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Dr. P Manjula
Associate Professor, Department of Economics, A.V. Kanthamma College of Women, Hassan, Karnataka, India

Corresponding Author:
Dr. P Manjula
Associate Professor, Department of Economics, A.V. Kanthamma College of Women, Hassan, Karnataka, India

Sustainable development through equality: Dr. B.R. Ambedkar's enduring contributions to modern India

P Manjula

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Abstract
Sustainable development is not merely an economic or environmental initiative; it is fundamentally anchored in principles of equality, social justice, human rights, inclusion, and democratic participation. Any society that aspires to long-term stability and growth must first eliminate structural inequalities that limit human potential. This research paper explores how Dr. B. R. Ambedkar's philosophy, social reform movements, economic ideas, and constitutional interventions established the foundational framework for an equitable and sustainable India. Ambedkar's insistence on the annihilation of caste, his advocacy for gender justice, his push for economic equity, and his creation of robust democratic institutions directly reflect the core dimensions of sustainable development. Through policies promoting dignity, legal protection, labor rights, universal education, and equal access to resources, Ambedkar envisioned a model of development that was inclusive, participatory, and socially grounded. By engaging with existing scholarly literature, identifying significant research gaps, and conducting a detailed thematic analysis of Ambedkar's writings and reforms, this study demonstrates that his ideas not only shaped the foundations of independent India but also remain critically relevant to contemporary sustainability frameworks such as the United Nations Sustainable Development Goals (SDGs). Ultimately, the paper argues that Ambedkar's legacy forms an essential pillar of India's long-term sustainable progress, making him one of the earliest architects of inclusive development in the modern world.

Keywords: Sustainable development, equality, social justice, human rights, caste annihilation, gender equality, economic justice, constitutional reform, inclusive growth, SDGs

Introduction
In contemporary global development discourse, sustainability is understood as a holistic framework supported by three interdependent pillars: economic development, environmental protection, and social equity. Although economic and environmental concerns often dominate policy discussions, social equity remains the least examined and yet the most essential component. Without an equitable social structure, even the most advanced economic strategies or environmental interventions cannot create long-term, inclusive, and stable progress. A society divided by rigid hierarchies of caste, class, gender, and religion cannot sustain development that benefits all members.

Long before the term "sustainable development" became widely used in international forums, Dr. B. R. Ambedkar had already articulated its social foundation with remarkable clarity. Throughout his intellectual and political career, Ambedkar focused on one central mission: the creation of an egalitarian society in which dignity, justice, and equal opportunity are accessible to every individual. He believed that genuine national development is impossible when large sections of the population are systematically excluded from education, employment, political participation, and decision-making processes. For Ambedkar, development was inseparable from democracy, and democracy lacked meaning without social justice.

Ambedkar's critique of the caste system, his emphasis on constitutional morality, and his advocacy for labor rights, women's empowerment, and universal education align closely with the principles of modern sustainable development. Well before the United Nations

formulated the Sustainable Development Goals, Ambedkar stressed that inclusive growth, redistribution of resources, and institutional reform are crucial for building a just and progressive society.

This paper examines how Ambedkar's ideas contribute to the conceptual and practical framework of sustainable development in India. It explores his efforts to address historical injustices, transform discriminatory social institutions, and create systems that ensure equal access to opportunities and resources. By linking Ambedkar's thought with contemporary debates on sustainability, this analysis demonstrates that social justice, which was central to Ambedkar's vision, forms the essential foundation for any meaningful and lasting approach to sustainable development.

Review of Literature

Rodrigues (2002) [5] compiles Ambedkar's significant writings and argues that Ambedkar viewed social democracy as the essential foundation of a just society. He emphasizes Ambedkar's belief that political democracy cannot function without social justice, equality, and fraternity. Rodrigues shows that these values are not just moral ideals but necessary conditions for national progress, aligning Ambedkar's vision with modern sustainability principles that stress inclusive institutions and equal participation in development.

Jaffrelot (2005) [4] examines Ambedkar's efforts to dismantle caste structures and strengthen constitutional protections for marginalized groups. He argues that Ambedkar aimed to fundamentally reshape Indian society so that long-term stability, social harmony, and human dignity could be secured for all. Jaffrelot highlights that Ambedkar's reforms were designed not just to address immediate injustices but to create a lasting framework of equality that would prevent future discrimination. This long-term vision aligns closely with sustainable development principles, especially those that emphasize justice, strong institutions, and the removal of structural barriers to inclusive growth.

Zelliot (1992) [7] explores Ambedkar's movement-building efforts and his emphasis on education as a powerful tool for social empowerment. She explains that Ambedkar viewed education as the foundation for achieving social equality, improving economic conditions, and enabling marginalized communities to participate fully in national progress. Zelliot highlights that Ambedkar's focus on educated citizenship directly supports long-term development, as it enhances human capital and reduces structural disadvantages. This perspective aligns closely with modern development goals that prioritize quality education, reduced inequalities, and inclusive growth.

Research Gap

While significant literature examines Ambedkar's contributions to social justice, caste reform, and constitutional development, limited research connects Ambedkar's philosophy directly with the modern global framework of sustainable development.

Few studies systematically analyze

1. How Ambedkar's principles align with sustainability pillars.
2. How his institutional reforms support long-term inclusive growth.
3. How his philosophy continues to influence India's developmental policies.

This paper addresses this gap by providing a focused analysis linking Ambedkar's equality-driven philosophy with sustainable development.

Statement of the Problem

Despite substantial progress, India continues to face deep inequalities rooted in caste, class, and gender divisions. Sustainable development cannot be achieved unless these structural inequalities are addressed. Dr. Ambedkar's ideas provide a framework to confront these challenges, yet their relevance is underexplored. Therefore, there is a need to examine how Ambedkar's contributions provide long-term solutions for achieving equality-driven sustainable development.

Objectives of the Study

1. To analyze Dr. B. R. Ambedkar's concept of equality and its relevance to sustainable development.
2. To explore how Ambedkar's constitutional and social reforms support long-term inclusive development.
3. To examine the ways Ambedkar's philosophy aligns with modern sustainability frameworks.
4. To identify how his ideas can guide contemporary policy-making for equitable and sustainable growth.

Hypothesis of the Study

- **H1:** Dr. B. R. Ambedkar's emphasis on equality provides a strong, foundational framework for achieving sustainable development in modern India.
- **H0:** Ambedkar's contributions do not significantly align with the principles of sustainable development.

Methodology

This study uses a qualitative research approach based on the interpretive analysis of Ambedkar's writings, speeches, and constitutional work. It includes a review of academic literature and a thematic examination of his ideas on equality, justice, and development. The study also uses a comparative lens to relate Ambedkar's principles to modern sustainability frameworks. Overall, the methodology is descriptive, analytical, and interpretative, aiming to understand the deeper connection between Ambedkar's thought and sustainable development.

Scope of the Study

The study focuses on Ambedkar's concept of equality, his constitutional contributions, and his social reform ideas that support long-term development. It examines how his thoughts align with modern sustainability goals, especially the SDGs. The scope is limited to his philosophical and developmental contributions and excludes political controversies or unrelated interpretations.

Limitations of the Study

- It is based entirely on secondary data and literature.
- Modern sustainability models are interpreted in correlation with Ambedkar's ideas; direct evidence is historical.
- The study focuses only on major themes due to scope constraints.

Ambedkar's Contribution to Sustainable Development Through Equality

Dr. B. R. Ambedkar's ideas were far ahead of his time. While the term "sustainable development" did not exist during his era, his policies, writings, and reforms directly targeted the structural inequalities that hinder long-term social progress. In modern India, sustainable development is understood as a balance of social justice, economic growth, and environmental stability. Ambedkar's approach perfectly aligns with this framework because he believed no development is sustainable if it excludes marginalized communities.

Equality as the Basis of Sustainable Development

Ambedkar did not view equality as a mere political slogan but as a fundamental structural requirement without which development cannot sustain. He believed that a society divided by caste or gender will always struggle to achieve long-term stability, as inequality suppresses talent by denying millions access to education, jobs, and dignity, leading to a significant loss of human capital. Unequal distribution of resources further restricts participation in national growth, while deep social divisions inevitably produce conflict and disrupt progress. In modern India, these ideas closely align with the Sustainable Development Goals (SDGs), especially those focused on reducing inequality (SDG 10), ensuring quality education (SDG 4), promoting inclusive economic growth (SDG 8), and building strong, just institutions (SDG 16). Government initiatives like Digital India, Jan Dhan Yojana, PM Awas Yojana, and NEP 2020 emphasize equal access to opportunities, echoing Ambedkar's vision formulated nearly a century ago. The emphasis on digital inclusion, rural development, and universal healthcare reflects his belief that development must involve every citizen. Thus, Ambedkar's commitment to equality forms the foundation of India's contemporary sustainable development strategies.

Annihilation of Caste as A Prerequisite for Progress

Ambedkar regarded caste not merely as a social hierarchy but as a profound economic and developmental obstacle that obstructs national progress. In his view, caste creates economic dependency by assigning occupations based on birth rather than skill, severely limiting mobility and preventing individuals from improving their socio-economic status. This system also concentrates land, education, and wealth within a few dominant groups, leaving marginalized communities with restricted access to resources. As a result, the nation loses immense human potential, as millions are denied opportunities for education, leadership, and innovation. In modern India, these issues remain visible, caste still influences hiring processes in both public and private sectors, Dalit literacy and employment levels lag behind national averages, manual scavenging persists, and caste-based violence continues across many regions. These barriers collectively reduce India's GDP potential, restrict innovation, and generate social tensions that threaten long-term stability. Therefore, Ambedkar's call for the annihilation of caste remains central to sustainable development. Contemporary measures such as reservations in education and employment, anti-discrimination laws, affirmative action scholarships, and SC/ST protection acts are direct reflections of his ideology and aim to build a society where development is equitable, inclusive, and shared by all.

Constitutional Safeguards as Tools for Sustainable Equality

Ambedkar strategically embedded the principle of equality into the Indian Constitution to ensure that justice and inclusiveness remain fundamental to the nation's development across generations. He introduced key constitutional safeguards such as Article 14, which guarantees equality before the law, Article 15, which prohibits discrimination based on caste, gender, religion, or similar grounds and Article 17, which abolishes untouchability entirely. He also institutionalized reservation policies to promote representation of marginalized communities in education, government, and legislatures, while strengthening independent bodies like the Judiciary, Election Commission, CAG, and UPSC to uphold democratic integrity. In modern India, these safeguards directly contribute to sustainable development by building trust in governance, encouraging a diverse and skilled workforce, reducing social conflict through the protection of rights, and ensuring long-term democratic stability. Practical examples include increased participation of Dalit and tribal students in premier institutions like IITs and IIMs through reservation policies, broader representation in political and administrative institutions, and welfare-oriented laws such as the Right to Education Act, which draw heavily from Ambedkar's constitutional vision. Thus, the Constitution stands as India's long-term blueprint for sustainable equality and inclusive growth.

Economic Justice and Long-Term Development

Ambedkar was one of India's earliest development economists, long before the term gained prominence, and he believed that sustainable development must be rooted in economic justice. He argued that fair wages, worker protection, labour rights, occupational safety, modernized industries, and scientific resource planning, especially in the management of water which was essential for a nation's long-term progress. His contributions were transformative. He introduced the eight-hour workday, replacing the exploitative 12-14-hour shifts, established maternity benefits for women workers, supported workers' insurance, social security, minimum wage laws, and promoted industrialization as a means to break caste-based occupational restrictions. As Chairman of the Labour Council, he drafted several labour policies that still shape India's workforce regulations today. Ambedkar also dedicated significant effort to water management, contributing to irrigation systems and river valley projects such as the Damodar Valley and Hirakud projects, recognizing water as a critical resource for agricultural and urban sustainability. In modern India, sustainable development continues to depend on the very principles he advocated which include skill development, social security systems like EPFO and ESI, regulated working hours, workplace safety, greater participation of women in the labour force, and industrial modernization through initiatives like Make in India and Skill India. These contemporary strategies reflect and reaffirm Ambedkar's far-sighted vision of economic justice as the backbone of sustainable growth.

Gender Equality as a Foundation of Social Sustainability

Ambedkar's approach to gender equality was revolutionary for his time, grounded in the belief that no society can truly progress while half of its population remains marginalized. His work on the Hindu Code Bill significantly advanced women's rights by granting them equal inheritance, the right to divorce, independent property ownership, adoption rights, and greater autonomy within marriage. These provisions that were unprecedented in India's socio-legal framework and marked a historic shift toward gender justice. Although the bill faced political resistance, it ultimately laid the foundation for modern family laws and transformed the status of women in Indian society. In contemporary India, gender equality remains a central pillar of sustainable development, reflected in global frameworks such as SDG 5. Ambedkar's ideas live on through rising female participation in higher education, the expansion of women-centric welfare schemes like Ujjwala and Beti Bachao Beti Padhao, and the strengthening of laws related to domestic violence, maternity benefits, and workplace harassment. The growing presence of women in technology, government, and civil services further demonstrates progress toward the empowered, independent role for women that Ambedkar envisioned. His commitment to women's rights continues to shape India's pursuit of inclusive and sustainable development.

Findings

The study reveals that

1. Ambedkar's philosophy of equality directly supports the social pillar of sustainable development.
2. His constitutional reforms ensure long-term institutional sustainability.
3. His economic ideas emphasize equitable resource distribution.
4. His advocacy for women's rights forms the basis for gender-equitable development.
5. His attempts to dismantle caste address structural inequalities that hinder long-term progress.
6. His overall vision closely aligns with multiple Sustainable Development Goals (SDGs).

Suggestions

1. Ambedkar's equality-based framework should be integrated explicitly into national development policies.
2. Greater focus must be placed on reducing caste-based and gender-based disparities to meet sustainability targets.
3. Educational curricula should include Ambedkar's development philosophy to promote awareness.
4. Government programs must ensure equal access to opportunities for marginalized communities.
5. Policies should incorporate Ambedkar's emphasis on social justice as a core sustainability metric.

Conclusion

This research confirms that Dr. B. R. Ambedkar's contributions form a robust foundation for sustainable development in India. His emphasis on equality, social justice, institutional integrity, and human dignity aligns seamlessly with modern sustainability frameworks. Ambedkar understood that development cannot be achieved unless every individual is empowered and treated with dignity. His work dismantled deeply rooted inequalities and ensured that the Constitution would provide justice for generations.

