be attributed to the Green Revolution of the 1960s, which introduced high-yielding varieties of crops, advanced irrigation techniques, and synthetic fertilizers. This transformation boosted productivity and positioned Punjab as a key contributor to India's food supplies. Yet, the very practices that fuelled this success have also led to several challenges, including soil degradation, over-extraction of groundwater, and environmental pollution.

To address these issues and ensure sustainable development, a multifaceted approach is essential. Agricultural innovations in Punjab encompass a range of technological, managerial, and biological advancements aimed at transforming traditional farming practices. These innovations include precision agriculture, advanced irrigation systems, crop diversification, and biotechnological advancements. Each of these plays a crucial role in addressing the specific challenges faced by Punjab's agriculture.

Objectives

1. To identify and discuss specific agricultural and rural development challenges faced in Punjab, such as water scarcity, soil degradation, and market access issues.
2. To explore ways to improve the economic and social conditions of rural communities in Punjab.

Agricultural and Rural development challenges faced in Punjab

Punjab, often referred to as the "breadbasket of India," has long been a significant contributor to India's agricultural output. However, the region faces several critical challenges in its agricultural and rural development landscape. Here's a detailed discussion of the key issues:

Water Scarcity: Punjab's agriculture is heavily reliant on water-intensive crops like rice and wheat. Over the years, this has led to significant groundwater depletion. The water table in many parts of Punjab is dropping at an alarming rate due to over-irrigation and the excessive use of tubewells. Around 80% of the state's blocks are overexploited, with groundwater extraction far exceeding recharge rates.

Soil Degradation: Years of intensive farming and overuse of chemical

fertilizers have led to a decline in soil health. Excessive use of urea and other nitrogen-based fertilizers has depleted essential nutrients in the soil, leading to reduced productivity. Continuous monocropping and limited use of organic manure have reduced soil organic matter.

Market Access Issues: Farmers in Punjab face challenges in accessing fair and reliable markets for their produce. The Agricultural Produce Market Committee (APMC) system has been both a strength and a limitation. While it provides a platform for selling produce, it often leads to exploitation by middlemen. While the Minimum Support Price (MSP) system provides a safety net, it primarily supports wheat and rice. Farmers growing other crops often face price fluctuations.

Rural Economic Challenges: Beyond agricultural concerns, rural Punjab faces broader socio-economic issues that hinder development. Mechanization in agriculture and limited opportunities in non-farm sectors have led to rising unemployment. This has spurred rural-to-urban migration and even emigration abroad. Many young people in rural areas are reluctant to take up farming due to low profitability and the perception of agriculture as a non-prestigious occupation.

Climate Change Impacts: Punjab is increasingly feeling the effects of climate change, including erratic rainfall, higher temperatures, and extreme weather events. These changes affect crop yields and increase the vulnerability of farmers.

Strategy for Sustainable Agricultural Development

First, soil health management is critical. The over-reliance on chemical fertilizers has depleted soil nutrients and led to imbalances. Emphasizing organic farming practices, crop rotation, and the use of green manures can rejuvenate soil health and improve long-term productivity.

Water management is another pressing concern. Punjab's intensive agriculture has significantly stressed its groundwater resources. Sustainable practices such as the adoption of drip irrigation, rainwater harvesting, and the promotion of drought-resistant crop varieties can help mitigate water depletion.

Diversification of crops is also a key strategy for sustainable agricultural development. Shifting from monoculture systems to a diverse cropping pattern can enhance soil fertility, reduce pest and disease risks, and improve resilience against climate change. Moreover, integrating modern technology and practices can enhance productivity and sustainability. Precision farming

techniques, which use data and technology to optimize resource use, can improve crop yields while minimizing environmental impact. The adoption of remote sensing, drones, and other innovative tools can assist farmers in monitoring crop health, managing pests, and making informed decisions.
Supportive policies and rural infrastructure development are equally important. Investment in rural infrastructure, such as roads, storage facilities, and markets, can facilitate better access to resources and markets, reducing post-harvest losses and enhancing farmers' profitability. Government initiatives and subsidies that promote sustainable practices, research, and development in agriculture can also play a crucial role in fostering long-term growth.

Education and capacity building are essential for empowering farmers and rural communities. Providing training on sustainable farming practices, financial literacy, and business management can enable farmers to adopt new techniques and improve their livelihoods. Encouraging farmer cooperatives and self-help groups can also strengthen community ties and enhance collective action towards sustainable development goals.

Impact of Agricultural Innovations on Agriculture

Punjab, a prominent agricultural hub in India, faces challenges such as environmental degradation, resource depletion, and socio-economic disparities among rural populations. By focusing on agricultural innovations Indian agriculture can have several key benefits:

1. **Enhanced Agricultural Productivity:** Innovations in agricultural practices, such as advanced crop varieties, precision farming technologies, and modern irrigation systems, can significantly boost productivity. For example, the adoption of high-yielding and drought-resistant crop varieties can help farmers increase their output and ensure food security. Precision farming technologies, including GPS and sensor-based systems, can optimize the use of inputs like water, fertilizers, and pesticides, leading to higher efficiency and reduced costs.
2. **Sustainable Farming Practices:** It can promote sustainable agricultural practices that address environmental concerns. Innovations such as organic farming, integrated pest management, and conservation tillage can reduce the environmental impact of farming. By encouraging practices that minimize soil erosion, conserve water, and reduce chemical runoff, it can help preserve natural resources and maintain ecological balance.

3. **Economic Empowerment of Farmers:** By introducing and disseminating innovative farming techniques and technologies, it can help increase the income of farmers. Improved productivity and reduced costs can lead to higher profits. Additionally, innovations that enhance market access, such as digital platforms for selling produce or blockchain for supply chain transparency, can help farmers get better prices for their products and reduce dependency on intermediaries.
4. **Rural Development and Infrastructure Improvement:** Agricultural innovations often necessitate improvements in rural infrastructure, such as better storage facilities, transportation networks, and energy supply. As these innovations are adopted, there can be a positive ripple effect on rural development, leading to enhanced living standards, better access to services, and overall economic growth in rural areas.
5. **Environmental and Social Benefits:** Sustainable agricultural practices can lead to better environmental outcomes, such as improved soil health and water quality. Socially, addressing issues like rural poverty and unemployment through innovative agriculture can lead to more equitable development and improved quality of life for rural communities.

In conclusion, agricultural development in Punjab, when aligned with sustainable practices, holds immense potential for fostering rural development. By addressing soil health, water management, crop diversification, technological innovation, and supportive policies, Punjab can pave the way for a more resilient and prosperous rural future. This holistic approach not only ensures the region's agricultural viability but also contributes to broader environmental and economic sustainability, reflecting a model for other regions facing similar challenges. Therefore, agricultural innovations in Punjab offer a comprehensive approach to addressing key challenges in agriculture and rural development. By promoting productivity, sustainability, and economic empowerment, and by fostering knowledge sharing and policy support, it can contribute significantly to the overall well-being and development of rural communities in Punjab.

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7

DIGITAL INCLUSION: RESHAPING RURAL INDIA

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Abstract

This article explores the transformative impact of digital inclusive services in rural regions of India. This transformation provides a significant opportunity for rural India to bridge longstanding socio-economic gaps and improve quality of life in agriculture, healthcare, education, disabled, and lifelong learning. By highlighting various Government and Non-Government initiatives, this paper showcases how digital inclusion enhance productivity, increase market access, and improve service delivery for rural populations. This article explores the transformative impact of digital inclusion in rural India. However, to maximize these benefits, this paper also discusses persistent challenges such as inadequate infrastructure, affordability, and low digital literacy.

Keywords: *Digital Inclusion, Rural India, Government and Non-Government Initiatives, Challenges to digital India*

Introduction

In India, the increasing adoption of technology and the government's emphasis on digitalization is shaping the changing landscape of information management (Malodia et al., 2021). Digital technologies, such as cloud computing and mobile applications, have become catalysts for economic growth and citizen empowerment worldwide (Tripathi & Dungarwal, 2020). India has made remarkable progress in technology and science, positioning itself as one of the leading economies in the developing world (Lema et al., 2021).

Digital inclusion refers to the ability of individuals and communities to access and use digital technologies such as smartphones, computers, and the internet. In rural India, where the majority of the population resides,

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lack of digital inclusion has a significant impact on economic opportunities, education, healthcare, and financial inclusion.

Digitalization, as exemplified by India's Digital India Program (DIP), is explicitly linked to inclusiveness. The DIP's efforts to provide digital access, resources, and services to all citizens, especially those in rural areas, emphasize inclusivity (Nedungadi et al., 2018). By bridging the digital divide, offering digital literacy, and promoting cashless transactions, digitalization contributes to a more inclusive and empowered society by ensuring that even marginalized communities can benefit from digital technologies. To achieve this vision, the Indian government has implemented strategies to transform the nation and create opportunities for its citizens through the utilization of ICT tools, leading to the launch of the Digital India Program (DIP) initiative. The program, initiated by Prime Minister Narendra Modi, aims to empower India digitally and generate prospects for its citizens through the harnessing of digital technologies (Mukherjee & Narang, 2022). The vision of the Digital India program, as highlighted by Kumar (2019), is to transform India into a digitally empowered society and knowledge economy. The program focuses on three key areas of vision: (1) digital infrastructure as a core utility to every citizen, (2) governance and services on demand, and (3) digital empowerment of citizens.

Review of Literature

Kumar (2020) have made a study on the title "Impact of Digital Inclusion on Rural Development: A Case Study of India". The aim of the study is to assess the socio-economic impact of digital inclusion initiatives in rural India with the objective to analyze how digital technologies improve access to education, healthcare, and economic opportunities in rural areas, The study found significant improvements in educational outcomes, healthcare access, and economic participation due to digital inclusion efforts.

Sharma (2018) had made a study on "Challenges and Opportunities of Digital Inclusion in Rural India" with the aim to identify barriers hindering digital inclusion in rural India and explore opportunities for improvement. The objective of the study is to analyze the impact of infrastructural limitations and digital literacy gaps on digital inclusion efforts. The findings highlighted the need for community-based training programs and government policies to address challenges in digital adoption.

Patel (2019) ha d made a study on, "Digital Tools in Agriculture: Enhancing Productivity and Market Access in Rural India". The aim of the

study is to examine the role of digital technologies in improving agricultural practices and market. The Findings of the study showed that farmers using digital tools achieved higher yields and better market prices, leading to improved livelihoods.

Reddy (2021) had undertaken a study on "Promoting Rural Entrepreneurship through Digital Inclusion: Case Studies from India". The aim of the study is to investigate how digital inclusion initiatives support entrepreneurship in rural India with the objective to analyze successful case studies of digital startups and their impact on local economies. The findings show identified digital payment systems and e-commerce platforms as crucial for fostering rural entrepreneurship and economic growth.

Bruntha and Subaithani (2024) explores the transformative impact of digital inclusive services in rural regions of India. It delves into the evolving landscape where technology is bridging longstanding gaps in access to essential services, education, healthcare, and economic opportunities. Study found that The integration of mobile health applications, remote monitoring devices, and electronic health records has not only improved health outcomes but also fostered a more efficient and equitable healthcare system in rural India.

Prabhu (2024) explored the multifaceted impact of digitalization in rural India, analyzing its potential to bridge socioeconomic gaps while identifying the challenges impeding full-scale adoption. This study presented that digital transformation presented a valuable opportunity for rural India to bridge longstanding socio-economic gaps and improve quality of life in agriculture, healthcare, and education. The progress made through initiatives like Digital India has demonstrated that digital tools can enhance productivity, increase market access, and improve service delivery for rural populations. However, to maximize these benefits, it is essential to address persistent challenges such as inadequate infrastructure, affordability, and low digital literacy.

Tiwari (2023) conducted a study on Digital Rural India: Possibilities and Challenges with special reference to Gorakhpur Divison in Uttar Pradesh, India. The aim is to analyzed the Possibilities and Challenges of Digital Rural India. The study highlighted the significance of digitalization in achieving economic growth, social justice, and improved living standards for the rural population. The government of India plays a vital role in providing technical and administrative support for the implementation of various programs aimed at poverty alleviation and the provision of basic amenities and infrastructure. The country has started a revolutionary path with programs like Digital India,

with the goal of bridging the digital divide and empowering people through digital inclusion. India's digital transformation has been remarkable, with improved connectivity and technological capabilities leading to increased digital access and inclusivity for its citizens. Initiatives such as the Digital India program, Pradhan Mantri Grameen Digital Saksharta Abhiyan (PMGDSA), and Unified Payments Interface (UPI), etc. have played a significant role in transforming India into a digitally empowered society and a major player in the digital economy.

Mishra and Ghumre (2023) explored that 'Digital India' program, spearheaded by the esteemed Prime Minister, Mr. Narendra Modi, is poised to usher in novel developments across all domains and inspire inventive ventures for the next generation. The idea is to create a system that is transparent, responsive, and participatory. The process of transforming analog materials into digital files through scanning or other means is known as digitalization. It is the driving force behind the current era of change. It is significant to our day-to-day existence.

Sindakis and Showkat (2024) revealed a predominantly young population in rural India, indicating a workforce with significant economic potential and a higher likelihood of embracing digital technologies. Moreover, the study highlighted the high levels of education among respondents, indicating a population well-equipped to understand and benefit from digital initiatives. Unexpectedly, the research showed a higher rate of digital technology adoption among female respondents, challenging the perception of gender disparities in technology access.

Objectives of The Study

1. To talk about the different Digital India initiatives that the government and non-government agencies has introduced.
2. To list the importance of digital inclusion for rural India
3. To list the main challenges facing during the digital inclusion for rural India.

Research Methodology

A descriptive and explorative methodology is followed. The secondary data based on various reports from Government departments, published sources on websites, journal, periodicals and reports are liberally used for the preparation of the paper.

Government-Led Initiatives

1. **BharatNet:** Bridging the Connectivity Gap One of the flagship initiatives

of the Indian government, BharatNet, aims to connect the remotest parts of the country with high-speed broadband internet. As one of the biggest rural telecom projects in the world, it envisions establishing a robust optical fiber network, extending broadband connectivity to over 250,000 Gram Panchayats (local administrative units) in rural India. By providing last-mile connectivity, BharatNet seeks to enable mobile operators, Internet Service Providers (ISPs), Cable TV operators, and content providers to offer various servicessuch as e-health, e-education and egovernance in rural and remote India. As of August, 2023, 196,544 Gram Panchayats are connected through the BharatNet project and 650,080 Km of optical fiber cable has been laid. Additionally, 601,026 Fibre-To-The-Home (FTTH) connections are commissioned and 104,674 Wi-Fi hotspots are installed to ensure last-mile connectivity. The Indian government recognizes the critical need to bridge the digital divide in rural areas and has initiated various programsto ensure that rural populations have access to digital resources.

2. **Common Service Centers (CSCs):** Digital Services at the Doorstep Common Service Centre (CSC) is a strategic cornerstone of the National e-Governance Plan (NeGP), approved by the government in September 2006. These are physical facilities that serve as access points for digital services in rural and remote areas. These centers offer a wide range of services, including internet browsing, online form submission, utility bill payments, and government document printing. As of May 2023, there are 4,13,999 functional CSCs across rural India.
3. **Digital India Campaign:** Enabling Digital Literacy and Access Launched in July 2015, the Digital India Campaign seeks to transform India into a digitally empowered society and knowledge economy. This campaign focuses on three key areas: digital infrastructure, digital literacy, and digital services. The government has taken up several initiatives under the Digital India campaign. Some of these include DigiLockers (this provides access to the citizens' authentic digital documents), E-Hospitals (the platform seeks to connect patients, hospitals, and doctors), E-Pathshala (it contains textbooks, audio, video, periodicals, and a variety of educational materials), and BHIM (a UPI payment app).
4. **Pradhan Mantri Gramin Saksharta Abhiyan (PMGDISHA):** Development for Digital Usage Digital Skill The PMGDISHA initiative, launched under the Digital India Campaign, focuses on imparting digital literacy skills to rural citizens. It seeks to make six crore people in rural

areas, across States/UTs, digitally literate, reaching around 40% of rural households by covering one member from every eligible household. According to the government press release (July, 2022), more than 6.15 crore candidates have been enrolled and 5.24 crore have been trained, out of which 3.89 crore candidates have been duly certified under the PMGDISHA Scheme. Also, more than 4.13 lakh common service centers are approved under the scheme.

Non-Governmental Organizations (NGOS) and Private Sector Involvement

While government initiatives play a pivotal role in advancing digital inclusion in rural India, the concerted efforts of non-governmental organizations (NGOs) and private sector entities have proven equally impactful. These stakeholders bring innovation, localized approaches, and corporate social responsibility (CSR) to the forefront, effectively complementing governmental efforts.

1. **Role of NGOs in Grassroots Level Digital Inclusion** NGOs often operate at the grassroots level, intimately understanding the unique challenges faced by rural communities. They facilitate workshops, training sessions, and awareness campaigns that empower rural populations to confidently operate in the digital landscape.
2. **Private Sector's CSR Initiatives for Digital Empowerment** Recognizing their role in social development, several private companies have undertaken corporate social responsibility initiatives aimed at promoting digital education and infrastructure in rural areas. Last year, Smartphone manufacturing company OPPO India contributed digital literacy tools to support the academics of first-generation learners through Project Dhruv, an initiative by Mensa India. As part of the association, 45 OPPO pads, styli, and internet dongles were distributed to the students at a school in Gurgaon. As a part of the Digital Learning Enabling Programme (DLEP), Atkins India installed computer labs in two rural schools in Karnataka. Contributions from global firms only strengthen digital empowerment efforts manifold. Like we had Wartsila, a Finland headquartered manufacturing company, partnered with a local NGO, the Digital Empowerment Foundation (DEF), to set up a digital classroom in a town in Haryana.
3. **Collaborative Efforts for Lasting Impact** Collaborations and partnerships between NGOs, private companies, and government

bodies enable the pooling of resources, expertise, and networks, leading to more effective and sustainable initiatives and result in holistic digital inclusion. Their involvement ensures that digital access and literacy are not only top-down approaches but also community-driven endeavors. For instance, in August 2023, OctaFX, an international broker, collaborated with Community Action for Rural Development (CARD) to set up a computer lab at a rural school in Tamil Nadu, aiming to address the digital divide. Often, such small but relevant steps encourage mass interest and participation

Importance of Digital Inclusion for Rural India

1. Agriculture

- **Precision Farming and Crop Management:** Digital tools like satellite-based soil monitoring, sensors, and drones allow farmers to optimize water use, track crop health, and monitor soil quality. Apps such as Kisan Suvidha provide timely information on weather forecasts, pest control, and fertilizer usage, which can directly increase crop yield and reduce input costs.
- **Market Access and Price Transparency:** The eNAM (Electronic National Agriculture Market) platform enables farmers to access national market prices and connect with buyers across regions, empowering them to negotiate better prices and reducing dependency on local middlemen.
- **Financing and Insurance:** Digital platforms are providing innovative financial solutions, including micro-loans, crop insurance, and credit scoring using data analytics. Programs like the PM-KISAN mobile app help ensure timely financial support to farmers.
- **Agriculture Extension and Training:** Digital initiatives have made it easier for farmers to access expert advice, training videos, and best practices in real-time. Through platforms like ICRISAT, farmers learn sustainable and efficient farming practices, directly impacting productivity.

2. Healthcare

- **Telemedicine:** Digital healthcare initiatives, such as eSanjeevani, provide rural patients access to remote consultations with doctors. This is especially vital in areas with a scarcity of healthcare facilities or specialists. Patients can receive timely diagnoses, reducing travel costs and delays in treatment.
- **Mobile Health Services:** Mobile health apps allow community health workers to track vaccinations, prenatal care, and chronic diseases.

Initiatives like Arogya Setu and Ayushman Bharat Digital Mission streamline patient information, which improves diagnosis and preventive care.

- **Access to Government Health Schemes**: Digital platforms facilitate enrollment and management of government health schemes and insurance programs. Rural residents can access information about available benefits, eligibility criteria, and claim processes, ensuring equitable healthcare access.
- **Data-Driven Health Insights:** Digital platforms collect health data that helps healthcare providers and policymakers understand disease patterns in rural areas, aiding in better-targeted health interventions and resource allocation.
- **Pharmaceutical Access:** Digital platforms for ordering medicines allow rural residents to access prescriptions more conveniently, addressing the challenge of limited availability of essential drugs in remote areas.

3. Education

Education is another sector that can greatly benefit from digital inclusion. Digital technologies have the potential to revolutionize education in rural India by providing access to quality educational resources and creating new opportunities for distance learning.

- **Digital Learning Platforms:** Platforms like Diksha provide educational resources, including video lessons, quizzes, and interactive materials. By overcoming geographical barriers, they enable students in rural areas to access quality content and supplemental learning materials.
- **Remote Classrooms and E-learning:** The integration of digital classrooms through initiatives like PM eVIDYA offers students interactive, real-time learning opportunities even in areas where teachers are scarce. This initiative bridges the educational gap and ensures continuity during disruptions.
- **Information for All :** Under this pillar, Govt plans to establish two way communication channel with the citizens in which public will have open and easy access to the information and at the same time provide feedback to the govt. Recently launched platform MyGov.in has already become a medium to exchange ideas/ suggestions with the Govt. Present government is also using social media in a big way to reach out to the citizen. Many stranded Indians in gulf countries used twitter to reach the External Affairs Minister and got help promptly.

4. **Digital India Benefits for Farmers :** Digital India' initiative would help the farmers in various ways e.g- A virtual platform of a National Agricultural Market (NAM) is launched. this will interconnect the mandis in various states electronically. This will ensure that the farmers get the maximum price for their produce as they will have access to information on the best price for their farm produce on their mobile phones. 'Pradhan Mantri Fasal Bima Yojana' launched recently, will leverage etechnology in a big way. After crop damage, farmer will send the photographs of his damaged crop through his smartphone to the authorities. Govt will use satellite imaginary to ascertain loss. Direct Benefit Transfer (DBT) of the claims to the farmer's bank account will reduce the delays in payments and eliminate middlemen. These days, farmers rely on many informal channels for information regarding agriculture e.g. fellow farmers, owner of the fertilizer shop, adhatiya etc., Information from there sources may be biassed at times. Through portals such as E-Kisan, farmers are able to get authentic information in real time. Information regarding weather can be made available to farmers in real time. Farmers can interact with agri-experts on digital platforms and learn about new techniques and methods. Govt. can use e-platforms to expand its agri- extension services and implement Lab-to-Land approach.
5. **Opportunities for the disabled**: As per the 'National Council on Disability' (NCD), digital inclusion improves workplace participation. And creates new prospects for people with disabilities. ICT is believed to bridge the gap between the employment opportunities of men, women, and disabled employees. And the latter will be able to break free from the hindrance of sticking on to part-time or low-skill-based jobs.
6. **Lifelong learning**: Another difference that ICT can make is the extension of learning possibilities. Other than improving the regular educational opportunities through an online school, digital technologies also support the idea of continuing education. It is a perfect channel to quench the thirst for knowledge. Which makes an individual more competitive and skilled for the global workforce. With online education, people of all age groups can now secure a good position in their existing organization. And even explore more attractive job opportunities by the virtue of their advanced skillsets
7. **Extends job markets with digital opportunities:** Digital jobs have extended more opportunities for the youth with options like freelancing, online work, and self-paced projects. These new ways of working are

ideal for a huge section of us unemployed or underemployed youth. Because these digital jobs give them a sense of self-worth.

Challenges to Digital India

India is achievable but it has its set of challenges. Some of these challenges are:

- **Cyber Threats:** With increased digitisation and e-services, threat of cyber crimes and frauds would increase. So precautions on this front need to be taken from the beginning, else it may erode the public confidence in e-services. People need to be made aware of cyber threats and ways to guard against them.
- **Coordination among Government and private sector:** Implementation of Digital India involves -Union Government, States, Union Territories and IT industry. Coordination among so many Govt departments and private players would be a gargantuan task and would largely decide the success of this initiative.
- **Interoperability:** There are different internet protocols in different states depending on what kind of hardware and software they use. This may cause problems in interoperability. Hence, all software protocols need to be standardised. Also, the software should be on open source basis, rather than propriety. Because, propriety solutions are more expensive and would be different to integrate across states.
- **Infrastructure Limitations:** Many rural areas in India lack reliable internet connectivity, with broadband penetration remaining low. Issues like poor mobile network coverage, frequent power outages, and a lack of digital infrastructure impede access to digital services.
- **Device Availability and Affordability:** The high cost of smartphones, tablets, and computers is a barrier for many rural residents. Additionally, maintenance and repair facilities are often scarce, making it difficult to sustain device usage.
- **Inadequate Technical Support and Training:** Rural regions often lack sufficient IT support and training centers, which are essential for troubleshooting, maintaining digital infrastructure, and supporting users in navigating digital platforms.
- **Affordability of Digital Services:** Data charges, internet plans, and the costs associated with certain digital services are prohibitive for lowincome households. Even as India's data rates are among the lowest globally, affordability remains a challenge for the rural poor.

- **Limited Financial Incentives:** For many small farmers, informal workers, or unskilled laborers, there is little direct economic incentive to adopt digital technology. This is especially true if the digital tools do not directly increase their income or reduce their costs in a visible way.
- **Dependence on Cash Economy:** Many rural regions still operate heavily on a cash-based economy. Limited access to digital banking services, low financial literacy, and mistrust in online banking hinder the adoption of digital financial tools, limiting participation in the digital economy.
- **Digital Literacy and Education:** A lack of digital literacy is one of the most significant barriers to digital adoption in rural areas. Many rural residents, especially older generations, are unfamiliar with digital platforms, and often there are no training programs available to bridge this gap.
- **Cultural Resistance and Trust Issues:** Traditional beliefs, cultural practices, and mistrust in technology can lead to reluctance in adopting digital tools. For example, many people may view telemedicine with skepticism and prefer in-person doctor consultations.
- **Gender Disparities:** Digital adoption is also hindered by gender inequality. Women, particularly in conservative rural areas, often have limited access to digital devices and online resources due to traditional gender roles and restrictions.
- **Access to Reliable Internet:** Many rural areas lack reliable internet connectivity or have limited bandwidth, hindering the adoption of digital technologies.
- **Electricity Supply:** Inadequate or unreliable electricity supply can disrupt digital services, especially in remote regions.
- **Hardware and Equipment:** Shortage of devices like computers, smartphones, and tablets necessary for accessing digital services.
- **Low Digital Literacy:** Many rural residents, particularly older generations, may lack basic digital literacy skills needed to effectively use digital tools.
- **Training and Education:** Limited availability of training programs and resources to educate communities on digital technologies and their benefits.
- **Cost of Devices and Services:** High costs associated with purchasing devices and accessing digital services can be prohibitive for rural populations with limited incomes.

- **Geographical Accessibility:** Physical distance to service centers or facilities offering digital services may prevent rural residents from easily accessing them.
- **Language Diversity:** Digital content and platforms may not be available in local languages spoken in rural areas, limiting accessibility and usability.
- **Cultural Sensitivity:** Digital solutions must be culturally relevant and sensitive to local customs and practices to ensure acceptance and adoption.
- **Healthcare Access:** Limited access to healthcare facilities equipped with digital technologies for telemedicine and health information systems.
- **Service Integration:** Challenges in integrating digital health solutions into existing healthcare systems and workflows in rural settings.

Conclusion

Digital transformation provides a significant opportunity for rural India to bridge longstanding socio-economic gaps and improve quality of life in agriculture, healthcare, education, disabled, and lifelong learning. Various government initiatives like Bharat Net, Common Service Centers (CSCs), Digital India, Pradhan Mantri Gramin Saksharta Abhiyan and various non-government initiatives enhance productivity, increase market access, and improve service delivery for rural populations. However, to maximize these benefits, it is essential to address persistent challenges such as inadequate infrastructure, affordability, and low digital literacy. By strengthening infrastructure, promoting affordability, expanding digital literacy, and adopting localized policies—digital transformation in rural India can be accelerated, creating inclusive and sustainable growth. As emerging technologies like 5G and IoT become more accessible, rural India stands to benefit immensely, potentially transforming into a digitally inclusive society where technology supports resilience, productivity, and equitable opportunities for all.

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8

FINANCIAL LITERACY AMONG STUDENTS IN THE DOABA REGION: SPECIAL REFERENCE TO FINANCIAL KNOWLEDGE AND FINANCIAL BEHAVIOUR

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Abstract

Financial literacy is essential for effective money management, informed financial decision-making and long-term financial stability. This study explores the level of financial literacy among students in the Doaba region, with a focus on financial knowledge and financial behavior. It examines students' understanding of financial concepts, their spending and saving habits, and the influence of socio-demographic factors on financial literacy. The study also identifies gaps in financial education and suggests strategies to enhance financial literacy among young adults.

Keywords: *Financial literacy, Financial knowledge, Financial behavior, Students, Doaba region, Financial education*

Introduction

Financial literacy is a crucial life skill that empowers individuals to make informed financial decisions, ensuring long-term financial well-being and economic security. It encompasses the knowledge and understanding of financial concepts such as budgeting, saving, investing, credit management, and financial planning. In today's rapidly evolving economic landscape, financial literacy is not just about managing personal finances but also about navigating complex financial products and services.

