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Editorial Note:

It gives us immense pleasure to present this **Special Issue of SAGAR: International Journal of Management and Research** (ISSN: 2456-2815), published for the period **July–December 2025**. This special issue is surving the selected research papers presented at the International seminar on “**Rural Transformation in the Realm of Viksit Bharat**” Organised by the Department of Rural Economics, Gujarat Vidyapith, Ahmedabad. The International Seminar had been scheduled for 4th and 5th March 2025, aims to explore the multifaceted challenges and opportunities in achieving rural transformation within India's vision of Viksit Bharat. Hosted at the Gujarat Vidyapith Campus in Ahmedabad, the event brings together researchers, policymakers, practitioners, and students to discuss the critical aspects of rural transformation. The central objectives of the seminar are about Rural transformation, integral to inclusive and sustainable development, which demands a dynamic reorganisation of economic, social, and cultural dimensions. While modern technologies bridge gaps, rural India still faces hurdles like poverty, unemployment, gender disparity, and inadequate education and healthcare. This seminar underscores the need for aligning rural transformation strategies with Viksit Bharat to foster equitable growth and self-reliant communities. This special issue brings together a diverse collection of scholarly articles that critically engage with contemporary economic, social, managerial, and developmental challenges facing India and other emerging economies.

This Special Issue has been curated under the guidance of **Prof. Nimisha Shukla (Guest Editor)**, whose academic insights and editorial support have significantly enriched the thematic coherence and scholarly quality of the issue. We gratefully acknowledge her valuable contribution in shaping this Special Issue.

The central objective of this issue is to encourage **interdisciplinary dialogue** on themes such as inclusive growth, sectoral transformation, financial inclusion, employment dynamics, rural development, governance, public policy, education, technology, and indigenous knowledge systems. The papers included here reflect rigorous academic inquiry and offer both empirical and conceptual insights that are relevant to researchers, policymakers, academicians, and practitioners.

Several contributions focus on **economic development and structural change**, including studies on financial inclusion, income convergence across Indian states, agricultural development patterns, employment restructuring, and fiscal dynamics of the central government. Together, these papers provide a nuanced understanding of regional disparities, sectoral performance, and policy-driven growth trajectories.

The issue also gives due importance to **labour, rural economy, and social development**, with research examining plantation labour conditions, public

employment schemes like MGNREGA, and the persistent rural–urban divide in the context of the vision of *Viksit Bharat*. These studies critically assess policy implementation gaps, livelihood challenges, and pathways for inclusive rural transformation.

Themes related to **education, technology, and knowledge systems** are addressed through studies on the use of Information and Communication Technology in higher education and the contemporary relevance of Ayurveda as an indigenous system of knowledge. These contributions highlight the role of innovation, digital access, and traditional wisdom in shaping sustainable development.

Collectively, the papers in this Special Issue underscore the importance of **sector-specific strategies, investment in human capital, good governance, and inclusive policy frameworks** for achieving balanced and sustainable development. The issue seeks to contribute meaningfully to academic discourse while offering insights for evidence-based policymaking.

We extend our sincere gratitude to all the authors for their scholarly contributions and to the reviewers for their critical evaluations and constructive suggestions, which helped maintain the academic rigor of this publication. We also acknowledge the dedicated efforts of the editorial and publication team of **SAGAR Foundation**.

This Special Issue has been edited under the stewardship of:

Editors

Dr. Naresh Chauhan

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Dr. Nasheman Bandukwala

We hope that this Special Issue will serve as a valuable resource for researchers and readers, resulting into stimulation for further inquiry and dialogue on the critical issues of, rural transformation, development, and inclusive growth.

Bridging the Gap: Analysing the Discrepancies between Rural Transformation and the Vision of a Viksit Bharat

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Abstract:

The dream of a Viksit Bharat (Developed India) envisions an inclusive prosperous and competitive nation in the world. But there is a huge divergence between rural development attempts and its fulfilment. This study is an attempt to analyse the socioeconomic, infrastructure related and policy-related divergences that limits rural development in India. By secondary data analysis, this study emphasises the long-standing rural-urban gap in income, education, health and infrastructure with rural sectors falling behind their urban counter parts. The study analyses the inefficiencies in implementation of rural development programs the socio-cultural constraints of gender disparity and caste discrimination, and the absence of effective governance mechanisms. The results indicate that in spite of the efforts by the government of India, the rural transformation and Viksit Bharat vision are far apart. The research concludes by suggesting, bridging this gap with better infrastructure, holistic policy reforms, skill acquisition, rural entrepreneurship and Empowerment of Women. With these challenges addressed, India can draw closer to its vision for a developed, Just and Sustainable future.