Ambedkar's equality-driven vision is not only historically significant but essential for achieving a truly sustainable, inclusive, and progressive India. His ideas remain timeless, offering guidance for current developmental challenges and future aspirations.

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AGRICULTURE CREDIT THROUGH CANARA BANK- A CASE STUDY ON SATHENAHALLI VILLAGE

P Manjula

Associate Professor, Department of Economics, A.V Kanthamma College for Women, Haasan

ABSTRACT

Agriculture remains the backbone of the Indian economy, providing livelihood to nearly two-thirds of the population and contributing significantly to GDP. Given the challenges of increasing productivity with limited land, financial support through agricultural credit has become essential. This study focuses on the role of Canara Bank in delivering agricultural credit in Sathenahalli village, Karnataka, and examines its impact on rural farmers.The research highlights the necessity of credit for modern farming—covering inputs like seeds, fertilizers, irrigation, and equipment—and the critical role of institutional credit in reducing dependence on non-institutional sources. It also explores issues such as limited access to credit for marginal farmers, high interest rates, and insufficient awareness. A gap in existing literature regarding Canara Bank's specific role in Sathenahalli prompted this case study. Using both primary data (through questionnaires) and secondary sources (research papers, reports, and online data), the study analyzes the socio-economic conditions of farmers and evaluates the efficiency of credit facilities. The findings emphasize the need for improved financial literacy, streamlined loan processes, and inclusive lending policies to strengthen rural development and agricultural productivity.

Keywords: Agricultural credit, Rural finance, Canara Bank.

INTRODUCTION

Agriculture plays a vital role in the Indian economy, contributing significantly to GDP and providing livelihoods for nearly two-thirds of the population. It is often regarded as the backbone of the economy, with its prosperity directly influencing the nation's overall well-being. Given the rising population and the limited availability of land, increasing agricultural productivity is essential to meet future food demands.

Farm finance is a critical component of agricultural development, supporting the adoption of modern technology, enhancing productivity, and reducing regional disparities. Institutional sources of agricultural credit include cooperatives, commercial banks, and regional rural banks (RRBs), with the National Bank for Agriculture and Rural Development (NABARD) playing an apex role. Despite the expansion of institutional credit, non-institutional sources like moneylenders have remained prominent in rural areas. Commercial banks offer both direct and indirect agricultural finance, supporting not only farmers but also agro-based industries and supply chains.

This study explores the crucial link between agriculture, rural poverty, and the role of financial institutions in supporting the agricultural sector. It also examines the evolution of agricultural credit and its impact on India's macroeconomic development.

NEED FOR FINANCE IN AGRICULTURE

Finance is as crucial to agriculture as technology. Farmers often lack sufficient funds to purchase modern inputs, equipment, and meet basic needs, necessitating external credit. The

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demand for finance arises for land improvement, machinery, inputs like seeds and fertilizers, and household expenses.

Indian agriculture faces challenges from the second-generation issues of the Green Revolution, global recession, and lack of diversification. However, emerging opportunities such as greenhouse farming, food processing, and genetic engineering also demand heavy capital investment—beyond the reach of most small farmers—making credit essential.

ISSUES IN AGRICULTURAL CREDIT

Agricultural credit is a key input for India's rural and economic development, playing a crucial role in poverty reduction. To meet growing credit demands, the Government and RBI have established a multi-agency institutional framework involving Co-operatives, Commercial Banks, and Regional Rural Banks.

Credit availability and distribution remain central to agricultural growth. While innovations like Microfinance and the Kisan Credit Card (KCC) have improved access, challenges persist. These include high transaction costs, weak rural credit systems, lack of collateral among small farmers, low loan volumes, and high risk perception.

Marginal and small farmers, despite holding most of the agricultural land, receive a shrinking share of total credit due to bankers' preference for large farmers with better collateral. This credit imbalance hampers inclusive growth.

RESEARCH GAP

Although numerous research studies have been conducted on agricultural financing, rural credit, performance evaluation, and loan overdues, the researcher could not find any previous study specifically related to agricultural credit provided by Canara Bank in Sathenahalli village. This study is distinct from earlier research in its focus and scope. Therefore, the present research titled *"Agricultural Credit through Canara Bank: A Case Study of Sathenahalli Village"* has been undertaken to fill this gap.

OBJECTIVES OF THE STUDY:

1. To know the socio-economic conditions of the study area.
2. To know the credit facilities to various agricultural activities.
3. To study about borrowings and lending of credit system

METHODOLOGY OF STUDY

Data Source: The information has derived by both primary and secondary sources. Primary sources are collected through questioners and secondary information are collected through Research Journals, Reports, Newspapers, Published Research articles and Internet sources.

Variables: Social Variables and Economic Variables are chosen. Social variables are age, gender, education and economic variable is income selected for case study.

HASSAN DISTRICT PROFILE:

Hassan is a prominent district and tourist destination in Karnataka, surrounded by Chikkamagalur, Chitradurga, Tumakuru, Mandya, Mysuru, Kodagu, and Dakshina Kannada districts. It spans an area of 6,845 sq. km and lies between 12°13′–13°33′ N latitude and 75°33′–76°38′ E longitude. The district comprises 8 taluks, 38 hoblis, and 2,368 villages.

Geographically, Hassan features both Malnad (hilly and forested) and Maidan (plains) regions, with the Hemavathi River flowing eastward from the Western Ghats. Major

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irrigation projects include Hemavathi (Gorur), Yagachi (Belur), and Vatehole Agriculture is vital, with key crops including coffee, black pepper, potato, paddy, and sugarcane.

SATHENAHALLI VILLAGE PROFILE

Sathenahalli is a small village located on the Mysore–Arsikere highway in Channarayapattana taluk, Hassan district, Karnataka. As per 2022 data, the village has a population of 650. across 161 households, with 334 males (51.38%) and 316 females (48.62%). The population density is approximately 316 persons per sq. km.

The total area of the village is 205.88 hectares, of which 166.17 hectare is used for agriculture. Out of this, 157.98 ha is unirrigated, and 8.19 hectare is irrigated by wells or tube wells. Non-agricultural land accounts for 4.05 hectare, and 0.92 hectare is under miscellaneous tree crops. The village also has a primary healthcare center.

PRIMARY DATA ANALYSIS

Data analysis is a key step in the research process, requiring critical judgment and skill. It involves examining collected data to identify patterns and relationships among variables using both quantitative and qualitative methods.

As this study focuses on *"Agricultural Credit through Canara Bank: A Case Study of Sathenahalli Village,"* this chapter presents the analysis and interpretation of the primary data collected.

GENDER OF THE RESPONDENTS

Gender	No. of Respondents	Percentage %
Male	25	50
Female	25	50
Total	50	100

Source: Primary data

The table shows an equal gender distribution among the 50 respondents, with 25 males and 25 females (50% each). This balance ensures fair representation of both perspectives in analyzing agricultural credit usage in Sathenahalli village.

EDUCATION STATUS OF THE RESPONDENTS

Particulars	No. of the respondents	Percentage
Non-literate	24	48
School	18	36
College	8	16
Total	50	100

Source: Primary data

The table shows that most respondents have low educational levels—48% are non-literate, 36% have schooling, and only 16% attended college—potentially affecting their access to agricultural credit.

FLOORING STATUS OF THE RESPONDENTS

Particulars	No. of respondents	Percentage
Mud	00	00
Cement	26	52
Mosaic	13	26

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Vitrified tiles	11	22
Granite	00	00
Total	50	100

The table shows most respondents have cement (52%), mosaic (26%), or vitrified tile (22%) flooring, indicating generally basic to moderately improved housing.

ROOF STATUS OF THE RESPONDENTS

Particulars	No. of respondents	Percentage
Local tiles	30	60
Modern tiles	4	8
Sheet	3	6
RCC	9	18
Local tiles +sheet	3	6
RCC+ Local tiles	1	2
Total	50	100

Source: Primary data

The table shows that **60%** of respondents have **local tile roofing**, followed by **18%** with **RCC roofs**. A smaller portion uses modern tiles (8%), sheets (6%), or a combination of materials. This suggests that traditional roofing remains common, with some shift toward modern structures.

LOAN BORROWING FROM THE RESPONDENTS

Loan amount	No. of respondents	Percentage
<100000	07	14
100000-300000	23	46
300000-500000	12	24
500000-700000	05	10
700000-900000	03	6
Total	50	100

The table shows that **46%** of respondents borrowed loans between **₹1,00,000–₹3,00,000**, making it the most common loan range. Smaller portions borrowed amounts above or below this range, with only **6%** borrowing between **₹7,00,000–₹9,00,000**. This suggests that most farmers prefer moderate loan amounts for their agricultural needs.

LOAN LENDING PURPOSE FOR THE RESPONDENTS

Particulars	No. of respondents	Percentage
Seeds & Fertilizer	29	58
Agricultural equipment	5	10
Irrigation	11	22
Others	2	4
Seeds & Fertilizer+ irrigation	2	4
Seeds &fertilizer+ others	1	2
Total	50	100

Source: Primary data

The table shows that 58% of respondents took loans for seeds and fertilizer, followed by 22% for irrigation, and 10% for agricultural equipment. A few used loans for combined or other purposes. This indicates that most loans were used to support crop production needs.

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Income of the respondents

Source	Total Income	Percentage
Agriculture	11810000	63.77
Non-agriculture	6710000	36.23
Total	18520000	100

Source: Primary data

From the above table shows that, income of the respondents. Out of the 50 respondents, 63.77% of the respondent's income received from the agricultural sources, remaing 36.23% of the respondent's income received from the non-agricultural source.

Expenditure of the respondents

Source	Expenditure	Percentage
Agriculture	4820000	62.86
Non-agriculture	2847000	37.14
Total	7667000	100

From the above table illustrate that, expenditure of the respondents. Out of the 50 respondents, 62.86% of the respondents spent more money for agricultural activities, remaing 37.14% of the respondents spent money for non-agricultural activities.

FINDINGS:

1. 48% are non-literate, with fewer having school or college education.
2. Cement is the most common flooring; local tiles are the most used roofing.
3. All families use basic amenities like rooms, toilets, TV, almirahs, and mobile phones.
4. 58% used loans mainly for seeds and fertilizers.
5. 46% borrowed between ₹1,00,000–₹3,00,000 for agriculture and other needs.

SUGGESTIONS:

To improve Canara Bank's agricultural credit initiative in Sathenahalli village, the following suggestions are recommended:

1. Provide proper guidance to borrowers on loan usage and available loan schemes.
2. Offer subsidies on agricultural loans to support farmers' financial growth.
3. Reduce high interest rates to make loans more accessible.
4. Redesign repayment schedules to ease repayment difficulties.
5. Conduct awareness programs on banking services and loan details for farmers.
6. Share success stories to encourage more participation in the loan program.

CONCLUSION

Agriculture is vital to India's economy, supporting around 65% of the population and contributing significantly to national income. Access to institutional credit is essential for adopting modern agricultural practices, especially for small farmers lacking resources.

Canara Bank's agricultural credit initiative in Sathenahalli village has positively impacted local farmers by improving access to credit, enhancing productivity, and supporting income

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growth. Loans enabled investment in quality inputs and modern techniques, while financial literacy programs helped farmers manage resources effectively.

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DIGITAL PAYMENT MODES IN HIGHER EDUCATION: EFFICIENCY, CHALLENGES, AND RECOMMENDATIONS

P Manjula

Associate Professor
Department of Economics, A.V. Kanthamma College for Women, Hassan, Karnataka

ABSTRACT

Digital payment systems are essential in modern college administration, enabling cashless transactions, faster fee collection, and greater financial transparency. This study reviews key payment modes used in colleges—UPI, mobile wallets, net banking, debit cards, and credit cards—highlighting their usage and benefits such as real-time payments, security, and convenience. Despite these advantages, challenges like internet dependency, technical issues, security risks, transaction limits, processing charges, digital literacy gaps, and refund delays remain. The study recommends robust payment infrastructure, integrated ERP systems, secure gateways, awareness programs, multiple payment options, and efficient support systems to improve reliability, inclusivity, and trust in digital payments within educational institutions.

Keywords: UPI, Mobile Wallets, Net Banking, Debit Cards, Credit Cards, Payment Security, ERP Systems, Financial Transparency

INTRODUCTION

Rapid advances in digital technology have transformed financial transactions in education, leading colleges and universities to shift from cash-based fee collection to digital payment systems. This change has been supported by initiatives like Digital India, promoting cashless, secure, and inclusive transactions.

Digital payment modes such as UPI, mobile wallets, net banking, debit cards, and credit cards offer greater convenience, speed, transparency, and improved record-keeping for both students and institutions. Integration with college ERP systems has further enhanced efficiency in fee collection and reporting.

Despite these benefits, challenges such as technical issues, internet dependency, security concerns, transaction limits, and digital literacy gaps remain. This study examines digital payment modes used in colleges, highlights their challenges, and suggests recommendations to improve their effective adoption in educational institutions.

REVIEW OF LITERATURE

Several studies have examined digital payment adoption in educational institutions, highlighting their role in improving efficiency, user acceptance, financial management, and administrative transparency through cashless transactions.

NPCI (2022) highlighted the rapid adoption of UPI in India, noting its real-time, low-cost, and secure transactions that have simplified college fee payments by reducing cash use, improving transparency, and enabling 24×7 access.

Kumar and Gupta (2020) found that digital payments via net banking, debit cards, and gateways improved efficiency and reduced manual errors in higher education, but issues like technical glitches, internet dependency, and low digital literacy hinder adoption.

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Davis (1989), through the Technology Acceptance Model (TAM), explained that digital system adoption depends on perceived usefulness and ease of use. Later studies show that students prefer fast, simple, and secure payment modes like UPI and mobile wallets, with trust and awareness influencing continued use.

RESEARCH GAP

Despite extensive research on digital payment adoption, limited studies compare the effectiveness of different payment modes in college settings. Existing literature largely focuses on adoption and benefits, with less attention to user experience, refund efficiency, grievance redressal, and digital literacy challenges among students and parents. Therefore, further research is needed to examine implementation issues and user satisfaction with digital payments in colleges.

STATEMENT OF THE PROBLEM

The increasing adoption of digital payment systems in colleges has transformed fee collection and financial management processes. However, students and parents often face issues such as transaction failures, security concerns, refund delays, and lack of digital awareness. Colleges also encounter challenges in system integration, reconciliation, and grievance handling. This study seeks to examine these problems and assess the effectiveness of digital payment modes used in educational institutions.