Importance of Financial Literacy

Financial literacy plays a vital role in promoting financial inclusion and economic stability. It enables individuals to effectively manage their income,

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minimize debt, invest wisely, and secure their financial future. Studies have shown that financially literate individuals are more likely to engage in sound financial practices, such as regular saving, responsible borrowing, and long-term financial planning (Lusardi & Mitchell, 2014). Conversely, low financial literacy can lead to poor financial decisions, resulting in high debt, inadequate savings, and financial distress.

Financial Literacy Among Youth

Young adults, especially students, represent a critical demographic for financial literacy initiatives as they are at the threshold of major financial decisions, including education loans, career choices, and personal investments. However, research indicates that financial literacy among youth is generally low, leading to poor financial behavior such as impulsive spending, inadequate saving, and high debt accumulation (OECD, 2018). This is particularly concerning as financial habits formed during adolescence often persist into adulthood.

Context of the Doaba Region

The Doaba region, located in Punjab, India, is known for its vibrant educational environment, with a high concentration of colleges and universities. The region is characterized by a diverse student population, including urban and rural youth from varied socio-economic backgrounds. Despite this, limited research has been conducted to understand financial literacy levels among students in this region. Given the increasing financial complexities faced by young adults, such as educational expenses, digital payments, and investment opportunities, it is crucial to evaluate their financial knowledge and behavior patterns.

Need for the Study

Although financial literacy is widely recognized as essential for economic stability, there is a significant gap in financial education, particularly among students in the Doaba region. Existing educational curricula focus on theoretical knowledge, with little emphasis on practical financial management skills. Additionally, the influence of socio-cultural factors, peer pressure, and digital media on financial behavior warrants a detailed investigation. This study aims to bridge this gap by evaluating financial literacy levels among students, focusing on financial knowledge and behavior, and exploring the impact of socio-demographic factors.

Research Questions

- What is the current level of financial knowledge among students in the Doaba region?
- What are the prevailing financial behavior patterns, including saving, spending, and investment habits?
- How do socio-demographic factors such as age, gender, educational background, and parental influence affect financial literacy?
- What are the gaps in financial education, and how can they be addressed?

Significance of the Study

This study contributes to the growing body of literature on financial literacy by providing region-specific insights into the financial knowledge and behavior of students in the Doaba region. The findings can inform policymakers, educational institutions, and financial organizations to design effective financial literacy programs. Additionally, by identifying gaps in financial education, the study offers recommendations to enhance financial awareness and responsible financial behavior among youth.

Objectives of the Study

- To assess the level of financial knowledge among students in the Doaba region.
- To analyze financial behavior patterns, including saving, spending, and investment habits.
- To explore the relationship between socio-demographic factors and financial literacy.
- To identify gaps in financial education and suggest measures to improve financial literacy among students.

Literature Review

Concept of Financial Literacy

Financial literacy is broadly defined as the ability to understand and effectively use financial knowledge to make informed decisions about budgeting, saving, investing, and managing financial risks (Huston, 2010). It involves a combination of financial knowledge, skills, attitudes, and behaviors that enable individuals to achieve financial well-being. According to the OECD (2018), financial literacy is a critical life skill that influences financial decision-making, financial security, and overall economic stability.

Financial Literacy among Youth

Young adults, particularly students, are at a crucial stage of financial socialization as they transition from financial dependence to independence. Studies indicate that financial literacy among youth is generally low worldwide, leading to poor financial decision-making and increased financial vulnerability (Lusardi, 2019). A study by Mandell (2008) revealed that high school and college students demonstrate low financial knowledge, particularly in areas such as credit management, investments, and retirement planning. This lack of knowledge often leads to impulsive spending, inadequate saving, and poor debt management.

Financial Knowledge and Behavior

Financial knowledge refers to the understanding of financial concepts such as budgeting, saving, interest rates, inflation, and investment options. Financial behavior, on the other hand, refers to the actions individuals take based on their financial knowledge, including saving habits, spending patterns, investment decisions, and debt management (Atkinson & Messy, 2012). Research suggests a positive relationship between financial knowledge and financial behavior, indicating that individuals with higher financial knowledge are more likely to engage in responsible financial practices (Lusardi & Tufano, 2015).

Financial Literacy in India

In India, financial literacy levels are significantly lower than the global average. According to the National Centre for Financial Education (2019), only 27% of Indian adults are financially literate. Among youth, financial literacy is even lower, primarily due to the lack of formal financial education in schools and colleges (Agarwal & Gupta, 2020). A study by RBI (2019) emphasized the need for comprehensive financial literacy programs targeting students and young adults.

Socio-Demographic Factors Influencing Financial Literacy

Several socio-demographic factors influence financial literacy, including age, gender, education, parental influence, and income level (Chen & Volpe, 2002). Studies indicate that males generally exhibit higher financial knowledge than females, and students pursuing commerce and management degrees demonstrate better financial literacy than those from non-financial disciplines (Lusardi & Mitchell, 2014). Parental influence also plays a significant role, as

financial socialization within families affects financial attitudes and behavior (Shim et al., 2010).

Financial Literacy in the Doaba Region

Limited research exists on financial literacy among students in the Doaba region. However, studies conducted in other parts of Punjab indicate moderate financial literacy levels, with significant gaps in investment awareness and financial planning (Kaur & Singh, 2021). The Doaba region, known for its high student population and diverse socio-economic backgrounds, presents unique financial literacy challenges and opportunities. This study aims to fill this gap by exploring financial knowledge and behavior patterns among students in this region.

Gaps in Existing Literature

- Most existing studies focus on urban populations, with limited research on financial literacy in semi-urban and rural areas of the Doaba region.
- There is a lack of comprehensive studies examining the influence of socio-demographic factors on financial literacy among students.
- Few studies investigate the relationship between financial knowledge and financial behavior in the context of digital financial services and social media influence.

Research Methodology

This study adopts a quantitative research approach using a structured questionnaire to collect data.

- **Data Collection:** Primary data collected through online and offline surveys.
- **Sample Size:** 300 students from colleges and universities in the Doaba region.
- **Sampling Technique:** Stratified random sampling to ensure representation from different educational institutions and socio-economic backgrounds.
- **Tools Used:** Descriptive statistics for analyzing financial knowledge and behavior patterns, and regression analysis to explore relationships between socio-demographic factors and financial literacy.

Financial Literacy in the Doaba Region

Financial Knowledge

- **Basic Financial Concepts:** 45% of students were familiar with basic financial terms such as savings, interest rates, and inflation.

- **Investment Awareness:** Only 30% had knowledge about investment options like mutual funds, stocks, and insurance.
- **Financial Planning:** 35% understood the importance of budgeting and financial planning, but few practiced it regularly.

Financial Behavior

- **Spending Habits:** 60% of students admitted to impulsive buying, influenced by peer pressure and social media.
- **Saving Habits:** 50% saved a portion of their pocket money or income, but most lacked a structured saving plan.
- **Investment Behavior:** Only 20% had invested in financial instruments, mainly in traditional options like fixed deposits.
- **Debt and Borrowing:** 25% of students used credit cards or borrowed from friends but had limited knowledge about interest rates and repayment obligations.

Socio-Demographic Factors Influencing Financial Literacy

The study found significant relationships between financial literacy and socio-demographic factors:

- **Gender:** Male students showed slightly higher financial knowledge than female students.
- **Educational Background:** Students pursuing commerce and management degrees exhibited better financial knowledge and behavior compared to those from arts and science streams.
- **Parental Influence:** Students whose parents were financially literate or employed in financial sectors showed better financial understanding and behavior.
- **Income Level:** Students from higher-income families had greater access to financial resources and exhibited more informed financial behavior.

Challenges and Gaps in Financial Literacy

- **Lack of Financial Education:** Only 20% of students received formal financial education in school or college.
- **Limited Practical Exposure:** Students had theoretical knowledge but lacked practical exposure to financial management and investments.
- **Peer Pressure and Social Media Influence:** Spending behavior was highly influenced by peer pressure and social media trends.
- **Cultural Factors:** Cultural norms emphasizing consumption and lifestyle impacted saving and investment behavior.

Opportunities and Recommendations

Integrating Financial Education

- **Curriculum Inclusion:** Financial literacy programs should be integrated into the academic curriculum at the school and college levels.
- **Workshops and Seminars:** Conducting regular workshops, seminars, and financial awareness campaigns to enhance financial knowledge.
- **Practical Exposure:** Collaboration with financial institutions for internships and practical training in financial management.

Use of Digital Platforms

- **Financial Literacy Apps:** Development of mobile apps and online platforms to educate students about financial planning, investments, and savings.
- **Social Media Campaigns:** Utilizing social media platforms to promote financial awareness and responsible financial behavior.

Parental and Community Involvement

- **Parental Guidance:** Encouraging parents to discuss financial matters with their children to develop responsible financial habits.
- **Community Engagement:** Involvement of community leaders and local organizations in financial literacy initiatives.

Conclusion

The study reveals that financial literacy among students in the Doaba region is moderate, with significant gaps in financial knowledge and behavior. While students are aware of basic financial concepts, their understanding of investment options and financial planning is limited. Socio-demographic factors such as education stream, parental influence, and income level significantly influence financial literacy. There is an urgent need for comprehensive financial education programs, practical exposure, and community involvement to improve financial literacy among young adults.

Recommendations for Future Research

- **Longitudinal Studies:** Conducting longitudinal studies to assess changes in financial behavior over time.
- **Comparative Analysis:** Comparing financial literacy levels between urban and rural students in the Doaba region.
- **Impact of Digital Financial Services:** Analyzing the impact of digital financial services on financial literacy and behavior.

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9

GREEN BANKING: CATALYSING A SUSTAINABLE FINANCIAL FUTURE

Mrs. Alka Sharma* & Ms. Diksha Bakshi**

Abstract

In today's world, balancing environmental protection with economic growth has become a vital global concern. The banking sector has stepped up as a potential leader in connecting economic development with environmental conservation through a concept known as "Green Banking." Green Banking signifies a major transformation in banking practices, where financial institutions actively engage in promoting environmental benefits alongside their usual banking operations. This approach is particularly important as it paves the way for a more sustainable future by influencing both environmental practices and economic choices.

At its essence, Green Banking emphasizes on developing inclusive banking strategies that foster economic growth, encouraging environmentally responsible practices, adopting the principle of 3r's: Reduce, Reuse, and Recycle, mainly reducing reliance on fossil fuels. Financial institutions are in a unique position to shape environmental outcomes for several reasons namely - they can integrate and advocate for green technologies within their operations, their lending and investment choices can promote sustainable practices across various industries, the quality of their assets and long-term returns are closely tied to environmental conditions. This commitment to environmental responsibility goes beyond traditional stakeholders like governments and direct polluters. Banks and financial institutions have emerged as essential partners in environmental stewardship, especially since they can influence both economic development and environmental protection through their policies and practices.

For emerging economies like India, the shift to green banking presents

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both challenges and opportunities. While awareness of green banking concepts has increased, there is still a pressing need for more tangible actions and implementations. Banks must take a more proactive stance in promoting and executing green banking practices to make a meaningful impact.

Keywords: *Green Banking, Environment, Green Banking Policies, Environmental Issues, Sustainable growth, Environmental Protection, Green initiatives, Carbon emission.*

Introduction

The banking sector strongly influences economic growth and development both quantitatively and qualitatively that further leads to a change in the nature of economic growth. The banking sector can play an intermediary role between economic development and environmental protection, for promoting environmentally sustainable and socially responsible investment, banking of this kind can be coined as "Green Banking". The term "green banking" describes banking activities carried out in certain areas and in a way that contributes to a general decrease in both internal and external carbon emissions. Banks in order to aid the reduction of external carbon emission, should finance green technology and pollution reducing projects. Banks may not be the polluters themselves but they generally have the relationship with certain companies or investment projects that are polluters or could be in near future. So, it can be rightly said that environmental impact of banks is not physically related to their banking activities but with the customer's activities and this environmental impact of bank's external activity is quite huge and is also difficult to estimate. Thus, it will not be wrong to say that, environment management in the banking business is like risk management. If this environment management is done efficiently, it enhances the enterprise value and lowers loss ratio as higher quality loan portfolio results in higher earnings. Hence, the banking sector must encourage environmentally responsible investments and prudent lending. Further, Green finance, as a part of, Green Banking thus makes a great contribution towards green industry and green economy as a whole. Green banking is thus a vital component of the global initiatives taken by a group of stakeholders to save our environment and this concept of "Green Banking" will be not only be beneficial to the banks but also for industries and the economy. Not only "Green Banking" will ensure the greening of the industries but it will also facilitate in improving the asset quality of the banks in future as they can help to evaluate that up to what extent they can get returns from the various

investments they have made as these investments also are in a manner have a connection with the overall environment.

The banking operation targets a certain long-term rate of return on their credit and investment but all these are associated with certain types of risks. Hence, it becomes essential that the banking sector follows certain environmental evaluation of the projects before financing. Moreover, studies have shown positive correlation with the financial performance if due environmental evaluation is done before hand. On these grounds, it can be said that it is imperative for the financial institutions in the recent scenario to consider environmental performance in deciding whether to invest in companies or advise clients to do so. The banking industry, therefore, shall be equipped with the required impetus to build upon these premises of environmental information in order to develop their credit extension and investment decisions. The banks should, therefore, play a pro-active role to take environmental and ecological aspects into due consideration as part of their lending principle, which further enables industries to go for a mandated investment for environmental management, use of appropriate technologies and management systems.

Objectives of The Study

1. To highlight the means to create awareness in internal as well as external sub systems among target groups and impart education to attain sustainable development through green banking.
2. To list down effective methods for green banking.
3. To enumerate various examples that use different methods and practices of green banking as adopted by banks.

Origin of The Green Bank

First Green Bank, based in Eustis and Clermont Florida, USA is the first bank of its kind to promote positive environmental and social responsibility not only this it also provided excellent service to investors and clients. The progressive approach to the community and the Earth sets it apart from other banks. State Bank of India (SBI), India's la India's largest commercial bank, took the lead in setting high sustainability standards and completed its 'Green Banking' initiative with Shri O.P. Bhatt, Chairman, SBI, inaugurating the bank's first wind farm project in Coimbatore. whereas, latest Green Bank initiatives include a push for solar powered ATMs, paperless banking for customers, clean energy projects and the building of windmills in rural India. Nowadays, State Bank of India is a leader in green banking. Green

banks in India are specialized financial institutions dedicated to promoting environmentally sustainable investments and encouraging eco-friendly practices.

Green Banking & Sustainable Development

In a time when environmental issues are becoming increasingly urgent, the banking sector finds itself at a pivotal crossroads between financial services and ecological responsibility. Although it has often been seen as an industry with a neutral environmental stance, banks have a substantial impact on global sustainability through their operational practices and their crucial role in financing industrial growth. This dual influence calls for a thorough exploration of how banking institutions can adapt their practices to promote environmental sustainability while still fulfilling their essential financial roles.

The idea of green banking has surfaced as a revolutionary approach to conventional banking methods, involving both changes in internal operations and decisions regarding external financing. At its essence, green banking signifies a major shift in how financial institutions perceive their societal role, evolving from a focus solely on profit to becoming proactive contributors to environmental care. This change is especially important considering the banking sector's considerable sway over industrial development via project financing and investment choices.

The internal workings of banks, often neglected, play a significant role in their environmental footprint. Contemporary banking facilities use large amounts of energy due to their reliance on electronic devices, lighting, and climate control systems. Moreover, even with the rise of digital technology, banks still produce a significant amount of paper waste in their everyday activities. These internal issues offer immediate chances for environmental enhancement through the adoption of energy-efficient technologies, transitioning to paperless operations, and implementing sustainable building practices. Innovative institutions are already putting in place comprehensive energy management systems, shifting to renewable energy sources, and constructing green buildings that reduce their environmental impact.

Green process

A Green Bank requires each of its functional units and activities to be eco-friendly and help to improve environmental sustainability. Several opportunities are available for banks to green their functional units and activities. Key opportunities among them are:

- **Supply chain management:** Adopt techniques and plans to minimize inventory and wasted freight and also adopt networked design using a carbon footprint.
- **Enterprise resource management:** Facilitate paperless transaction and adopt techniques for workforce and provide optimization as well as intelligent device management.
- **Customer relationship management:** electronic means to maintain contact with and correspond with customers and potential customers, and minimise paper-based correspondences.
- **Sourcing and procurement:** Vendors by the sustainability rating of their products, services and operations
- **Product life cycle management:** Design and offer banking products and services in such a way that consume less resources and energy and thereby reduce carbon footprint. Implement effective systems for product end of life management that have minimal impact on the environment.

Green Banking Strategies

The strategies that are employed effectively in order to attain success in green bank process are:

- To start with, it requires immense involvement with key stakeholders and create awareness of environmental issues and what impact it has on our economy, the environment, and the society. The business and environmental value and the necessity of greening the bank processes, products, and service should also be laid stress upon.
- Another move in this regard, is to conduct energy audits and an efficient review mechanism in order to assess IT's environmental and cost impact and identify areas to be "greened"
- Further, set SMART (Specific, Measurable, Attainable, Realistic, and Timely) green goals as the internal targets and develop a strong criterion for measuring progress towards the goals
- Now, develop and implement a green policy that aims at higher utilization of systems while reducing energy use and lessening their environmental impact.
- Furthermore, encourage, motivate, and energize the workforce to follow the green path and to come up with and implement their own ideas and also encourage clients, suppliers, and outsourcers to adopt green practices.
- Not only this, will help us achieve our targets but a continuous monitoring

mechanism should be adopted to review the progress regularly and also it enables to keep a close eye on industry trends and new developments thus assisting in revising the green policy from time to time.

Green Banking Product Coverage includes

- Green mortgages
- Green loans
- Green credit cards Research Methodology
- Green savings accounts
- Green checking accounts
- Green CDs
- Green money market accounts progressive approach to the community and the Earth
- Mobile Banking
- Online banking
- Remote deposit (RDC)

Methods Adopting Green Banking

1. **Online Savings Account:** Online savings account and mobile banking are the effective steps that makes a bank green and help the environment. Green banking includes setting up direct deposit to receiving pay cheques, receiving electronic statements from your bank and by paying bills online. All these steps can greatly reduce the amount of paper produced by one's bank. Online banking is a highly effective way to keep track of your finances and to avoid late payment fees. Another green banking step is "Remote Deposit". Remote deposits help banks to clear cheques digitally.
2. **Paperless Statements:** Online banking at most banks is an option for customers to receive their statements electronically through a secure login. Copies of banking records and statements can then be stored electronically instead of keeping paper loaded record files. Receiving statements electronically also reduces the chance of security disruptions.
3. **Use Direct Deposit:** Most employers will give employees the option to receive their pay cheques electronically. This speeds up the availability of money and it saves people from wastage of paper, from hassle of going to banks and saves time etc.
4. **Online Bill Payments:** Paying bills online is also a solution for promoting green banking. E-payments and QR code enabled payments

helps in paying Telephone bills, cable bills, utility bills, credit card payments and mortgage payment.

5. **Use Green Credit Cards:** Banks in order to pace up joined up with environment-friendly movement are promoting different schemes of using plastic money rather than currency notes.
6. **Mobile Banking:** Mobile banking saves time and energy of the customers it further helps in reducing the use of energy and paper of the bank.

Benefits of Green Banking

1. **Avoids Paper Work:** Paperless banking almost all banks in India are computerized or operate on a core banking solution (CBS). Thus, this provides ample scope for the banks to adopt paperless or less paper for office correspondence, audit, reporting etc. and in this manner banks can switch over to electronic correspondence thus leading to controlled deforestation.
2. **Creating Awareness to Business People about Environment:** Various NGOs and environmentalists are taking steps to propagate environment consciousness among the public in general by arranging awareness programs and organizing seminars etc. in this Banks can contribute by sponsoring such programs and they can also tie up with corporate who are actively participating in such awareness programs as it will help to brighten the image of the bank.
3. **Loans at Comparatively Lesser Rates:** Banks have introduced green bank loans which offer financial concessions to those that are indulged in environment friendly products and projects such as fuel-efficient vehicles, green building projects, housing and house furnishing loans to install solar energy system etc. to promote such programs at a large level.
4. **Environmental Standards for Lending:** If Banks follow environmental standards for lending, it will make business owners to adopt eco-friendly practices thus promoting sustainable responsible investment and leading our nation towards brighter future prospects.

Green Banking Initiatives in India

1. **Yes Bank** - A pioneer in adopting green banking practices, this bank emphasizes financing for renewable energy and various sustainability initiatives.

2. **State Bank of India (SBI)** - Known for its green channel counters, SBI offers paperless banking options and funds renewable energy projects.
3. **IDFC First Bank** - This bank is committed to sustainable financing and has pledged not to support new coal projects.
4. **Axis Bank** - With a range of sustainability initiatives, Axis Bank also provides green bonds to support eco-friendly projects.
5. **Indian Renewable Energy Development Agency (IREDA)** - A government-owned non-banking financial institution, IREDA focuses specifically on financing renewable energy projects.
6. The **Reserve Bank of India (RBI)** has been actively encouraging banks to embrace green financing through various guidelines and frameworks. Additionally, the rise of green bonds and sustainability-linked loans has provided essential funding for environmentally friendly projects.

Latest Trends in India

- **Renewable Energy Financing:** Banks in India have been increasingly involved in financing renewable energy projects. This includes funding for solar, wind, and other clean energy initiatives to support the country's goals of reducing carbon emissions.
- **Environmentally Responsible Investments:** Banks are incorporating environmental, social, and governance (ESG) criteria into their investment decisions. This involves considering the environmental impact of the companies they invest in and promoting sustainable business practices.
- **Green Loans:** Financial institutions have been offering specific loan products to promote green initiatives. These loans may have favourable terms for projects related to energy efficiency, pollution control, and sustainable development.
- **Carbon Neutrality Commitments:** Some banks are committing to becoming carbon-neutral or reducing their carbon footprint. This involves measuring and offsetting the carbon emissions associated with their operations.
- **Sustainable Finance Guidelines:** Regulatory bodies in India may introduce guidelines to encourage banks to adopt sustainable finance practices. These guidelines may include reporting requirements on environmental and social risks and opportunities.
- **Green Bonds:** The issuance of green bonds has been on the rise globally, including in India. These bonds are specifically earmarked for financing green projects, and the funds raised are expected to have a positive impact on the environment.

- **Technology Integration:** Banks are leveraging technology to enhance their green banking initiatives. This includes digital platforms for monitoring and reporting environmental performance and providing online services to support sustainable banking practices.
- **Digitalization of Agri-finance** as conceptualized jointly by the Reserve Bank and the Reserve Bank Innovation Hub (RBIH). This will enable delivery of Kisan Credit Card (KCC) loans in a fully digital and hassle-free manner.

Examples of Green Banking Practices in India

Digital Transformation Initiatives

1. **HDFC Bank's Paperless Banking Revolution:** In 2024, HDFC Bank finished its full-fledged digital transformation process, cutting down paper usage by more than 85% across all operations. The bank launched end-to-end digital account opening processes, virtual credit cards, and AI-driven document verification processes. This move alone avoided the usage of nearly 2,000 tons of paper every year, which translates to saving 48,000 trees.
2. **SBI's Carbon Footprint Tracker:** State Bank of India introduced a pioneering mobile app feature enabling customers to monitor the carbon footprint of their expenditures. The application processes transaction history to estimate linked carbon emissions and proposes alternatives for more environmentally friendly consumption patterns. Since its introduction in January 2025, the feature has reduced the carbon footprint of enrolled customers by an estimated 15%.

Green Financing Innovations

1. **Axis Bank's Sustainability-Linked Loan Program:** Axis Bank introduced a complete sustainability-linked lending program in October 2024 in which interest charges are made dependent on borrowers' success in achieving pre-established environmental objectives. For corporate clients, these include minimizing carbon emissions, water usage, and waste creation. Initial findings indicate the involved companies have expedited their sustainability efforts, with average reductions in emissions being 22% more than the industry average.
2. **YES Bank's Renewable Energy Project Finance Platform:** YES Bank developed a dedicated digital platform to bring together renewable energy developers and prospective financiers. The platform simplifies

the process of financing solar and wind projects by offering standardized paperwork, risk valuation tools, and a green bonds marketplace. Ever since its development in mid-2024, the platform has helped finance in excess of 3 GW renewable energy capacity.

Climate Risk Management

1. **ICICI Bank's Climate Risk Assessment Framework:** ICICI Bank adopted a sophisticated climate risk management framework in 2024 that assesses physical and transition risks across its full loan book. The bank now applies climate scenario analysis to its stress testing processes, enabling it to monetize potential financial effects under different climate paths. This framework has guided a strategic shift of capital from carbon-emitting sectors to climate-resilient investments.
2. **RBL Bank's Climate-Adjusted Credit Scoring:** RBL Bank launched climate-adjusted corporate borrower credit scoring in 2024, which considers climate risks and transition preparedness along with conventional financial parameters. This has enhanced risk management by the bank while encouraging corporate sustainability enhancements. Preliminary evidence suggests a strong positive relation between good climate performance and loan repayment rates.

Sustainable Investment Products

1. **Kotak Mahindra's Green Deposit Scheme:** Kotak Mahindra Bank introduced a green deposit plan that channels funds solely into sustainable projects. The plan provides attractive interest rates and transparent reporting on the environmental gains realized. The bank raised over ₹5,000 crore under these deposits in just six months since its introduction, funding projects likely to lower carbon emissions by 1.2 million tons every year.
2. **Federal Bank's ESG Mutual Fund Platform:** Federal Bank collaborated with asset management firms to establish a dedicated platform for ESG-oriented mutual funds. The platform provides educational content on sustainable investment and comparison tools for the environmental and social performance of various funds. The move has served to divert retail investments into firms with robust sustainability policies.

Policy and Regulatory Frameworks

1. **RBI's Green Taxonomy Guidelines:** The Reserve Bank of India

published detailed green taxonomy guidelines in early 2025, which offered precise definitions and criteria for green asset classification. The taxonomy has introduced long-awaited standardization to the market, lowering the risk of greenwashing and providing consistency in environmental reporting among financial institutions.

2. **SEBI's Stronger ESG Disclosure Requirements:** The Securities and Exchange Board of India (SEBI) introduced upgraded ESG disclosure norms for listed corporations and financial institutions in late 2024. These norms require intense reporting on climate-related risks, transition strategies, and environmental impacts. Banks have acted by enhancing their own ESG due diligence processes and disclosure practices.

Capacity Building and Collaboration

1. **Indian Banks' Association (IBA) Green Banking Academy:** The IBA set up a Green Banking Academy in 2024 to develop technical capacity within the banking industry. The academy provides specialized training courses on green finance, climate risk management, and sustainable banking. More than 5,000 banking practitioners were certified through these courses within the first year alone.
2. **Banking Sector Climate Action Consortium:** Ten biggest banks of India came together to create the Banking Sector Climate Action Consortium in 2024 to work towards common challenges faced in green banking. The consortium is engaged in creating common metrics for measuring financed emissions, facilitating best practices exchange, and policy engagement on enabler regulatory environments. This coalescing action has hastened the uptake of green banking activities across the sector.

Conclusion

Green banking represents a crucial evolution in the financial sector's response to environmental challenges. As environmental concerns continue to grow, the role of banks in promoting sustainable development becomes increasingly important. The success of green banking initiatives depends on the commitment of financial institutions to implement comprehensive environmental strategies while maintaining their financial performance.

The transformation of banking practices from traditional to green banking is not merely a trend but a necessary evolution for sustainable development. While progress has been made, particularly in countries like

India; continued effort is needed to fully realize the potential of green banking. The future success of this initiative relies on the collective commitment of banks, regulators, and customers to embrace sustainable banking practices.

As we move forward, green banking will likely become the standard rather than the exception in the financial industry. This transition is essential for addressing environmental challenges while maintaining economic growth. The banking sector's role in promoting environmental sustainability through green banking practices will be crucial in shaping a more sustainable future for coming generations.

The path forward requires continued innovation, commitment to environmental principles, and adaptation to changing environmental needs. Banks must balance their traditional role as financial intermediaries with their new responsibility as environmental stewards. Through proper implementation of green banking practices, the banking sector can make a significant contribution to environmental protection while maintaining its crucial role in economic development

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INNOVATING FOR SUSTAINABILITY: HARNESSING INDIGENOUS TECHNOLOGIES AND DIGITAL STORY TELLING

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Prof. Syed Zahoor Ahmad Geelani****

Abstract

Sustainability has become a critical global challenge, requiring an integrated approach that includes environmental, social, and economic dimensions. Indigenous knowledge systems, developed through centuries of interaction with local ecosystems, offer valuable insights into sustainable practices. Digital Story Telling, a dynamic tool for conveying narratives using digital media, provides an effective platform for sharing these traditional ecological knowledge systems, making them accessible and engaging for diverse audiences. This review explores the intersection of indigenous technologies and digital storytelling in promoting sustainability education at global and Indian levels. Globally, countries like Canada, Australia, and New Zealand have integrated indigenous knowledge into educational frameworks, employing digital tools to preserve and share cultural practices related to sustainability. In India, efforts are underway to incorporate indigenous knowledge into the education system, focusing on water conservation, agroecology, and forest management. However, challenges persist, including access to technology, cultural sensitivity, and institutional barriers. Despite these obstacles, the fusion of indigenous wisdom with modern digital technologies holds immense potential for fostering sustainability and bridging the gap between traditional and contemporary knowledge systems. This review highlights the transformative role of digital storytelling in creating culturally relevant and environmentally sustainable educational practices.