Keywords: Rural Transformation, Viksit Bharat, Rural Development, Socio-economic disparities, Infrastructure gaps, Gender Inequality, Inclusive Development.

1. Introduction:

The dream of a "Viksit Bharat" or Developed India has been at the centre of India's national agenda for years now. A developed India embodies dreams of economic development, social balance, infrastructural superiority, scientific progress, and better living standards for all Indians. But the reality of developing such a country has always faced the scathing gap between rural and urban India. While cities have seen tremendous leaps in industrial development, infrastructure expansion, and improvements in the standard of living, rural India has been mostly kept at arm's length from such progress.

The "rural transformation" is a multi-faceted process that was initiated for the betterment of the economic, social, and infrastructural status of rural regions. It targets the betterment of the livelihood of the rural people by alleviating poverty, ensuring quality education and healthcare, enhancing connectivity, and creating employment opportunities. Yet, despite numerous government schemes, rural India has failed to match the claims of a Viksit Bharat.

This research paper aims to trace the divergences between visions of rural turnaround and the image of a Viksit Bharat. This is meant to delineate gaps responsible for inhibiting rural advancement into economic, education, infrastructure, and social inequities. By doing so, this study will evaluate the efficacy of the existing rural development policies and recommend strategies for achieving equitable development across the nation.

2. Objectives of the Study

The primary objective of this study is to analyze the gaps between the concept of rural transformation and the broader goal of Viksit Bharat. Specific objectives include:

- To examine the existing rural development policies and their alignment with the vision of a Viksit Bharat.
- To analyze the socioeconomic disparities between rural and urban areas.
- To identify the infrastructural and social gaps in rural areas.
- To evaluate the role of political and administrative structures in rural development.
- To recommend strategies for bridging the rural-urban divide and achieving holistic development.

3. Research Methodology:

(1) Research design

This study is systematic and structured descriptive research, aimed to examine the gaps between rural transformation and the vision of a Viksit Bharat. The research, based on secondary database will also explore the relationship between rural transformation efforts and the larger goal of a developed India (Viksit Bharat).

(2) Data Collection: For the purpose of the current study, information is collected from existing sources that include:

Government Reports and Publications

- ❖ Reports from various ministries such as the Ministry of Rural Development (MRD), Ministry of Agriculture & Farmers Welfare, Ministry of Rural Employment, and others that focus on rural development policies, schemes, and performance evaluations.
- ❖ National Sample Survey (NSSO) data, Planning Commission Reports, and Economic Surveys, which provide insight into economic disparities, infrastructure gaps, and rural-urban dynamics.
- ❖ Reports from specific government programs such as the Pradhan Mantri Gram Sadak Yojana (PMGSY), Swachh Bharat Abhiyan, and Digital India initiatives.

Census Data

- ❖ The Census of India provides crucial demographic data, literacy rates, urbanization trends, and rural-urban divides that will be useful in assessing the socio-economic status of rural populations.

Academic Journals and Research Papers:

- ❖ Articles and studies on rural transformation, rural development models, and critiques of current government policies will be analyzed to understand the gaps in implementation and theory.

Reports from International Organizations

- ❖ Data and reports from organizations like the World Bank, United Nations Development Programme (UNDP), and International Fund for Agricultural Development (IFAD), which frequently focus on rural development and provide comparative insights into global best practices.

Case Studies and Real-life Examples

- ❖ Relevant case studies that highlight both successful and failed rural transformation projects across India will be used to understand the root causes of these discrepancies.

(3) **Data Analysis Techniques:** After collection of the Secondary data for the purpose of the study, the following analytical techniques is applied:

1. Comparative Analysis:

This will compare rural and urban indicators such as income levels, literacy rates, employment, access to healthcare, and infrastructure development. The purpose is to evaluate the extent of the disparity and the uneven distribution of resources and opportunities across India.