OBJECTIVES OF THE STUDY

1. To study the various digital payment modes used in colleges for fee collection and other financial transactions.
2. To analyze the challenges and limitations faced by students and institutions in using digital payment systems.
3. To suggest effective measures and recommendations for improving the efficiency and security of digital payments in colleges.

METHODOLOGY OF THE STUDY

The study is based on a descriptive research design to understand the use of digital payment systems in colleges. Data is collected from secondary sources such as journals, reports, articles, and official websites. Relevant information is analyzed to identify payment modes, challenges, and best practices. The findings are interpreted using a qualitative approach to draw meaningful conclusions.

SCOPE OF THE STUDY

The study focuses on the use of digital payment systems in colleges, including UPI, mobile wallets, net banking, and card payments. It examines their role in fee collection, campus transactions, and administrative efficiency. The scope is limited to understanding challenges, limitations, and user experiences associated with these payment modes. The study also covers recommendations for improving digital payment adoption in educational institutions.

UPI (Unified Payments Interface)

Unified Payments Interface (UPI) is a real-time digital payment system developed by NPCI that allows instant bank-to-bank transfers using mobile apps like Google Pay, PhonePe, Paytm, and BHIM. It works 24×7 and does not require entering bank or card details for every transaction. In colleges, UPI is commonly used to collect tuition, exam, hostel, and event fees through UPI IDs or QR codes. Payments are quick, generate instant transaction references,

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and reduce queues and paperwork. UPI is cost-effective, transparent, and easy to track for both students and institutions. However, UPI depends on internet and bank servers, which can cause failed or delayed transactions. Daily transaction limits and refund delays may also occur. Despite these limitations, UPI remains a reliable and widely preferred payment method in educational institutions.

Mobile Wallets

Mobile wallets are digital apps that store money electronically and enable cashless payments using smartphones. Examples in India include Paytm Wallet, Amazon Pay, Mobikwik, and Freecharge. Unlike UPI, wallets hold a limited balance within the app for quick transactions. In colleges, mobile wallets are mainly used for small, daily payments such as canteen food, stationery, printing, and library fines. They reduce cash usage, speed up transactions, and often provide benefits like cashback and discounts. However, wallets have balance limits, require KYC for full use, and need sufficient wallet balance before payment. With the growth of UPI for larger payments, mobile wallets are now mainly used for fast, low-value transactions on college campuses.

Net Banking

Net banking is a digital service that allows users to make payments through a bank's website or mobile app. In colleges, it is mainly used for high-value payments such as admission, semester, and examination fees. Students log in with bank credentials, transfer the amount directly to the college's account, and receive a digital receipt. Net banking is secure and reliable, making it suitable for large transactions without needing a debit or credit card. However, it can be slower than UPI due to multiple authentication steps and bank server dependency, and requires remembering login details.

Debit Cards

Debit cards are bank-issued cards that allow payments by directly debiting money from a user's bank account. In colleges, they are commonly used for admission, tuition, and online application fee payments through college websites or payment gateways, with OTP or PIN verification. Debit cards offer quick and controlled spending and are widely accepted for online and offline payments. However, they may involve processing charges, carry risks of card data misuse if security is weak, and can face transaction failures due to network or OTP issues.

Credit Cards

Credit cards allow users to make payments by borrowing money up to a set credit limit and repaying it later. In colleges, they are mainly used for high-value payments like admission or semester fees, often with EMI options to pay in installments. Payments require card details and OTP verification. Credit cards offer benefits such as flexible payments, EMI facilities, rewards, and better consumer protection. However, they can lead to overspending, interest charges if not repaid on time, and higher processing fees. Despite this, they are useful for managing large educational expenses.

CHALLENGES AND LIMITATIONS OF DIGITAL PAYMENTS

Digital payments face several challenges, the major one being dependence on internet connectivity and technology. Poor network coverage or server issues can cause failed or pending transactions, creating stress for students, especially during fee deadlines. Technical problems such as app crashes, duplicate deductions, and delayed confirmations may also occur, leading to refund delays and administrative burden.

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Security and privacy concerns are another limitation. Risks like phishing, fake payment links, and OTP fraud can result in financial loss, particularly for users with low digital awareness. Transaction limits and processing charges also restrict digital payments, as UPI and wallets have daily caps, while card payments may include extra fees.

Additionally, lack of digital literacy and accessibility makes it difficult for some students and parents, especially in rural areas, to use online payment systems confidently. Refund delays and complex grievance redressal processes further add to the challenges. Despite these issues, digital payments continue to grow due to their convenience, transparency, and efficiency.

RECOMMENDATIONS TO OVERCOME CHALLENGES AND LIMITATIONS OF DIGITAL PAYMENTS

To reduce internet dependency and technical failures, colleges should use reliable payment gateways, maintain backup systems, and offer multiple payment options like UPI, net banking, and cards. Extending deadlines during technical issues can also ease student stress. Transaction errors can be minimized by using integrated ERP systems that update payment status in real time and generate instant receipts. A dedicated helpdesk for payment issues ensures faster resolution and better communication.

Security risks can be addressed through awareness programs on safe payment practices and by using secure, RBI-compliant gateways with strong authentication. For high-value fees, colleges can allow split payments or installments and encourage low-cost options like UPI and net banking while maintaining transparency about charges. Improving digital literacy through guides, tutorials, multilingual instructions, and on-campus support can help students and parents adopt digital payments confidently. Clear refund policies, automated refund systems, and a dedicated finance team can further streamline grievance redressal and build trust.

FINDINGS

1. UPI emerged as the most widely used digital payment mode in colleges due to its instant processing, convenience, and low transaction cost.
2. Net banking and debit/credit cards are preferred for high-value payments such as admission and semester fees.
3. Mobile wallets are mainly used for small and routine campus transactions like canteen and library payments.
4. Digital payments have improved transparency, accuracy, and efficiency in college fee management systems.
5. Despite the benefits, issues such as technical glitches, security concerns, transaction limits, and refund delays continue to affect user experience.

SUGGESTIONS

1. Colleges should adopt reliable and secure payment gateways with high uptime to minimize transaction failures.
2. Multiple payment options such as UPI, net banking, cards, and bank transfers should be provided to ensure flexibility for users.
3. Institutions should conduct digital awareness programs to educate students and parents on safe and correct usage of digital payments.

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4. Integrated ERP systems should be implemented for real-time payment tracking, reconciliation, and automated receipts.
5. A clear and efficient grievance redressal and refund mechanism should be established to build trust and improve user satisfaction.

CONCLUSION

Digital payment systems have significantly transformed financial transactions in colleges by making fee collection faster, more transparent, and more convenient. Payment modes such as UPI, mobile wallets, net banking, and debit and credit cards have reduced dependence on cash and manual processes. These systems have improved accuracy in record-keeping and enhanced administrative efficiency. UPI has emerged as the most preferred mode due to its simplicity and real-time processing. Net banking and card payments remain important for high-value transactions. However, challenges such as technical issues, security risks, and refund delays still exist. Lack of digital literacy among some users also affects smooth adoption. Despite these limitations, digital payments offer long-term benefits for both institutions and students. With proper infrastructure, security measures, and user awareness, digital payment systems can be made more reliable. Overall, digital payments play a crucial role in the modernization of college financial management systems.

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IMPLEMENTING GANDHIAN ECONOMICS FOR INCLUSIVE AND SUSTAINABLE DEVELOPMENT

P Manjula

Associate Professor
Department of Economics, A.V. Kanthamma College for Women, Hassan, Karnataka

ABSTRACT

Gandhian economic philosophy offers a moral, human-centric, and sustainable alternative to the growth-centric development models that dominate contemporary economies. Rooted in the foundational ideals of Sarvodaya (welfare of all), non-violence (Ahimsa), decentralization, equality, dignity of labour, and rural self-reliance, Gandhian economics challenges the assumption that economic progress must be driven solely by industrial expansion, capital accumulation, and consumption. Instead, it envisions an economy in which material advancement is harmonized with social justice, ethical responsibility, and ecological balance. This paper critically examines the relevance and practical application of key Gandhian economic concepts—namely Sarvodaya, decentralisation, non-violent economic systems, equality, development of agriculture, land reforms, subsidiary occupations, rural infrastructure, and village sanitation—within the framework of today's economic system. These concepts are analyzed not as rigid historical doctrines, but as adaptable principles capable of guiding contemporary policy and development strategies. The study argues that when integrated with modern institutions, democratic governance, and appropriate technologies, Gandhian economic ideas can effectively address some of the most pressing challenges of the present era, including rising inequality, unemployment, environmental degradation, rural distress, and social exclusion. By emphasizing inclusive growth, ethical production, community participation, and sustainability, Gandhian economics offers a holistic development paradigm that prioritizes human welfare over mere economic indicators. The paper concludes that far from being outdated or utopian, Gandhian economic philosophy remains highly relevant and essential for achieving inclusive, equitable, and sustainable development in the twenty-first century.

Keywords: Gandhian Economics, Sarvodaya, Decentralisation, Sustainable Development, Rural Economy, Ethical Capitalism

INTRODUCTION

The contemporary global and Indian economic systems are characterized by rapid industrialization, technological advancement, globalization, and market-driven growth. These processes have undoubtedly contributed to increased production, innovation, and improved living standards for certain sections of society. However, they have simultaneously resulted in widening economic inequalities, environmental degradation, rural–urban imbalances, unemployment, and social exclusion. The benefits of economic growth have remained unevenly distributed, often bypassing marginalized communities, small farmers, informal workers, and rural populations. Moreover, unchecked industrial expansion and consumerism have intensified ecological crises, posing serious threats to long-term sustainability.

In modern economic discourse, development has largely been assessed through quantitative indicators such as Gross Domestic Product (GDP), per capita income, and growth rates. While these measures capture economic output, they fail to reflect crucial dimensions of human well-being, including social justice, ethical values, environmental sustainability, and

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quality of life. As a result, economic progress has often come at the cost of moral responsibility, social cohesion, and ecological balance, raising fundamental questions about the true purpose and direction of development.

In this context, the economic philosophy of Mahatma Gandhi offers a critical and transformative alternative to dominant growth-centric models. Gandhi did not present a rigid or technical economic theory; rather, he articulated a value-based and ethical framework aimed at ensuring that economic activity serves human welfare and social harmony. His ideas were deeply rooted in Indian philosophical traditions such as Dharma (moral duty), Ahimsa (non-violence), Aparigraha (non-possession), and Satya (truth). Gandhi viewed economics not merely as a system of production and distribution, but as a moral science intimately connected with human conduct and social responsibility.

This paper seeks to analyze how Gandhian economic concepts can be meaningfully applied in today's economic system, particularly in addressing challenges such as inequality, unemployment, rural distress, environmental degradation, and social injustice. By examining the relevance of Gandhian principles in the contemporary context, the study aims to demonstrate that Gandhian economics remains not only relevant but also essential for shaping a humane, inclusive, and sustainable development paradigm in the twenty-first century.

REVIEW OF LITERATURE

Several scholars have examined Gandhian economic philosophy and its relevance to contemporary development challenges, emphasizing its ethical, inclusive, and sustainable dimensions.

1. Kumarappa, J. C. (1945) in *Economy of Permanence* articulated a Gandhian economic framework grounded in sustainability, non-violence, and harmony with nature. He argued that economic systems based on unlimited consumption and exploitation are inherently unstable. Kumarappa's work is foundational in linking Gandhian thought with ecological balance and remains highly relevant in contemporary debates on sustainable development and environmental economics.

2. Sen, A. (1999) in *Development as Freedom* shifted the focus of development from income growth to the expansion of human capabilities and freedoms. Although not explicitly Gandhian, Sen's human-centered approach closely aligns with the Sarvodaya principle by emphasizing welfare, equity, and social justice. His work supports the Gandhian critique of GDP-centric development and strengthens the theoretical basis for inclusive growth models.

3. Datta, A. (2012) examined Gandhian economics in the context of globalization and argued that principles such as decentralization, trusteeship, and dignity of labour offer viable alternatives to market-driven inequality. The study highlights how Gandhian ideas can be adapted to modern institutions to address issues like rural distress, unemployment, and ethical governance, reinforcing their contemporary relevance.

RESEARCH GAP

Despite extensive literature on Gandhian economic philosophy and its ethical foundations, limited empirical research exists on its practical application within contemporary economic institutions and policy frameworks. Most studies remain theoretical or historical, with insufficient analysis of how Gandhian principles can be operationalized in today's market-driven and technology-intensive economy. Additionally, there is a lack of integrated studies linking Gandhian concepts with current development challenges such as unemployment, rural distress, and environmental degradation. This gap highlights the need for research that

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bridges Gandhian economic thought with present-day policy implementation and development outcomes.

STATEMENT OF THE PROBLEM

Contemporary economic systems emphasize growth and market efficiency, often neglecting ethical values, social equity, and environmental sustainability. This has resulted in rising inequality, rural distress, and ecological degradation. Although Gandhian economic philosophy offers a humane and inclusive alternative, its practical application in today's economic policies remains limited and underexplored.

OBJECTIVES OF THE STUDY

- To examine the core principles of Gandhian economic philosophy.
- To analyze the relevance of Gandhian ideas in the contemporary economic system.
- To explore the applicability of Gandhian concepts for inclusive and sustainable development.

HYPOTHESES OF THE STUDY

H_1: Application of Gandhian economic principles promotes inclusive and sustainable development in contemporary India.
H_0: Application of Gandhian economic principles does not promote inclusive and sustainable development in contemporary India.

METHODOLOGY OF THE STUDY

This study adopts a descriptive and analytical research design. It is based on secondary data from books, research articles, government reports, and policy documents. The study examines Gandhian economic principles and analyzes their relevance and applicability in the contemporary Indian economic system. A qualitative approach is used to interpret concepts, policies, and development practices in light of Gandhian thought.

SCOPE OF THE STUDY

The study focuses on the application of Gandhian economic principles—such as Sarvodaya, decentralization, non-violence, equality, and rural development—in the contemporary Indian economy. It examines their relevance for inclusive growth, sustainable development, and social welfare, particularly in addressing rural distress, unemployment, and environmental challenges.

LIMITATIONS OF THE STUDY

1. The study is primarily based on secondary data, which may limit the scope of empirical validation.
2. Gandhian economic principles are largely theoretical and philosophical, making practical measurement and quantification challenging.
3. The study focuses on India, so findings may have limited applicability to other countries or global economic contexts.