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Keywords: *Digital storytelling, Indigenous knowledge, Sustainability, and Indigenous wisdom.*

Introduction

Sustainability has become global challenge of the 21st centuryrequiring a comprehensive approach that encompasses environmental, social, and economic dimensions. As the world grapples with urgent issues like climate change, resource depletion, and biodiversity loss, adopting sustainable practices has become essential. In this context, indigenous knowledge systems developed over centuries through close relationships with local ecosystems hold significant promise for shaping modern sustainability efforts. These systems embody a deep understanding of ecological balance, offering valuable insights that have supported diverse communities throughout history. By integrating indigenous wisdom with contemporary technologies, we can enhance sustainability outcomes and foster more resilient, sustainable futures.

The rise of digital technologies has transformed communication, allowing stories to cross geographical and cultural boundaries. Digital story telling that involves use of digital tools to convey narratives (Lambert, 2013) has become an influential method for engaging audiences on pressing issues. In the realm of sustainability, digital storytelling provides a powerful platform to connect with individuals and communities, making complex environmental and social challenges more accessible and compelling (Couldry et al., 2015).

Digital storytelling has the potential to drive significant change by boosting public engagement through dynamic multimedia narratives that capture attention and communicate messages effectively (Mason et al., 2018). It offers a space for marginalized communities to express their experiences and viewpoints, thereby amplifying their voices (Lundby, 2008). By crafting stories that reflect local values and traditions, digital storytelling ensures cultural relevance, which strengthens the impact of sustainability messages (Wang &Yeh, 2020). Furthermore, emotionally engaging and persuasive narratives have the power to shift attitudes and inspire behavior change, encouraging the adoption of sustainable practices (Dahlstrom, 2014).

By utilizing these platforms to share indigenous wisdom, we can bridge the gap between traditional ecological knowledge and modern technological advancements, offering a more holistic approach to sustainability education. This review examines the role of indigenous technologies and digital storytelling in promoting sustainability education, focusing on both global and Indian perspectives. The intersection of these two domains provides

a unique opportunity to innovate and enrich educational practices that are environmentally sustainable and culturally inclusive.

Harnessing Indigenous Technologies via Digital Storytelling at Global Level

The integration of indigenous knowledge and digital storytelling into educational systems is a growing trend globally, especially as educational frameworks increasingly emphasize the importance of sustainability, cultural preservation, and environmental awareness. Indigenous knowledge systems offer a unique perspective on the environment, resource management, and social organization. Digital storytelling, in turn, provides a platform for capturing and disseminating these teachings in an engaging and accessible manner.

Western Education Systems: Incorporating Indigenous Knowledge

In Western countries, the incorporation of indigenous knowledge into educational curricula has historically been limited, often due to colonial histories that disregarded indigenous ways of knowing and understanding the world. However, in recent decades, there has been a conscious effort to rectify this historical oversight.

Canada is at the forefront of integrating indigenous knowledge into education, particularly in post-secondary institutions. Canadian universities, including the University of Victoria and University of British Columbia, have developed academic programs that highlight the role of indigenous knowledge in environmental management, sustainable resource use, and community well-being (Bliege Bird, 2008). These programs often include the use of digital tools to document traditional ecological knowledge, such as firestick farming, sustainable forestry practices, and land stewardship.

The First Nations Storytelling Program at the University of Victoria is an example of a project aimed at preserving indigenous oral traditions. Digital storytelling workshops allow indigenous elders to share their teachings on land management and spirituality. These stories are recorded and archived digitally for future generations, enabling young learners to connect with their cultural roots while gaining valuable environmental insights (Battiste, 2014).
In Australia, the integration of Indigenous knowledge into education has also gained momentum. The Australian curriculum now includes content related to the understanding of indigenous perspectives on natural resource management, with a focus on sustainable practices such as Kaitiakitanga (environmental stewardship), particularly in the management of forests

and water resources (McAllister, 2023). Digital platforms like digital story telling as well as YouTube channels have been instrumental in making these indigenous narratives accessible to wider audiences, including schoolchildren, through multimedia storytelling techniques.

For example, the "Firesticks Alliance" in Australia works with indigenous communities to revitalize traditional fire management practices such as cultural burning. These methods are taught through both face-to-face learning and digital content, thus providing a comprehensive educational model that blends modern technology with traditional ecological knowledge (Bliege Bird, 2008).

Indigenous Knowledge and Digital Storytelling in K-12 and Higher Education

In primary and secondary education (K-12), many school districts in countries like the United States and New Zealand have started integrating indigenous knowledge into their curricula. For instance, New Zealand's TeWhāriki curriculum for early childhood education emphasizes indigenous knowledge and values (McAllister, 2023). Schools across North America and Australia also now include lessons on indigenous histories, perspectives, and sustainable practices as part of their environmental education programs.

In the United States, initiatives such as The Digital Storytelling Project by Voices of the World focus on collecting indigenous stories about climate change and environmental justice. These stories are transformed into short, engaging videos that are then incorporated into classrooms, particularly in areas with a significant indigenous student population. Teachers are trained to use digital storytelling as a pedagogical tool to engage students with indigenous ecological knowledge and foster environmental awareness.

At the university level, the use of digital storytelling has been incorporated into many environmental science and indigenous studies programs. For example, students in these programs may be tasked with creating digital stories that document indigenous community responses to climate change or the implementation of traditional ecological practices, such as the sustainable harvesting of forest resources or community-led water conservation efforts.

Challenges in Global Education Systems

Despite the positive momentum, there are still challenges in the global integration of indigenous knowledge into mainstream education. These include:

Cultural Sensitivity and Appropriation: There is a growing concern about how indigenous knowledge is portrayed in educational contexts. It is essential that indigenous communities maintain control over how their knowledge is shared. There is a risk of misrepresentation, cultural appropriation, or oversimplification when traditional knowledge is shared without proper context or consultation with indigenous elders and knowledge keepers (Battiste, 2014).

Access to Technology: In some regions, particularly in rural or marginalized indigenous communities, access to the digital tools necessary for creating and sharing digital stories can be a barrier. There is a need for educational institutions to ensure that these communities have the necessary resources to participate in digital storytelling initiatives.

Curricular Integration: The integration of indigenous knowledge into established educational frameworks requires systemic changes. For instance, some countries' educational systems may not prioritize traditional ecological knowledge, and the integration of such content may be viewed as supplementary rather than core to the curriculum.

Harnessing Indigenous Technologies via Digital Storytelling at National Level

In India, education about sustainability and the environment has gained prominence, particularly with the rise of awareness regarding the environmental crises such as climate change, water scarcity, and deforestation. Indigenous communities across India have long practiced sustainable living, from water conservation techniques to agroecology and forest management practices. However, their knowledge is often overlooked or marginalized in formal education systems, which have historically been influenced by western models of education.

Indigenous Knowledge in Indian Education: The Need for Integration

India has an incredible diversity of indigenous communities, each with its own unique ecological knowledge and sustainable practices. Yet, the country's formal education system has largely overlooked these traditional systems. The Indian education system has primarily focused on scientific, technological, and western-based knowledge in the fields of agriculture, environmental science, and ecology. As a result, there is often a disconnection between modern education and the traditional ecological knowledge held by indigenous communities.

Efforts to address this gap have begun to emerge, and there is growing

recognition of the value of indigenous knowledge in addressing India's sustainability challenges. The National Curriculum Framework (NCF) 2005, which guides the Indian education system, calls for a more inclusive approach to education, encouraging the integration of diverse knowledge systems, including indigenous perspectives on natural resource management, climate adaptation, and community resilience.

The Ministry of Environment, Forest and Climate Change (MoEFCC) has initiated programs aimed at integrating traditional ecological knowledge into environmental education, particularly at the school and college levels. These initiatives focus on engaging students with indigenous practices such as water conservation, forest management, and organic farming.

Digital Storytelling in India: Preserving Indigenous Knowledge

The use of digital storytelling has also found a place in India's educational landscape. Various non-governmental organizations (NGOs) and educational institutions are leveraging digital tools to document and disseminate Indigenous knowledge.

The Digital Empowerment Foundation (DEF) is one of the leading organizations working in this area, creating digital content that showcases the sustainable practices of indigenous communities. DEF has partnered with rural communities across India to develop digital stories that highlight traditional knowledge in agriculture, water management, and ecology. These stories are made accessible through mobile apps, YouTube, and other online platforms, reaching both local and global audiences (DEF, 2020).

In Rajasthan, indigenous practices like Johads (rainwater harvesting ponds) and traditional farming systems have been documented through digital storytelling initiatives, offering a platform for rural communities to showcase their knowledge. These digital stories are being used to educate schoolchildren, local farmers, and policy-makers about sustainable water management practices.

At the university level, institutions such as the Indian Institute of Technology (IITs) and Jawaharlal Nehru University (JNU) have started integrating indigenous knowledge into their environmental science curricula. Students in these programs are encouraged to explore traditional knowledge systems and their relevance to contemporary environmental issues such as climate change adaptation, water conservation, and biodiversity preservation.

Challenges in Indian Education Systems

The incorporation of indigenous knowledge and digital storytelling into

India's educational system faces several challenges which are mentioned below:

Institutional Barriers: India's formal education system remains largely westernized and is often reluctant to embrace indigenous knowledge. Teachers may lack proper training or resources to teach traditional ecological practices, and schools often focus on standardized curriculums that do not include indigenous perspectives.

Technological Accessibility: While India has made significant strides in expanding digital literacy, remote and rural areas still struggle with limited internet connectivity, infrastructure, and access to digital devices. As a result, indigenous communities in these areas may find it difficult to participate in digital storytelling initiatives.

Cultural Sensitivity and Ethical Concerns: There are also ethical concerns around how indigenous knowledge is shared, particularly when it is digitized. The misrepresentation or commercialization of indigenous knowledge without proper consent or context could lead to exploitation or cultural appropriation.

Conclusion

The integration of indigenous knowledge and digital storytelling into sustainability education offers a unique opportunity to bridge the gap between traditional and modern knowledge systems. In both the global and Indian contexts, educational initiatives are starting to recognize the importance of preserving and promoting indigenous knowledge, especially in the face of growing environmental challenges.

Globally, countries like Canada, Australia, and New Zealand are leading the way in integrating indigenous knowledge into formal education through digital platforms. Similarly, India has begun incorporating indigenous knowledge into environmental curricula at the school and university levels.

While there are significant challenges, such as access to technology, cultural sensitivity, and institutional barriers, there is great potential for educational systems worldwide to embrace these approaches, creating a more inclusive, sustainable, and culturally aware generation of learners.

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11

EMPOWERING SUSTAINABLE DEVELOPMENT: INNOVATION & INDIGENOUS TECHNOLOGIES FOR INCLUSIVE GROWTH IN INDIA

Maram Pavithra*

Abstract

This seminar focuses on the importance of sustainable farming practices, specifically through terrace gardening, as a way to grow fresh and healthy food without using harmful chemicals. In today's world, the excessive use of chemical fertilizers and pesticides in agriculture is a major concern, as these chemicals can enter our bodies and cause long-term health problems. By growing vegetables and greens on rooftops or in small spaces, we can avoid these chemicals and enjoy natural, nutritious food. This approach not only improves our health but also helps in protecting the environment by reducing pollution and promoting water conservation. The seminar also emphasizes educating students on the benefits of natural farming practices, teaching them how to grow food in an eco-friendly way, and encouraging them to adopt these practices at home. Through hands-on experience and projects, students learn how to grow food in a sustainable manner, contributing to a healthier future for themselves and the planet.

Introduction

Food is one of the basic needs for humans. The methods we use today to grow food focus on increasing yields, but often involve using too many chemical fertilizers. Chemicals are also used to control diseases in crops, and when vegetables and greens are harvested, they are sometimes dipped in chemicals to keep them fresh for longer. While this helps preserve the produce, it also brings up a major concern: what happens to the consumers who eat this food? These chemicals get absorbed into the plants, and when

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we eat them, they enter our bodies, causing health problems over time. So, why not grow our own vegetables and greens in our homes or on our rooftops? This would allow us to avoid chemicals and eat healthier.

Objectives

- To grow fresh, healthy vegetables and greens without causing harm to terrace.
- To reuse water efficiently for rooftop gardening.
- To reduce plant diseases using natural methods.
- To teach students how to grow natural food without harming the environment.
- To grow vegetables that contribute to good health while protecting natural resources.

Significance

Many people, despite not having bad habits, are facing health issues, and the main reason for this is the food they consume. During cultivation, chemicals are used excessively, and produce is often mixed with other substances to preserve it. Although this may not cause immediate harm, eating such food over time can lead to health problems. Farmers who use these methods not only contaminate food, but they also pollute the air, water, and soil. Therefore, it's important for each of us to grow our own vegetables, even if it's in a small space or on our rooftops. This way, we take control of our health. Moreover, we can grow plants in an environmentally friendly way, causing no harm to nature.

Methodology

At home, we didn't have enough space in the backyard to grow vegetables, so we decided to plant them on the roof. To protect the roof from damage, we applied waterproof paint. We also set up stands to keep the plants raised off the roof, so the water doesn't damage it. The water is collected in pipes and stored in a drum, where a small motor pumps it back to the plants using drip irrigation. This method helps us reuse water efficiently.

Image 1: Stands for water management on terrace

Table 1: Water Usage before and after smart management of water

Water usage per day before smart management of water	Water usage per day after smart management of water
150 liters	100 liters

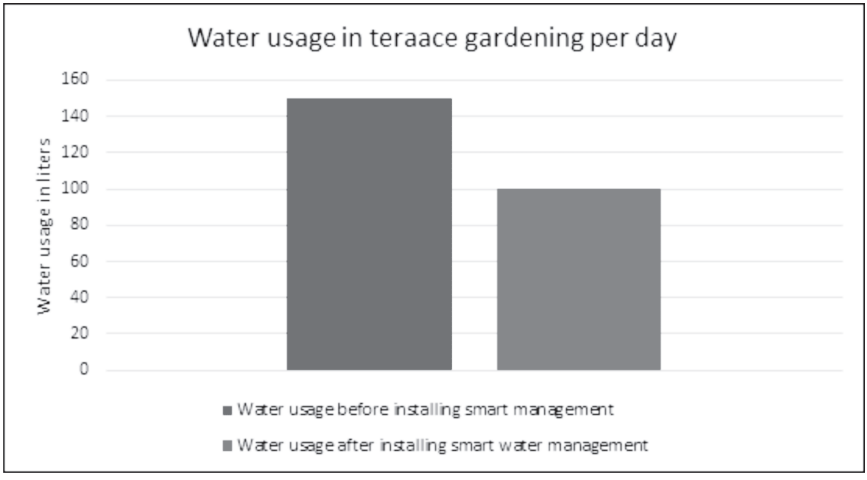

Figure 1: Water Usage in Terrace Gardening per day

We use natural fertilizers made from kitchen waste to nourish the plants. We also use compost from the village, crushed chicken eggshells for calcium, and banana peel water to provide potassium and zinc to the plants. Other natural fertilizers, like ash powder and neem powder, vermicompost and vermiwash are also used. These methods help keep the soil healthy and improve plant growth.

Image 2: Pest Control Methods

To deal with pests, we manually remove them from the plants and use natural methods like neem oil and garlic paste to control them. If plants get diseases, we spray diluted buttermilk for a few days to help them recover. Any diseased leaves are quickly removed to prevent further spread. By using these natural methods, we are growing healthy food without using harmful pesticides.

Image 3: Students harvesting natural products

We invited students to our home to show them how we grow food naturally without harming the environment. I encouraged them to write about what they learned and present their findings at the National Children's Science Congress. The students also worked on projects that showed how to grow healthy food in an eco-friendly way, and one of their projects, "Water Management in Terrace Gardening," was even selected for a state-level exhibition. Students presented the topics in district level national children science congress are bio tonic, natural farming practices in terrace gardening etc.

Image 4: Water management in terrace gardening

Findings

By waterproofing the roof, we have been growing plants for the past three years without causing any damage. Since today's students will be tomorrow's citizens, it is very important for them to understand environmental issues and be aware of the food they consume. This understanding will lead to a healthier life for them. Through the students' projects, other students learned how to grow food without harming the environment.

Table 2: Description of Students regarding Natural Farming

Total number of students in the class	Natural farming practising at home before visiting my terrace garden	Natural farming practising after visiting my terrace garden
24	4	22

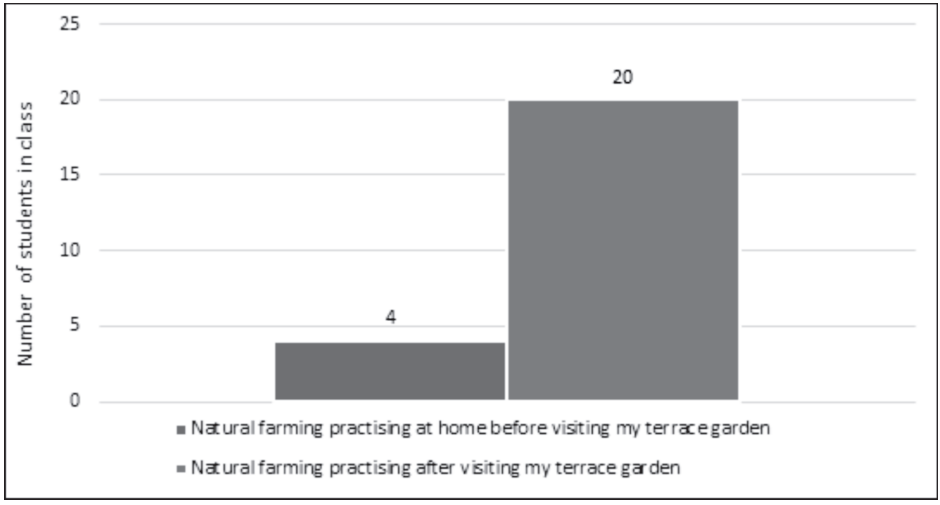

Figure 2: Description of Students regarding Natural Farming

The water used for the plants is collected and reused through a drip irrigation system, reducing waste. By using natural fertilizers, we keep the soil healthy and grow nutritious food. The taste of the vegetables has also improved. Since we don't use chemical pesticides, we are not harming the environment.

Conclusion

Our health is in our hands. Even though we may not be able to grow everything we need, we can still grow essential vegetables, greens, and fruits on our rooftops or in small spaces. Working in a garden every day helps us stay healthy and gives us chemical-free food. Teaching students how to grow food naturally will help them adopt these methods in their homes, reducing pollution and creating a healthier environment. By eating healthy, chemical-free food, we are contributing to the development of healthier citizens for the future.

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2023 -2024 8th and 9th students from ZPHS Gaddipally

2024 – 2025 9th class students from ZPHS Penpahad

My Terrace garden in Suryapet, H.No. 1-9- 62/7/1, suryapet district, Telangana state.

12

HOW RESTRICTIONS ON WOMEN'S MOBILITY IMPACT WOMEN'S LEADERSHIP OPPORTUNITIES

Amanpreet Kaur*

Abstract

This review paper explores the connection of women's mobility and their leadership opportunities. Women's ability to move freely is essential for engaging in educational, economic, and political activities, all of which are key components of leadership. However, societal norms often impose restrictions on women's mobility, limiting their access to opportunities. Through a comprehensive review of literature, this paper analyzes the various ways that mobility constraints—both physical and digital—hinder women's leadership potential. This paper reviews recent studies to understand the relationship between mobility restrictions and women's leadership opportunities, exploring theoretical frameworks, forms of restrictions, and their broader implications.

Keywords: *Women's Mobility, Leadership Opportunities, Gender Equality, Empowerment.*

Introduction

Mobility is a fundamental aspect of personal and social development, enabling individuals to access education, employment, and political participation. However, gendered social norms often restrict women's mobility, which directly impacts their capacity to take on leadership roles. These mobility restrictions may be both physical and digital, affecting women in various cultural, geographical, and socio-economic contexts. This paper reviews existing literature to explore how mobility restrictions—imposed by societal, cultural, and institutional factors—limit women's leadership

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opportunities. It further evaluates the role of international organizations and national policies in alleviating these restrictions and empowering women.

Theoretical Frameworks and Literature Review

Theoretical Approaches to Mobility and Leadership

The connection between mobility and leadership opportunities for women can be understood through several theoretical frameworks:

1. **Feminist Theory**: Feminist scholars argue that social structures often prevent women from achieving equality in areas like education and employment, both of which require freedom of movement (Molyneux & Razavi, 2002). By restricting women's mobility, society limits their access to the social, economic, and political capital required for leadership.
2. **Social Capital Theory**: Putnam (2000) suggests that social capital—defined as the networks and relationships that individuals build through mobility—is vital for leadership. Women, often constrained by cultural norms, have less access to such networks, hindering their leadership development.
3. **Capability Approach**: The capability approach, as introduced by Sen (1999), posits that freedom of movement is a critical capability for individuals to access opportunities, including leadership roles. Mobility restrictions curtail women's capabilities, thus limiting their ability to lead effectively.

Social Norms around Women's Mobility

In many societies, the movement of women is heavily influenced by gendered cultural norms. For example, in patriarchal communities, women's movement may be restricted due to safety concerns, fear of reputational damage, or traditional roles that prioritize domestic responsibilities (Good Business Lab, n.d.). These cultural restrictions contribute significantly to limiting women's access to leadership positions in both the public and private sectors.

In India, rural women often face greater mobility restrictions, limiting their participation in the workforce and their ability to become leaders (Dasgupta, 2021). Furthermore, educational opportunities for women in rural areas are constrained by the lack of infrastructure and societal norms that prioritize male education. The National Policy on Education (NPE, 1986) and National Education Policy (NEP, 2020) recognize the need to overcome such barriers, with the latter focusing on the empowerment of women

through educational access and digital inclusion. UNESCO (2020) advocates for the removal of barriers to women's education and emphasizes the need for gender-responsive policies to ensure women's unrestricted movement in educational settings. These policies aim to foster a learning environment that empowers women to take on leadership roles in various sectors.UNICEF (2021) focuses on the intersection between gender and mobility, recognizing that empowering young girls through access to education and freedom of movement is key to building future leaders.

Nationally, India's National Policy on Education (NPE) 1986 laid the foundation for women's educational empowerment, stressing the importance of removing social and cultural barriers to women's access to education. It also recognized the need to address mobility restrictions as a barrier to women's full participation in educational settings. The more recent National Education Policy (NEP) 2020 builds on this foundation, aiming to bridge gender gaps in education by promoting inclusive policies that address mobility and access, particularly for women in rural areas.

Impact of Mobility Restrictions on Women's Leadership

- **Education:** Education is often the gateway to leadership opportunities. Women who face mobility restrictions—such as societal norms that prioritize male education—have limited access to educational institutions. UNESCO (2020) emphasizes that eliminating barriers to women's access to education is essential for achieving gender equality and promoting female leadership globally. According to the World Bank (2022), in many rural regions, women's mobility restrictions prevent them from attending schools and universities, curtailing their educational development and reducing their chances of assuming leadership roles.
- **Economic Participation:** Women's limited mobility also impacts their participation in economic activities. As women in restricted environments miss out on career opportunities, their economic independence and leadership potential are significantly diminished. The Women's Fund Miami (2023) highlights the financial barriers caused by mobility restrictions, which prevent women from accessing economic opportunities that could foster their leadership in business.
- **Political Leadership:** Political leadership requires women to be able to move freely to network, campaign, and represent their constituencies. However, in societies where women's mobility is restricted, they are often excluded from political processes. The United Nations (2020) recognizes

the importance of women's participation in political leadership as a cornerstone of achieving gender equality. The lack of mobility creates a barrier for women aspiring to hold political office, especially in more conservative regions where women's political engagement is discouraged (UN Women, 2021).

Strategies to Overcome Mobility Restrictions

Efforts to overcome the challenges posed by mobility restrictions include:

- **Education and Awareness Campaigns**: Raising awareness about the importance of women's mobility for leadership and advocating for policy changes that ensure equal access to education and economic opportunities for women (Sen, 1999).
- **Policy Interventions**: Governments can play a key role in ensuring women have the legal right to move freely and access education and employment opportunities (World Bank, 2022).
- **Community-Led Solutions**: Grassroots movements and community organizations can empower women by challenging traditional norms, providing mobility-focused training, and advocating for change at the local level (Putnam, 2000).
- **Technology and Digital Mobility**: Advancing women's access to digital platforms and online spaces can help circumvent geographic mobility restrictions and provide leadership training and opportunities (Good Business Lab, n.d.).

Conclusion

Social norms that restrict women's mobility are powerful inhibitors of women's leadership opportunities. These norms often limit women's access to education, employment, and political participation, while reinforcing gender inequality. Overcoming these restrictions requires a multi-faceted approach, including legal reforms, shifts in cultural attitudes, and the promotion of digital mobility. By enabling women to move freely and access opportunities, societies can unlock the full potential of women as leaders, contributing to more equitable and sustainable development.

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13

SUSTAINABLE AGRO-TOURISM: A HOLISTIC APPROACH

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Abstract

Farm tourism entrepreneurship is increasingly emerging as a significant catalyst for rural economic and social development. This paper delves into the concept of farm tourism, shedding light on its vast potential to integrate agricultural activities with tourism, thereby fostering economic diversification and cultural exchange. By engaging in farm tourism, farmers gain the opportunity to offer immersive rural experiences that include guided tours, demonstrations of traditional farming practices, and participation in cultural events. These activities enable them to supplement their income while simultaneously promoting local heritage and traditions. The study underscores the critical importance of sustainable agro-tourism, emphasizing its role in enhancing the economic prospects of rural communities while prioritizing environmental conservation and responsible tourism practices. It identifies Punjab as a region with vast untapped potential, owing to its rich agricultural heritage.

Keywords: *Sustainable, agricultural, tourism, development, rural, farm.*

Introduction to Sustainable Agro-Tourism

Sustainable agro-tourism is an innovative concept that integrates tourism with agricultural activities, fostering an environment conducive to environmental conservation and cultural preservation. It is beneficial to both farmers and visitors, as it offers farmers an additional source of income while providing tourists with authentic, hands-on experiences in agricultural settings. By facilitating cultural exchanges and raising awareness about ecological conservation, agro-tourism serves as a crucial tool for sustainable

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rural development. Additionally, it contributes to infrastructure enhancement and generates employment opportunities in rural areas, thereby uplifting the local economy. Farm tourism enables farmers to transform their agricultural spaces into engaging destinations where visitors can experience rural life. Since farm tourism primarily consists of small-scale businesses that may have limited marketing resources, governmental and institutional support plays a crucial role in ensuring their operational success. In many cases, the farm owner acts as both a host and a guide, ensuring visitors experience a welcoming environment with modern amenities. Preference is given to farms with substantial agricultural land, where tourists can witness and engage in diverse agricultural activities such as floriculture, harvesting, beekeeping, and dairy farming. Beyond agricultural experiences, farm tourism also serves as a gateway to local community life. Tourists are encouraged to take part in cultural events, engage in village meetings, enjoy traditional music and cuisine, and explore local arts and crafts. A village tour may include interactions with artisans such as carpenters, blacksmiths, and weavers. Additionally, tourists can partake in local festivals, witness traditional weddings, and visit historical sites and monuments. Each farm tourism initiative has the potential to carve out a unique niche by incorporating specialized attractions such as organic farming, herbal plantations, floriculture, or wellness retreats focusing on natural healing practices.

Objective of the Paper

- To highlight the scope and challenges of agro-tourism in India
- To evaluate the growth prospects of agro-tourism in India by doing SWOT Analysis of agro-tourism in Punjab.

Scope and Benefits of Farm Tourism

Cost-Effectiveness: Farm tourism offers an affordable alternative to conventional vacations, making it accessible to a broader audience while providing a diverse range of experiences tailored to different age groups and interests.

Authentic Rural Experience: This form of tourism is centered around the essence of traditional village life, encompassing cultural activities, livestock rearing, and engagement with local craftsmanship, thereby offering an enriching and educational experience.

Family-Friendly Activities: Rural tourism destinations offer an array of recreational activities suited for families, making farm tourism an inclusive experience that caters to individuals of all ages.

Income Diversification: Farmers gain access to an additional revenue stream while also being able to directly market their produce to consumers, thereby increasing profitability.

Cultural Exchange: Visitors are exposed to authentic agricultural practices, regional traditions, and local cuisine, fostering a deeper appreciation for rural heritage.

Environmental Awareness: Agro-tourism encourages conservation practices and promotes sustainable farming methods that help minimize the adverse effects of urban tourism, such as overcrowding and pollution.