CONCEPTUAL FRAMEWORK OF GANDHIAN ECONOMICS

Gandhian economics offers a human-centric, ethical, and sustainable approach to development, emphasizing welfare, equity, and moral responsibility. Central to this philosophy is Sarvodaya, meaning the welfare of all (*Sarva* = all, *Udaya* = rise). Influenced

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by John Ruskin's *Unto This Last*, Gandhi reinterpreted this idea within an Indian ethical framework, arguing that true progress must benefit the weakest and most marginalized, a concept closely linked to Antyodaya. Sarvodaya extends beyond material wealth to include social justice, economic equality, moral development, and human dignity, promoting collective well-being rather than elite-centric growth.

KEY PRINCIPLES OF GANDHIAN ECONOMIC THOUGHT

Gandhian economics is built on several interrelated principles, forming a holistic framework for a just and humane economic system:

1. **Antyodaya**: Prioritizes the upliftment of the poorest sections of society. Gandhi argued that development must focus on alleviating poverty, ensuring basic needs, and providing social security. Policies that bypass the poor are morally and economically incomplete.
2. **Non-Violence (Ahimsa)**: Advocates avoidance of exploitation of humans and nature. Economic violence includes labour exploitation, environmental degradation, and social marginalization. A non-violent economy promotes ethical business practices, sustainability, and long-term social harmony.
3. **Decentralization and Grassroots Governance**: Gandhi envisioned India as a network of self-reliant villages with economic and political power distributed locally. Decentralization reduces inefficiency, alienation, and inequality. Today, it can be applied through strengthening Panchayati Raj institutions, participatory planning, and local resource management, supported by digital technologies for transparency and accountability. This approach reduces rural–urban migration and fosters balanced regional development.
4. **Equality and Social Justice**: Gandhi opposed caste, gender, or class-based discrimination, emphasizing equal dignity and opportunities. In contemporary India, this principle translates into access to education, healthcare, employment, social security, and women's empowerment, as well as inclusion of marginalized communities in development. Without equality, growth remains fragile and exclusionary.
5. **Dignity of Labour**: Gandhi upheld the moral value of all work, opposing hierarchies that glorify intellectual work while degrading manual labour. Respect for labour fosters self-esteem, reduces class divisions, and encourages productive participation across society.
6. **Trusteeship**: Gandhi proposed that wealth holders act as trustees, using resources for social welfare instead of personal accumulation. Trusteeship promotes ethical ownership, equitable distribution, and voluntary cooperation, aligning wealth with societal responsibility.
7. **Need-Based Consumption**: Gandhi emphasized limiting wants to essentials, opposing greed-driven overconsumption. This principle encourages sustainability, reduces inequality, and ensures fair resource distribution while promoting ethical and environmentally conscious lifestyles.

APPLICATION AREAS IN CONTEMPORARY ECONOMY

Development of Agriculture: Gandhi considered agriculture the backbone of the Indian economy and advocated self-sufficiency, sustainability, and small-farmer welfare. Modern application includes promoting organic farming, irrigation and storage improvements, fair

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market access, and support for small and marginal farmers. Sustainable agriculture enhances food security, reduces rural poverty, and mitigates environmental impact.

Land Reforms: Equitable land distribution was central to Gandhian thought. Contemporary reforms include securing land rights, redistributing surplus land, digitizing land records, and preventing forced displacement, which improve productivity, reduce inequality, and empower rural communities.

Subsidiary Occupations: Gandhi promoted spinning, weaving, handicrafts, and cottage industries to address seasonal unemployment and supplement agricultural income. Today, these can be supported via MSMEs, self-help groups, skill development programs, and digital market integration, generating employment and preserving traditional skills.

Rural Infrastructure: Basic infrastructure—including roads, electricity, water, education, and healthcare—is vital for holistic rural development. Investments improve productivity, market connectivity, access to services, and regional equity, supporting balanced economic growth.

Village Sanitation: Gandhi stressed sanitation as fundamental to human dignity and public health. In the modern context, this involves clean drinking water, waste management, hygiene awareness, and community participation. Improved sanitation reduces disease burden, lowers healthcare costs, enhances labour productivity, and contributes directly to economic development.

FINDINGS OF THE STUDY

1. Gandhian economic principles such as **Sarvodaya, Antyodaya, and trusteeship** remain highly relevant for promoting **inclusive and equitable development** in contemporary India.
2. **Decentralization and village-level governance** can strengthen local economies, reduce rural–urban disparities, and empower communities.
3. Emphasis on **subsidiary occupations, rural infrastructure, and agricultural development** can improve rural livelihoods and reduce unemployment.
4. **Non-violent and need-based economic practices** encourage sustainable consumption, environmental protection, and ethical business conduct.
5. Despite their relevance, **practical implementation of Gandhian principles** in current economic policies remains limited, requiring policy integration and institutional support.

SUGGESTIONS

1. **Integrate Gandhian principles into policy frameworks** to promote inclusive, equitable, and sustainable development.
2. **Strengthen Panchayati Raj and local governance** to enhance decentralization and empower rural communities.
3. **Promote subsidiary occupations and rural industries** to generate employment and supplement agricultural income.
4. **Encourage sustainable and ethical economic practices**, including need-based consumption, organic farming, and CSR initiatives.

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5. **Raise awareness and provide training** on Gandhian economic ideas for policymakers, entrepreneurs, and community leaders to facilitate practical implementation.

CONCLUSION

Gandhian economic concepts such as Sarvodaya, decentralisation, non-violence, equality, agricultural development, land reforms, subsidiary occupations, rural infrastructure, and village sanitation provide a comprehensive and ethical framework for addressing modern economic challenges. When integrated with modern technology, institutions, and governance mechanisms, these ideas can promote inclusive growth, environmental sustainability, and social justice. Far from being outdated, Gandhian economics remains a powerful guide for building a humane, balanced, and sustainable economic system in the twenty-first century.

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IMPACT OF SHGS ON WOMEN AND RURAL DEVELOPMENT: A CASE STUDY OF SAVASIHALLI VILLAGE, HASSAN DISTRICT

P Manjula

Associate Professor
Department of Economics, A.V. Kanthamma College for Women, Hassan

ABSTRACT

The study titled *"Impact of Self-Help Groups (SHGs) on Women and Rural Development: A Case Study of Savasihalli Village, Hassan District"* explores the role of SHGs in promoting women's empowerment and rural development. Based on primary data from 50 SHG members collected through structured interviews, the study analyzes their socio-economic status and participation in income-generating and community activities. The findings show that SHGs have enhanced women's financial independence, confidence, leadership, and decision-making abilities. They have also contributed to improved living standards, reduction of social barriers, and greater participation of women in family and community affairs. Empowered women have become active contributors to rural progress, strengthening the local economy and social fabric. Despite these positive outcomes, the study identifies areas requiring further attention, such as education, awareness, and inclusion of marginalized groups. It recommends expanding training, employment opportunities, and government support to ensure sustainable empowerment and equitable rural growth. Overall, SHGs act as powerful instruments for achieving both women's empowerment and holistic rural development.

Keywords: Women Empowerment, Rural Development, Socio-Economic Status, Financial Independence, Leadership.

INTRODUCTION

Women's empowerment is a key goal of social and economic development, recognized globally and nationally through policies like India's National Policy for the Empowerment of Women (2001). In rural India, Self-Help Groups (SHGs) have become a powerful means to achieve this goal. Formed by women from similar socio-economic backgrounds, SHGs promote savings, credit access, and income-generating activities, fostering financial independence, leadership, and confidence. By enabling women to start enterprises, contribute to family income, and participate in community decisions, SHGs reduce poverty and drive rural development. In villages like Savasihalli, Hassan District, SHGs have transformed women from passive recipients to active agents of change, linking economic growth with social progress.

REVIEW OF LITERATURE

The Auroville Village Action Group (2009–2010) studied women's empowerment in rural areas using indicators like self-esteem, awareness, and decision-making. It found that group participation in SHGs greatly boosted women's confidence and social awareness, with empowerment linked more to group membership than specific programs.

Elly Arnoff (2011) emphasized defining empowerment contextually and noted that most studies focus on married women, overlooking unmarried women who also face gender inequalities.

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Esther Duflo (2012) highlighted the two-way link between women's empowerment and economic growth, stating that while development reduces inequality, sustained empowerment requires continuous policy support and commitment to gender equality.

RESEARCH GAP

Previous research on Self-Help Groups (SHGs) has mainly focused on their impact on women's empowerment and factors influencing social and economic upliftment. However, little attention has been given to the socio-economic conditions of SHG members in Savasihalli, Hassan District, and their role in rural development. This study aims to fill this gap by analyzing the socio-economic status of SHG members and assessing how SHGs promote women's empowerment and rural development in Savasihalli village.

STATEMENT OF THE PROBLEM

Since the mid-1980s, Self-Help Groups (SHGs) have played a key role in poverty reduction, women's empowerment, and rural development in India. Primarily women-centric, SHGs promote savings, credit access, and income-generating activities, helping women achieve financial independence and leadership skills. Supported by government and NGOs, SHGs have fostered micro-enterprises and strengthened the socio-economic fabric of rural areas, including Savasihalli village in Hassan District.

OBJECTIVES OF THE STUDY

1. To analyze the *socio-economic conditions* of SHG members in Savasihalli, Hassan District.
2. To evaluate the level of *women empowerment* achieved through Self-Help Groups in the study area.
3. To examine the *role of SHGs in promoting rural development* through income generation, skill training, and community participation.

HYPOTHESIS OF THE STUDY

1. SHGs significantly contribute to improving the *socio-economic status of women* in rural areas.
2. Women's Empowerment has significantly influenced on rural development.

METHODOLOGY

This empirical study is based on primary data collected through structured interviews with 50 SHG members in Savasihalli Village, Hassan District, using a systematic random sampling method. Data were gathered from women engaged in savings, micro-enterprises, and livelihood programs. The area was chosen for its active SHGs that promote financial independence, cooperation, and self-reliance.

SCOPE OF THE STUDY

The study focuses on the role of SHGs in empowering women and fostering rural development in Savasihalli. It examines how SHG participation improves women's economic status, confidence, and decision-making, and how it supports entrepreneurship, skill development, and income generation in the community.

LIMITATIONS OF THE STUDY

1.The survey is conducted only in Savasihalli village in Hassan District.

2.The study largely is based on the perception of the respondents.

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SAVASIHALLI VILLAGE PROFILE

Savasihalli village is a village in Belur Taluk in Hassan District of the Karnataka State, India. It belongs to Mysore Division. It is located 26 km towards South from District headquarters Hassan. 22 km from Belur. 206 km from State capital Bangalore. Savasihalli local language is Kannada. Savasihalli village total population is 1224. The data for this report is obtained for Gram Panchayath office Savasihalli as per 2010-11 census

Census Parameters	Census Data
Total population	1224
Total number of houses	456
Female population %	45.58%(558)
Male	54.41%(666)
Total literacy %	65.52%(802)
Female literacy rate %	65.77(367)
Working population %	58.49%(716)

Source: 2011 Census, Savasihalli Gramapanchayath

Table-1: Educational Qualification of SHG Members

S.No	Qualification	Members	Percentage
1	Primary School	25	50%
2	Middle School	10	20%
3	High School	10	20%
4	PUC	3	6%
5	Degree	2	4%
	Total	**50**	**100%**

Source: Primary Data

In this survey, the educational qualification chart shows that **50% of the SHG members have only primary education**, **20% have completed middle school**, and **20% have studied up to high school**. A small percentage—**6% hold PUC** and **4% possess a degree**. This indicates that all most all selected respondents are educated. Empowered women are capable to provide quality education facilities to her family members in study area. It is also one of the positive impacts on rural development.

Table–2: Ownership of Houses among SHG Members

House	Member	Percentage
Own	50	100%
Rent	-	
Total	**50**	**100%**

Source: Primary Data

The above table shows that respondents are living in own house or rented house. As per this table, all the respondent are living in their own house. When the women's are empowered no doubt about it, the capable to obtain own house and enjoy all needs. This is become a positive impact on rural development in study area.

Table–3: Annual Income of the Family

	Member	Percentage
10000-50000	08	16%
50000-100000	10	20%
100000-200000	**24**	**48%**

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200000-300000	**08**	**16%**
Total	**50**	**100%**

Source: primary Data

The above table shows the annual income of the respondents' families. Out of 50 respondents, 08 families have an annual income between ₹10,000–₹50,000, 10 families between ₹50,000–₹1,00,000, 24 families between ₹1,00,000–₹2,00,000, and 08 families between ₹2,00,000–₹3,00,000. This indicates that the majority of respondents' families are above the poverty line, showing signs of economic improvement among empowered women in the study area.

Table–4: Contribution of Empowered Women to Family Income

	Member	**Percentage**
10000-20000	26	52%
20000-30000	14	28%
30000-40000	**7**	**14%**
40000-50000	**3**	**6%**
Total	**50**	**100%**

Source: primary Data

The above table shows women's contribution to their family income. Out of 50 respondents, 26 contribute between ₹10,000–₹20,000 annually, while others contribute up to ₹50,000. This reflects that **empowered women are significantly contributing to household income**, indicating their growing financial independence and positive role in family welfare.

Table–5: Status of Empowered Women in Their Family

	Member	**Percentage**
High Position	36	72%
Middle Position	14	28%

Source: primary Data

The above table indicates the position of empowered women in their families. Among 50 respondents, 36 women have achieved a **higher position** in their families, while 14 women hold a **middle position**. This shows that the majority of empowered women have attained **a good social and decision-making status** within their households. After empowerment, women are actively participating in family matters, managing finances, and maintaining household budgets. Their exposure to education and media has improved their knowledge, awareness, and confidence, leading to **enhanced family roles and social recognition**. Overall, women empowerment has brought about **positive changes in rural lifestyle and development** in the study area.

Table–6: Healthy Facility for Empowered Women

Answers	**Member**	**Percentage**
Yes	50	100%

Source: primary Data

The above table shows that **all respondents (100%)** reported having access to health facilities. This demonstrates that empowered women are now capable of availing health services using their own income sources. As a result of empowerment, women have gained **financial independence**, which enables them to secure healthcare for themselves and their families. Additionally, the study area has witnessed growth in healthcare infrastructure —

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including hospitals, clinics, and medical shops — reflecting the **positive impact of women empowerment on rural development**.

Table–7: Health Condition

	Member	**Percentage**
High Position	44	88%
Middle Position	6	12%

Source: primary Data

As per the above table, out of 50 respondents, **44** reported being in good health, while **6** did not. This shows that the **majority of empowered women** in the study area maintain good health due to better access to healthcare facilities. Empowerment enables women to take care of their physical well-being, as they have financial means and awareness about health practices. Health is a vital indicator of **rural development**, as healthy citizens contribute productively to the nation. When women are empowered, they not only ensure their own well-being but also provide **better health facilities for their families**, fostering a healthier rural society.

Table–8: Children Education

Answers	**Member**	**Percentage**
Yes	50	100

Source: primary Data

After empowerment, all the respondents (100%) stated that they are able to **provide quality education** to their children. This clearly indicates that empowerment has created a **progressive impact** on rural families — especially in promoting education for the next generation. Empowered women invest their income and awareness in improving their children's educational standards, which contributes directly to **long-term rural development and social upliftment**.

Table–9: Equality in working place

Answers	**Member**	**Percentage**
Yes	43	86%
No	07	14%

Source: primary Data

The above table shows that **86%** of respondents feel they experience **equality in the workplace**, while **14%** do not. This implies that the majority of empowered women have gained **confidence and recognition** at work, participating equally with men in employment and income-earning activities. However, a minority still faces challenges, suggesting that **continued efforts are required** to achieve complete workplace equality in rural areas. Overall, empowerment initiatives have significantly contributed to enhancing **gender equality, social respect, and professional opportunities** for women.

FINDINGS OF THE STUDY

1. **Socio-Economic Upliftment:**
   Women's empowerment has played a crucial role in improving the **socio-economic status of women** in rural India, enhancing their ability to contribute meaningfully to household and community welfare.

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2. **Economic Independence:**
   Empowered women have become **economically stronger**, generating and managing income through occupations, small enterprises, and self-help group (SHG) initiatives.
3. **Reduction in Superstitions and Social Barriers:**
   Traditional beliefs and superstitions that once prevented rural women from accessing education and financial opportunities are gradually diminishing, fostering **greater awareness and self-confidence** among women.
4. **Improved Family Status:**
   The study found that a **majority of empowered women enjoy higher status** within their families. They now participate actively in household decisions, financial planning, and children's education.
5. **Equality and Social Justice:**
   Empowered women in the study area have achieved **equal status with men**, reflecting a decline in gender inequality and an increase in mutual respect within both households and workplaces.
6. **Increasing Workforce Participation:**
   Women's **work participation rate** has risen substantially in recent years. Women are now contributing to multiple sectors of the economy, strengthening their **economic, social, and political status**.
7. **Employment and Empowerment:**
   Employment has emerged as a **key driver of empowerment**, providing women with financial independence, self-sufficiency, and a stronger voice in family and community matters.
8. **Enhanced Standard of Living:**
   Empowered women are now able to afford modern household goods such as **mixers, televisions, refrigerators, and fans**, reflecting improvements in their quality of life and family comfort.

SUGGESTIONS

1. Employment is an effective tool for reducing poverty and enhancing women's capacity.
2. Women's community and political participation should be strengthened since many employed women remain voiceless in decision-making spaces.
3. The government should provide more facilities and schemes to uplift the economic and social status of **SC and ST women**.
4. Awareness about **women empowerment programmes** must be increased.
5. Women should be provided **equal rights** in workplaces.
6. Steps should be taken to **increase literacy and employment** among women.
7. The number of opportunities for women in education, employment, and politics should be expanded to raise the **female participation rate**.
8. Programmes must be accelerated through **consultation, coordination, and collaboration** between government and local organizations.

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9. Practical, skill-based training should be provided to women to make them **self-reliant and employable**.

CONCLUSION

The study concludes that employment has a positive impact on the women of Savasihalli village. Empowerment enables women to recognize their potential, identity, and power in all aspects of life. Empowered women play a vital role in rural development, actively participating in the village economy. The study emphasizes that economic and social liberalization of women is essential for true empowerment. Only when women are given equal opportunities and participation in development processes can real rural development occur. Thus, women's empowerment is a key driver of rural progress in India.

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DIGITAL AGRICULTURE AND INCOME ENHANCEMENT: A STUDY OF INDIAN FARMERS

P Manjula

Associate Professor
Department of Economics, A.V. Kanthamma College for Women, Hassan, Karnataka

ABSTRACT

Digital technologies are increasingly transforming Indian agriculture by improving access to information, enhancing productivity, and strengthening market linkages. This study examines the impact of digital tools such as mobile apps, ICT platforms, AI systems, remote sensing, and e-marketplaces on farmers' income in India. These technologies help farmers make informed decisions on sowing, irrigation, pest management, and marketing, leading to higher yields, reduced input costs, and better price realisation. Government initiatives like the Digital Agriculture Mission, PM-Kisan (DBT), eNAM, Kisan Call Centres, and Soil Health Card Scheme have further supported digital adoption and improved service delivery. However, the adoption of digital technologies remains limited due to challenges such as low awareness, inadequate digital literacy, poor rural infrastructure, affordability issues, and unequal access among small and marginal farmers. Despite these constraints, digital agriculture holds significant potential to enhance income stability and promote sustainable rural development. The study concludes that strengthening infrastructure, expanding training programs, and promoting inclusive digital policies are essential to maximize the benefits of digital technologies and ensure equitable growth for farmers across India.

Keywords: Digital Agriculture, Farmers' Income, Mobile Apps, ICT Platforms, Artificial Intelligence (AI), E-marketplaces, Government Initiatives, eNAM, PM-Kisan, Digital Literacy, Agricultural Technology.

INTRODUCTION

Agriculture is a key sector in India, providing livelihoods to a large portion of the population and contributing significantly to national income and food security. However, the sector faces challenges such as low productivity, climate variability, fragmented land holdings, weak market systems, and limited access to timely information. These issues restrict income growth and increase economic vulnerability, especially among small and marginal farmers.

Recent advancements in digital technologies have created new opportunities to transform Indian agriculture. Tools such as mobile applications, ICT platforms, Artificial Intelligence (AI), remote sensing, and digital marketplaces help address information gaps, improve advisory services, and enhance market access. These technologies enable real-time data sharing, expert guidance, and transparent market mechanisms, allowing farmers to make better decisions about crop planning, resource management, and selling produce. They also support efficient monitoring of crop health and weather risks, reducing losses and improving productivity.

The Government of India has supported this shift through initiatives focused on e-governance, digital public infrastructure, and direct benefit transfers. These programs aim to improve service delivery, reduce inefficiencies, and ensure financial inclusion. Despite these efforts, adoption remains uneven due to low digital literacy, poor infrastructure, and affordability issues. This study examines the impact of digital technologies on farmers'

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income in India, highlighting both benefits and challenges to understand their role in promoting sustainable and inclusive agricultural growth.

REVIEW OF LITERATURE

Gautam et al. (2021) found a positive relationship between digital technology adoption and farmers' income using panel data. Digital finance and ICT tools helped improve information access, reduce costs, and enhance market participation.

Kumar and Singh (2022) studied mobile-based advisory services and reported that users achieved higher yields and income. Timely weather and crop guidance improved farming practices, but adoption was limited by digital literacy and smartphone availability.

Reddy and Sharma (2023) evaluated the eNAM platform and found it increased price realization and reduced middlemen influence. However, limited internet connectivity and logistics issues restricted its reach, especially in remote areas.

Overall, these studies show digital technologies can increase productivity and income but highlight barriers like infrastructure, awareness, and equitable access.

RESEARCH GAP

Despite evidence that digital tools improve productivity and market access, most studies focus on specific technologies or regions, lacking a comprehensive national-level analysis. Limited research exists on long-term income effects and sustainability of digital adoption among small and marginal farmers. There is also inadequate understanding of barriers like digital literacy, infrastructure, and affordability across diverse agro-climatic zones. Finally, the unequal impact of digital agriculture on vulnerable farmers remains underexplored, requiring more inclusive evaluation.

STATEMENT OF THE PROBLEM

Indian agriculture continues to face persistent challenges such as low productivity, fragmented land holdings, climate uncertainty, and inefficient market systems, which restrict farmers' income growth and financial stability. Although digital technologies have the potential to address these issues through better access to information, improved market linkages, and efficient service delivery, adoption remains uneven and limited. The digital divide, low literacy, poor rural infrastructure, and affordability barriers hinder the effective use of digital tools, particularly among small and marginal farmers. Therefore, there is a need to assess the real impact of digital technologies on farmers' income and identify the key factors affecting adoption, to ensure inclusive and sustainable agricultural development.

OBJECTIVES OF THE STUDY

1. To examine the role of digital technologies in improving agricultural productivity and farmers' income in India.
2. To analyze the impact of digital tools such as mobile apps, ICT platforms, AI, remote sensing, and e-marketplaces on farm income and decision-making.
3. To evaluate the effectiveness of government policies and initiatives in promoting digital agriculture and enhancing farmers' benefits.
4. To identify the key challenges and barriers limiting the adoption of digital technologies among Indian farmers.
5. To recommend strategies for enhancing digital inclusion and ensuring equitable income growth for small and marginal farmers**.**

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HYPOTHESES OF THE STUDY

H_1: Digital technologies increase farmers' income in India.

H_0: Digital technologies do not increase farmers' income.

METHODOLOGY OF THE STUDY

This study uses a descriptive research design based on secondary data from government reports, research articles, and credible agricultural sources to analyze the impact of digital technologies on farmers' income in India. It examines the role of digital tools like mobile apps, AI, remote sensing, and e-marketplaces across different farmer groups and regions. The analysis combines qualitative review of literature and policies with basic quantitative measures such as percentages and correlations to assess the relationship between digital adoption and income, while acknowledging limitations due to data availability and regional disparities.

SCOPE OF THE STUDY

This study focuses on the impact of digital technologies on farmers' income in India, covering key tools such as mobile apps, AI, remote sensing, ICT platforms, and e-marketplaces. It examines how these technologies influence productivity, cost reduction, market access, and access to government benefits. The study also reviews major government policies and initiatives supporting digital agriculture, while identifying challenges such as digital literacy, infrastructure gaps, and unequal adoption. The scope is limited to secondary data sources and general trends across India, without conducting primary field surveys.

LIMITATIONS OF THE STUDY

1. **Secondary Data Dependence:** The study relies only on existing reports and research, which may limit the accuracy and current relevance of findings.
2. **Regional Variations Not Covered Deeply:** India has diverse agricultural conditions, but the study may not fully represent every state or region.
3. **Limited Primary Evidence:** No direct field surveys or interviews were conducted, which may reduce real-time validation of digital adoption.

DIGITAL TECHNOLOGIES IN INDIAN AGRICULTURE

Digital technologies are transforming Indian agriculture by improving access to information, increasing efficiency, and supporting better decision-making. Tools such as mobile apps, ICT platforms, and AI systems address long-standing challenges like information gaps, market inefficiencies, and climate uncertainty. Mobile applications provide weather forecasts, crop advisories, and real-time market prices, enabling farmers to plan sowing, irrigation, and harvesting more effectively and reducing dependence on intermediaries. ICT platforms such as Kisan Call Centres and chatbots connect farmers directly with experts, helping them manage crop diseases, soil health, and improved farming practices, especially in remote areas.

Artificial Intelligence (AI) further enhances agriculture by analyzing large volumes of data to provide predictive insights on sowing time, suitable crop varieties, pest outbreaks, and yield forecasts. These AI-driven recommendations help farmers take preventive actions, optimize resource use, and plan better for storage and marketing, thereby increasing productivity and income. Overall, the integration of these digital tools improves productivity, transparency, and resilience in farming, helping farmers adapt to climate change and improve income stability. However, adoption varies across regions due to social and infrastructural constraints.

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BENEFITS OF DIGITAL TECHNOLOGIES TO FARMERS' INCOME

Digital technologies boost farmers' income by improving productivity, lowering costs, enhancing market access, and ensuring timely financial support. Mobile advisories, AI tools, and remote sensing help farmers make informed decisions on sowing, irrigation, nutrient management, and pest control, leading to higher yields and reduced crop losses. Precision farming also optimizes land and water use, resulting in better output per hectare and increased farm income.

Digital tools also reduce production costs by guiding correct input usage and preventing unnecessary purchases, often lowering expenses by 15–25%. Market linkages through digital marketplaces and price information apps connect farmers directly with buyers, reduce intermediaries, and improve price transparency. This enables farmers to sell at better prices and reduce post-harvest losses. Overall, when combined with supportive government policies and training, digital agriculture strengthens financial stability and supports inclusive rural development in India.

ISSUES AND CHALLENGES IN ADOPTION OF DIGITAL TECHNOLOGIES

Despite the potential of digital technologies to improve farmers' income, their adoption in India remains limited due to several challenges. A major issue is low awareness, with over 86% of farmers reportedly unaware of modern digital tools or lacking access to them. Many still rely on traditional practices and informal advice networks, as targeted awareness programs and extension services are inadequate.

Additionally, digital literacy and infrastructure constraints hinder effective adoption, especially among small and marginal farmers. Poor internet connectivity, unreliable electricity, and limited smartphone access reduce the usability of digital solutions. High investment costs for advanced technologies like drones and sensors make them unaffordable for small landholders, limiting scalability. Furthermore, digital benefits are unevenly distributed, often favoring better-off farmers with more education and resources, which can widen income disparities and raise concerns about inclusive agricultural development.

GOVERNMENT POLICIES AND INITIATIVES

The Government of India has actively promoted digital agriculture through several key policies and initiatives aimed at improving productivity, transparency, and market access. The Digital Agriculture Mission focuses on building a comprehensive digital ecosystem, including Digital Public Infrastructure for crop management and advisory services. The PM-Kisan scheme uses Direct Benefit Transfer (DBT) to provide direct income support to farmers through digital payment systems, reducing delays and leakages. eNAM (National Agriculture Market) connects mandis across the country, offering real-time price information and online trading to reduce intermediary dependence and improve price realization. Kisan Call Centres (KCC) and mobile advisory services provide expert guidance, weather updates, and pest alerts, especially benefiting remote areas. The Soil Health Card Scheme offers digital soil testing records and fertilizer recommendations, supporting precision farming. To support these initiatives, the government has also strengthened rural connectivity through programs like BharatNet and expanded 4G coverage, while promoting digital literacy through training programs. Collectively, these policies aim to create an inclusive digital ecosystem that enhances farmers' access to information, financial services, and markets, thereby improving income and agricultural sustainability.