Rural Development: The industry facilitates job creation, skills development, and business expansion in rural areas, thereby driving economic growth.

Sustainable and Ethical Tourism: By prioritizing responsible travel practices, agro-tourism actively supports biodiversity conservation and environmental protection.

Farmer Empowerment: Agro-tourism provides farmers with economic independence and a platform to showcase their expertise in agricultural and rural traditions.

Challenges in Agro-Tourism Development in India

Despite its vast potential, the agro-tourism sector in India faces several obstacles:

Limited Awareness and Knowledge: Many farmers lack adequate awareness of agro-tourism opportunities and practices.

Training and Education Deficit: There is a scarcity of formal training programs aimed at equipping farmers with tourism management skills.

Infrastructural and Policy Gaps: Inadequate infrastructure and lack of comprehensive policy support hinder the growth of this sector.

Marketing Barriers: Limited promotional strategies and branding efforts restrict the visibility of agro-tourism destinations.

Entrepreneurial Limitations: Farmers often lack the necessary business acumen to effectively manage and expand their agro-tourism ventures.

Financial Constraints: Securing investment and funding for the development of tourism infrastructure remains a challenge.

Agro-Tourism: Growth prospects

Sustainable Rural Development: Agro-tourism facilitates awareness

of organic farming practices, biodiversity conservation, and sustainable agricultural techniques.

Diversified Income Sources: Farmers can mitigate financial risks posed by market fluctuations and climate uncertainties by offering guided tours, farm stays, and workshops.

Educational Opportunities: Agro-tourism helps generate employment opportunities for local communities, thereby reducing rural-to-urban migration and fostering balanced regional development.

Preservation of Heritage and Cultural Exchange: By engaging visitors in local traditions, cuisine, and customs, agro-tourism contributes to the preservation of indigenous knowledge and artisanal craftsmanship.

Government Support and Policy Framework: Although the Indian government has taken initiatives to promote agro-tourism, there is a pressing need for more robust policy interventions and funding schemes.

Infrastructure Development and Conservation: Strengthening rural infrastructure while simultaneously preserving ecological balance is crucial for ensuring the sustainable growth of the agro-tourism sector.

Swot Analysis

SWOT analysis of agrotourism in Punjab helps in analysing the factors having a positive and negative impact on the growth of agrotourism in the state.

Strengths:

- Punjab has reasonably good infrastructure.
- Perception and perception of Punjab as a welcoming region
- Knowledge about Punjab's customs, food, and culture worldwide
- Overall prosperity of villages in Punjab and thereby availability of modern facilities
- The residents' wide-heartedness and colourful nature

Weaknesses:

- Severe weather conditions, include bitterly cold winters and intense summer heat
- Compared to well-known tourist attractions, farm tourism marketing is more challenging
- The total quality of service is impacted by the lack of qualified personnel
- Tourists are discouraged by the very inadequate medical services in rural India.

Opportunities:

- Many NRIs from Punjab will support destination marketing.
- Growing urbanisation will make farm and rural life more appealing.
- Growing crowds at popular tourist locations will generate demand for upscale niche travel
- The comparatively inexpensive cost of a farm vacation will also draw low-budget tourists.

Threats:

- Some components' dishonest actions could harm farm tourism's reputation.
- A language barrier could discourage overseas visitors
- Any resurgence of insurgency in Punjab will negatively harm the business
- The usually straightforward rural canvas could become overly commercialised.

Along with this the Government of Punjab is also instrumental in developing this sector in Punjab. The Punjab government's Department of Tourism & Cultural Affairs introduced the "Punjab Farm Tourism Scheme." The plan aims to give visitors a comfortable, sanitary, and clean stay in farmhouses located around the State of Punjab. Through exposure to rural life, the program also seeks to give both local and foreign tourists a cultural experience. The idea will also assist in giving the farming community access to more revenue streams. In the largely agricultural State of Punjab, it will therefore offer visitors a comprehensive package of farm tourism, adventure tourism, rural and village tourism, and cultural tourism. Therefore, the Department of Tourism (DoT)/Punjab Heritage Tourism Promotion Board (PHTPB) has decided to register the farm stay units and establish appropriate rules for them which is a helpful way for the registered Farm Stay units' farm owners to supplement their income.

Conclusion

By fusing the financial advantages of tourism with the conservation of agricultural customs and environmental sustainability, farm tourism entrepreneurship acts as a game-changing instrument for rural development. This industry has the ability to boost rural economies, create jobs, and improve infrastructure development by combining tourism with agriculture. Agro-tourism in India has the potential to develop into a lucrative and sustainable sector that benefits both tourists and rural people with the help of targeted

infrastructure investments, well-designed training programs, and sufficient legislative backing.

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PRESERVING THE PAST, SUSTAINING THE FUTURE: INTEGRATING CULTURAL HERITAGE WITH SUSTAINABLE DEVELOPMENT

Ms. Mehak*

Abstract

Cultural heritage represents the identity, traditions, and historical legacy of societies, making its preservation essential for future generations. However, rapid urbanization, climate change, and unsustainable development practices threaten cultural heritage worldwide. While various conservation efforts exist, there remains a significant gap in integrating sustainable development frameworks with heritage preservation, particularly in ensuring long-term environmental and socio-economic viability. Many existing studies focus on either heritage conservation or sustainability independently, with limited research exploring their intersection in a comprehensive and actionable manner.

This study aims to bridge this gap by examining the integration of cultural heritage preservation with sustainable development. It explores eco-friendly conservation strategies, traditional knowledge systems, and responsible tourism, emphasizing how these approaches can contribute to both heritage protection and broader sustainability goals. By analyzing case studies from diverse cultural contexts, this paper highlights successful models that balance heritage conservation with environmental, economic, and social sustainability. Furthermore, it discusses policy frameworks, community engagement, and technological innovations that support sustainable heritage management.

The research ultimately argues that a holistic approach—incorporating local traditions, modern sustainability practices, and global cooperation—is key to ensuring that cultural heritage not only survives but thrives in a rapidly changing world. The findings aim to contribute to policy recommendations and practical

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strategies for heritage professionals, urban planners, and sustainability advocates working towards an integrated model of cultural heritage preservation and sustainable development.

Keywords: *Eco-friendly Conservation, Resilient Heritage, Technological Innovations in Conservation,Sustainable Development*

Introduction

Cultural heritage is a cornerstone of human identity, encompassing tangible and intangible elements that define societies. It includes historical monuments, archaeological sites, traditions, languages, rituals, and artistic expressions that embody the cultural legacy of communities.

Preserving these assets ensures continuity between past, present, and future generations, maintaining social cohesion and collective memory.

However, modern challenges such as rapid urbanization, climate change, globalization, and unsustainable development practices threaten the survival of cultural heritage. Industrial expansion and real estate development often lead to the destruction of historic structures, while climate change accelerates decay through rising temperatures, flooding, and extreme weather events. Furthermore, the economic demands of contemporary society sometimes prioritize short-term financial gains over long-term heritage conservation.

Despite existing conservation efforts, the integration of cultural heritage preservation with sustainable development remains underexplored. A holistic and interdisciplinary approach is necessary to safeguard cultural heritage while ensuring environmental sustainability, economic viability, and social equity. This paper investigates how sustainable strategies can enhance cultural heritage conservation, ensuring its relevance and resilience in contemporary society. By examining best practices, policy frameworks, and technological innovations, this research provides insights into achieving a balance between heritage preservation and sustainable progress.

Cultural heritage embodies the identity, traditions, and historical legacy of societies. Its preservation is crucial for future generations, yet it faces mounting challenges due to urbanization, climate change, and unsustainable development practices. While numerous conservation strategies exist, an integrated approach that aligns cultural heritage preservation with sustainable development remains underexplored. This research examines the intersection of these two domains, highlighting eco-friendly conservation strategies, traditional knowledge systems, and responsible tourism as mechanisms for achieving sustainability in heritage management.

Defining the Intersections

- **Sustainable Development:** This paper adopts the Brundtland Commission's definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It recognizes the three pillars of sustainability – environmental, economic, and social – and emphasizes the importance of balancing these pillars in heritage preservation efforts. The UN Sustainable Development Goals (SDGs), particularly Goal 11 (Sustainable Cities and Communities), Goal 8 (Decent Work and Economic Growth), Goal 13 (Climate Action), and others, provide a framework for understanding the link between cultural heritage and sustainable development.
- **Cultural Heritage:** This research encompasses both tangible and intangible cultural heritage, recognizing their interconnectedness. Tangible heritage includes physical artifacts and built environments, while intangible heritage encompasse traditions,practices, knowledge, and skills. The paper acknowledges the diverse values associated with cultural heritage, including historical, aesthetic, social, economic, and spiritual significance.

The Intersection of Cultural Heritage and Sustainable Development

Sustainable development seeks to meet present needs without compromising future generations. Similarly, cultural heritage preservation aims to maintain historical legacies for posterity. Integrating these concepts involves adopting environmentally responsible, socially inclusive, and economically viable approaches. Several frameworks, including the UN Sustainable Development Goals (SDGs), highlight the role of cultural heritage in achieving sustainability (UNESCO, 2016). Heritage contributes to sustainable development by fostering identity, social cohesion, and economic resilience (Bandarin & van Oers, 2012).

Research Methodology

This study employs a qualitative research approach, utilizing a combination of case study analysis and literature review. Data is gathered from academic sources, policy documents, and field reports to assess the effectiveness of integrating sustainable practices with heritage conservation. Case studies from diverse cultural contexts are examined to identify best practices and challenges. Additionally, stakeholder interviews with conservation experts,

urban planners, and community representatives provide insight into practical applications of sustainable heritage management.

Review of Literature

Theoretical Foundations of Heritage Conservation

Heritage conservation theories have evolved over time, moving from a purely aesthetic focus to a more inclusive approach that considers social, economic, and environmental factors (Muñoz Viñas, 2005). The concept of "living heritage" has gained prominence, emphasizing the dynamic nature of cultural assets and the necessity of integrating traditional practices with contemporary conservation methods.

The Role of Sustainability in Cultural Heritage

The integration of sustainability into heritage management has been increasingly recognized as essential for long-term viability. Studies highlight the benefits of using renewable resources, minimizing environmental footprints, and involving local communities in conservation efforts (Fairclough et al., 2008). Sustainable tourism models, such as those proposed by UNESCO, have also been instrumental in ensuring economic benefits without compromising cultural integrity (UNESCO, 2019).

Policy and Governance in Heritage Conservation

Sustainable heritage management requires well-defined policies and legal frameworks that prioritize conservation while fostering socio-economic development. The Venice Charter (1964) and the Burra Charter (1979) emphasize the importance of community participation and sustainability in conservation efforts (ICOMOS, 2021). However, discrepancies in policy implementation and enforcement often result in fragmented conservation strategies. Scholars argue that adaptive governance—where policies are flexible and responsive to local conditions—is essential for balancing preservation and development goals (Pendlebury, Short, & While, 2009).

Economic Implications of Sustainable Heritage Conservation

Economic sustainability is a key factor in heritage conservation. Research indicates that well-managed heritage sites contribute to local economies through tourism, job creation, and small business development (Timothy & Nyaupane, 2009). Heritage-led regeneration projects have been successful in revitalizing urban spaces and fostering economic growth, yet they require substantial investment and effective stakeholder collaboration.

Studies emphasize the need for financial sustainability through public-private partnerships, grants, and heritage trust funds (Rodwell, 2020).

Technological Innovations in Conservation

Digital documentation, 3D scanning, and artificial intelligence are transforming heritage conservation by enhancing site monitoring, preservation, and restoration efforts (Kalay, Kvan, & Affleck, 2019). Digital twin technology, which creates virtual replicas of heritage sites, allows for predictive conservation strategies that mitigate environmental and structural risks (Forte, 2020). Moreover, blockchain technology is being explored for secure documentation of heritage assets and preventing illicit trade of cultural artifacts (Chang, Kuo, & Wu, 2021).

Community Engagement and Social Sustainability

Community participation is crucial in sustainable heritage conservation. Research highlights the significance of local knowledge, traditions, and grassroots initiatives in ensuring long-term heritage protection (Smith & Jones, 2018). Heritage education programs, volunteer-driven conservation projects, and participatory decision-making models foster community ownership and cultural continuity (Waterton & Watson, 2013). However, challenges such as gentrification and cultural commodification must be carefully managed to prevent displacement and loss of authenticity (Logan, 2012).

Sustainable Strategies for Cultural Heritage Conservation Eco-Friendly Conservation Approaches

Sustainable heritage management incorporates environmentally conscious techniques such as adaptive reuse, green building practices, and climate-responsive conservation methods. Traditional materials and techniques that align with local ecosystems are emphasized to reduce the environmental footprint of conservation efforts (Rodwell, 2020). Furthermore, energy-efficient lighting, renewable energy integration, and sustainable landscaping contribute to reducing the environmental impact of heritage sites.

Traditional Knowledge Systems

Indigenous and local knowledge play a significant role in heritage conservation. Traditional building techniques, land-use practices, and community governance systems contribute to sustainable cultural heritage preservation (Smith & Jones, 2018). Integrating these systems into contemporary conservation frameworks fosters resilience and environmental

harmony. Local craftsmanship and vernacular architecture serve as significant assets in maintaining cultural integrity while adapting to modern sustainability challenges.

Responsible Tourism

Tourism is a double-edged sword in heritage preservation. While it generates economic benefits, uncontrolled tourism can degrade cultural sites. Sustainable tourism strategies such as visitor caps, eco-tourism initiatives, and heritage-sensitive infrastructure development mitigate negative impacts while supporting local economies (UNESCO, 2019). Additionally, digital tourism, such as virtual heritage experiences and augmented reality applications, provides alternative means of engagement without placing excessive strain on physical sites.

Green Building Techniques

Traditional and modern green building methods can minimize environmental impact in heritage conservation. Adaptive reuse of historic structures, energy-efficient retrofitting, and the use of sustainable materials reduce carbon footprints while maintaining architectural integrity (Rodwell, 2007). Case studies from Europe and Asia highlight the effectiveness of passive cooling, natural lighting, and solar integration in restoring historic sites while maintaining their historical aesthetics. Applying green building principles to the design and construction of new facilities at heritage sites, such as visitor centers and museums.

Climate-Resilient Heritage Management

Extreme weather and rising temperatures pose risks to cultural sites. Implementing climate adaptation strategies—such as improved drainage systems, bio-based construction materials, and sustainable landscaping—can enhance resilience (Labadi & Logan, 2016). In Venice, Italy, flood management technologies, including mobile barriers and advanced water drainage systems, have been implemented to protect historic structures from rising sea levels (UNESCO, 2016).

Indigenous Practices and Sustainable Conservation

Indigenous and local communities often employ sustainable methods for maintaining heritage sites. Examples include traditional water conservation techniques, natural dye preservation, and earthen architecture that aligns with ecological principles (Vecco, 2010). In India, traditional step wells have been

restored using ancient water conservation techniques, blending sustainability with cultural preservation.

Oral Histories and Community Involvement

Community participation is vital for heritage sustainability. Oral histories and local narratives enrich conservation efforts, ensuring that cultural preservation aligns with community values and traditions (Jokilehto, 2007). The inclusion of local artisans and craftspeople in restoration projects enhances authenticity while promoting economic sustainability.

Responsible Tourism and Economic Sustainability

Sustainable Tourism Models

Heritage tourism, if managed responsibly, can generate economic benefits while ensuring cultural sustainability. Strategies such as eco-tourism, community-based tourism, and capacity-building initiatives help mitigate negative impacts and enhance local engagement (Bandarin & van Oers, 2012). The historic city of Kyoto, Japan, successfully balances tourism with preservation by limiting visitor numbers, implementing eco-tourism initiatives, and promoting cultural education programs.

Balancing Economic Growth and Conservation

Policymakers and stakeholders must balance economic development with heritage preservation. Incentives for sustainable business practices, heritage-linked entrepreneurship, and regulatory frameworks can support this equilibrium (UNESCO, 2016). In Morocco, adaptive reuse of heritage buildings for eco-friendly hotels has generated income while preserving traditional architectural styles (Labadi & Logan, 2016).

Technological Innovations in Heritage Conservation

Digital Documentation and Virtual Preservation

Technological advancements, including 3D scanning, augmented reality (AR), and digital archiving, enable precise documentation and preservation of heritage assets (ICOMOS, 2011). The Louvre Museum in France has integrated virtual reality experiences, allowing visitors to explore heritage collections remotely, reducing foot traffic and potential wear on delicate artifacts.

Smart Conservation Technologies

Emerging technologies, such as AI-driven restoration, climate monitoring

sensors, and drone-based inspections, enhance conservation efforts, making them more efficient and adaptable (Rodwell, 2007). The use of AI in Italy's Pompeii Archaeological Park has facilitated predictive maintenance and early detection of structural weaknesses, prolonging the site's longevity (UNESCO, 2016).

Policy Frameworks and Community Engagement

Effective heritage preservation requires robust policy frameworks that balance conservation with sustainable growth. International guidelines, such as those set by UNESCO and ICOMOS, provide valuable frameworks, yet local adaptations are necessary for practical implementation (ICOMOS, 2021). Community engagement is equally critical, as local populations are key stakeholders in preserving and sustaining cultural heritage. Participatory approaches, including heritage festivals, educational programs, and public-private partnerships, ensure community ownership and long-term commitment to conservation efforts.

National and International Policies

Governments play a crucial role in integrating heritage preservation with sustainable development through regulatory measures and funding. UNESCO conventions, national heritage acts, and local conservation policies provide guiding frameworks (UNESCO, 2016). The Historic Urban Landscape (HUL) approach emphasizes integrated urban heritage management, promoting sustainability and economic resilience.

Cross-Sector Collaboration and Public-Private Partnerships

Collaboration among governments, private enterprises, academia, and civil society fosters innovative and sustainable heritage conservation models. Public-private partnerships (PPPs) can mobilize resources and expertise for large-scale preservation efforts (Labadi & Logan, 2016). The Aga Khan Trust for Culture has successfully restored historic sites across Africa and Asia by combining private investment with local community engagement.

Chamllenges and Future Directions

Despite the advancements in sustainable heritage conservation, several challenges remain. Funding limitations, bureaucratic constraints, and conflicts between development and conservation priorities often hinder implementation efforts. Moreover, climate change poses a growing threat to cultural heritage, necessitating climate adaptation strategies that include

flood-resistant designs, temperature regulation measures, and disaster preparedness plans.

Future research should explore interdisciplinary collaborations between conservationists, architects, policymakers, and technologists to develop innovative models that integrate cultural heritage with sustainability. Expanding digital heritage repositories, leveraging artificial intelligence for predictive conservation, and strengthening global networks for knowledge-sharing can contribute to more resilient heritage management practices.

Conclusion

A holistic approach to cultural heritage conservation—incorporating sustainable practices, technological advancements, and community engagement—is essential for long-term viability. By aligning heritage preservation with sustainability goals, societies can protect their cultural legacies while fostering economic growth, social inclusion, and environmental stewardship. Case studies from diverse cultural contexts demonstrate that integrating traditional knowledge, responsible tourism, and emerging technologies can create resilient heritage conservation models. The findings of this study contribute to policy recommendations and practical strategies that support integrated heritage conservation and sustainable development.

Cultural heritage and sustainable development are intrinsically linked, necessitating an integrated approach to conservation. By incorporating eco-friendly practices, traditional knowledge, responsible tourism, and technological advancements, heritage can be preserved in a manner that ensures long-term environmental, social, and economic sustainability. Policymakers, conservation professionals, and communities must collaborate to implement holistic strategies that allow cultural heritage to thrive amidst global challenges.

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AGRO-BASED INDUSTRY IN INDIA AND THE ISSUE OF SUSTAINABILITY

Dr. Monika* & Dr. Jatinder Pal**

Abstract

An Agro-based industry refers to any industry that uses agricultural produce as its raw materials. This means they are directly or indirectly connected to agriculture. These industries rely on crops, livestock, and other agricultural products for their input. The agro-based industry is one of the most significant sectors in India from the point of view of output and employment generation. However, the sector faces increasing pressure to adopt sustainable practices to face environmental and social challenges. This paper investigates the role of agro-based industries in India, with a particular focus on sustainability challenges. Key issues such as resource utilization, waste management, environmental degradation, and social implications are explored. Through a comprehensive literature review and case studies, the paper highlights sustainability practices in the agro-processing sector. The study concludes with recommendations for fostering sustainability through technological advancements, policy measures, and industry best practices.

Keywords: *Agro-Based Industry, Sustainability, India, Resource Management, Agro-Processing, Environmental Degradation*

Introduction

The National Institute of Rural Development (NIRD) categorizes agro-based industries into primary and secondary. Primary industries involve the direct processing of agricultural products (e.g., grain milling), while secondary industries involve further value addition (e.g., packaged food production).

Agro-based industries are vital to India's economy, supporting millions of farmers and providing employment in both rural and urban areas. With huge number of the population dependent on agriculture, these industries are

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integral to the agricultural value chain, transforming raw materials like cereals, fruits, vegetables, dairy, and meat into value-added products. They play a crucial role in boosting export earnings, enhancing agricultural productivity, and generating employment.

However, the sustainability of these industries is under scrutiny due to excessive resource consumption, waste generation, environmental degradation, and overexploitation of natural resources. To ensure long-term growth and minimize environmental harm, adopting sustainable practices in agro-based industries is essential.

This paper examines the sustainability challenges faced by agro-based industries in India and proposes measures to address them. By analysing existing literature and case studies, the paper underscores the importance of sustainability and explores how businesses, governments, and communities can collaborate to promote eco-friendly practices.

Literature Review

Authors focusing on economic impact often emphasize the sector's role in employment generation, rural development, and GDP contribution. However, they also highlight challenges like fragmented supply chains, lack of access to credit, and inadequate infrastructure.

- Studies by economists like **Ramesh Chand and Ashok Gulati** analyze the economic policies and their impact on the agro-processing sector, pointing out the need for reforms to enhance competitiveness and value addition.
- Researchers like **V.S. Vyas** have long emphasized the importance of integrating agriculture with industry for sustainable rural development, stressing the need for equitable distribution of benefits.
- Studies on the sugar and textile industries often highlight the high water consumption and waste generation, leading to environmental degradation. **Authors like Vandana Shiva** have brought attention to the impacts of intensive agriculture and industrial processing on biodiversity and ecological balance.
- **Social sustainability** is also a critical concern, with research focusing on fair labor practices, equitable income distribution, and the empowerment of smallholder farmers.
- **Authors like M.S. Swaminathan** have long advocated for integrated approaches to agricultural development, emphasizing the need for a

holistic approach that considers economic, social, and environmental factors.

- **Collaborative approaches** involving farmers, processors, researchers, and policymakers are seen as critical for achieving sustainable outcomes.

The Importance of Agro-Based Industries in India

Agro-based industries are crucial to India's economy, with over 60% of the population engaged in agriculture. According to the Ministry of Food Processing Industries (MOFPI), the food processing sector alone contributes 8.59% to GDP and 13.33% to industrial output. These industries enhance agricultural productivity, create jobs, and improve rural economies.

The agro-processing sector also provides essential infrastructure for agricultural marketing, storage, and transportation. It supports India's goal of increasing export volumes and plays a vital role in ensuring domestic food security and boosting international trade.

Sustainability Issues in Agro-Based Industries

Despite their importance, agro-based industries face significant sustainability challenges:

- **Resource Depletion**: These industries require substantial water and land resources. Intensive farming and high water consumption in processing lead to the depletion of natural resources and groundwater.
- **Waste Management**: Agro-industries generate large amounts of agricultural waste, such as husks and stems, which are often poorly managed, causing environmental pollution.
- **Energy Consumption**: Agro-processing industries, particularly in food production, consume significant energy for refrigeration, cooking, and packaging, resulting in a high carbon footprint.
- **Environmental Degradation**: The use of chemical fertilizers, pesticides, and inefficient waste disposal systems contribute to soil degradation, air and water pollution, and biodiversity loss.
- **Social Implications**: Workers in agro-based industries often face poor working conditions, low wages, and lack of social security. There is also an imbalance in the distribution of economic benefits between rural farmers and urban processors.

Sustainable Practices in Agro-Based Industries

There is growing interest in integrating sustainability practices into agro-based industries. Strategies include:

- **Water and Energy Efficiency**: Adopting technologies that reduce water and energy consumption, such as rainwater harvesting, solar-powered facilities, and waste-to-energy systems.
- **Waste Utilization and Recycling**: Converting agricultural waste into valuable products like biofuels, fertilizers, and animal feed.
- **Sustainable Sourcing and Fair Trade**: Promoting organic farming, fair trade practices, and reducing the use of harmful chemicals.
- **Policy Interventions**: Governments can incentivize sustainable practices through subsidies, grants, and frameworks for waste management and energy efficiency.
- **Technology and Innovation**: Encouraging research and development to create environmentally friendly packaging, processing methods, and alternative raw materials.

Case Studies

1. Case Study 1: ITC Limited's Agro-Based Sustainability Initiatives

ITC Limited, a leading agro-processing company in India, has implemented several sustainability initiatives. Its "Wellness and Sustainability" framework focuses on reducing environmental impacts through energy conservation, water management, and sustainable sourcing of raw materials.

The e-Choupal initiative empowers farmers by providing access to the latest information and technology, improving productivity and promoting sustainable farming practices like water conservation and organic farming. ITC's "responsible sourcing" model ensures sustainable raw material procurement, benefiting both farmers and the environment.

2. Case Study 2: Amul's Dairy Sustainability Model

Amul, a major dairy cooperative in India, has established a sustainable business model by ensuring farmer welfare and adopting environmentally friendly practices. The company encourages dairy farmers to use biogas for energy and implement efficient waste management practices.

Amul has invested in waste-to-energy plants, converting animal waste into biogas for electricity generation. This reduces environmental impact and provides a sustainable energy source for its operations.

3. Case Study 3: Sugarcane Industry in Uttar Pradesh

The sugarcane industry in Uttar Pradesh exemplifies how agro-based industries can integrate sustainability practices. Several sugar mills have

adopted cogeneration technology, using bagasse (a sugarcane by-product) to produce electricity. This renewable energy reduces dependency on external power sources and promotes energy efficiency.

Government initiatives like the "National Policy for the Promotion of Biofuels" encourage the use of biofuels from agro-residues, reducing greenhouse gas emissions and minimizing waste disposal problems.

Discussion

Agro-based industries in India are crucial for economic growth but face significant sustainability challenges. The literature review and case studies reveal that while some companies have made progress in adopting sustainable practices, the sector as a whole needs to intensify its efforts.

Key challenges include inefficient water and energy use, with many industries relying on outdated technologies that result in high resource consumption and pollution. Waste management is another critical issue, as agro-industries generate substantial by-products that are not always effectively utilized.

The case studies demonstrate that sustainable practices offer environmental and economic benefits. Companies like ITC and Amul show that eco-friendly practices can lead to cost savings, improved brand reputation, and enhanced market access.

Conclusion

Agro-based industries are integral to India's economic and social fabric but face sustainability challenges such as resource depletion, environmental degradation, and poor worker conditions. Addressing these issues requires a multi-faceted approach involving technological innovation, policy interventions, and responsible business practices.

The case studies highlight the potential for sustainable development in agro-based industries. By adopting green technologies, promoting fair trade, and reducing waste, companies can significantly reduce their environmental impact and improve operational efficiency.

Future research should focus on scaling up sustainable practices across all agro-based sectors in India and analyzing the long-term impact of sustainability initiatives on economic and social well-being. A holistic approach to sustainability can help India's agro-based industries contribute to a greener, more inclusive future.

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CONTRIBUTION OF AI IN ATTAINING SDG 2030

Nisha Arora* & Pooja**

Abstract

This research explores the diverse contributions of Artificial Intelligence (AI) to achieving the UN's Sustainable Development Goals (SDGs) by 2030. It examines AI applications across key sectors like healthcare, education, agriculture, and environment, showcasing its potential to accelerate progress towards specific SDG targets.The research aims to provide a comprehensive overview of AI's potential and challenges in the context of the SDGs.

Introduction

The United Nations' Sustainable Development Goals (SDGs), particularly the ambitious Agenda 2030, represent a global commitment to addressing vital social, economic, and environmental challenges. Achieving these goals requires innovative solutions and transformative approaches. Artificial intelligence (AI), with its remarkable ability to analyze data, automate processes, and generate insights, has emerged as a powerful tool with the potential to significantly contribute to the attainment of the SDGs.This research explores the multifaceted contributions of AI in achieving the SDG 2030. It delves into the diverse applications of AI across various sectors, including healthcare, education, agriculture, and environmental conservation, examining how AI-powered solutions can accelerate progress towards specific goals. The study also investigates the challenges and ethical considerations associated with AI implementation, emphasizing the importance of responsible and inclusive AI development. By examining the potential of AI, this research aims to provide valuable insights into the role of AI in shaping a sustainable and equitable future for all. The research paper explores how AI applications can accelerate progress across diverse sectors crucial for SDG achievement,

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including healthcare (e.g., disease diagnosis, drug discovery), education (e.g., personalized learning, accessible education), agriculture (e.g., precision farming, crop yield prediction), and environmental conservation (e.g., climate modeling, biodiversity monitoring). The figure 1 highlights the central role of AI in achieving the goals set for sustainable development.

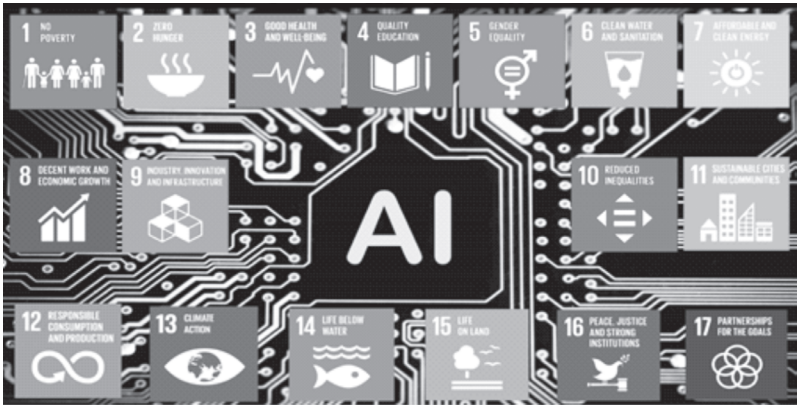

Figure1: AI and SDG 2030

Sustainable Development Goals (SDG2030)

Fifty years of discussion and agreement on sustainable development led to SDGs.At the 2015 UN Sustainable Development Summit, world leaders adopted the 2030 Agenda for Sustainable Development, which they describe as "a plan of action for people, planet, and prosperity," in an effort to steer the globe toward a more resilient and sustainable future.This universal, integrated, and transformative agenda is based on 17 SDGs, 169 targets, and 232 indicators (United Nations, 2022a). Figure.2 depicts all 17 SDGs organized into three pillars: environmental, social, and economic.

Environmental Pillar		Social Pillar		Economic Pillar	
6. Clean Water & Sanitation	7. Affordable & Clean Energy	4. Quality Education	5. Gender Equality	1. No Poverty	2. Zero Hunger
12. Responsible Consumption & Production	13. Climate Action	10. Reduced Inequalities	11. Sustainable Cities and Communities	3. Good Health & Well-being	8. Decent Work & Economic Growth
14. Life Below Water	15. Life on Land	16. Peace, Justice & Strong Institutions	17. Partnerships for the Goals	9. Industry, Innovation & Infrastructure	

Figure 2: SDGs 17 Goals organized into three pillars

The following section highlights the major contibution of AI in attaining goals of SDG 2030.

AI and SDG 2030

SDG1: No Poverty: AI is a powerful tool in the fight against poverty, contributing to the achievement of the first Sustainable Development Goal (SDG1). In predictive analysis, AI can analyze vast amounts of data to identify patterns and predict economic downturns[1], natural disasters[2], and other events that can exacerbate poverty. This allows for proactive measures to mitigate the impact on vulnerable populations. Job Creation as an aim, AI can drive economic growth and create new job opportunities, contributing to poverty reduction.

SDG2: Zero Hunger: AI is playing a crucial role in addressing the complex challenges of food security and helping to achieve SDG Goal 2: Zero Hunger. By improving agricultural practices, optimizing supply chains, and reducing food waste[3], AI is contributing to a more sustainable and food-secure future for all..By optimizing food supply chain, it contributes by predicting demand, managing inventory, and improving logistics. This reduces food waste and ensures that food reaches those who need it most, especially in remote areas. Improvement of agricultural practices through AI algorithms can assisst in analyzing images and data to detect crop diseases[4] and pests early on, allowing for timely interventions and preventing widespread damage. This helps to minimize losses and ensure food security.

SDG3: Good Health and Well Being: AI is revolutionizing healthcare and contributing significantly to SDG Goal 3 [5]. AI has contributed in following healthcare services:

A. **Early and Accurate Diagnosis:** Through image analysis and symptom checker, the prompt diagnosis of deadly diseases is possible, which further assist in treating the patient instantaneously.[6]
B. **Drug Discovery and Development:** AI can analyze vast amounts of biological and chemical data to identify potential drug candidates and predict their effectiveness, significantly speeding up the drug discovery process.
C. **Remote Healthcare and Telemedicine:** AI-powered telemedicine platforms can provide remote consultations, diagnosis, and monitoring, especially in underserved areas with limited access to healthcare facilities. Addidtionally, AI algorithms can analyze data from wearable sensors to track vital signs, detect anomalies, and provide early warnings of potential health issues, enabling proactive interventions.[7]

D. **Mental Health Support:** AI can analyze text and speech to detect signs of mental distress, enabling early interventions and personalized support[8].

SDG4:Quality Education: AI has the potential to significantly contribute to the attainemnet of quality education. Through personalised learning, improved accessibility and enhanced teaching practices, AI has revolutionised the traditional educational system and has assisted in achieving high quality in education.AI can recommend relevant courses and learning materials based on an individual's interests and career goals, supporting lifelong learning and skill development. It also enhances efficiency and effectiveness by optimizing resource allocation in educational institutions and predicting student enrollment, henceforth, identifying areas where resources are needed most[9].

SDG5: Gender Equality: AI can be used to develop apps and systems that help women report and prevent gender-based violence. AI can analyze data to identify high-risk areas or patterns of abuse.For women empowerment, AI can help women entrepreneurs access funding, mentorship, and business resources. AI-powered platforms can connect women with investors or provide personalized business advice. Although, AI has the potential to be a powerful tool for advancing gender equality[10], but it's not a silver bullet. Addressing the challenges and ensuring ethical development are crucial to realizing the positive potential of AI for SDG5.Bias in algorithm, privacy concerns, digital divide and job displacement are some of the crucial challenges that needs to be addressed while handling gender equality through AI.

SDG6: Clean Water and Sanitation: AI helps in monitoring quality of water in real time and assists in detecting pollutants and anomalies quickly. Additionally, AI algorithms can predict when pipes or treatment facilities are likely to fail, allowing for proactive maintenance and preventing costly disruptions in service. For sanitation services, AI can analyze data from sanitation systems[11] to identify problems like overflows or blockages, enabling timely interventions and preventing the spread of disease. Pridiction of water availability can be achioved by analyzing weather patterns, climate data, and other factors to predict water availability in rivers, lakes, and aquifers.This helps communities plan for droughts or floods and manage water resources sustainably.

SDG7: Affordable and clean energy: AI algorithms analyze weather patterns, historical data, and other factors to accurately predict solar and wind energy generation.This allows for better grid management and integration of

renewables. AI-powered smart grids can optimize energy distribution, reduce transmission losses, and integrate distributed energy resources, such as rooftop solar panels. It can also accelerate the discovery of new materials for solar panels, batteries, and other clean energy technologies.AI can analyze data on energy demand, resources, and infrastructure to help governments and organizations plan for expanding access to clean energy.Overall, AI has the potential to accelerate the transition to a more sustainable energy future. By leveraging the power of AI, we can make significant progress towards achieving SDG7 and ensuring access to affordable, reliable, sustainable, and modern energy for all.

SDG8: Decent work and economic growth: By Boosting Productivity and Efficiency, AI automates repetitive tasks, freeing up human workers to focus on more creative and strategic work. This increases productivity and efficiency across various industries. The development, implementation, and maintenance of AI systems create new job opportunities in fields like data science, AI engineering, and AI ethics thereby, aiding in accelerating economic growth. Additionally, AI can analyze data on job postings and worker skills to identify skills gaps and inform education and training programs. AI can help small businesses and entrepreneurs access funding and resources, promoting economic growth and job creation.

SDG9: Industry,Innovation and Infrastructure: SDG9 include poverty free, healthy, child friendly, water sufficient, clean & green, self-sufficient infrastructure, socially secured, good governance and women friendly villages.AI promotes SDG9, which embraces three essential attributes of sustainable development: infrastructure, industrialization, and innovation. AI-based innovation (such as digital financial services) SDG9 stimulates economic growth, creates employment opportunities (SDG8), and reduces poverty (SDG1) in cross-country settings, as indicated by several prior studies[12].

SDG10:Reduced Inequality:AI can be used to make recruiting more equal by integrating data-driven insights into hiring choices. Through the use of AI-powered algorithms, employers can guarantee that applicants from any demographic category have an equal probability of being hired[13].Health inequity and education inequity are significant issues in many parts of the world. AI has the potential to bridge this gap by making healthcare,education facility more accessible and affordable for everyone.Artificial intelligence is playing an important role in reducing inequalities around the world.As

technology continues to evolve, so will our ability to use it to reduce inequality gaps even further, making the world fairer and more sustainable for everyone.

SDG11: Sustainable Cities and community: Reports from international organizations indicate that over 50% of people worldwide live in cities, and by 2050, over two-thirds of the population will do so, offering significant investment prospects for tech development firms. The role of AI in sustainable cities is going to play a big role in making urbanization smarter, aiming to accomplish sustainable growth by making the cities prepared with advanced features to live, shop, walk, and enjoy a safe and more convenient life in such environments.Advance Security Camera,Face Detection Cameras,Surveillance System,Autonomous Flying Objects for Ariel View Monitoring and Movement for Public Safety are major role of AI in obtaining sustainable cities and community.

SDG12: Responsible Consumption and Production: Digital and artificial intelligence (AI) technology can create disruptive and commercially successful new product and service models.AI plays a significant role in promoting responsible consumption by enabling businesses and consumers to make informed decisions based on data analysis, allowing for optimized resource usage, reduced waste, and increased transparency throughout the product lifecycle, ultimately contributing to more sustainable practices in production and consumption patterns.

SDG13:Climate action :AI has been trained to measure changes in icebergs 10,000 times faster than a human could do it.This will help scientists understand how much meltwater icebergs release into the ocean – a process accelerating as climate change warms the atmosphere.AI system is helping to tackle climate change by making waste management more efficient. AI can also be used to improve agriculture and reduce its environmental impact by processing data from sensors placed on crops.

SDG14:Life below water : By analyzing massive amounts of underwater data to identify marine species, monitor ocean health, detect pollution, optimize fisheries management, and even help clean up ocean debris, artificial intelligence (AI) can greatly aid in the protection and understanding of life below the surface. This is made possible by sophisticated algorithms and autonomous underwater vehicles (AUVs) that can reach difficult-to-reach areas.

SDG15:Life on Land: It aims to 'Protect, restore and promote sustainable use of terrestrial ecosystems,sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity

loss'.AI helps to monitor environmental conditions,detecting threats to biodiversity, and predicting weather patterns, ultimately helping to conserve ecosystems and mitigate climate change impacts by providing data-driven solutions for sustainable practices in agriculture, forestry, and conservation efforts.

SDG16: Peace, Justice and Strong Institutions: AI powered legal analytics for judicial decision support. AI based algorithmic tools for identifying and addressing human rights violations,predictive policing and crime prevention algorithms[14] provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.

SDG17: Parternerships for goals: AI driven data collaboration platforms for global development initiatives. Predictive analytics for identifying partnership opportunities and enhancing collaboration effectiveness[15]. By streamlining data exchange, decision-making procedures, and resource allocation for the SDGs, artificial intelligence (AI) can promote cooperation and partnership among stakeholders. AI functions as a potent tool to optimize global efforts towards achieving a sustainable future and strengthen partnerships.

Conclusion

The paper has examined the nuanced relationship between Artificial Intelligence (AI) and the Sustainable Development Goals (SDGs).It includes the potential of AI in advancing specific SDGs through its capabilities in data analysis, prediction, and optimization.In order to guarantee that AI supports sustainable development initiatives, stakeholders must give ethical considerations, human-centered methods, and proactive mitigation strategies top priority. This highlights the significance of responsible AI deployment.

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17

AWARENESS LEVEL OF YOUNGSTERS TOWARDS SUSTAINABLE FASHION: A CASE STUDY OF PUNJAB

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Abstract

One of the global markets with the quickest growth is the retail sector. Marketers nowadays, use sustainable practices to maintain their competitiveness. This study aims to pinpoint the informational sources that play an important role to aware the youngsters regarding sustainable practices adopted by fashion retailers. In order to collect information from 750 respondents in the state of Punjab, stratified random sampling was used. For the aim of research, Ludhiana, Patiala and Sangrur districts from Malwa region, from Majha region Amritsar district and from Doaba region Jalandhar district had selected. These five districts were chosen based on the highest population according to the 2011 Census. The research was conducted using an exploratory and descriptive research approach. The information was examined by using weighted average score (WAS). It was found in the study that social media such as Instagram, Facebook, LinkedIn, Snapchat, Blogs were the strongest platforms used by the marketer to influence the behaviour of youngsters towards sustainable fashion clothing brands.

Keywords: *Buying habits, Sustainable fashion, Clothing industry and Youngsters behaviour.*

Introduction

Youngsters typically refer to young people, often adolescents or young adults, who are in the process of transitioning from childhood to adulthood. The exact age range can vary depending on context, but it usually refers to individuals aged anywhere from their early teens to their mid-20s. In this phase of life, youngsters often go through significant physical, emotional, social, and intellectual development. This period is also marked by the

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exploration of independence, personal identity, and the pursuit of education or career opportunities. Youngsters represent the future, and their choices, attitudes, and actions shape the world around them. They are heavily influenced by technology, culture, and social movements, while also facing unique challenges as they navigate personal growth, career development, and societal expectations. As they continue to develop, they are likely to have a profound impact on the world, fostering new ideas, cultural shifts, and technological advancements. Youngsters' behavior towards sustainable clothing has been evolving significantly in recent years, driven by growing awareness related to environmental issues, social justice, and the long-term consequences of fast fashion. This demographic is increasingly focused on making ethical, environmentally conscious, and socially responsible choices in their clothing purchases.

Review of Literature

Niinimaki (2009) conducted research in Finland to the ideology of consumers towards eco- clothing. The data was gathered from 246 respondents and was analyzed by mean. The findings of the study showed that consumers ethical commitment towards purchasing eco- clothes played significant role in influencing their buying behaviour. The findings further revealed that 94.6% of respondents were ready to buy durable, better quality, clothes in future to lower the adverse effects on the environment.

Bianchi et al. (2012) have done research on comparative study of buying behaviour of consumers towards sustainable clothing in Australia and Chile. The data was collected from 488 respondents viz. 239 and 249 from Australia and Chile respectively. Further, the data was analyzed by using Structural Equation Model. The findings of the study showed that consumer awareness related to the environment protection and age of the consumers significantly influence their behaviour in both the consumers.

Koszewska (2016) examined to understand the consumer behaviour in the sustainable clothes market. The data was collected from 98 consumers of Poland and analyzed by using Structural Equation Model. The findings of the study showed that there was positive attitude of consumers towards sustainable apparel products. The findings also showed that they were ready to pay premium price for sustainable goods.

Jalil and Shaharuddin (2019) experimented research on consumer buying behaviour towards eco- fashion clothes. The research was conducted in Malaysia. The data was collected from 583 respondents using snowball sampling technique and analyzed by using factor analysis and Structural

Equation Model. The findings of the research showed that positive attitude of consumers towards eco- fashion clothes proved to be the most significant factor that had influence on buying intentions of consumers. Additionally, there was a strong positive correlation between consumers' purchasing habits for eco-fashion items and their sustainable disposal behavior. Based on customer wants and happiness, the study also recommended that manufacturers create clothing using recycled materials.

Rausch and Kopplin (2020) studied on buying intention of consumers towards sustainable clothing. The data was collected from 464 German respondents and analyzed by using Partial least square Structural Equation Model (PLS- SEM). The study's conclusions demonstrated that customers' favourable attitudes about eco-friendly apparel had the biggest influence on their intents to purchase. Further the study revealed that consumers perceived aesthetic and economic risk had no significant impact on buying behaviour of consumers.

Bielawska and Krawczyk (2021) carried research on choice behaviour of consumers towards green clothing. The purpose of the research was to find the factors that influence consumer behaviour of green clothing products. The data was collected from 496 Polish consumers and analyzed by using Structural Equation Model. The findings of the study found that emotional, environmental and conditional values had significantly positive impact on choice behaviour of consumers towards green clothing products. On the other hand, functional, epistemic and social values had no impact on it. The results also recommended for producers and retailers of green clothes for building strong marketing network for Polish market.

Metodzi et al. (2022) led research on the influence of knowledge of sustainable clothing on buying behaviour of consumers. The data was collected from 305 consumers of South Africa and analyzed by using Stata/ SE 14.0. The findings of the research revealed that durability of sustainable clothes played an important role in influencing buying behaviour. The findings of the research showed that civic education about the environment among consumers also had significant influence on buying behaviour of consumers.

Banyte et al. (2023) conducted research on investigating the sustainable clothing attitude of consumers. The data was collected from 218 respondents of Lithuania, Europe. The data was analyzed by factor analysis and Structural Equation Model. The findings of the research showed that consumer attitude played a significant role in influencing sustainable clothing buying behaviour of consumers.

Vrablikova et al. (2024) had done research on the buying behaviour of Generations X and Y towards sustainable clothing. The research was conducted in Slovak Republic. The data was gathered from 139 respondents and analyzed by using Chi- square test. The findings of the study showed that influencer marketing on social network played a significant role in influencing buying behaviour of respondents towards sustainable clothing.

Research Methodology

Objectives

- To examine the role of various sources of information on level of awareness among youngsters about sustainable clothing.
- To understand the most influential source that effect buying behaviour of youngsters in relation to sustainable clothing.

Scope of The Study

Punjab state has been chosen for research purposes. Further, the study has been conducted on the respondents from the top five districts of Punjab which are selected on the basis of highest population as per 2011 Census of India. These five districts are Ludhiana, Patiala, Bathinda, Jalandhar and Amritsar. Furthermore, the scope of the study was constrained to a single sector that is retail sector.

Research Design

This study's research design was exploratory and descriptive. Exploratory research helped to explore the topic as well as the area of research. The descriptive research helped to determine the youngster's buying behaviour towards readymade garments in the state of Punjab, India. Descriptive research is some kind of enquiry that aims to answer the questions.

Data Collection

Data have been gathered for the study from both primary and secondary sources. Via the distribution of a questionnaire to the respondents, primary data was gathered from the respondents. Secondary data was gathered from a variety of published sources, including books, journals, magazines, research reports, the internet etc.

Sample Design

Target population: Punjab state broadly divided into 3 regions on the basis of socio- cultural regions i.e. Malwa, Doaba and Majha. At present

there are 23 districts in Punjab. Out of these 15 districts are falling under Malwa region and 4 districts in each Doaba and Majha. Out of these districts, total 5 districts were chosen for the purpose of study on the basis of highest population. At the first stage, 3 districts with highest population will have chosen from Malwa region and 1 each from Doaba and Majha region. Therefore, Ludhiana, Patiala and Sangrur districts from Malwa region, from Majha region Amritsar district and from Doaba region Jalandhar district had selected for the purpose of research.

Sampling technique: To have greater control over the research problem, multistage stratified sampling technique has chosen. In this technique the sample can be drawn from a population using smaller and smaller groups at each stage.

Sample size: 150 respondents were to be selected from each district i.e.75 respondents from villages and 75 respondents from cities. In this way total number of respondents were to be 750 i.e. 375 respondents from rural areas and same number from urban areas.

Role of various informational sources on level of awareness of youngsters towards sustainable fashion

Application of weighted average score (WAS)

This section examined how different informational sources affect youngsters' knowledge towards sustainable practices adopted by marketers. Without these platforms youngsters would not be aware about marketers' strategies. These informational sources were found in the relevant literature. The respondents were asked to rate the various sources they believed will be used to notify them.

Table 1

Role of Informational Sources on Awareness Level of Consumers

Rank Sources	1	2	3	4	5	6	7	8	9	10	11	Total	WAS	WAS	R_K
Relevant weights	11	10	9	8	7	6	5	4	3	2	1				
Fashion brands	98	39	45	49	119	62	56	60	57	99	66	750	4425	5.9	7
Advertisement	33	66	59	86	65	98	55	75	83	54	76	750	4293	5.724	8

Documentaries and films	43	40	54	72	83	121	69	64	87	63	54	750	4284	5.712	9
Educational institutions	60	58	99	95	57	36	60	112	67	49	57	750	4610	6.14667	4
Peer Influence	56	63	54	85	68	71	85	64	98	55	51	750	4450	5.93333	6
Journals/ Research papers	78	50	63	89	74	59	96	53	46	105	37	750	4586	6.11467	5
Government policies	49	54	105	45	58	50	61	51	51	61	165	750	4039	5.38533	11
Blogs	89	112	89	30	55	59	66	81	43	61	65	750	4849	6.46533	2
Influencers	29	123	87	49	96	62	42	58	59	92	53	750	4624	6.16533	3
Social media	187	86	45	44	47	56	42	81	70	49	43	750	5224	6.96533	1
Community movements	28	59	50	106	28	76	118	51	89	62	83	750	4116	5.488	10
Total	750	750	750	750	750	750	750	750	750	750	750				

(Source: Researcher's own compilation)

The respondents' rankings ranged from 1 to 11, with 1 representing the most favoured platform and 11 representing the least liked informational source. For each of these rankings, the associated weights were assigned in reverse order (11 to 1), and the WAS was computed.

Table 1 revealed the WAS for each informational source, which was derived using the rankings provided by the respondents. According to the respondents' rankings of the various sources, the category "Social media" had the highest weighted average score (WAS 6.96533); demonstrating social media platforms like Instagram, Facebook, LinkedIn, Snapchat may potentially affect youngsters purchasing decisions regarding sustainable clothing. With a WAS of 6.46533, "Blogs" was found to be the second most influential source, clearly indicating that the platform's extensive reach, targeting options and engagement tools make it an ideal space for influencing youngsters' behaviour. "Influencers" was found to be the third-most significant platform with a WAS of 6.16533, thus, it shows that through product reviews, unboxings, tutorials and personal stories, influencers build trust and credibility with their audience, offering in-depth insights and demonstrations about the product. "Educational institutions" was found to be the next highly influenced

platform having WAS 6.14667. Thus, the platform's intimate atmosphere allows youngsters to build a deeper connection with each other and making product recommendations feel more personal and trustworthy.

After that "Journals/ Research papers" ranked fifth with a WAS of 6.11467. The respondents also influenced by advertisements, peer influence, fashion brands, documentaries and films. Besides these, with a WAS of 5.488, "Community movements" was the tenth platform, which clearly signified that marketers also use movements of communities to influence youngsters' behaviour by creating visually appealing and highly shareable content that inspires users and drives product discovery. With a WAS of 5.38533, "Government policies" was the platform that had the least impact. Surprisingly, this suggested that the influence of this platform on youngsters' awareness level is not very important.

Implications and Conclusion

The study's findings highlighted that social media was the most influential platform used by marketers to aware the respondents while government policies had the least preferred platform by the youngsters. Therefore, the research suggested that the government should make policies that promote sustainable fashion so as to reduce the environmental impact.

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18

CASE STUDIES OF INSPIRING INDIGENOUS ENTREPRENEURS

Dr. Sachin Kumar* & Dr. Nishi Bala**

Abstract

Entrepreneur is one who converts a new idea into innovation. Idea is seed for fruitful tree of entrepreneurship. This paper articulates the relationship of innovative ideas and indigenous entrepreneurship. Ideas generation process includes problem finding, ideation and evaluation. This paper studies the cases of few Inspiring indigenous Indian entrepreneurs, who set up their business empire by successful innovation of idea. Secondary data from research papers, newspaper and magazine articles are studied to conceptualize this paper. This research is limited to published work. This research will motivate the budding entrepreneurs for entrepreneurship.

Keywords: *Entrepreneur; Entrepreneurship; Idea Generation; Innovation*

Introduction

Our honorable Prime Minister has given boost to entrepreneurship by launching Make in India Movement followed by start-up India Movement. Startup India campaign is based on an action plan aimed at promoting bank financing for start-up ventures to boost entrepreneurship and encourage startups with job creation. Campaign is focused on to restrict role of States in policy domain and to get rid of "license raj" and hindrances like in land permissions, foreign investment proposal, environmental clearances. It was organized by Department of Industrial Policy and Promotion. So it is important to understand entrepreneurship.

Objective of Study

1. To define the entrepreneurship

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2. To understand relationship of entrepreneurship and idea
3. To find out process of idea generation
4. To study the cases of successful Indian entrepreneur who innovated the idea.

Research Methodology

Secondary data from research papers, newspaper and magazine articles are studied to conceptualize this paper. 4 Research paper, 1 article from book and 5 news paper articles are referred for this paper.

According to **Joseph Schumpeter** (1950) "***Entrepreneur is one who coverts a new invention or idea in to successful innovation".*** Schumpeter in his definition made the distinction between entrepreneurs and inventors clear. The inventor might create a new product but the entrepreneur gathers resources, organizes talent and provides leadership to make the venture a commercial success. Our honorable Prime Minister has given boost to entrepreneurship by launching Make in India Movement followed by start-up India Movement. Startup India campaign is based on an action plan aimed at promoting bank financing for start-up ventures to boost entrepreneurship and encourage startups with job creation. Campaign is focused on to restrict role of States in policy domain and to get rid of "license raj" and hindrances like in land permissions, foreign investment proposal, environmental clearances. It was organized by Department of Industrial Policy and Promotion.

Novel and useful ideas are basics for entrepreneur success. To become a successful, entrepreneur must generate valuable ideas for new goods and services. Entrepreneur must figure out how to bring the project to fruition. (Gilad,1984;Whiting, 1988). Runco and Chand (1994,1995) described the process of idea generation as problem finding, ideation and evaluation. The idea can be generated from our daily life. Most of the successful entrepreneurs had got idea for business when they faced a problem in their real life and tried to find out solution to that problem. Solution to the problem led them to multi crore business turnover by just starting from the scratch. I am discussing below few stories of entrepreneur who started from scratch and build up the great empire of business, just from an idea:

1. **Red Bus Story:** Redbus is an Indian maker of bus tickets through web site, windows phone, ios and mobile apps. In 2013, Redbus was acquired by the IBIBO group for $100 million(Rs 600-700 crores). There is interesting story behind setting up of Redbus. Phanindra Sama was working

as Senior Design Engineer for Texes Instrument in Banglore. During Diwali of 2005, he wanted to spend the festival with his family at Hyderbad. Since he don't know the schedule till the end, taking bus was the only option. He ran around town hunting for a ticket, but they were all sold out before he reached the travel agent. Travel agents are not having information regarding all the possible bus operators. So there was a gap and customers had to take decision based on limited information. Most of agents were not able to sell the return ticket. This had given him thought of possibility of solving these issues by putting to gather information on a platform where customer could access it easily and take better decisions. He figured there could be a web solution where all bus operators could put in their seat inventory and people could buy those seats online. He shared the idea with his friends and they started working on the idea. They went to bus operators in Madiwala and Kalasipalayam to sell the idea, but received little encouragement. "The operators listened, but they had a lot of apprehensions about the internet. This idea made him to start Redbus. Redbus sells over a million tickets per month.

2. **Story of Biocon:** Kiran Mazumdar Shaw founder of Biocon a biotechnology company. Mazumdar shaw was named as richest women in India with networth of more than Rs. 2000 crores in 2004. Kiran Mazumdar Shaw was always inclined towards studies and education. She pursued B.Sc in Zoology from Bangalore University. With a thirst to study further, she went to Australia for post-graduation. She studied at Ballarat University in Melbourne and got the qualification of a Master Brewer. After working for a brief period of four years as trainee Manager with Biocon Biochemicals Limited, Ireland, she returned to india. She started Biocon India in 1978 in a garage of her rented house with capital of Rs.10,000. The companny's initial project was the extraction of Papain(an enzyme from papaya used to tenderize the meat). Within a year of its inception, Biocon india was able to manufacture enzymes and to export them to United States and Europe.

3. **Story of Mitticool:** Mansukhbhai Prajapati from Gujarat began as a simple potter. Mansukhbhai joined Jagdamba Potteries as a trainee in 1985. As he picked up the tricks of the trade, a business idea sparked in his mind. Mansukhbhai quit his job, borrowed Rs.30,000 from a moneylender and bought a small piece of land to set up a workshop at Wankaner. When a businessman came looking for a vendor who could supply clay water filters, Mansukhbhai impressed him with an innovative terracotta filter with a ceramic candle and bagged an order worth Rs 1 lakh. In 2001 Gujarat

was hit by a massive earthquake. This was the inspiration that finally led him to the refrigerator made out of clay. In 2005, this potter was credited for a ground-breaking green innovation-Mitticool, a refrigerator that runs without electricity. In 2010, Manshukhbhai found himself on the Forbes' list of Top 7 Rural Entrepreneurs.