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FINDINGS

1. **Digital tools improve farm decisions** through weather updates, crop advice, and market prices, helping farmers plan better and reduce losses.
2. **Productivity and yields increase** due to precision farming, early pest detection, and optimized input use.
3. **Costs decrease** as farmers use fertilizers, pesticides, and water more efficiently, saving up to 15–25%.
4. **Market access improves** through eNAM and price platforms, enabling better prices and reducing middlemen.
5. **Government support becomes faster and transparent** via DBT, Soil Health Cards, and digital advisory services.
6. **Adoption is uneven**, with small and remote farmers facing barriers like low digital literacy and poor infrastructure.
7. **Need for training and infrastructure** to make digital agriculture more inclusive and widely adopted.

SUGGESTIONS

1. **Increase digital awareness programs** through village-level workshops and agricultural extension services to help farmers understand and use digital tools effectively.
2. **Improve rural internet and power infrastructure** by expanding BharatNet and strengthening 4G/5G coverage in remote areas.
3. **Provide affordable access to devices** such as subsidized smartphones or shared community digital kiosks for small and marginal farmers.
4. **Strengthen digital literacy training** focusing on basic app usage, online marketplaces, and digital payments.
5. **Promote shared service models** (cooperatives, agri-tech hubs) for expensive technologies like drones and sensors to reduce costs.

CONCLUSION

Digital technologies have the potential to transform Indian agriculture by improving productivity, reducing costs, enhancing market access, and ensuring timely delivery of government support. Tools such as mobile apps, AI systems, and e-marketplaces help farmers make informed decisions, optimize resources, and receive fair prices for their produce. Government initiatives like PM-Kisan, eNAM, and Digital Agriculture Mission further strengthen the digital ecosystem and promote inclusive growth.

However, adoption remains uneven due to challenges like low awareness, limited digital literacy, poor infrastructure, and affordability issues. To fully realize the benefits of digital agriculture, it is essential to strengthen rural connectivity, expand training programs, and promote affordable access to digital tools—especially for small and marginal farmers. With sustained efforts and supportive policies, digital agriculture can significantly enhance farmers' income and contribute to sustainable rural development in India.

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WASTE MANAGEMENT AND ENVIRONMENTAL SUSTAINABILITY: CHALLENGES, STRATEGIES, AND FUTURE PERSPECTIVES

P. Manjula

Associate Professor
Department of Economics, A.V. Kanthamma College for Women, Hassan

ABSTRACT

Rapid urbanization, industrialization, and population growth have significantly increased the generation of solid waste worldwide, posing serious threats to environmental sustainability. Inefficient waste management practices lead to land degradation, water and air pollution, and adverse health effects. This research paper explores the concept of waste management, its importance in achieving environmental sustainability, current challenges, and effective strategies such as the 3Rs (Reduce, Reuse, Recycle), circular economy, and technological innovations. The paper also highlights the role of governments, industries, and individuals in building a sustainable future.

Keywords: Waste management, environmental sustainability, recycling, circular economy, solid waste

INTRODUCTION

Environmental sustainability emphasizes maintaining ecological balance by conserving natural resources and minimizing environmental degradation. With rapid population growth, urbanization, and industrial expansion, the volume of waste generated globally has increased at an alarming rate. According to environmental studies, unmanaged waste contributes significantly to soil contamination, water pollution, air quality deterioration, and climate change.

In developing countries, waste management systems often struggle due to inadequate infrastructure, lack of awareness, and limited financial resources. Open dumping, unsegregated waste disposal, and uncontrolled burning remain common practices, leading to serious environmental and public health concerns. These practices release toxic substances and greenhouse gases, affecting ecosystems and human well-being.

Sustainable waste management integrates environmental protection, economic efficiency, and social responsibility. It involves waste reduction, segregation, recycling, recovery, and safe disposal methods. By adopting sustainable waste management practices, societies can minimize environmental damage, conserve resources, and promote long-term sustainability. Therefore, understanding effective waste management strategies is essential for achieving environmental sustainability.

REVIEW OF LITERATURE

Guerrero, Maas, and Hogland (2013) examine the challenges of municipal solid waste management in developing countries and argue that weak governance structures and limited public participation are major barriers to sustainable waste management. They emphasize that the absence of community involvement, inadequate policy implementation, and poor institutional coordination result in inefficient waste handling systems. Their study highlights that sustainable waste management cannot be achieved solely through technological solutions but requires strong governance and active citizen participation to ensure long-term environmental protection.

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Kaza et al. (2018), in a comprehensive World Bank report, analyze global waste generation trends and warn that waste volumes are expected to increase by nearly 70 percent by 2050 if current practices continue. The authors stress that traditional linear models of production and disposal are environmentally unsustainable. They advocate for recycling, resource recovery, and circular economy frameworks as essential strategies for reducing environmental degradation and conserving natural resources. Their findings underline the need for systemic changes in waste management policies to support environmental sustainability on a global scale.

Singh and Sharma (2016) study the environmental consequences of improper waste disposal in urban India and conclude that unscientific landfilling, open dumping, and waste burning are primary contributors to air and groundwater pollution. They demonstrate how inadequate waste segregation and poor disposal infrastructure lead to severe public health risks and ecological damage. Their research emphasizes the urgency of adopting scientifically planned waste management systems to mitigate environmental pollution and promote sustainable urban development.

Research Gap

Although extensive research has been conducted on waste management and sustainability, several gaps remain:

- Limited studies focus on the practical implementation challenges of sustainable waste management in developing regions.
- Insufficient research on public awareness and behavioral factors influencing waste segregation and recycling.
- Lack of integrated studies connecting policy frameworks, technology adoption, and environmental outcomes.

This study aims to address these gaps by examining waste management practices and their contribution to environmental sustainability.

Statement of the Problem

Improper waste management practices continue to pose significant environmental and health risks despite existing policies and technological solutions. The increasing volume of waste, inadequate infrastructure, lack of awareness, and poor enforcement of regulations hinder the adoption of sustainable waste management practices. This problem necessitates a comprehensive analysis of waste management strategies and their effectiveness in promoting environmental sustainability.

Objectives of the Study

The objectives of the study are:

1. To analyze the current waste management practices.
2. To examine the environmental impacts of improper waste disposal.
3. To study the role of sustainable waste management in environmental sustainability.
4. To identify challenges in implementing effective waste management systems.
5. To suggest strategies for improving sustainable waste management practices.

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Hypothesis of the Study

- **H_0 (Null Hypothesis):** There is no significant relationship between waste management practices and environmental sustainability.
- **H_1 (Alternative Hypothesis):** Effective waste management practices significantly contribute to environmental sustainability.

Methodology

The study adopts a **descriptive and analytical research design** to examine the relationship between waste management practices and environmental sustainability. The research is primarily based on **secondary data** collected from a wide range of reliable sources, including peer-reviewed research journals, government reports, and publications from international organizations such as the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the World Bank. In addition, relevant information has been gathered from academic books and authenticated online databases. The collected data is analyzed using **qualitative methods** to identify prevailing waste management trends, assess existing challenges, and evaluate their implications for environmental sustainability.

Scope of the Study

The scope of the study includes:

- Examination of various types of waste and management techniques
- Analysis of environmental impacts related to waste disposal
- Focus on sustainable practices applicable to developing countries
- Understanding the role of government, technology, and public participation

The study does not focus on a specific city or country but provides a generalized overview.

Limitations of the Study

The study has certain limitations:

- Reliance on secondary data, which may limit real-time accuracy
- Findings may vary based on regional waste management policies
- Technological and economic constraints are not deeply quantified

Types of Waste

Waste can be broadly classified based on its source, composition, and potential environmental impact. **Municipal solid waste** is generated from households, commercial establishments, institutions, and public spaces and includes food waste, paper, plastics, glass, metals, and textiles. This type of waste constitutes a significant portion of urban waste and requires efficient collection, segregation, and disposal systems to prevent environmental pollution.

Industrial waste is produced by manufacturing and industrial activities and may include solid, liquid, or gaseous waste. It often contains hazardous substances such as heavy metals, chemicals, and toxic by-products, which pose serious risks to human health and the environment if not properly treated. Effective industrial waste management involves waste minimization, treatment, recycling, and compliance with environmental regulations.

Biomedical waste, generated by hospitals, clinics, laboratories, and healthcare facilities, includes infectious waste, sharps, pharmaceutical waste, and pathological waste. Improper handling of biomedical waste can lead to the spread of infectious diseases and environmental

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contamination. Therefore, it requires strict segregation, safe storage, treatment, and disposal methods such as incineration or autoclaving.

Electronic waste (e-waste) consists of discarded electrical and electronic equipment such as computers, mobile phones, televisions, and household appliances. E-waste contains valuable materials like copper and gold, as well as hazardous substances such as lead, mercury, and cadmium. Sustainable management of e-waste involves safe recycling, recovery of valuable components, and environmentally sound disposal to reduce pollution and conserve resources.

Environmental Impacts of Improper Waste Management

Improper waste management practices result in severe environmental and health consequences. **Open dumping** of waste contaminates soil through the release of harmful chemicals, reducing land productivity and affecting agricultural activities. The degradation of soil quality also disrupts natural ecosystems and biodiversity.

Landfills, when not properly designed or managed, produce leachate that seeps into groundwater and nearby water bodies. This leachate contains toxic substances and pathogens that pollute drinking water sources and harm aquatic ecosystems. Water pollution caused by waste disposal poses serious risks to human health and food security.

Open burning of waste releases toxic gases, particulate matter, and greenhouse gases such as carbon dioxide and methane into the atmosphere. These emissions contribute to air pollution, respiratory diseases, and climate change. The uncontrolled release of methane from decomposing organic waste further accelerates global warming.

Additionally, improperly managed waste creates breeding grounds for disease-carrying organisms such as mosquitoes, flies, and rodents. This increases the risk of infectious diseases, particularly in densely populated urban areas. Thus, ineffective waste management poses a major threat to environmental sustainability and public health.

Waste Management Strategies for Sustainability

Sustainable waste management strategies aim to reduce the environmental impact of waste while maximizing resource efficiency. The 3Rs—Reduce, Reuse, and Recycle form the foundation of sustainable waste management. Reducing waste at the source minimizes the amount of waste generated, while reusing products extends their lifespan and decreases the demand for new resources. Recycling transforms waste materials into new products, conserving natural resources and reducing energy consumption.

Composting is an environmentally friendly method of managing organic waste such as food scraps and agricultural residues. It converts biodegradable waste into nutrient-rich compost that enhances soil fertility and reduces the need for chemical fertilizers. Composting also helps reduce methane emissions from landfills.

Waste-to-energy (WtE) technologies involve converting non-recyclable waste into usable energy through processes such as incineration, anaerobic digestion, and gasification. These technologies reduce landfill volume while generating electricity or heat. However, they require strict emission control measures to prevent environmental pollution.

Sanitary landfills are designed to minimize environmental risks through the use of liners, leachate collection systems, and gas recovery mechanisms. When properly managed, they provide a safer alternative to open dumping and help control pollution associated with waste disposal.

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Role of Technology in Waste Management

Technological advancements play a crucial role in improving the efficiency and sustainability of waste management systems. Smart waste bins equipped with sensors monitor fill levels and optimize waste collection routes, reducing fuel consumption and operational costs. These systems contribute to more efficient urban waste management.

Automated waste segregation technologies use artificial intelligence and robotics to separate waste materials accurately, improving recycling efficiency and reducing human exposure to hazardous waste. Advanced recycling technologies enable the recovery of valuable materials from complex waste streams, particularly e-waste.

Waste-to-energy plants utilize modern technologies to convert waste into renewable energy, reducing dependence on fossil fuels and lowering greenhouse gas emissions. Innovations in biodegradable materials and eco-friendly packaging further support sustainable waste reduction.

Overall, technology enhances resource recovery, reduces environmental impact, and supports the transition toward sustainable waste management systems.

Role of Government and Public Participation

Governments play a vital role in ensuring effective waste management through policy formulation, regulation enforcement, and infrastructure development. Environmental laws, waste management rules, and extended producer responsibility (EPR) policies encourage industries to manage waste responsibly. Financial investment and institutional support are essential for implementing sustainable waste management systems.

Public participation is equally important in achieving environmental sustainability. Waste segregation at the source, responsible consumption, and active participation in recycling programs significantly reduce waste generation. Awareness campaigns and environmental education help foster sustainable behavior among citizens.

Collaboration between governments, industries, non-governmental organizations, and communities is essential for building efficient and sustainable waste management systems. Collective responsibility and coordinated action can significantly contribute to environmental protection and long-term sustainability.

FINDINGS

The study reveals that:

1. Improper waste management practices significantly contribute to environmental degradation, including soil, water, and air pollution.
2. Rapid urbanization and population growth have increased waste generation beyond the capacity of existing management systems, particularly in developing countries.
3. Lack of public awareness, inadequate infrastructure, and weak enforcement of waste management policies hinder the adoption of sustainable practices.
4. Sustainable waste management strategies such as the 3Rs, composting, and waste-to-energy technologies effectively reduce environmental impact when properly implemented.
5. Technological innovations play a crucial role in improving waste segregation, recycling efficiency, and resource recovery.

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6. Active government involvement and public participation are essential for achieving environmentally sustainable waste management systems.

SUGGESTIONS

1. Governments should strengthen waste management policies and ensure strict enforcement of environmental regulations.
2. Public awareness programs should be expanded to promote waste segregation at the source and responsible consumption practices.
3. Investment in modern waste management infrastructure and eco-friendly technologies should be increased.
4. Industries should adopt circular economy principles and extended producer responsibility to reduce waste generation.
5. Educational institutions should incorporate environmental sustainability and waste management concepts into academic curricula.

CONCLUSION

This research confirms that effective waste management is a fundamental pillar of environmental sustainability. Improper waste disposal practices pose serious threats to ecosystems, public health, and climate stability. The study highlights that sustainable waste management strategies—supported by technological innovation, policy enforcement, and public participation—can significantly reduce environmental degradation and conserve natural resources.

Waste management is not merely a technical challenge but a collective social responsibility. Long-term environmental sustainability can only be achieved through coordinated efforts involving governments, industries, and individuals. By adopting integrated and sustainable waste management systems, societies can move toward a cleaner, healthier, and more sustainable future for generations to come.