4. **Story of Dosa Plaza:** Prem Ganapathy was only 17 when he moved from his village Tuticorin Tamilnadu to Mumbai, leaving his family behind. Now is owner of Dosa plaza with a turnover of around Rs.30 crore a year. Prem started working as dishwasher in a hotel for a monthly salary of Rs.150. In 1992, Prem had managed to save money and started selling idlies and dosas on street opposite Vashi Railway station. Prem was having some educated roommates who helped him learn how to use a computer. He was used to take a break of 2 hours in evening and used too surf on internet. He was used to read about business and learned a lot. After witnessing success of Mcdonld's restaurant besides his cart, he decided to start his own restaurant. In1997 Prem started restaurant having name Prem Sagar Dosa point. In first year itself he introduced 26 Different varieties of Dosa, including Schezwan dosa, Paneer chilli and Spring roll dosa. By 2002 He was able to offer 105 different varieties of dosa. Today Dosa Plaza opertate 45 outlets in india and seven international in three countries UAE, Oman and NewZealand.

5. **TAC Solution:** TAC Solution is Founded by Trishneet Arora, born on 2nd November,1992 hails from Ludhiana. He is first Generation Entrepreneur. At the age of 20, when most youngsters are still pursuing their studies and are undecided about their future, Ludhiana-based Trishneet Arora is an internationally recognised ethical hacker who assists industry in IT security, the police in cracking down on cyber crime, and companies in training employees. TAC solution offers training, consulting and IT security solutions, and his clients include MNCs as well as domestic organisations such as Reliance Industries, ICICI Bank, Ralson (India) Ltd, the police forces of Punjab and Gujarat, and the Central Bureau of Investigation. Besides being a successful entrepreneur, he is the world's second youngest writer of books on ethical hacking.

6. **Mendha-Lekha:** In Maharashtra, India, the Mendha-Lekha hamlet is renowned for its dry woods, tribal population, and wildlife. It is inhabited by the Gond tribe and is situated in the Gadchiroli district. It has about 400 residents. At first, poverty dominated the village, with most residents subsisting on farming and forest products. Mendha-Lekha became the first Indian hamlet to gain community forest rights following six years of court

battle.The average landholding in the village remained at five acres, and subsistence farming and forests were the main sources of income. Non-timber forest produce (NTFP) and daily earnings from labor activities with public and commercial organizations were the primary sources of revenue. The right to manage, conserve, protect, and regenerate forests and their resources was extended to forest occupants by the Forest Rights Act of 2006. Village residents were given ownership of minor forest products under the act, with the exception of timber. After a six-year court battle, the first hamlet to be granted community forest rights was Mendha Lekha, a tribal village in Maharashtra. The community, which is primarily inhabited by Gond tribe members, now earns millions of rupees from growing bamboo for the paper business. The earnings go toward social welfare and development initiatives. Then-Minister of Environment and Forests Jairam Ramesh and Maharashtra Chief Minister Prithviraj Chavan gave the biodiversity registry that the villagers in Gadchiroli, Maharashtra, had established to manage their forest a "transit passbook." In addition to implementing integrated development concepts like conserving soil and water, fortifying roads, constructing barricades, and establishing five natural reservoirs for wildlife, the passbook permits the gram sabha to transport bamboo outside the community. The gram sabha also wants to train individuals to make bamboo artifacts and provide job possibilities for youth. Up until September 2011, 737 community forest rights disputes had been resolved in the district, making Gadchiroli a model in Maharashtra. From being only a benefactor to becoming an active citizen, the community of Mendha Lekha has witnessed a dramatic change in perspective. The community has successfully established basic utilities, encouraged good administration, and ensured the transparent and effective operation of its gram-sabha. Members of the Panchayati Raj Institute (PRI) are chosen by consensus; there are no election-related costs. As a result of this transformation, the village is now a model for self-help and group decision-making, advancing the general welfare of rural communities. Mendha village has not held a Panchayat election in year.

7. With the help of the German business Leaf Democracy, more than 3,500 women from 127 tribal hamlets in Kandhamal, Sambalpur, Angul, and Deogarh provide 100,000 siali leaf plates, or pattals, each month. Popular in European markets, these environmentally friendly plates provide a sustainable substitute for plastic and Styrofoam. The women, who formerly marketed small-scale forest products, have established a self-help organization that sustains their livelihoods and acts as an example of

sustainability and empowerment. Biodegradable plates produced from siali leaves from tribal areas of Odisha that are free of holes and black markings are also being used by upscale hotels in Europe. Biodegradable plates, usually made from leaves, have become popular in these countries' hotel industries since they break down naturally over time and don't harm the environment. According to the German company's specifications, the leaves used for the plates must be green, dry, and free of holes or dark markings. Before being exported to Germany, the leaf plates are presently being hauled to the port of Vishakhapatnam. A German company and a women's organization in Odisha, India, have formally agreed to use siali leaves, a staple diet for the state's impoverished tribal people who live in its jungles, to make leaf plates. Bamboo shavings are used to stitch the plates formed from the plentiful siali creeper leaf, together to create round plates. These environmental friendly plates formerly bought by middlemen for a nominal price and supplied to supermarkets and small hotels, are now made by more than 70% of indigenous women in these districts. The intermediaries, who used to buy the leaves in bulk for Rs 10 a kilogram, are now fiercely competing with the Leaf Democracy, which pays Re 1 every leaf, or Rs 150 per kilogram. The impoverished tribal people, who were previously taken advantage of by traders, are anticipated to get a sizable income from the enterprise.

Conclusion

The idea is the key for successful entrepreneur. The above cases show how important is role of innovation in developing entrepreneurship. The need is that one should analysis the problem faced in our daily life and try to work out solution for the problem that will not only help him but can also help society and Skillful innovating of that idea can lead to a successful business venture.

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19

THE ROLE OF MICROFINANCE IN EMPOWERING WOMEN ENTREPRENEURS: A PATHWAY TO ECONOMIC AND SOCIAL EMPOWERMENT

Jyoti Bala*

Abstract

Microfinance has emerged as a powerful tool for empowering women entrepreneurs, particularly in developing economies. By providing access to small loans, savings, and financial literacy, microfinance institutions (MFIs) enable women to start and scale businesses, thereby fostering economic independence and social empowerment. This study examines the role of microfinance in supporting women entrepreneurs, focusing on its impact on income generation, decision-making autonomy, and community development. Using a mixed-methods approach, the research analyzes data from 150 women entrepreneurs in rural and urban India who have utilized microloans. Findings reveal that microfinance significantly enhances women's entrepreneurial success, self-confidence, and household decision-making power. However, challenges such as high interest rates, limited financial literacy, and sociocultural barriers persist. The paper concludes with policy recommendations to optimize microfinance's impact on women's entrepreneurship.

Keywords: *Empowerment, Entrepreneur, Microfinance, Financial Literacy.*

Introduction

Background

Women entrepreneurs play a critical role in economic development, yet they often face systemic barriers such as limited access to credit, lack of collateral, and sociocultural constraints. Microfinance has emerged as a transformative solution, offering financial services to underserved populations, particularly women. By providing small loans, savings accounts,

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and financial training, microfinance institutions (MFIs) empower women to start businesses, generate income, and improve their socioeconomic status.

Problem Statement

Despite the growing popularity of microfinance, its effectiveness in empowering women entrepreneurs remains contested. While some studies highlight its positive impact on income and empowerment, others point to challenges such as debt traps and limited scalability. This study seeks to address this gap by examining the multifaceted role of microfinance in supporting women entrepreneurs.

Research Objectives

1. To assess the impact of microfinance on women's entrepreneurial success.
2. To explore the social and economic empowerment outcomes of microfinance.
3. To identify challenges faced by women entrepreneurs in accessing and utilizing microloans.

Literature Review

Microfinance and Women's Empowerment

Microfinance has been widely recognized as a tool for women's empowerment. According to Kabeer (2005), access to financial resources enhances women's decision-making power within households and communities. The Grameen Bank model, pioneered by Muhammad Yunus, demonstrates how microloans can enable women to break the cycle of poverty and achieve economic independence (Yunus, 2007).

Economic Impact of Microfinance

Studies show that microfinance significantly increases women's income and business productivity. For instance, a World Bank (2014) report found that women entrepreneurs in Bangladesh who accessed microloans experienced a 20% increase in household income. However, critics argue that high interest rates and rigid repayment schedules can exacerbate financial stress (Bateman, 2010).

Social Empowerment Outcomes

Beyond economic benefits, microfinance fosters social empowerment by enhancing women's self-esteem, leadership skills, and community

participation. Mayoux (2001) highlights how women's participation in microfinance groups strengthens social networks and collective action.

Challenges in Microfinance

Despite its potential, microfinance faces challenges such as limited financial literacy, sociocultural barriers, and inadequate support for business scalability (Armendáriz & Morduch, 2010).

Research Methodology

Research Design

This study adopts a mixed-methods approach, combining quantitative surveys and qualitative interviews to capture the multifaceted impact of microfinance on women entrepreneurs.

Data Collection

Quantitative Data: Surveys were conducted with 150 women entrepreneurs in rural and urban India who have utilized microloans.

Qualitative Data: In-depth interviews were conducted with 20 women to explore their experiences and challenges.

Data Analysis

Quantitative data were analyzed using statistical tools to measure income growth, business performance, and empowerment indicators.

Qualitative data were analyzed thematically to identify patterns and insights.

Analysis and Findings

Economic Impact

Income Growth*: 78% of respondents reported a significant increase in income after accessing microloans.

Business Expansion*: 65% of women used loans to expand their businesses, such as purchasing inventory or equipment.

Social Empowerment

Decision-Making Power*: 82% of women reported greater involvement in household financial decisions.

Self-Confidence*: 70% of respondents noted improved self-esteem and leadership skills.

Challenges

High Interest Rates: 45% of women cited high interest rates as a major barrier.

Financial Literacy: 30% struggled with understanding loan terms and financial management.

Sociocultural Barriers*: 25% faced resistance from family members or societal norms.

Discussion

The findings highlight the transformative potential of microfinance in empowering women entrepreneurs. By providing access to credit, MFIs enable women to generate income, gain financial independence, and challenge traditional gender roles. However, challenges such as high interest rates and limited financial literacy underscore the need for targeted interventions.

Policy Implications

Interest Rate Regulation*: Governments should cap interest rates to make microloans more affordable.

Financial Literacy Programs*: MFIs should integrate financial education into their services.

Sociocultural Sensitization*: Community awareness campaigns can address gender biases and encourage family support.

Theoretical Contributions

This study contributes to the literature by providing empirical evidence on the dual economic and social benefits of microfinance for women entrepreneurs. It also highlights the importance of addressing structural barriers to maximize impact.

Conclusion

Microfinance has proven to be a powerful tool for empowering women entrepreneurs, enabling them to achieve economic independence and social empowerment. However, its full potential can only be realized by addressing challenges such as high interest rates, financial illiteracy, and sociocultural barriers. Policymakers, MFIs, and communities must work together to create an enabling environment for women entrepreneurs to thrive.

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"Women, Work, and Economic Empowerment" - edited by Sheila Rowbotham and Swasti Mitter.

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BRIDGING THE GAP: TECHNIQUES FOR EFFICIENT WASTE HANDLING AND THE SHIFT TO A CIRCULAR ECONOMY

Megha Dua*

Abstract

The world today is facing a number of serious environmental, financial, and societal issues due to inappropriate techniques of waste management. Conventional waste management techniques emphasise treatment and disposal, however these approaches are frequently expensive, ineffective, and detrimental to the environment. A circular economy strategy, on the other hand, aims to decrease waste, increase resource efficiency, and encourage sustainable patterns of production and consumption. In order to identify important tactics and best practices for efficient waste reduction, recycling, and reuse, this study examines the body of research on waste management and the circular economy. It examines the case studies from different industries and geographical areas, emphasising effective programs and laws that advance the ideas of the circular economy.

Keywords: *Waste management, circular economy, sustainability, resource efficiency, waste reduction, recycling, reuse.*

Introduction

The world is currently dealing with a serious waste management challenge. Global trash production is growing at an accelerated rate, which has created serious problems for the environment, the economy, and society. The World Bank estimates that 2 billion tonnes of municipal solid waste (MSW) were produced worldwide in 2016, and that amount is projected to rise to 3.4 billion tonnes by 2050 (World Bank, 2018). Conventional waste management techniques emphasise treatment and disposal, however these approaches are frequently expensive, ineffective, and detrimental to the environment.

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Literature Review

The concept of a circular economy has gained significant attention in recent years as a potential solution to the waste management crisis. A circular economy is an economic system that is restorative and regenerative by design, aiming to keep resources in use for as long as possible, extract the maximum value from them, and recover and regenerate materials at the end of their service life (Geiss Doerfer et al., 2017). The circular economy approach seeks to reduce waste, promote resource efficiency, and foster sustainable consumption and production patterns.

Traditional waste management practices focus on disposal and treatment, but these methods are often inefficient, costly, and environmentally harmful. Landfills, for example, are a major source of greenhouse gas emissions and can contaminate soil and groundwater (Kumar et al., 2017). Incineration, on the other hand, can release toxic pollutants into the air and produce hazardous ash (Liu et al., 2018).

The circular economy strategy aims to reduce waste, improve resource efficiency, and promote sustainable patterns of consumption and production. The circular economy concept is based on three fundamental principles: planning for circularity, sharing and collaboration, and closing resource loops (Geiss Doerfer et al., 2017). Creating products and services that are restorative and regenerative by design is known as "design for circularity." Collaboration and sharing entail encouraging the reuse and sharing of goods and services. Designing closed-loop systems, in which materials are continuously recycled back into production, is necessary to close resource loops (McDonough & Braungart, 2002).

Recycling and waste reduction are essential elements of a circular economy. Recycling is the process of turning garbage into new products, whereas waste reduction is the process of lowering the quantity of waste produced. Research has demonstrated that recycling and waste reduction can save natural resources and drastically cut greenhouse gas emissions (EPA, 2020). Reusing aluminium cans, for instance, consumes 95% less energy than making new aluminium from scratch (Aluminium Association, 2020).

Circular business models involve designing business models that are restorative and regenerative by design. Examples of circular business models include product-as-a-service, sharing and leasing, and closed-loop production (Tukker, 2004). Product-as-a-service involves providing customers with access to products rather than ownership. Sharing and leasing involve providing customers with access to products for a limited period of time.

Objectives of the study:

In order to identify important tactics and best practices for efficient waste reduction, recycling, and reuse, this study examines the body of research on waste management and the circular economy

1. To find out the best practices for efficient waste reduction.
2. To highlight the waste management initiatives in India.
3. To identify the challenges in the implementation of initiatives.
4. To give recommendations for the successful implementation of initiatives.

Research Methodology: The study uses a number of case studies by looking through journals, publications, and other pertinent literature.

Case Studies

Several case studies have demonstrated the effectiveness of circular economy strategies in reducing waste and promoting resource efficiency. For example, the city of Stockholm has implemented a waste-to-energy program that converts waste into heat and electricity (City of Stockholm, 2020). The program has reduced the city's greenhouse gas emissions by 70% and has provided heat and electricity to over 800,000 residents.

Sweden's Waste-to-Energy Program

- Sweden's waste-to-energy program is a successful example of a circular economy approach to waste management. The program involves the incineration of waste to produce heat and electricity, reducing the country's reliance on fossil fuels and decreasing greenhouse gas emissions (Swedish Environmental Protection Agency, 2020).

Japan's Recycling Program

- Japan's recycling program is another successful example of a circular economy approach to waste management. The program involves the recycling of a wide range of materials, including paper, plastic, glass, and metal, reducing the country's waste disposal costs and promoting resource efficiency (Japanese Ministry of the Environment, 2020).

India's Waste Management Initiatives

India's waste management initiatives are a successful example of a circular economy approach to waste management. The initiatives involve the segregation of waste at source, the composting of organic waste, and the recycling of inorganic waste, reducing the country's waste disposal costs and promoting resource efficiency (Indian Ministry of Environment, Forest

and Climate Change, 2020).Some of the major initiatives taken in India for Waste Management include :

- **Mumbai's Waste-to-Energy Plant**: The trash-to-energy facility established by the Mumbai Municipal Corporation produces 12 MW of electricity daily from 600 tonnes of rubbish. The city's greenhouse gas emissions and garbage disposal expenses have decreased as a result of this project.
- **Delhi's Composting Initiative**: The Delhi government has launched a composting initiative that aims to convert 50% of the city's organic waste into compost. This initiative has helped reduce the city's waste disposal costs and promote sustainable agriculture practices.
- **Bangalore's Recycling Program**: The Bangalore Municipal Corporation has launched a recycling program that aims to recycle 100% of the city's dry waste. This initiative has helped reduce the city's waste disposal costs and promote sustainable consumption practices.
- **Chennai's Waste Management Initiative**: The Chennai Municipal Corporation has started a waste management program with the goals of recycling dry garbage, composting organic waste, and separating waste at the source. This program has promoted sustainable waste management techniques and assisted in lowering the city's garbage disposal expenses.
- **Kerala's Zero-Waste Initiative**: The Kerala government has launched a zero-waste initiative that aims to eliminate waste disposal in landfills. This initiative has helped promote sustainable waste management practices and reduce the state's waste disposal costs.
- **Tamil Nadu's Plastic-Free Initiative**: The Tamil Nadu government has launched a plastic-free initiative that aims to eliminate single-use plastics in the state. This initiative has helped promote sustainable consumption practices and reduce plastic waste.
- **Pune's Waste-to-Compost Initiative**: In an effort to turn all of the city's organic waste into compost, the Pune Municipal Corporation has started a waste-to-compost program. This program has promoted sustainable farming methods and assisted in lowering the city's trash disposal expenses.
- **Ahmedabad's Recycling Program**: The Ahmedabad Municipal Corporation has launched a recycling program that aims to recycle 100% of the city's dry waste. This initiative has helped reduce the city's waste disposal costs and promote sustainable consumption practices.

- **Hyderabad's Waste Management Initiative**: The Hyderabad Municipal Corporation has launched a waste management initiative that aims to segregate waste at source, compost organic waste, and recycle dry waste. This initiative has helped reduce the city's waste disposal costs and promote sustainable waste management practices.
- **Gujarat's Zero-Waste Initiative**: The Gujarat government has launched a zero-waste initiative that aims to eliminate waste disposal in landfills. This initiative has helped promote sustainable waste management practices and reduce the state's waste disposal costs.

Results

The various case studies point out that successful waste management initiatives in India are those that adopt a circular economy approach, promoting waste reduction, reuse, and recycling. The initiatives also highlight the importance of community engagement, education, and awareness in promoting sustainable waste management practices.

- **Increasing garbage Generation**: As a result of population increase and urbanisation, garbage generation has surpassed municipalities' ability to efficiently manage it.
- **Lack of Segregation at the Source**: Recycling efforts are made more difficult by the fact that many homes and institutions do not separate biodegradable and non-biodegradable waste.
- **Hazardous and Biomedical Waste**: Poor enforcement of guidelines for hazardous and biomedical waste disposal poses risks to human health and the environment.
- **Inadequate Infrastructure**: Urban municipal governments frequently lack the facilities required for the collection, processing, and disposal of waste. The issue is made worse by inadequate waste treatment facilities and outdated technologies.
- **Landfill Overload**: Methane emissions and groundwater contamination are among the environmental problems caused by the majority of landfills in India being overloaded.
- **Budgetary Restrictions**: The adoption of sustainable methods is hampered by a lack of funds for waste management initiatives.
- **Public understanding and Participation**: Inadequate disposal methods are frequently the result of a lack of community involvement and understanding of waste management programs.
- **Hazardous and Biomedical Waste**: Poor enforcement of guidelines

for hazardous and biomedical waste disposal poses risks to human health and the environment.

Discussion

The findings of this research paper suggest that adopting a circular economy approach to waste management is critical for promoting sustainable waste management practices in India. The circular economy approach promotes waste reduction, reuse, and recycling, and has been shown to have numerous environmental, economic, and social benefits. However, the adoption of a circular economy approach to waste management in India is faced with several challenges, including lack of infrastructure, lack of awareness, and lack of policy support.

Conclusion

In conclusion, this research paper highlights the importance of adopting a circular economy approach to waste management in India. The circular economy approach promotes waste reduction, reuse, and recycling, and has been shown to have numerous environmental, economic, and social benefits. The case studies presented in this research paper demonstrate that successful waste management initiatives in India are those that adopt a circular economy approach, promoting waste reduction, reuse, and recycling.

Recommendations

Based on the findings of this research paper, the following recommendations are made:

- There is a need to adopt a circular economy approach towards waste management.
- Efforts should be made to promote community engagement, education as well as awareness.
- Infrastructure should be developed for waste reduction, reuse as well as recycling.
- Provision of policy support for circular economy initiatives.
- More and more public private partnerships should be encouraged for waste management initiatives.

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HARNESSING AI FOR A SUSTAINABLE AND INTELLIGENT FUTURE

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Abstract

Artificial Intelligence (AI) has become a ground-breaking force, significantly transforming how humans live by enhancing numerous areas, including healthcare, education, transportation, and sustainability. This study investigates AI's role in improving the quality of life by examining its applications across diverse sectors. It focuses on how AI-driven solutions positively impact well-being, personal health, efficiency, and sustainability. By reviewing existing research, case studies, and analysis, the paper assesses both the advantages and challenges of incorporating AI into daily life. The results suggest that, although AI holds great promise for enhancing life quality, its ethical implications and societal effects require careful consideration to ensure responsible implementation.

Introduction

Artificial Intelligence (AI) encompasses systems or machines created to replicate human cognitive abilities such as learning, problem-solving, decision-making, and processing natural language. In today's world, AI has become a vital tool across multiple industries, improving human life by increasing efficiency, personalization, and accessibility. AI's applications span from innovations in healthcare to customized education, intelligent transportation, and environmental sustainability. As AI technologies advance, they hold the potential to greatly enhance both individual well-being and societal progress. This study examines how AI is integrated into contemporary life, highlighting its contributions to healthcare, education, and sustainability. It also addresses the ethical issues surrounding AI's use and provides insights into how it can further improve quality of life.

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Literature Review

AI in Healthcare

AI has revolutionized healthcare through innovations in diagnostics, patient care, and treatment optimization. According to Topol (2019), AI algorithms in medical imaging have significantly improved the accuracy of disease detection, particularly in early-stage cancer, heart disease, and neurological disorders. Deep learning technologies can analyse large datasets from medical images such as X-rays and MRIs, identifying abnormalities with greater precision than traditional methods.

Example:

IBM's Watson AI has been used in cancer diagnosis and treatment recommendations, helping oncologists make better-informed decisions. Another example is Google's DeepMind, which developed an AI model that predicts acute kidney injury up to 48 hours before it occurs, allowing for early intervention and improved patient outcomes.

Furthermore, AI is contributing to personalized medicine, where treatments are customized based on an individual's genetic makeup, improving treatment outcomes (Jiang et al., 2017). AI-powered chatbots like Ada and Buoy Health assist patients in self-diagnosing common illnesses and providing recommendations on when to seek medical help.

AI in Education

AI's potential to revolutionize education is evident through adaptive learning systems that provide personalized learning experiences. As highlighted by Holmes et al. (2019), AI-enabled platforms assess students' strengths and weaknesses, tailoring learning materials and assessments to fit individual needs. These technologies foster a more engaging and effective educational environment by adapting in real time to students' progress.

Example:

Duolingo, an AI-powered language learning app, customizes lessons based on a learner's performance and engagement. Similarly, Carnegie Learning's AI-driven math software personalizes exercises for students, ensuring they grasp difficult concepts through targeted practice.

AI also promotes inclusivity, making education more accessible for students with disabilities by offering assistive technologies such as speech-to-text and real-time translation tools (Smith et al., 2020). Microsoft's Seeing AI app helps visually impaired students by reading printed text aloud, while

AI-powered speech recognition software supports students with dyslexia in writing and reading comprehension.

AI in Transportation

AI is transforming the transportation industry, particularly through the development of autonomous vehicles. Self-driving cars use AI algorithms to interpret sensor data and make real-time decisions to navigate roads safely. As noted by Goodall (2014), autonomous vehicles can reduce accidents caused by human error and improve overall road safety.

Example:

Tesla's Autopilot and Waymo's self-driving technology utilize AI for real-time navigation, object detection, and accident prevention. AI-powered traffic management systems, such as those deployed in Singapore and Los Angeles, dynamically adjust traffic signals to reduce congestion and enhance mobility.

Additionally, AI is optimizing logistics and supply chain management. Companies like Amazon and FedEx use AI-driven route optimization to reduce delivery times and fuel consumption, improving efficiency and sustainability in transportation.

AI in Environmental Sustainability

AI's role in sustainability focuses on optimizing energy consumption, reducing waste, and mitigating the effects of climate change. As reported by Rolnick et al. (2019), AI technologies are used to manage energy grids efficiently, reducing carbon emissions and improving energy use in real time.

Example:

Google's DeepMind has collaborated with data centers to reduce energy consumption by 40% through AI-powered cooling system optimization. AI-driven climate models, like those developed by NASA and the European Space Agency, help predict natural disasters and assist governments in disaster preparedness.

Furthermore, AI helps monitor environmental changes through satellite imagery and predictive modeling, aiding in conservation efforts and resource management (Tebaldi et al., 2020). AI-powered drones are being used in rainforest conservation efforts to track illegal deforestation and poaching in the Amazon.

AI in Security and Surveillance

AI plays a critical role in enhancing security and surveillance by enabling real-time threat detection and analysis.

Example:

Facial recognition systems powered by AI help law enforcement agencies identify suspects and track criminal activity. AI-based cybersecurity solutions detect and prevent cyber threats by analyzing patterns and predicting potential attacks.

AI in Entertainment and Media

AI is reshaping the entertainment industry by personalizing content and improving user experiences.

Example:

Streaming services like Netflix and Spotify use AI-driven recommendation engines to suggest movies, shows, and music based on user preferences. AI is also used in video game development, enhancing virtual environments and character interactions.

AI in Business and Finance

AI has significantly transformed the business and financial sectors by improving efficiency, risk assessment, and decision-making.

Example:

AI-powered chatbots, like those used by banks and online retailers, enhance customer service by providing instant responses to inquiries. In finance, AI-driven algorithms predict stock market trends, detect fraudulent transactions, and automate trading processes, ensuring greater accuracy and efficiency in financial operations.

Objectives

This research aims to:

- Investigate the role of AI in enhancing the quality of life in modern human lifestyles.
- Analyse how AI contributes to healthcare, education, transportation, and environmental sustainability.
- Examine the challenges and ethical considerations related to the widespread adoption of AI technologies.
- Propose recommendations for the responsible integration of AI to maximize its benefits and minimize negative impacts.

Analysis and Findings

AI in Healthcare

- **Benefit:** Improved diagnostic accuracy (e.g., AI in cancer detection and genetic analysis).
- **Challenge:** Data privacy concerns and potential biases in AI algorithms.

AI in Education

- **Benefit:** Adaptive learning platforms improve student engagement and performance.
- **Challenge:** The digital divide limits access to AI-powered educational tools in underserved areas.

AI in Transportation

- **Benefit:** AI reduces human error in driving, leading to fewer road accidents.
- **Challenge:** Public trust and regulatory frameworks need to evolve alongside AI-driven automation.

AI in Sustainability

- **Benefit:** AI enhances energy efficiency and assists in climate change mitigation.
- **Challenge:** High computational power for AI models contributes to carbon emissions.

AI in Business and Finance

- **Benefit:** Automated financial analysis and fraud detection (e.g., AI-driven stock market predictions and Mastercard's fraud prevention system).
- **Challenge:** Over-reliance on AI in financial decision-making, leading to systemic risks.

AI in Security and Surveillance

- **Benefit:** Improved law enforcement through AI-powered facial recognition and cybersecurity systems (e.g., AI-driven threat detection in cybersecurity).
- **Challenge:** Ethical concerns regarding mass surveillance and data privacy.

AI in Entertainment and Media

- **Benefit:** AI-based content recommendation systems for personalized entertainment (e.g., Netflix and Spotify recommendations).

- **Challenge:** Risks of AI-generated deepfake content and misinformation.

Conclusion

Artificial Intelligence has the potential to significantly enhance the quality of life by transforming healthcare, education, transportation, and sustainability. AI-driven innovations have improved personal well-being, optimized resource management, and made various sectors more efficient and accessible. However, the widespread adoption of AI presents ethical challenges related to data privacy, bias, and job displacement.

To maximize the benefits of AI, it is crucial to develop and enforce ethical guidelines, invest in education and retraining programs for workers, and ensure equitable access to AI technologies. AI is a powerful tool that, when responsibly integrated, can lead to a more efficient, sustainable, and equitable future for all.

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VALUE EDUCATION FOR GREEN ENVIRONMENT

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Abstract

The idea of value education and its importance in fostering a green environment are examined in this research paper. Value education has been acknowledged as a crucial element in fostering environmental understanding and conduct, and the significance of environmental sustainability has grown in recent years. This paper explores how environmental awareness and value education are related, as well as how value education might encourage environmentally friendly behavior. The theoretical frameworks that support the idea of value education are also examined in the study such as the social learning theory and the theory of planned behavior. The study also addresses the impact of value education on fostering a green world, including the creation of environmental education initiatives and encouraging community participation in environmental preservation projects. The significance of value education in fostering a green environment is emphasized in the paper's conclusion, which also offers suggestions for methods of integrating value education into academic programs.