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WOMEN, AGRICULTURE, AND RURAL DEVELOPMENT: ISSUES AND CHALLENGES

P. Manjula

Associate Professor
Department of Economics, A.V. Kanthamma College for Women, Hassan, Karnataka

ABSTRACT

Women play a vital role in agriculture and rural development, particularly in developing countries where agriculture remains a primary source of livelihood. They contribute extensively to crop production, livestock management, food processing, and household food security. Despite their significant involvement, women in agriculture continue to face numerous challenges such as lack of land ownership, limited access to credit, technology, education, and decision-making power. This research paper examines the role of women in agriculture, the issues and challenges they encounter, and the impact of gender inequality on rural development. The study also highlights the importance of empowering women through policy interventions, institutional support, and social change to achieve inclusive and sustainable rural development.

Keywords: Women in agriculture, rural development, gender inequality, women farmers, agricultural sustainability

INTRODUCTION

Agriculture in rural areas is not only a source of livelihood but also a means of sustaining social and economic stability. Women, as primary contributors to both crop cultivation and livestock management, play a pivotal role in ensuring household food security and nutrition. They are often responsible for collecting seeds, managing small livestock, and preserving traditional knowledge related to sustainable farming practices. Their involvement in post-harvest activities such as sorting, processing, and marketing agricultural produce adds significant value to the rural economy. Moreover, women's work in agriculture extends beyond production; they contribute to local decision-making, cooperative management, and community-based development initiatives, thereby strengthening rural institutions and social cohesion.

However, the recognition of women's role in agriculture remains limited, and they continue to face systemic challenges. Lack of access to land, credit, modern technology, and extension services significantly hampers their productivity. In many regions, cultural norms restrict women's mobility, limit their participation in formal agricultural training programs, and reduce their decision-making power within households and communities. These constraints not only limit women's economic empowerment but also reduce the overall efficiency and sustainability of agricultural systems. Addressing these structural barriers through targeted policies, financial inclusion, skill development, and awareness programs is critical for unlocking the full potential of women in agriculture and promoting inclusive rural development.

In addition to economic contributions, women play a crucial role in promoting environmental sustainability and climate resilience in agriculture. Their traditional knowledge of crop rotation, seed selection, soil fertility management, and water conservation practices helps maintain ecosystem balance and ensures long-term productivity. Women are often responsible for managing household gardens, collecting fuel and water, and preserving biodiversity through the cultivation of native crops

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and medicinal plants. By integrating indigenous knowledge with modern agricultural techniques, women contribute to sustainable farming practices that reduce environmental degradation, enhance resource efficiency, and support community resilience against climate-related challenges. Recognizing and supporting women's role in sustainable agriculture is therefore essential for achieving both ecological and socio-economic development goals in rural areas.

REVIEW OF LITERATURE

Agarwal (2010) emphasizes that women's access to land ownership is a key determinant of agricultural productivity and rural development. She argues that secure land rights enhance women's bargaining power, access to credit, and decision-making ability.

FAO (2011) highlights that women contribute nearly half of the agricultural labor force in developing countries. The report states that providing women with equal access to resources such as land, credit, and technology could significantly increase agricultural output and reduce hunger.

Kumar and Singh (2018) analyze the challenges faced by women farmers in rural India and identify lack of training, limited access to financial services, and social restrictions as major constraints. They conclude that women's empowerment is essential for inclusive rural development.

World Bank (2020) reports that gender inequality in agriculture leads to inefficient use of resources and slows economic growth. The study emphasizes the need for gender-responsive agricultural policies and institutional reforms.

RESEARCH GAP

Although several studies focus on women's participation in agriculture, there is limited research on the direct relationship between women's empowerment and rural development outcomes. Insufficient attention has been given to implementation challenges of government schemes targeting women farmers. Moreover, the social and cultural barriers affecting women's participation in decision-making processes remain underexplored. This study aims to bridge these gaps by examining the issues and challenges faced by women in agriculture and their impact on rural development.

STATEMENT OF THE PROBLEM

Women play a critical role in agricultural production and rural livelihoods, yet they continue to face systemic discrimination and unequal access to resources. Despite policy initiatives and development programs, women farmers often lack land ownership, financial support, training, and technological access. These challenges restrict their productivity, income, and participation in rural development, thereby affecting agricultural growth and food security.

OBJECTIVES OF THE STUDY

The objectives of the study are:

1. To examine the role of women in agriculture and rural development.
2. To identify the major issues and challenges faced by women in the agricultural sector.
3. To analyze the impact of gender inequality on agricultural productivity and rural development.
4. To study existing policies and support systems for women farmers.
5. To suggest measures for empowering women in agriculture.

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HYPOTHESIS OF THE STUDY

- **H_0 (Null Hypothesis):** Women's participation in agriculture has no significant impact on rural development.
- **H_1 (Alternative Hypothesis):** Women's participation in agriculture significantly contributes to rural development.

METHODOLOGY

The study adopts a descriptive and analytical research design. It is based on secondary data collected from research journals, government reports, and publications by organizations such as the Food and Agriculture Organization (FAO), World Bank, and United Nations agencies. Information has also been sourced from academic books and reliable online databases. The collected data is analyzed qualitatively to understand women's roles in agriculture, the challenges they face, and their contribution to rural development.

SCOPE OF THE STUDY

The scope of the study includes analysis of women's role in agriculture, the challenges they face, and their contribution to rural development. The study provides a general overview applicable to developing countries and does not focus on a specific geographic region.

LIMITATIONS OF THE STUDY

- The study does not include primary data from women farmers, which may limit insights into firsthand experiences and challenges.
- Implementation and effectiveness of government programs are not evaluated at the community level.
- Environmental and climate-related factors affecting women in agriculture are not fully explored.
- Intersectional factors such as age, education, and caste affecting women's participation are not considered.

ROLE OF WOMEN IN AGRICULTURE AND RURAL DEVELOPMENT

Women are actively involved in almost every stage of agricultural production and play a crucial role in sustaining rural economies. Their participation begins from the early stages of farming such as land preparation, seed selection, sowing, and transplantation, and continues through weeding, irrigation, harvesting, and storage. Women possess traditional knowledge related to crop varieties, soil fertility, and pest control, which contributes significantly to agricultural productivity and environmental sustainability.

In addition to crop cultivation, women are deeply engaged in allied agricultural activities including livestock management, dairy farming, poultry rearing, fisheries, and sericulture. These activities provide supplementary income to rural households and enhance livelihood security. Women also play a key role in post-harvest operations such as cleaning, grading, processing, preservation, and value addition of agricultural produce. Their involvement in local markets and small-scale agribusinesses further contributes to rural economic development.

Beyond direct agricultural activities, women significantly contribute to rural development through

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effective household resource management, ensuring food and nutritional security, and preserving indigenous knowledge related to farming practices and biodiversity conservation. Their active participation in self-help groups, cooperatives, and community organizations strengthens social capital and promotes inclusive development. Thus, women act as key agents of sustainable agriculture and rural transformation.

ISSUES AND CHALLENGES FACED BY WOMEN IN AGRICULTURE

Despite their substantial contribution, women in agriculture face several structural, economic, and social challenges that limit their potential and productivity.

Lack of Land Ownership

Land ownership serves as a critical source of economic security, social status, and empowerment in rural areas. However, women rarely own or control agricultural land due to discriminatory inheritance laws, customary practices, and deep-rooted gender biases. Even when legal provisions exist, social norms often prevent women from claiming land rights. The absence of land ownership restricts women's access to institutional credit, government welfare schemes, and agricultural subsidies. It also limits their participation in farm-level decision-making and reduces their bargaining power within households and communities.

Limited Access to Credit and Financial Services

Access to finance is essential for adopting improved agricultural practices and increasing productivity. However, women farmers often face difficulties in obtaining formal credit due to lack of collateral, low income levels, and limited financial literacy. Many financial institutions perceive women as high-risk borrowers, further restricting their access to loans and insurance services. As a result, women depend on informal sources of credit with high interest rates, which increases their financial vulnerability and limits investment in quality seeds, fertilizers, machinery, and irrigation facilities.

Limited Access to Technology and Training

Agricultural extension services and training programs often fail to adequately include women farmers. Most training sessions are conducted at times or locations that are inaccessible to women due to household responsibilities and mobility restrictions. Moreover, agricultural technologies are frequently designed without considering women's physical and social needs. This lack of access to modern tools, mechanization, and information on sustainable farming practices reduces women's productivity and efficiency, widening the gender gap in agriculture.

Heavy Workload and Time Constraints

Women in rural areas face a heavy workload as they perform both productive and reproductive roles. Along with agricultural labor, they are primarily responsible for household chores such as cooking, childcare, elderly care, water collection, and fuel gathering. This dual burden leaves them with limited time for education, skill development, and participation in income-generating activities. The excessive workload also affects their health and well-being, further constraining their ability to contribute effectively to agricultural and rural development.

Social and Cultural Barriers

Social and cultural norms rooted in patriarchy continue to restrict women's mobility, leadership opportunities, and participation in decision-making processes. Women are often excluded from farmers' organizations, cooperatives, and village-level institutions where key agricultural decisions are

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made. Gender stereotypes portray farming as a male-dominated activity, leading to the undervaluation of women's labor and knowledge. These barriers reduce women's visibility, voice, and influence in rural development initiatives.

Impact of Gender Inequality on Rural Development

Gender inequality in agriculture has far-reaching consequences for rural development. When women lack access to land, credit, technology, and decision-making power, agricultural productivity and efficiency decline. This inequality contributes to lower household incomes, poor nutrition, and increased poverty levels. Studies show that empowering women farmers can significantly improve crop yields, enhance food security, and promote sustainable resource management. Gender equality in agriculture also leads to better educational and health outcomes for rural families, thereby accelerating overall rural development.

Government Initiatives and Policy Support

Governments and international organizations have introduced initiatives to empower women in agriculture, recognizing their key role in productivity, food security, and rural livelihoods. Measures include **self-help groups (SHGs)**, women-centric credit and insurance schemes, and microfinance programs, which improve access to financial resources for agricultural inputs, livestock, and small enterprises. **Skill development and training programs** enhance technical knowledge in sustainable farming, livestock management, agro-processing, and entrepreneurship, boosting productivity, income, and household food security.

Despite these efforts, challenges such as limited awareness, bureaucratic hurdles, weak implementation, and socio-cultural barriers reduce program effectiveness. Strengthening institutional support, improving outreach, and tailoring initiatives to women's specific needs are essential. A holistic and inclusive approach can significantly enhance women's contributions to agriculture and rural development while promoting sustainable and resilient rural economies.

FINDINGS

The study reveals that:

1. Women play a vital and multifaceted role in agricultural production, livestock management, post-harvest activities, and rural livelihood systems.
2. Despite their substantial contribution, women's work in agriculture remains largely unpaid, unrecognized, and undervalued.
3. Gender inequality significantly restricts women's access to critical resources such as land ownership, institutional credit, agricultural inputs, and modern technology.
4. Social and cultural norms continue to limit women's mobility, leadership roles, and participation in decision-making processes at household and community levels.
5. Limited access to education, training, and extension services reduces women's productivity and adoption of sustainable agricultural practices.
6. Empowering women farmers has a positive impact on agricultural productivity, household food security, nutritional outcomes, and income generation.
7. Various government policies and development programs exist to support women in agriculture, but gaps in implementation, awareness, and outreach reduce their effectiveness.

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SUGGESTIONS

1. Legal and institutional reforms should be strengthened to ensure equal land ownership and inheritance rights for women, with effective enforcement at the grassroots level.
2. Gender-sensitive credit facilities, crop insurance schemes, and financial literacy programs should be expanded to improve women's access to formal financial services.
3. Agricultural extension services and training programs should be redesigned to actively include women farmers, considering their time constraints and local conditions.
4. Technology development and dissemination should be gender-responsive, ensuring that farm tools and mechanization are accessible and suitable for women.
5. Awareness and sensitization programs should be implemented to address deep-rooted social and cultural barriers that restrict women's participation in agriculture.
6. Women's participation in rural institutions, cooperatives, farmer-producer organizations, and self-help groups should be actively promoted and supported.
7. Monitoring and evaluation mechanisms should be strengthened to assess the impact of women-centric agricultural policies and programs.

CONCLUSION

Women are central to agriculture and rural development, contributing significantly to food production, household welfare, and environmental sustainability. However, persistent gender inequalities in access to resources, decision-making power, and institutional support continue to limit their full potential. This study highlights that empowering women in agriculture is not only a matter of social justice but also a critical requirement for achieving food security, poverty reduction, and sustainable rural development.

Addressing these challenges requires comprehensive policy reforms, effective institutional support, and transformative social change. An inclusive and gender-equitable agricultural system that recognizes and supports women's contributions is essential for long-term rural prosperity and overall national development.

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Sustainable Agriculture As A Pathway To Doubling Farmers' Income By 2047

Dr. P Manjula, Associate Professor, Department of Economics

A.V. Kanthamma College for Women, Hassan, Karnataka

Abstract

Sustainable agriculture programmes in India play a pivotal role in addressing the growing challenges of climate change, natural resource degradation, water scarcity, and declining farm profitability. These programmes are strategically designed to promote environmentally sound, economically viable, and socially inclusive farming systems that ensure long-term agricultural sustainability. Initiatives such as the National Mission for Sustainable Agriculture (NMSA), Paramparagat Krishi Vikas Yojana (PKVY), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Soil Health Card Scheme, agroforestry missions, organic and natural farming programmes, crop insurance schemes, and the promotion of Farmer Producer Organizations (FPOs) collectively strengthen farmers' resilience and income potential. By integrating climate-resilient practices, efficient water and soil management, organic and natural inputs, technological innovation, value-chain development, and institutional support, these programmes reduce production risks, lower input costs, and enhance productivity and market access. The combined impact of these initiatives contributes significantly to income diversification, livelihood security, and environmental conservation. This abstract highlights how India's sustainable agriculture programmes form a comprehensive framework to enhance farmers' income, ensure food security, and support the national vision of doubling farmers' income by 2047 while safeguarding ecological balance for future generations.

Keywords:
Sustainable Agriculture, Climate-Resilient Agriculture, Organic Farming, Soil Health Management, Agroforestry, Climate-Smart Practices.

Introduction

Agriculture remains the backbone of the Indian economy, supporting the livelihoods of a large rural population and playing a vital role in ensuring food security. However, the sector faces persistent challenges such as declining soil fertility, water scarcity, fragmented landholdings, climate variability, low productivity, and unstable farm incomes. These issues have made agriculture increasingly vulnerable, particularly for small and marginal farmers. In this context, achieving the national goal of doubling farmers' income by 2047 requires a shift from conventional, input-intensive farming towards more resilient and economically viable agricultural systems.

Sustainable agriculture offers a comprehensive approach to address these challenges by integrating economic growth with environmental conservation and social inclusion. It emphasizes efficient resource use, soil and water conservation, biodiversity protection, and the adoption of climate-resilient practices. With Indian agriculture being highly dependent on monsoon rainfall, climate change has emerged as a major threat, leading to frequent droughts, floods, and unpredictable weather patterns. Sustainable and climate-smart agricultural practices aim to reduce production risks, enhance resilience to climate shocks, and ensure long-term productivity while minimizing environmental degradation.

Recognizing the importance of sustainability, the Government of India has introduced several programmes such as the National Mission for Sustainable Agriculture, Pradhan Mantri Krishi Sinchayee Yojana, Paramparagat Krishi Vikas Yojana, Soil Health Card Scheme, natural farming initiatives, agroforestry missions, and Farmer Producer Organization promotion programmes. These initiatives focus on improving resource-use efficiency, reducing input costs, strengthening market linkages, and providing institutional and risk management support to farmers. Together, they form a robust framework for promoting sustainable agriculture, enhancing farm incomes, and ensuring the long-term resilience and growth of Indian agriculture.

Review of Literature

Several studies emphasize the role of sustainable and climate-smart agriculture in improving farm productivity, resilience, and income. Aggarwal et al. (2024) highlight that climate-smart agricultural practices such as conservation agriculture, integrated nutrient management, and crop diversification significantly enhance productivity while reducing climate-related risks. Their review concludes that these practices help stabilize farmers' income by improving resource-use efficiency and resilience to climate variability.

Devi et al. (2025) focus on climate-smart organic agriculture and note that integrating organic farming with climate-resilient practices improves soil health, reduces dependence on chemical inputs, and enhances farmers' adaptive capacity. The study finds that such integrated approaches contribute to long-term sustainability and higher net returns by lowering production costs and improving market opportunities.

Empirical evidence from India, particularly from semi-arid regions, shows that farmers adopting multiple climate-smart practices earn higher incomes compared to conventional farmers. Studies indicate a positive relationship between the intensity of climate-smart practice adoption and net farm income, demonstrating that sustainable agriculture is both environmentally beneficial and economically viable. Overall, the literature supports sustainable agriculture as a key pathway for increasing farmers' income and achieving long-term agricultural sustainability.

Research Gap

Although numerous studies highlight the benefits of climate-smart and sustainable agriculture, most focus on individual practices rather than their integrated impact on income and resilience. Limited research exists on the combined effect of government programmes and technology adoption on small and marginal farmers' livelihoods. There is a lack of long-term empirical studies tracking income growth under sustainable agriculture initiatives. Regional disparities in adoption and effectiveness of practices remain underexplored. Additionally, the link between sustainable practices and achieving the national goal of doubling farmers' income by 2047 requires more comprehensive investigation.

Statement of the Problem

Indian agriculture faces challenges like declining soil fertility, water scarcity, and climate variability, which reduce farm productivity and income. Small and marginal farmers are especially vulnerable, leading to economic insecurity and unstable livelihoods. Despite government programmes, adoption of sustainable and climate-smart practices remains limited. This limits the potential to improve productivity, reduce costs, and enhance resilience. The study explores how sustainable agriculture can be leveraged to double farmers' income by 2047 while ensuring long-term environmental and economic sustainability.

Objectives of the Study

1. To examine the role of sustainable and climate-smart agricultural practices in improving farm productivity.
2. To analyze how government programmes support farmers in adopting sustainable agriculture.
3. To assess the impact of sustainable practices on farmers' income and livelihood security.
4. To identify challenges and barriers in implementing sustainable agriculture at the farm level.
5. To explore strategies for leveraging sustainable agriculture to achieve the goal of doubling farmers' income by 2047.

Hypothesis of the Study

H_1 (Alternative Hypothesis): Adoption of sustainable and climate-smart agricultural practices, supported by government programmes and technological interventions, has a significant positive impact on farmers' income and livelihood security.

H_0 (Null Hypothesis): Adoption of sustainable and climate-smart agricultural practices, supported by government programmes and technological interventions, has no significant impact on farmers' income and livelihood security.

Methodology of the Study

The study uses a descriptive and analytical research design to examine the impact of sustainable agriculture on farmers' income. Secondary data is collected from government reports, research papers, and records of agricultural programmes. Primary data is gathered through surveys and interviews with small and marginal farmers across different regions. Quantitative analysis such as correlation and regression is used to assess the relationship between sustainable practices and income. Qualitative insights are also analyzed to identify challenges, barriers, and farmers' perceptions of programme effectiveness.

Scope of the Study

The study focuses on exploring how sustainable and climate-smart agricultural practices can enhance productivity, resilience, and income for farmers in India. It examines the role of government programmes, technology adoption, and institutional support in promoting sustainable agriculture. The research covers small and marginal farmers, who are most vulnerable to climate variability and resource constraints. It also analyzes both economic and environmental benefits of adopting sustainable practices. The findings aim to provide insights for policy formulation, programme improvement, and strategies to achieve the goal of doubling farmers' income by 2047.

Limitations of the Study

1. The research is limited to selected regions and may not fully represent all agro-climatic zones of India.
2. Availability and accessibility of comprehensive secondary data from government programmes and agricultural databases may be constrained.
3. External factors such as market fluctuations, policy changes, and extreme weather events may influence outcomes and are beyond the control of the study.

Sustainable Agriculture Programmes in India

Sustainable agriculture programmes in India are designed to address the interconnected challenges of declining soil fertility, water scarcity, climate change, low farm incomes, and environmental degradation. These programmes aim to promote farming systems that are economically viable, environmentally sound, and socially inclusive. By integrating climate resilience, resource efficiency, technological innovation, and institutional support, sustainable agriculture programmes play a crucial role in ensuring long-term agricultural growth and achieving the national objective of doubling farmers' income by 2047.

National Mission for Sustainable Agriculture (NMSA)

The National Mission for Sustainable Agriculture (NMSA) is one of the most comprehensive initiatives launched under the National Action Plan on Climate Change (NAPCC). The mission aims to make Indian agriculture more resilient to climate variability by promoting sustainable practices that enhance productivity while conserving natural resources. NMSA focuses particularly on rainfed areas, which are highly vulnerable to climate risks such as droughts and erratic rainfall. By emphasizing soil health management, efficient water use, and the adoption of climate-resilient crop varieties, the mission seeks to stabilize farm production under adverse climatic conditions.

Through components like Rainfed Area Development, Soil Health Management, and Climate Change Adaptation strategies, NMSA helps farmers improve crop yields and reduce production risks. Improved soil fertility and water-use efficiency lower the cost of cultivation, while resilient cropping systems ensure consistent yields. As a result, farmers benefit from greater income stability and reduced vulnerability to climate shocks, making NMSA a cornerstone of sustainable agricultural development in India.

Paramparagat Krishi Vikas Yojana (PKVY)

Paramparagat Krishi Vikas Yojana (PKVY) is a flagship programme aimed at promoting organic farming across the country. The scheme encourages farmers to adopt traditional, eco-friendly agricultural practices that avoid synthetic fertilizers and pesticides. The programme supports farmers by providing financial assistance for organic inputs, training in organic cultivation techniques, and help with certification processes. Organic farming under PKVY improves soil organic matter, enhances biodiversity, and reduces environmental pollution. Economically, it reduces dependency on costly chemical inputs and enables farmers to access premium markets for organic produce. Over time, this leads to higher net income, improved soil health, and sustainable farm livelihoods.

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched with the objective of improving water-use efficiency in agriculture under the slogan **"More Crop Per Drop."** Recognizing water scarcity as a major constraint to agricultural sustainability, PMKSY focuses on expanding irrigation coverage and promoting micro-irrigation technologies such as drip and sprinkler systems.

The scheme integrates watershed development, rainwater harvesting, and efficient irrigation infrastructure to ensure optimal utilization of available water resources. By reducing water wastage and energy consumption, PMKSY significantly lowers irrigation costs. Consequently, PMKSY contributes to both environmental sustainability and increased farm income.

Soil Health Card Scheme

The Soil Health Card Scheme is a critical initiative aimed at improving soil fertility and promoting balanced nutrient management. Under this scheme, farmers receive soil health cards that provide detailed information about the nutrient status of their fields, along with crop-specific fertilizer recommendations. This scientific approach helps farmers avoid excessive or imbalanced fertilizer use.

By promoting judicious input application, the scheme reduces production costs and prevents soil degradation. Improved soil health leads to better crop yields and long-term productivity. The Soil Health Card Scheme thus plays a vital role in sustainable agriculture by linking scientific soil management with economic benefits for farmers.

Mission Organic Value Chain Development for North Eastern Region (MOVCD-NER)

The Mission Organic Value Chain Development for the North Eastern Region (MOVCD-NER) focuses on promoting organic farming in India's North-Eastern states, which have high potential for organic agriculture due to minimal chemical usage. Unlike schemes that focus only on production, MOVCD-NER adopts a **value-chain approach**, covering production, processing, certification, marketing, and export.

The programme strengthens Farmer Producer Organizations (FPOs), develops organic input supply chains, and creates processing and storage infrastructure. By improving market access and linking farmers to premium organic markets, MOVCD-NER significantly enhances income opportunities. It also promotes environmentally sustainable farming while preserving the ecological richness of the region.

Rainfed Area Development Programme (RADP)

The Rainfed Area Development Programme (RADP) addresses the challenges faced by farmers in rain-dependent regions, which constitute a significant portion of India's agricultural landscape. RADP promotes **integrated farming systems**, combining crops with livestock, fisheries, and agroforestry to optimize resource use and diversify income sources.

By reducing dependence on a single crop, RADP minimizes income risk and enhances livelihood security. Integrated systems improve nutrient recycling, soil fertility, and water efficiency. Farmers benefit from multiple income streams, making agriculture more resilient and economically sustainable in rainfed areas.

National Agroforestry Policy and Sub-Mission on Agroforestry (SMAF)

The National Agroforestry Policy and Sub-Mission on Agroforestry (SMAF) promote the integration of trees with crops and livestock. Agroforestry systems enhance carbon sequestration, improve soil structure, and conserve water resources. Trees also act as windbreaks and provide shade, reducing climate stress on crops.

From an economic perspective, agroforestry offers additional income through timber, fruits, fodder, and fuelwood. It also contributes to long-term sustainability by improving ecosystem services. SMAF thus supports both environmental conservation and income diversification for farmers.

Pradhan Mantri Fasal Bima Yojana (PMFBY)

The Pradhan Mantri Fasal Bima Yojana (PMFBY) is a crop insurance scheme designed to protect farmers against losses due to natural calamities, pests, and diseases. Climate risks pose a major threat to farm income, and PMFBY provides a financial safety net that enhances income stability. Timely compensation helps farmers recover from losses and reinvest in agriculture, contributing to long-term sustainability and income security.

Farmer Producer Organizations (FPOs) Promotion Programme

The promotion of Farmer Producer Organizations (FPOs) aims to strengthen farmers' collective capacity in production, processing, and marketing. Through FPOs, small and marginal farmers gain access to better technology, credit, and markets.

Collective marketing improves price realization and reduces exploitation by intermediaries. This institutional support plays a crucial role in increasing farmers' income and making agriculture more sustainable.

National Innovations in Climate Resilient Agriculture (NICRA)

National Innovations in Climate Resilient Agriculture (NICRA), implemented by the Indian Council of Agricultural Research (ICAR), focuses on developing and disseminating climate-resilient technologies. The programme conducts research, pilot demonstrations, and capacity-building activities to enhance farmers' adaptive capacity. NICRA promotes climate-resilient crop varieties, water-saving technologies, and risk management practices.

Findings of the Study

1. Farmers adopting sustainable and climate-smart practices, such as crop diversification, soil health management, and efficient water use, reported higher productivity than conventional methods.
2. Reduced input costs and access to premium markets for organic produce led to increased income and financial stability.
3. Climate-smart practices improved resilience to droughts, floods, and erratic rainfall, minimizing production losses.
4. Government programmes like NMSA, PMKSY, PKVY, and Soil Health Card Scheme effectively supported adoption of sustainable practices.
5. Barriers such as limited awareness, lack of finance, and insufficient training constrained wider adoption.

Overall, sustainable agriculture combined with government support has strong potential to enhance productivity, diversify income, and contribute to doubling farmers' income by 2047.

Suggestions

1. **Promote Awareness and Training:** Organize regular training programmes and workshops to educate farmers about climate-smart and sustainable practices, including organic farming, soil health management, and water-efficient techniques.
2. **Strengthen Financial and Institutional Support:** Provide easier access to credit, subsidies, and crop insurance to encourage farmers, especially small and marginal ones, to adopt sustainable agriculture.
3. **Encourage Technology Adoption:** Facilitate the use of modern tools, digital platforms, and precision farming techniques to improve productivity and resource-use efficiency.
4. **Support Farmer Producer Organizations (FPOs):** Promote collective farming, marketing, and value-chain linkages to ensure better price realization and reduce dependency on intermediaries.
5. **Integrate Policies and Programmes:** Ensure coordination among national and state-level agriculture schemes to provide comprehensive support for sustainable agriculture adoption.
6. **Focus on Research and Development:** Invest in research to develop climate-resilient crop varieties, natural inputs, and region-specific sustainable practices to improve adoption and impact.

These measures can enhance productivity, reduce costs, improve resilience, and help achieve the goal of doubling farmers' income by 2047**.**

Conclusion

Sustainable agriculture is emerging as a vital strategy for transforming Indian agriculture, ensuring environmental sustainability, and improving farmers' livelihoods. The study highlights that climate-smart practices, organic and natural farming, efficient water and soil management, and agroforestry not only enhance productivity but also reduce costs and increase resilience to climate variability. Government initiatives such as NMSA, PMKSY, PKVY, Soil Health Card Scheme, and support for Farmer Producer Organizations have played a significant role in promoting adoption of these practices. Despite challenges like limited awareness, financial constraints, and fragmented landholdings, the integration of sustainable practices with technological support and institutional frameworks has demonstrated substantial potential to improve farmers' income. By effectively implementing and scaling these programmes, Indian agriculture can achieve higher productivity, diversify income sources, strengthen climate resilience, and contribute significantly toward the national goal of doubling farmers' income by 2047. Sustainable agriculture, therefore, provides a robust pathway for economic growth, environmental conservation, and long-term food security in India.

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