Keywords: *value education, green environment, curriculum.*

Introduction

In recent years, the significance of environmental conservation has been increased. The earth and its people suffer greatly as a result of pollution, climate change, and the depletion of natural resources. According to estimates from the World Health Organization (WHO), environmental issues such as air and water pollution and climate change are responsible for 24% of all deaths worldwide (WHO, 2018). Moreover, one of the main issues confronting

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humanity in the twenty-first century is environmental deterioration, according to the United Nations (UN) (UN, 2015).

As a result of these difficulties, the value of education in fostering environmental consciousness and conduct has come to light. According to UNESCO (2017), education is essential for advancing environmental preservation and sustainable development. A key approach for encouraging environmental consciousness and action has been identified as value education in particular (Hungerford & Volk, 1990).

The process of teaching people the value of qualities like empathy, respect, and accountability is known as value education. Because they encourage people to take action to safeguard the environment and help them acquire a sense of responsibility for it, these values are crucial in fostering environmental awareness and behavior. Value education, however, has not received enough attention in environmental education research and practice, despite its significance.

By examining the idea of value education and its importance in fostering a green environment, this paper seeks to close this gap. The study explores the connection between environmental awareness and value education as well as how value education can encourage environmentally friendly behavior. The theoretical frameworks supporting the idea of value education are also examined in the article, such as the social learning theory and the theory of planned behavior.

Literature Review

It is becoming more widely acknowledged that promoting sustainable development needs to include green education into the educational system. The present situation of green education in India, its difficulties, and its potential to further sustainability are examined in this literature review.

According to Hawkes (2007), values-based education is a method of thinking about education that centers on the exploration of meaning and purpose. The most crucial way to address all of the issues facing contemporary society, including the ecological disaster, is to cultivate human values through values-based education (Baba, 1979). Green education, sometimes referred to as environmental education, seeks to raise students' awareness of environmental challenges and encourage sustainable behavior. It includes a number of elements, such as learning new information, changing one's attitude, and changing one's behavior with regard to environmental education, as Filho et al. (2018).

Green education has been progressively integrated into India's official educational system during the past ten years. The Indian government and a number of non-governmental organizations have taken steps to integrate sustainability concepts into school curricula, according to Mukherjee (2019). These programs are in line with the global Sustainable Development Goals (SDGs), particularly SDG 4, which places a strong priority on giving everyone access to high-quality education and opportunities for lifelong learning. Notwithstanding these initiatives, there are still several barriers to the adoption of ecologically friendly education in India.

For green education to be successful, pedagogical techniques and curriculum design must be strong. Students' understanding and retention of sustainability concepts can be improved by including environmental issues into a variety of subjects rather than treating them as stand-alone modules, claim Sharma and Singh (2018). Additionally, research has shown how beneficial active learning strategies like field excursions and project-based learning are. Das (2021)

In India, the idea of "green schools," which incorporate ecological principles into their operations and instructional strategies, is becoming more popular. According to Bhardwaj and Sharma (2020), green schools set an example for pupils to follow by practicing environmental principles in addition to teaching them. These educational institutions frequently employ water conservation, waste segregation, and renewable energy.

Research suggests that although green education in India has great potential to promote sustainable development, overcoming current obstacles would take collaboration. Realizing the full potential of green education requires improved teacher preparation, sufficient funding, and effective policy implementation.

Significance

- Promoting a green environment requires value education.
- People can better grasp the significance of environmental preservation and the effects of human activity on the environment thanks to it. Value education motivates people to accept accountability for their behaviors and their effects on the environment by raising environmental awareness. In turn, this cultivates compassion and empathy for all living things, including plants and animals, which is crucial for advancing environmental preservation.
- Additionally, values education promotes a lifelong learning style, which

is necessary to stay current with emerging environmental issues and solutions.

- Additionally, it develops critical thinking and problem-solving abilities, which are crucial for dealing with environmental issues.
- In addition, value education fosters intellectual, emotional, and social growth—all of which are critical for advancing environmental preservation. It inspires people to embrace a global citizenship mindset, which is crucial for advancing sustainable development and environmental preservation.
- Additionally, value education encourages cultural variety and fosters a recognition of the significance of cultural heritage preservation, both of which are critical for advancing environmental conservation.

Objectives

- To understand the value to preserving the environment.
- To cultivate critical thinking abilities in order to assess environmental policy.
- To encourage community-based efforts to preserve cultural heritage.
- To foster sense of responsibility.

For Objective 1

In a society where pollution is a major concern, it is essential to understand the importance of protecting the environment. Climate change, biodiversity loss, and damage to ecosystems are all consequences of human activity's permanent environmental harm. Maintaining ecological balance and ensuring a sustainable future for future generations depend on environmental preservation. In addition, people have a moral duty to preserve the environment, which is closely related to social fairness, economic growth, and human well-being.

For Objective 2

Effectively evaluating environmental policies requires the development of critical thinking skills. People may assess environmental policy and make well-informed decisions that strike a balance between environmental preservation and human needs by using critical thinking. Additionally, it helps in evaluating the effectiveness of environmental policies, pinpointing regions in need of development and guaranteeing that they accomplish their stated objectives. Additionally, critical thinking develops environmental literacy, which empowers people to make educated decisions and traverse

complicated environmental challenges, ultimately encouraging democratic involvement and active citizenship.

For Objective 3

Promoting collective ownership and preserving community identity require supporting community-based initiatives to conserve cultural treasures. A community's sense of continuity and belonging depends heavily on its rich history of culture. Traditional customs, languages and practices are examples of intangible cultural heritage that is preserved through community-based initiatives. Additionally, community-based initiatives can help local economies and generate revenue while preserving cultural heritage by promoting sustainable tourism.

For Objective 4

In order to encourage environmental responsibility and motivate people to take action to preserve the environment, it is essential to foster a sense of responsibility. A sense of responsibility promotes individual freedom and responsibility by allowing people to make decisions that affect the environment. Additionally, it promotes community-based initiatives to address environmental issues by encouraging group action. Additionally, a feeling of responsibility fosters intergenerational fairness and sustainable development by acknowledging the needs and rights of future generations.

Challanges

There are lots of challenges to research on value education for a green environment.

- Measuring environmental values and attitudes, providing appropriate sample, and considering unrelated variables are among the methodological challenges.
- Developing an effective theory, defining and applying important concepts, and integrating several disciplines are all examples of theoretical problems.
- Accessing people, providing participant honesty, and collecting longitudinal data are some of the difficulties in data collection.
- Analyzing complex data, detecting causal connections, and accounting for confounding variables are all part of the analytical challenges.

In the end, bringing value education programs into action, maintaining program honesty, and evaluating program effectiveness are examples of practical challenges.

Educational Implications

- Understand environmental issues: Students learning environmental issues like pollution, climate change, and conservation.
- Creating eco-friendly habits: Value education motivates students to take up eco-friendly practices such as recycling, reusing, and reducing.
- Experiential learning: Students take part in everyday situations such as conservation initiatives, and gardening.
- Educational institutions may encourage students to become environmentally conscious, responsible, and engaged citizens by implementing value education for a green environment.

Recommendation

The following suggestions are offered in the context of the paper's findings:

1. To encourage a green environment that integrate value education into school curricula. Include environmental education and values in already-taught courses like language arts, social studies, and science.
2. Develop environmental education programs that integrate value education ideas, create and manage effective procedures that encourage value and environmental education in schools.
3. Provide funds and resources to enhance community involvement and teacher training programs related to environmental education. Also provide teachers with opportunities for professional development so they can learn about value and environmental education.
4. Include practical, hands-on learning activities that help students improve in their understanding of the environment and establish a connection with it.

Conclusion

A key element in fostering a green environment is value education. It encourages environmental awareness and conduct, fosters a sense of responsibility for the environment, and inspires people to take action to save the environment. Value education must thus be integrated into school curricula in order to support a green environment.

As a result, in order to promote a green environment, educators, legislators, and stakeholders must give value education top priority. This can be accomplished through encouraging community service, fostering the growth of emotional intelligence, and integrating value education into school

curricula. Together, we can assure a sustainable future for future generations and advance a greener environment.

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SUSTAINABLE ECONOMY FOR A DEVELOPED NATION: THE ROAD MAP

Ashish Baghla*

Abstract

Development is the major objective of every economy on the globe. Development was used to be understood as growth only or increase in GDP only but actually development is a different concept and based on various parameters. Growth is simply an indicator of economy as moving but development includes growth and also includes the concepts like upliftment of standard of living, improvement in healthcare and education quality, infrastructure, use of eco-friendly energy tools and better governance in all respects. Hence, the concept of development is vast and must be seen in broad manner with proactive approach. United Nations had set up agenda for 2030 with 17 sustainable development goals in 2015. International organizations and the agreements across various nations are setting up foundation stones for coming time to see sustainable energy, sustainable environment and of course sustainable productions in the field of agriculture and manufacturing sector. Use of electrical vehicles and solar energy are reducing the carbon emissions on one side but at the same time there are risks associated with the environmental damage at the time of disposal of batteries. As far as the agriculture sector was concerned, the farmers started using pesticides, fertilizers etc. to increase the production but ultimately it affected the productivity of land and also the quality of food grains. It clearly shows that people are looking towards growth perspective only but not on the development side. Development requires an extensive and collaborative approach towards changes to be brought in our life practices.

Keywords: *Development, sustainability, innovation.*

Introduction

This paper highlights few industries which could be the guiding measures

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for all other sectors to have development in long term. Every nation across the world talks about growth and development in terms of GDP and Per capita income. Development is the major objective of every economy on the globe. Development was used to be understood as growth only or increase in GDP only but actually development is a different concept and based on various parameters. Growth is simply an indicator of economy as moving but development includes growth and also includes the concepts like upliftment of standard of living, improvement in healthcare and education quality, infrastructure, use of eco-friendly energy tools and better governance in all respects.

Sustainability is not only a word, but it needs to be a campaign across the world. When we think of something good about the nature and the environment as a whole, all of us get a word in our mind called sustainable practices or sustainability. Now the thing is what sustainability actually means? Sustainability is not limited to planting trees only or running electrical vehicles only in place of fuel operated vehicles, but sustainability here means the way of living the life and changing our habits which should be pro-environment in every aspect. Environment constitutes a significant place not only in the lives of people but also for the economic considerations as well. A clean, hygienic and healthy environment or landscapes attracts a lot of tourism as well, which is beneficial for the economy as well as to build a strong image of the nation in international domain as well.

The concept of developed nation is more about economic grounds. Developed nation means an economy which has attained full level of employment, adequate healthcare facilities, zero hunger, quality infrastructure to cater the needs of business and society etc. At our earth, not majority of the countries have attained the stage of development in totality. Considerably majority of the countries are on the path of development but the pace is not adequate to attain the highest level.

So here is a crucial need of sustainable development first. As the global economy is marching towards development, the prime need is to inculcate sustainability into the practices of development. Sustainable development means the development in an area that harnesses the environmental and economic development for present generations without compromising with the needs of future generations. With the passage of time, in last three decades our globe had seen tremendous growth and exploitation of natural resources as well. The destruction of natural resources had resulted in imbalance with the nature and its elements. Clean water, productive soil, clean air, green lands, hygienic food etc. had been the matter of past. At present, the political

differences across international organizations, groups and nations, civil wars, increasing use of fossil fuels in vehicles and industries had resulted in polluted environment for the people. Hence, the ultimate goal of sustainability is to preserve the environment.

Objectives of The Study

1. To understand the concept and need of sustainable development.
2. To analyze the present Government initiatives for a sustainable economy.
3. To suggest the measures to have sustainability matched with the goal of developed nation.

Research Methodology

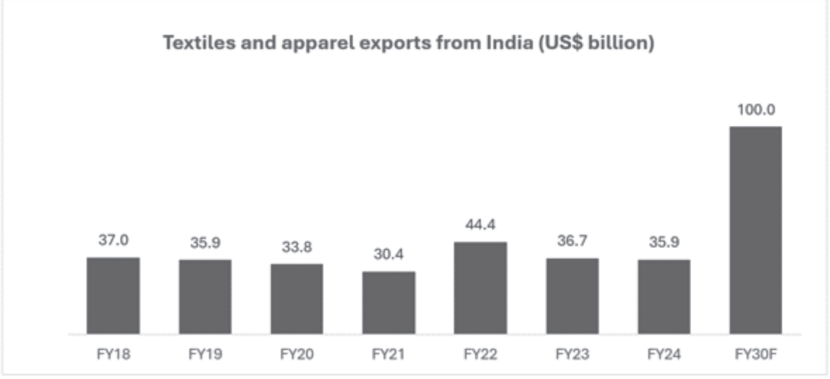
For the purpose of our study, more of secondary data have been used along with the brainstorming technique of the author in which descriptive analysis and suggestions are given as per the judgement and experience of the past trends and future needs.

Limitations of The Study

1. Chances of manipulated reports and data available on the internet.
2. As some of the measures are based on own judgements. So there might be some errors of broad coverage of the concept.

Data Analysis and Present Status of Various Initiatives

1. **Textile Industry:** Textiles industry in India constitutes a major share in the economic growth and also provides a good amount of employment to people in organized and unorganized sector. The data given below shows the trends that Indian textile industry had seen during past years and it also reflects that there were not huge differences made in the year on year growth rate. Still there are some highlights of government schemes and the achievements made by Indian textile industry



At present, India is the world's second-largest producer of textiles and garments, accounting for 4.6% of global trade and ranked as the third-largest textiles exporter in the world after China and Germany. In FY24, India exported US$ 35.9 billion of textile products, and it is projected to reach US$ 100 billion by FY30. As the textile market is huge and still expanding, it employs a substantial workforce of approximately 4.5 crore people, including 35 lakh handloom workers.

Need for sustainable transition

The textile industry's fast growth and shift towards synthetic fibres have increased concerns over environmental sustainability. Production volumes have doubled, while garment lifespan has decreased by 36% in the past 15 years. Even after a prolonged period, only 1% of fibres are used for recycled clothing, which shows dependency on fresh raw materials. Along with increase in demand, consumption and waste of textile, need to shift towards a more sustainable model also increased. The textile industry's value chain consumes significant resources, including chemicals, dyes, utilities and fuels, leading to negative environmental and social impacts. Key issues include wastewater discharge, air and noise pollution and workplace safety. Addressing these environmental challenges has become a primary focus for the textile industry.

Sustainable manufacturing of textile in India

Campaigns like Make In India, Start Up India have focused on boosting the manufacturing in the country and also to make the country self-reliant in various parameters. The textile sector had also seen good amount of investments coming to the clusters and accordingly some challenges were also posed for the environment as well. The government is responding to this issue by introducing policies focused on promoting sustainable manufacturing to balance the environmental sustainability.

Some of the key initiatives seen in this industry are mentioned below:

- **Recycling and Upcycling:** India's textile companies are implementing a culture of recycling and upcycling (where pre- or post-consumer textile waste material is converted into new garments) into their manufacturing practices. Many companies are using their waste and converting it into unique garments, thereby contributing to the global circular economy. A few Indian brands, including Pomogrenade, The Second Life and Patch over Patch, have implemented this sustainable concept of upcycling.

- **Using solar energy:** Many textile manufacturers are setting up rooftop solar panels, which not only reduce the usage of fossil fuels but also promotes eco friendly power. For example, Welspun a leading textile company, is shifting towards renewable energy sources, for instance solar and wind power.
- **Eco-conscious water management and dyeing process:** The excessive wastewater generation in the industry is a big concern, but in recent times Indian manufacturers are addressing this through innovative solutions. Some companies are reusing wastewater in their manufacturing processes and applying water recycling systems, which reduce their overall water footprint and promote water management in the sector. For example, BRFL Textiles Private Limited (BTPL), India's largest fabric processing facility, has introduced a new sulphur dyeing process, involving continuous dyeing without requiring water.

Innovation in textile industry

The Indian textile industry has experienced a transformational shift, with evolving technology as a driving force for innovation. Traditional methods are now combined with modern-edge advancements, exposing new abilities within the industry from the invention of spinning machines to synthetic fibres, with each innovation playing an important role in improving efficiency and productivity. Advanced machinery, automation and agile production methods have further advanced the industry's capabilities, positioning it for continued success in the years to come.

- **3D printing:** 3D printing offers improved flexibility in yarn processing and textile design, enabling unique and customised products. Digital printing has been gaining popularity, enhancing the industry's capabilities.
- **Pleating technology and Nanotechnology:** Pleating technology is the process of folding fabric into different shapes, creating differences in the volume and better texture of the fabric. Nanotechnology allows more efficient, water-resistant and low-maintenance production procedures, addressing energy concerns.
- **Artificial intelligence in design:** Artificial Intelligence (AI) is becoming a part of the textile industry, renovating the designing process. Machine learning algorithms now analyse extensive datasets, empowering designers to create innovative and trending patterns. This technology confirms that the industry remains at the forefront of evolving consumer preferences.

- **Biodegradable textiles:** Textile industry is also responding to the growing issue over waste management by using biodegradable fabrics. Advancement in material science has supported the development of textiles that naturally decompose, reducing the environmental impact. This transition displays the industry's commitment to sustainability and its efforts to minimise the ecological footprint of textile production and consumption.

Government Initiatives

- **Amended Technology Up-gradation Fund Scheme (A-TUFS)** The Government of India has implemented this credit-linked Capital Investment Subsidy (CIS) scheme to promote ease of doing business in India and create employment opportunity by supporting exports through the "Make in India" initiative in manufacturing in the textile industry. A total of US$ 75.74 million (Rs. 621.41 crore) in subsidies was distributed in 3,159 cases under the scheme.
- **Pradhan Mantri Mega Integrated Textile Region and Apparel (PM MITRA):** The PM MITRA is a government programme, with a purpose to support India in reaching the United Nations Sustainable Development Goal 9. The Government of India has approved the institution of seven textile parks under this scheme, with a total investment of US$ 541.82 million (Rs. 4,445 crore) for the years up to 2027–28.

Agricultural Industry

Agriculture holds a significant place in the Indian Economy if we consider the number of people employed by this sector in Direct or Indirect manner. Agriculture is the lifeblood for many other small and large industries in India but in the past decades, Agriculture is facing some challenges which are mentioned below:

- Primarily the reducing fertility of soil, financial issues of farmers, rising cost of inputs, traditional means of production fetching lower amount of produce and income etc. Hence, drastic changes need to be done in the overall processes and administration of agricultural industry in India.
- The another big challenge of this industry is limited amount of research in this field by farm scientists and lesser boost by the governments to promote innovation.

Suggestions to Handle Various Issues

Whenever a government speaks of poverty or poor, they consider it

as a static concept or phenomenon, but actually it is not. Poverty can be reduced by adopting various measures and not only by providing concessions or freebies for longer period of time. It would be necessary to mention here that criticism is not being done for the financial help being given to the poor people of marginal people but the issue is of financial burden which a nation would have to bear in longer period of time if the schemes continue to be there. Here are few suggestive measures to reduce poverty in the coming time:

1. Reservation criteria need to be based more on economic parameters than on social parameters which is prevalent in the nation since decades. The issue here is to analyze the economic status of various groups in our country irrespective of their caste or religion or residence.
2. Schemes like free education, free power supply, free healthcare etc are good measures but for short term only. After a family gets better economic status in the society, their welfare measures should be passed by the government to some other parts of society which is still unprivileged.
3. Technological upgradation and infrastructural development needs a strong push on the part of government because government spending is a prime source of income to the poor section of the society. Labour class and poor farmers should be provided interest free loans for a long term so as to build their shelters and also on the condition to repay the amount. As far as their livelihood is concerned, then small group of farmers need to set up their micro level firms of processed food, packed food etc. Here the labour class could get better employment opportunities if able entrepreneurs are encouraged from various parts of society to set up private industries.
4. We all talk about eco-friendly products and vehicles but all those things have limited contribution in overall reduction of harm to environment. Carbon emissions goes high with consumption of various products. Population here needs to be controlled or the concept of late marriages needs to be implemented to let the government organize the resources for its citizens in a nation.

Conclusion

As far as the protection of environment is concerned, people around the world has a lot to say, to implement and to think but the issue is lack of speedy implementation of projects at global level. It is understood that each nation is not capable of implementing the plans at the same pace that

of developed and capable nations but here all the countries needs to have collaborative approach towards sustainable development.

We talk about unemployment and poverty, but here also able entrepreneurship needs to be encouraged from within us. Collaborative approach for economic and social development would be the key to harness sustainable growth to achieve the dream of a developed nation. Missions like Clean India, Green India should not be kept in media only, but

Some of the notable environmental initiatives in India include – the Environment Protection Act, 1986; Wildlife Protection Act, 1972; National Action Plan on Climate Change (NAPCC); etc.

At last, it can be said that environment would be able to protect the people when people had put their best efforts to maintain a balanced development approach. Development can be green development when more use of recycling, reducing like principles will be followed for production, consumption or delivery of service.

United Nations had set up agenda for 2030 with 17 sustainable development goals in 2015. International organizations and the agreements across various nations are setting up foundation stones for coming time to see sustainable energy, sustainable environment and of course sustainable productions in the field of agriculture and manufacturing sector. Use of electrical vehicles and solar energy are reducing the carbon emissions on one side but at the same time there are risks associated with the environmental damage at the time of disposal of batteries. As far as the agriculture sector was concerned, the farmers started using pesticides, fertilizers etc. to increase the production but ultimately it affected the productivity of land and also the quality of food grains. It clearly shows that people are looking towards growth perspective only but not on the development side. Development requires an extensive and collaborative approach towards changes to be brought in our life practices.

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THE PARADOX OF FASHION: TECHNOLOGICAL ADVANCEMENTS VS. SUSTAINABILITY

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Abstract

The fashion industry, known for its rapid innovation and creativity, faces a paradox between technological advancement and sustainability. Its crucial to tread carefully, balancing innovation with the principles of responsible consumption and ethical production. By critically evaluating the paradox of technological advancements and sustainability, the fashion sector can work towards a future that embraces both creativity and responsibility, ensuring the longevity of both the environment and the industry itself.

The fashion world is perhaps one of the most dynamically innovative and creative industries in the world. However, new technologies clash with self-sustaining practices within fashion. It is critical to find a middle ground, which entails self-sustained consumption and production through innovation. By thoroughly scrutinizing the contradictions brought upon by technological revolutions, the fashion sector can strive for a future that welcomes innovation alongside responsibility. This will help foster the industry's growth as well as preserve the environment.

This research focuses on how the intersection of fashion and technology helps combat sustainability efforts while increasing environmental degradation. With this work, examining cutting-edge technologies, sustainable approaches, and the challenges behind them will ease the struggle of researching how to make fashion produce sustainably. Applying sustainable practices in the fashion industry is gradually becoming the goal while it simultaneously poses many difficulties, mainly economic, social, and technological. These problems can positively be tackled by the brands, consumers, and government regulation and policy for fostering self-

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sustained practices. Transparency and education alongside technology within the fashion industry can help alleviate these obstacles and facilitate a one step forward approach towards sustainable fashion.

Keywords: *Sustainable fashion, Ethical production, Innovations, Environmental degradation, disposal*

Introduction

The fashion industry is a prominent global sector that influences cultural, social, and economic landscapes. However, it is also one of the most environmentally detrimental industries, contributing to pollution, waste, and unethical labor practices. With the rise of technological advancements, the industry is at a crossroads: while technology offers solutions to enhance sustainability, it also complicates the challenges related to overconsumption and waste. This paper delves into the tension between these two forces, assessing how they coexist in the contemporary fashion landscape.

1. Understanding Fashion's Environmental Impact

Understanding fashion's environmental impact involves analyzing its effects throughout the lifecycle of garments, from raw material sourcing and production to consumption and disposal. This impact is both extensive and complex, affecting ecosystems, water resources, air quality, and human health. Below, we will break down the key components of fashion's environmental impact in detail.

(i) Resource Extraction

- ***Water Consumption:*** The fashion industry is a major consumer of water, with estimates suggesting that it takes approximately 2,700 liters of water to produce the cotton needed for a single t-shirt. Water-intensive crops like cotton and leather production lead to significant water depletion in certain regions, affecting local communities and ecosystems.
- ***Land Use***: The cultivation of raw materials for textiles (such as cotton, wool, and synthetic fibers) requires large areas of land. This can lead to deforestation, loss of biodiversity, and habitat destruction. The use of land for cash crops can also affect food security in vulnerable communities.

(ii) Production Processes

- ***Chemical Use***: The dyeing and treatment of fabrics involve harmful chemicals, such as toxic dyes and solvents, which can pollute water

systems when not properly managed. These chemicals pose risks to the health of workers and local populations, as well as to aquatic life.

- ***Energy Consumption***: The fashion industry is energy-intensive, consuming considerable amounts of fossil fuels during textile production, garment manufacturing, and transportation. The use of non-renewable energy sources contributes to greenhouse gas emissions.

(iii) **Greenhouse Gas Emissions**

- ***Carbon Footprint:*** The production and transportation of garments contribute significantly to carbon emissions. The United Nations Framework Convention on Climate Change (UNFCCC) reports that the fashion industry accounts for approximately 10% of global carbon emissions, more than international flights and maritime shipping combined.
- ***Waste Generation***: Landfilling textiles contributes to greenhouse gas emissions as organic materials decompose. Synthetic fibers, such as polyester and nylon, take hundreds of years to decompose, leading to long-term environmental consequences.

(iv) **Water Pollution**

- ***Effluent Discharge***: In many countries, the fashion industry frequently discharges untreated wastewater into rivers and oceans, leading to severe water quality issues. This effluent can be laden with harmful chemicals, contributing to the degradation of aquatic ecosystems and affecting drinking water sources.
- ***Microplastics***: Synthetic textiles shed microplastics during washing, which are not filtered out by treatment plants. These tiny plastic particles infiltrate aquatic ecosystems, harming marine life and potentially entering the human food chain.

(v) **Waste Accumulation**

- ***Fast Fashion and Landfills:*** The rise of fast fashion has resulted in higher levels of textile waste. Approximately 92 million tons of clothing is thrown away each year, a figure expected to increase if current consumption patterns continue. Many discarded garments end up in landfills, where they may take centuries to decompose.
- ***Incineration***: Some brands resort to incinerating unsold inventory, which generates harmful emissions and wastes resources. Incineration releases greenhouse gases and toxic substances, further contributing to environmental degradation.

(vi) **Transport and Logistics**

- ***Global Supply Chains:*** The fashion industry often relies on complex global supply chains that involve significant transportation emissions. Shipping garments across continents contributes to air pollution and increases carbon footprints associated with products.
- ***Last-Mile Delivery***: The rise of e-commerce has led to increased delivery traffic, which further exacerbates pollution and congestion, particularly in urban areas.

(vii) **Consumer Behavior**

- ***Overconsumption***: The culture of fast fashion promotes overconsumption, leading to more production and waste. Consumers often purchase low-cost garments that are worn only a few times before being discarded, creating a cycle of demand that drives environmental impact.
- ***Disposable Culture:*** The perception of clothing as a disposable commodity undermines investments in higher-quality, sustainable options. This mindset contributes to short-lived trends and further strains resources.

(viii) **Social and Economic Impact**

- ***Labor Practices***: While not strictly an environmental issue, unethical labor practices often accompany environmental degradation in the fashion industry. The pressure to produce cheap clothing can lead to exploitative labor practices, creating societal issues alongside environmental harm.
- ***Impact on Local Communities***: Environmental degradation caused by the fashion industry, such as water pollution and land exploitation, can adversely affect local communities, impacting their health, livelihoods, and access to resources.

The environmental impact of fashion is profound and multifaceted, affecting ecosystems, public health, and climate systems. A shift towards sustainable practices in the industry involves rethinking materials, production methods, and consumer behaviors. To mitigate these impacts, stakeholders across the supply chain must adopt circular economy principles, invest in sustainable technologies, and foster a culture of mindful consumption. This holistic approach will help create an industry that respects both the planet and its people.

2. Technological Advancements in Fashion

Technological advancements in fashion have paved the way for innovative sustainable materials, significantly reshaping how garments are created, produced, and consumed. These innovations aim to reduce environmental impacts, enhance durability, and promote circularity in the fashion industry. Here's a detailed overview of some key technologies and materials that illustrate this evolution toward sustainability:

Recycled Materials

- ***Post-Consumer Recycled Fabrics:*** Brands are increasingly using materials made from post-consumer waste, such as recycled polyester derived from plastic bottles. Companies like Patagonia and Adidas have successfully integrated recycled plastics into their product lines, reducing reliance on virgin materials and diverting waste from landfills.
- ***Recycled Cotton and Denim:*** Recycled cotton is created from pre-consumer and post-consumer cotton waste. Techniques include mechanically tearing down cotton waste and re-spinning it into new yarns. This process conserves resources and reduces the environmental impact associated with growing new cotton.

Bio fabrication

- ***Lab-Grown Materials***: Advances in biotechnology have led to the development of lab-grown materials, such as mycelium leather (derived from fungi) and bioengineered fabrics made from agricultural waste. Companies like MycoWorks and Bolt Threads are at the forefront of this innovation, producing sustainable, biodegradable alternatives to traditional leather and textiles.
- ***Cellulose-Based Fabrics: I***nnovative fabric production methods, such as those developed by companies like Tencel (Lyocell) and Spinnova, involve transforming plant materials (like wood pulp and agricultural waste) into fibers. The production processes use closed-loop systems that minimize waste and utilize non-toxic solvents.

Innovative Natural Fibers

- ***Organic Cotton:*** Unlike conventional cotton, organic cotton is grown without harmful pesticides and fertilizers. Its cultivation promotes healthier soil and biodiversity. Brands are increasingly adopting organic cotton to minimize the adverse environmental effects of traditional cotton farming.

- ***Sustainable Wool:*** Innovations in sustainable wool production focus on regenerative grazing practices and certification of ethical farming methods (such as ZQ Merino). These practices ensure animal welfare and contribute to soil health and carbon sequestration.
- ***Recycled Wool:*** Similar to recycled cotton, recycled wool is made from post-consumer garments or post-industrial production waste. This process conserves resources and reduces the negative impacts associated with new wool production.

Waterless and Low-Impact Dyeing Technologies

- ***Waterless Dyeing Techniques:*** Traditional dyeing processes consume huge amounts of water and are often harmful to the environment. Technologies such as digital printing and supercritical CO2 dyeing enable dyeing without water or with minimal water usage. Brands like DyeCoo utilize supercritical carbon dioxide to dye textiles, drastically reducing water consumption.
- ***Natural Dyes***: Advances in extracting and applying natural dyes from plants, minerals, and insects have gained popularity as sustainable alternatives. These dyes are often biodegradable and less harmful to the environment than synthetic dyes.

Smart Textiles and Fabrics

- ***Wearable Technology***: Integrating technology with textiles allows for the creation of smart fabrics that enhance user experience while promoting sustainability. For example, fabrics that regulate temperature or moisture reduce the need for frequent washing and increase garment longevity.
- ***E-textiles***: Fabrics embedded with electronic components can monitor various factors, from body temperature to physical activity, encouraging responsible use and care. This innovation may contribute to less frequent clothing replacements.

Closed-Loop Systems and Circular Economy Practices

- ***Take-Back and Recycling Programs:*** Advanced technologies enable companies to recycle and upcycle materials at the end of a garment's life cycle. Brands like H&M and Levi's have established take-back schemes where consumers can return used garments for recycling into new products.
- ***Blockchain for Transparency***: Utilizing blockchain technology,

companies can track the lifecycle of their products, providing transparency about sourcing and manufacturing. This innovation promotes greater accountability in sustainable practices and informs consumers about the environmental impact of their purchases.

Eco-Friendly Packaging and Distribution

- ***Biodegradable and Recyclable Packaging***: Advances in packaging technology enable brands to implement eco-friendly materials, such as compostable bags made from plant-based polymers or recycled cardboard for shipping. This reduces plastic waste and helps in achieving sustainability goals.
- ***Sustainable Distribution Methods:*** Companies are adopting more sustainable logistics solutions, like electric delivery vehicles and consolidated shipping practices, which minimize carbon footprints associated with garment distribution.

3D Printing and Additive Manufacturing

- ***3D-Customization:*** 3D printing allows for customized design and production, reducing waste from excess materials that are typical in conventional manufacturing processes. Brands are exploring 3D-printed accessories and garments tailored to customer preferences, promoting a made-to-order production model.
- ***Reduction of Waste:*** Additive manufacturing techniques minimize material waste by building garments layer by layer, contrasting with traditional subtractive manufacturing methods which cut away fabric to form shapes.

Technological advancements in sustainable materials are crucial in addressing the environmental challenges posed by the fashion industry. Innovations in recycling, biofabrication, natural fibers, and eco-friendly production processes can significantly reduce the ecological footprint of clothing production. As technology continues to evolve, the potential for creating a more sustainable fashion industry grows, allowing brands to meet consumer demand while respecting the planet. Stakeholder collaboration, from designers and manufacturers to consumers and policymakers, will be essential in driving these changes forward and making sustainable fashion the norm rather than the exception.

The Sustainability Challenges of Technology

The integration of technology in fashion has both positive and negative

environmental impacts. Here are some of the sustainability challenges associated with technology in fashion:

- **E-waste and Digital Pollution**:
  - The rapid obsolescence of wearable technology and smart clothing contributes to e-waste
  - The production of digital components and batteries also generates waste
- **Resource Extraction**:
  - The mining of rare earth minerals for electronics and textiles is often associated with environmental degradation
  - The production of synthetic materials used in technology-infused clothing requires non-renewable resources
- **Energy Consumption**:
  - The manufacturing and transportation of technology-infused clothing requires significant energy
  - The use of fast fashion business models can lead to overconsumption and waste
- **Data Collection and Surveillance**:
  - The use of wearable technology and smart clothing can raise concerns about data collection and surveillance
  - This can lead to a loss of consumer autonomy and control over personal data

Examples of Unsustainable Technology in Fashion

- **Smart Clothing with Built-in Batteries**: The use of non-rechargeable batteries in smart clothing can contribute to e-waste and pollution.
- **3D Printing with Non-Biodegradable Materials**: The use of non-biodegradable materials in 3D printing can lead to the creation of plastic waste.
- **Wearable Technology with Rare Earth Minerals**: The mining of rare earth minerals for wearable technology can have negative environmental impacts.

Opportunities for Sustainable Technology in Fashion

- **Circular Business Models**: Designing clothing and technology that can be easily recycled or repurposed can reduce waste and pollution.

- **Biodegradable Materials**: Developing biodegradable materials for technology-infused clothing can reduce the environmental impact of production and disposal.
- **Energy-Efficient Manufacturing**: Implementing energy-efficient manufacturing processes can reduce the environmental impact of production.

Strategies for a Sustainable Fashion Future

To achieve a sustainable fashion future, the industry must adopt a multifaceted approach that addresses environmental, social, and economic challenges. Here are some strategies to consider:

Environmental Strategies

1. **Reduce Waste**:
    - Implement closed-loop production and recycling systems
    - Design garments for longevity and recyclability
    - Encourage customers to return or recycle old clothing
2. **Use Sustainable Materials**:
    - Source eco-friendly materials, such as organic cotton, recycled polyester, and plant-based fabrics
    - Develop biodegradable and compostable materials
    - Reduce the use of synthetic materials
3. **Conserve Resources**:
    - Implement water-saving technologies and efficient dyeing processes
    - Reduce energy consumption through renewable energy sources and efficient manufacturing processes
    - Optimize supply chain logistics to minimize transportation emissions

Social Strategies

1. **Ensure Fair Labor Practices**:
    - Implement fair labor standards and working conditions
    - Provide training and education for workers
    - Ensure equal pay and opportunities for advancement
2. **Promote Diversity and Inclusion**:
    - Foster a diverse and inclusive workplace culture
    - Celebrate and support diverse talent and perspectives

- Encourage diverse representation in marketing and advertising

3. **Support Local Communities**:
   - Partner with local suppliers and manufacturers
   - Invest in community development and education programs
   - Encourage sustainable practices in local supply chains

Economic Strategies

1. **Design for Affordability**:
   - Create affordable and accessible fashion options
   - Offer rental or sharing services for luxury items
   - Implement price transparency and fair pricing practices
2. **Foster Collaborative Business Models**:
   - Partner with suppliers, manufacturers, and retailers to share knowledge and resources
   - Develop joint sustainability initiatives and goals
   - Encourage collaboration and information-sharing within the industry
3. **Invest in Sustainable Infrastructure**:
   - Develop and invest in sustainable manufacturing facilities and equipment
   - Implement energy-efficient and renewable energy systems
   - Invest in research and development of new sustainable technologies and materials

Industry-Wide Initiatives

1. **Establish Sustainability Standards**:
   - Develop and implement industry-wide sustainability standards and guidelines
   - Encourage brands to report on their sustainability performance
   - Foster transparency and accountability within the industry
2. **Foster Education and Awareness**:
   - Educate consumers about sustainable fashion practices and benefits
   - Provide resources and tools for consumers to make informed purchasing decisions
   - Encourage industry-wide education and training programs

3. **Support Policy and Regulatory Changes**:
    - Advocate for policy and regulatory changes that support sustainable fashion practices
    - Collaborate with governments and industry organizations to develop and implement sustainable fashion policies
    - Encourage industry-wide adoption of sustainable fashion practices and standards.

Conclusion

The fashion industry stands at a critical juncture, where the integration of technology can offer pathways to sustainability. However, it is crucial to tread carefully, balancing innovation with the principles of responsible consumption and ethical production. By critically evaluating the paradox of technological advancements and sustainability, the fashion sector can work towards a future that embraces both creativity and responsibility, ensuring the longevity of both the environment and the industry itself.

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A STUDY OF CORPORATE SOCIAL RESPONSIBILITY IN MEETING SUSTAINABLE DEVELOPMENT GOALS IN INDIA

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Abstract

Corporate Social Responsibility (CSR) has gained significant attention in India as a means for achieving Sustainability objectives outlined by the United Nations. This paper aims to look at the role in advancing India's progress toward these global objectives, centering on the assimilation of social, environmental, and economic initiatives by corporations. India's mandatory CSR framework, established by THE COMPANIES ACT (2013), mandates businesses to add a portion of their profits to social development, encouraging corporate participation in nation-building. The study examines various CSR strategies implemented by Indian companies and assesses their alignment with the SDGs, particularly in areas such as poverty reduction, quality education, clean energy, health, and gender equality. Through qualitative analysis of CSR reports, case studies, and interviews with corporate leaders and stakeholders, this paper identifies the challenges and opportunities for CSR in the Indian context. It discusses the impact of corporate initiatives on local communities, sustainable livelihoods, and environmental conservation. The paper highlights the synergies between business objectives and the SDGs, emphasizing the need for transparent reporting and accountability in CSR efforts. It concludes by offering recommendations for enhancing the successfulness of CSR in this country, urging companies to adopt innovative approaches that foster long-term sustainable development and put in implication fully to the SDGs. This research contributes to a deeper understanding of how CSR practices can be strategically aligned with global sustainability frameworks to drive positive change in India.

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Keywords: *Corporate Social Responsibility, SDGs, Sustainable Development, Poverty Alleviation, Environmental Conservation.*

Introduction

The concept of corporate social responsibility, or CSR, has undergone significant transformation over time, with businesses increasingly recognizing their role in contributing to societal and environmental well-being. In India, CSR has become an essential component of the corporate landscape, particularly following the adoption of the Companies Act of 2013, which mandates certain companies to allocate a portion of their profits toward environmental and social projects. CSR has emerged as a crucial tool for companies to match their operations with more general global sustainability goals as the world works to achieve the Sustainable Development Goals (SDGs), which were set forward by the UN. India's commitment to the SDGs, which aim to address critical issues such as poverty, inequality, environmental degradation, and climate change, has prompted a move in how companies view their responsibilities. Corporate entities are being asked to take on a more crucial role in fostering sustainable development, especially in areas such as education, health, clean energy, and gender equality. CSR initiatives, therefore, offer an opportunity for businesses to contribute directly to these goals by investing in projects that create long-term social impact. While CSR has grown in importance in India, questions remain regarding its effectiveness in meeting the SDGs. The Indian corporate sector faces challenges such as resource limitations, a lack of clear strategies for measuring impact, and inconsistent implementation across industries. This study aims to explore the alignment of CSR initiatives in relation to the SDGs, evaluating how Indian businesses are contributing to sustainable development and identifying the gaps must be dealt with to enhance CSR's potential in meeting these global goals. The study also explores how corporate India can build extra efficient enterprises among administration as well as public to impel sustainable progress in the nation.

Sustainable Development (SD) and Corporate Social Responsibility (CSR)-Concept and Evolution

The idea of "Sustainable Development" has its origins in the 18th century within forestry practices, where a regulated approach to cutting trees was introduced to ensure long-term ecological balance. This practice ensured the ongoing supply of wood without depleting resources for future generations. The international conversation around sustainability gained momentum

in the 1970s, particularly following the "*LIMITS TO GROWTH"* report by the Club of Rome (1972). This report sparked discussions about eco-development, focusing on the need to protect resources and the environment for future generations. The WCED-World Commission on Environment and Development (1987) defined SD as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition emphasized both the urgency of addressing the needs of the world's poor and the limitations imposed by technology and social systems. The SD things must be dealt with by Elkington (1998), who introduced the idea of the "triple-bottom-line," emphasizing the need for businesses to balance profit with environmental and social concerns.

Corporate Social Responsibility (CSR), on the other hand, emerged earlier, with its foundations in the 1950s and 1960s. Bowen (1953) defined CSR as an obligation for companies to adopt policies and actions aligned with societal values. Initially, the term "social responsibility" was used more commonly, referring to the expansion of companies' economic and legal obligations to include responsibilities towards society. Carroll (1979) identified CSR as comprising four components economic, legal, ethical, and discretionary responsibilities. The CSR perspective challenges the neoclassical economic view, represented by Friedman (1962), which stated that companies should center exclusively on revenue maximization. Instead, CSR acknowledges that companies have environmental and social obligations to fulfill. The WBCSD, World Business Council for Sustainable Development (2006) and the European Commission (2001) further expanded CSR, framing it as a commitment by businesses to contribute to sustainable growth in a social context with accountable practices.

The Transition to Sustainable Practices and Corporate Social Responsibility

The focus on social, environmental, and economic sustainability has develop into a central element of many CSR initiatives. Originally, sustainability was seen primarily as the protection and protection of resources. On the other hand, in 1987, the World Commission led by G.H. Brundtland (former PM Norway) introduced a ground breaking action plan for environmental sustainability. The Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." This definition has happen to a cornerstone for businesses today, challenging them to create strategies that foster economic success while also safeguarding their employees and the environment.

As sustainability concerns grow, commences are at this time in front of growing stress from stakeholders, including customers, employees, investors, and activists, to create a clear framework for balancing economic prosperity with social responsibility and environmental care. Concurrently, institutional shareholders are being insisted on to consider CSR factors when evaluating companies (Moon, 2007). In 2005, the UNEP (United Nations Environment Programme) Financial Initiative commissioned a study by a leading law firm to examine whether institutional investors, such as pension funds and insurance companies, could legally integrate ESG- environmental, social, and governance issues into their investment processes. The resulting account create that not merely were investors permitted to consider ESG factors, but in several case in points, they were also obligated to do so.

CSR and Sustainable Development in India

CSR in this country has developed from being a charitable practice to fitting a lawfully mandated framework under the India's Companies Act (2013). Over the days, CSR, expanded significance as companies have recognized their role in addressing the social and environmental challenges facing the country. By arrange in a lining commercial practices with SDGs, these initiatives are contributing significantly to India's progress in areas i.e. poverty alleviation, environmental sustainability, healthcare, education and gender equality.

CSR activities in India underwent a dramatic change as a result of the Companies Act of 2013. Companies with a net worth of at least Rs. 500 crore, an annual turnover of at least Rs. 1,000 crore, or a net profit of at least Rs. 5 crore are required under Section 135 of the Act to devote at least 2% of their average net earnings over the previous three years to corporate social responsibility initiatives. Large firms now feel obligated to support sustainable development and societal well-being as a result of this clause.

Schedule VII of the Act also offers a comprehensive list of CSR emphasis areas. Promoting healthcare, education, rural development, environmental sustainability, ending hunger and poverty, gender equality, and addressing social injustices are a few examples. The framework pushes businesses to concentrate on long-term sustainable projects that have a big influence on the environment and the community.

The Sustainable Development Goals (SDGs) of the United Nations are a global blueprint for achieving a more sustainable and equitable future for all. India, being a signatory to the SDGs, has aligned its CSR efforts with these

global objectives. The Indian government and companies have recognized that business success is more than just economic expansion. but also about fostering positive social and environmental outcomes. Indian businesses are increasingly integrating their CSR initiatives with the SDGs, focusing on issues such as economical and renewable energy, gender equality, clean water and sanitation, climate change, and high-quality education (Payne, 2006). Incorporating the SDGs into their CSR strategies, companies not only contribute to the global development agenda but also help build a better society for future generations. For example, by lowering their carbon footprint and supporting sustainable energy sources, businesses who invest in renewable energy are directly supporting SDG 7 (Affordable and Clean Energy). Initiatives in the fields of education and healthcare also support SDG 4 (Quality Education) and SDG 3 (Good Health and Well-Being) (Herrmann, 2004).

Key Focus Areas of CSR in India

1. **Education**- Education is a key pillar of CSR in India. Many businesses are concentrated on on promoting quality education, especially in underprivileged and rural regions. Initiatives include building schools, providing scholarships, and setting up training programs to improve skills and employment opportunities for youth. Companies also invest in teacher training programs and digital learning platforms to enhance the quality of education in remote locations.
2. **Healthcare** -Healthcare is another critical area for CSR investments. Companies often set up mobile medical clinics, support hospitals in rural regions, and fund health awareness campaigns. These initiatives aim to reduce the disparity between rural and urban people' access to healthcare and improve overall health outcomes in underdeveloped regions. Some companies also invest in healthcare infrastructure and provide medical supplies to underserved communities.
3. **Environmental Sustainability**- Environmental conservation is a growing concern in India, given the country's rapid industrialization and the environmental challenges it faces, such as air pollution, water scarcity, and deforestation. Many businesses concentrate their CSR efforts on on sustainable environmental practices, including afforestation programs, waste management, water conservation, and promoting renewable energy. Projects like rainwater harvesting and the restoration of natural ecosystems are increasingly common.

4. **Gender Equality and Women Empowerment** - Promoting gender equality is a significant CSR focus in India. Many companies have introduced programs to empower women by providing skill development, leadership training, and equal opportunities in the workplace. Women's health initiatives, awareness programs, and financial literacy workshops are also common. These programs not only enhance the lives of women but also contribute to SDG 5 (Gender Equality).
5. **Rural Development** - Rural India remains a significant focus area for CSR in India. Companies engage in projects related to rural infrastructure development, skill enhancement, and financial inclusion. These projects often focus on improving living standards, providing access to clean water, electricity, and improving sanitation facilities in rural areas.
6. **Disaster Relief** - Disaster management and relief work form an integral part of CSR. Corporations often engage in providing emergency supplies, setting up relief camps, and rebuilding infrastructure post-disaster (Ray, 2013). Whether it is floods, droughts, or earthquakes, businesses play an essential role in the recovery and rehabilitation of affected communities.

Challenges and Criticism

While CSR is a crucial instrument for sustainable growth, there are several challenges and criticisms associated with its implementation in India (Sharma, 2009). One of the main concerns is the probable for "green washing," where companies exaggerate or misrepresent their CSR activities to advance their civic picture devoid of building a substantial impact. This creates a misleading perception of corporate responsibility and may undermine the effectiveness of genuine CSR initiatives. Another challenge is the be deficient in of intelligibility and answerability in CSR activities. Companies sometimes fail to report on the impact of their CSR initiatives or do not provide adequate information about how funds are allocated and utilized (Ghosh & Chakraborti, 2010). As a result, there is a need for stronger monitoring mechanisms and greater transparency to ensure that CSR funds are being used effectively. There is often criticism that CSR efforts are fragmented and lack strategic integration with a company's core business goals. Many companies focus on short-term initiatives or one-off projects rather than long-term, sustainable solutions.

Conclusion

CSR, in India has become a crucial mechanism for advancing sustainable

development. The legal mandate introduced by the Companies Act, 2013 has significantly increased corporate participation in addressing the nation's public and ecological challenges. Through strategic alignment with the United Nations' -SDGs, Indian businesses have increasingly focused on contributing to poverty alleviation, gender equality, healthcare,, environmental sustainability, quality education and other critical areas. CSR initiatives, such as rural development projects, skill-building programs, healthcare camps, and environmental conservation efforts, are driving positive social change. These efforts directly support India's broader developmental objectives and contribute to meeting global sustainability targets. For instance, companies investing in renewable energy or water conservation are helping mitigate climate change and ensure access to clean water, aligning with SDG 13 (Climate Action) and SDG 6 (Clean Water and Sanitation). Challenges persist, including concerns about transparency, accountability, and the authenticity of CSR activities. To maximize the effects of CSR in India, it is indispensable to strengthen monitoring and evaluation mechanisms, making sure that resource are inefficiently utilized and aligned with long-term sustainable goals. The focus should shift from short-term philanthropic activities to integrated, strategic initiatives that bring about lasting change in the communities they serve. CSR in India plays a vital role in achieving the SDGs. By prioritizing social and environmental considerations alongside business goals, corporations can drive a new equitable, inclusive and sustainable future. The growing emphasis on aligning CSR with sustainability objectives reflects an evolving recognition that long-term success is inseparable from contributing to the broader well-being of society and the planet.

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SUSTAINABILITY: ENDEAVORS AND CHALLENGES

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Abstract

Sustainability is a multifaceted concept encompassing environmental, social, and economic dimensions, crucial for ensuring a viable future for generations to come. This research article examines recent endeavors in sustainability across various sectors, identifies the challenges hindering progress, and proposes potential solutions and policy frameworks to facilitate a more sustainable trajectory. Ten recent studies have been reviewed highlighting innovative efforts in renewable energy, sustainable agriculture, circular economy, and urban planning, while also addressing challenges such as climate change, resource depletion, social inequality, and governance limitations. By analyzing these efforts and challenges, the paper aims to contribute to a deeper understanding of the complexities involved and provide insights for policymakers, researchers, and practitioners striving to advance sustainability globally.

Keywords: *Sustainability, Climate Change, Resource Depletion, Circular Economy, Renewable Energy, Sustainable Agriculture, Policy Framework.*

Introduction

Sustainability has emerged as a critical imperative in the 21st century, driven by growing awareness of the interconnectedness between human activities and the environment. The concept transcends mere environmental protection and encompasses the need to balance economic development, social equity, and ecological integrity (WCED, 1987). The United Nations Sustainable Development Goals (SDGs) further solidify this global commitment, providing a comprehensive framework for addressing diverse sustainability challenges.

The concept of sustainability, often defined as meeting the needs of

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the present without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987), has gained prominence in response to growing concerns about environmental degradation, resource depletion, and social inequities. Governments, businesses, and individuals are increasingly recognizing the urgency of transitioning towards sustainable practices. This transition requires a comprehensive approach that encompasses environmental, social, and economic dimensions of sustainability.

However, achieving sustainability is not without its obstacles. The pursuit of economic growth often clashes with environmental conservation, leading to resource depletion, pollution, and climate change. Social inequalities exacerbate these issues, with marginalized communities often bearing the brunt of environmental degradation. Furthermore, inadequate governance structures and policy frameworks hinder effective implementation of sustainable practices.

This research article aims to provide a comprehensive overview of recent endeavors in sustainability, highlighting innovative solutions and strategies across various sectors. It also analyzes the challenges that impede progress and propose potential solutions and policy frameworks to overcome these obstacles. By examining both the achievements and the limitations, the study seek to contribute to a deeper understanding of the complexities involved and inform future efforts towards a more sustainable world.

Objectives

The objectives of this research article are:

- To review recent studies highlighting endeavors in sustainability across various sectors.
- To identify the key challenges hindering progress towards sustainability goals.
- To analyze potential solutions and strategies for overcoming these challenges.
- To propose a policy framework that can facilitate the transition to a more sustainable future.

Endeavors for Sustainability: A Review of Recent Research

This section presents a review of ten recent studies showcasing innovative efforts in sustainability across various sectors.

Renewable Energy:

- **Study 1 (Jacobson et al., 2018):** This study proposes a roadmap for transitioning the United States to %100 renewable energy by 2050, focusing on wind, water, and solar power. The research finds that this transition is technically and economically feasible, offering significant benefits in terms of air quality, job creation, and climate change mitigation.
- **Study 2 (IRENA, 2021):** The International Renewable Energy Agency (IRENA) reports on the declining costs of renewable energy technologies, making them increasingly competitive with fossil fuels. The study highlights the potential for renewable energy to power the global economy while reducing carbon emissions.

Sustainable Agriculture:

- **Study 3 (Pretty et al., 2018):** This study investigates the benefits of agroecological farming practices, such as crop diversification, reduced tillage, and integrated pest management. The research demonstrates that these practices can enhance biodiversity, improve soil health, and increase crop yields while reducing reliance on synthetic fertilizers and pesticides.
- **Study 4 (Poore & Nemecek, 2018):** This study provides a comprehensive assessment of the environmental impacts of food production, identifying animal agriculture as a major contributor to greenhouse gas emissions, land use, and water pollution. The research highlights the potential for shifting towards plant-based diets to reduce the environmental footprint of food consumption.

Circular Economy:

- **Study 5 (Ellen MacArthur Foundation, 2015):** This report defines the circular economy as a regenerative system that minimizes waste and maximizes resource utilization. The report outlines strategies for designing products for durability, repairability, and recyclability, and for developing closed-loop supply chains that recover and reuse materials.
- **Study 6 (Schroeder et al., 2019):** This study analyzes the barriers and opportunities for implementing circular economy principles in European cities. The research identifies the need for supportive policies, collaborative partnerships, and innovative business models to facilitate the transition to a circular economy.

Urban Planning:

- **Study 7 (Newman & Jennings, 2011):** Authors review the concept of sustainable urban development and the different approaches to implement it around the world. The authors highlight the need for integrated planning approach to deliver a sustainable city.
- **Study 8 (Glaeser, 2011):** This study examines the role of cities in promoting sustainability, arguing that urban density and innovation can lead to more efficient resource utilization and reduced carbon emissions. The research highlights the importance of investing in public transportation, energy-efficient buildings, and green infrastructure.

Social and Technological innovations

- **Study 9 (Hossain, 2024)**: This study highlights the importance of community engagement and participatory research in fostering sustainable development initiatives for community-based sustainability
- **Study 10 (Sivarajah, 2023)**: This study identifies the role of digital technologies in driving sustainability transitions, as well as related challenges and opportunities for future research. This study emphasized the impact of technology on sustainability transition

Challenges to Sustainability

Despite significant endeavors, substantial challenges continue to hinder progress towards sustainability.

Climate Change:

The escalating threat of climate change poses a fundamental challenge to sustainability. Rising global temperatures, sea-level rise, and extreme weather events threaten ecosystems, infrastructure, and human well-being. Mitigation efforts, such as reducing greenhouse gas emissions, and adaptation strategies, such as building resilience to climate impacts, are crucial for addressing this challenge.

Resource Depletion:

The unsustainable consumption of natural resources; including water, minerals, and fossil fuels, leads to resource depletion and environmental degradation. Transitioning to a circular economy, reducing consumption, and investing in resource-efficient technologies are essential for managing resource scarcity.

Social Inequality:

Social inequalities within and between countries exacerbate sustainability challenges (Hossain, 2023). Marginalized communities often bear the brunt of environmental degradation, while lacking access to resources and opportunities for sustainable development. Addressing social inequalities and promoting inclusive development are crucial for achieving equitable and sustainable outcomes.

Governance Limitations:

Inadequate governance structures and policy frameworks hinder effective implementation of sustainable practices. Weak enforcement of environmental regulations, lack of coordination between government agencies, and insufficient public participation impede progress towards sustainability. Strengthening governance, promoting transparency, and fostering collaboration are essential for overcoming these limitations.

Potential Solutions and Policy Framework

Addressing the challenges to sustainability requires a multifaceted approach encompassing technological innovation, policy interventions, and behavioral changes.

Technological Innovation:

Investing in research and development of sustainable technologies, such as renewable energy, energy storage, and sustainable agriculture, is crucial for accelerating the transition to a low-carbon economy. Promoting technology transfer and diffusion to developing countries is also essential for ensuring equitable access to sustainable technologies.

Policy Interventions:

Implementing effective policies, such as carbon pricing, renewable energy mandates, and environmental regulations, can incentivize sustainable practices and discourage unsustainable activities. Providing financial incentives, such as subsidies and tax credits, can also support the adoption of sustainable technologies and practices. Government policies such as environmental tax reform (ETR) can address the pollution and environmental damage caused by production and consumption activities by changing relative prices to reflect external environmental costs (Hossain, 2022).

Behavioral Changes:

Promoting public awareness and education about sustainability issues

can encourage individuals to adopt more sustainable lifestyles. Supporting community-based initiatives and empowering local communities to participate in decision-making processes can foster a sense of ownership and responsibility for sustainability.

Policy Framework:

Developing a comprehensive policy framework that integrates environmental, social, and economic considerations is essential for guiding sustainable development. This framework should include clear goals, targets, and indicators for measuring progress, as well as mechanisms for monitoring and enforcement. International cooperation and collaboration are also crucial for addressing global sustainability challenges.

Conclusion

Sustainability is a complex and multifaceted challenge that requires concerted efforts across various sectors. While significant endeavors are underway to promote sustainability through technological innovation, policy interventions, and behavioral changes, substantial challenges remain. Climate change, resource depletion, social inequality, and governance limitations continue to hinder progress towards sustainability goals.

Overcoming these challenges requires a holistic and integrated approach that addresses the interconnectedness between environmental, social, and economic dimensions. Investing in sustainable technologies, implementing effective policies, promoting public awareness, and strengthening governance are crucial for accelerating the transition to a more sustainable future. International cooperation and collaboration are also essential for addressing global sustainability challenges. By embracing sustainability as a guiding principle, we can create a more equitable, resilient, and prosperous world for generations to come.

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