2. Trend Analysis:

Analyzing data over time to identify trends in rural development and the impact of government initiatives. This will help assess whether policies and schemes aimed at rural transformation have been effective in bridging the gaps with urban development.

3. Gap Analysis:

Identifying and quantifying the specific gaps in rural development related to infrastructure (e.g., electricity, roads, internet connectivity), social indicators (e.g., gender equality, healthcare access), and economic factors (e.g., income inequality, employment opportunities). The analysis will highlight areas where rural India is falling short of achieving the Viksit Bharat vision.

4. Descriptive Statistics

Basic statistical methods will be used to analyze and interpret the collected data. Measures like means, medians, percentages, and frequency distributions will help summarize key data points related to rural development and socio-economic disparities.

5. Qualitative Content Analysis:

A qualitative review of policy documents, government reports, and academic articles will help to identify themes, patterns, and recommendations for improving rural development policies. This analysis will also explore socio-cultural factors that

might contribute to rural-urban divides.

(4) Scope and Limitations of the Study:

Scope:

- This study will primarily focus on secondary data collected from national-level sources and will examine rural transformation and its gaps within the context of India's overall development goals (Viksit Bharat).
- The geographic focus will be on rural areas across India, with an emphasis on those regions where gaps are most pronounced.

Limitations:

(1) As this research relies solely on secondary data, the analysis is constrained by the availability and accuracy of existing data. There may be discrepancies or limitations in data reporting at the rural level, especially for remote regions.

(2) The data used will be current up to the most recent available reports (e.g., Census 2021 data or the latest government publications), which may not account for more recent changes or developments.

(3) **Focus on National-level Data:** This study will mainly focus on broad national trends and may not delve deeply into the specific experiences of individual states or regions, where rural transformation efforts may have different dynamics.

4. Hypotheses for the Study:

1. Hypothesis for Objective 1: To examine the existing rural development policies and their alignment with the vision of a Viksit Bharat.

H₀₁: The existing rural development policies are insufficiently aligned with the goals of achieving a Viksit Bharat due to inadequate implementation, under-funding, and lack of targeted interventions in key areas of infrastructure, education, and healthcare.

2. Hypothesis for Objective 2: To analyze the socioeconomic disparities between rural and urban areas.

H₀₂: There is a significant socio-economic disparity between rural and urban India, with rural areas lagging behind urban areas in terms of income levels, literacy rates, employment opportunities, and access to quality healthcare, thus hindering the achievement of the Viksit Bharat vision.

3. Hypothesis for Objective 3: To identify the infrastructural and social gaps in rural areas.

H₀₃: Rural India faces significant infrastructural and social gaps—such as poor road connectivity, limited access to electricity and internet, and inadequate healthcare services—that impede the realization of rural transformation and the broader objective of a Viksit Bharat.

4. Hypothesis for Objective 4: To evaluate the role of political and administrative structures in rural development.

H₀₄: Political and administrative inefficiencies, coupled with a lack of local governance empowerment, contribute to the slow progress of rural development initiatives, further

widening the gap between rural transformation and the vision of a Viksit Bharat.

5. Hypothesis for Objective 5: To recommend strategies for bridging the rural-urban divide and achieving holistic development.

H₀₅: A more integrated approach to rural development—through the introduction of innovative technologies, a focus on rural entrepreneurship, gender-inclusive policies, and improved governance—will significantly reduce the rural-urban divide and accelerate the realization of Viksit Bharat.

Overall *Hypothesis*:

H₀ (Null Hypothesis): There is no significant discrepancy between the current rural transformation initiatives and the vision of a Viksit Bharat, and the rural-urban divide does not hinder national development goals.

H₁ (Alternative Hypothesis): There is a significant discrepancy between the current rural transformation initiatives and the vision of a Viksit Bharat, with the rural-urban divide serving as a major obstacle to achieving equitable national development.

These hypotheses aim to guide the investigation into the various dimensions of rural transformation and the challenges that prevent rural areas from aligning with the national vision of a developed India. The hypotheses will be tested using secondary data and qualitative analyses of government reports, academic studies, and case examples to determine whether the gaps identified are statistically and practically significant.

5. Findings

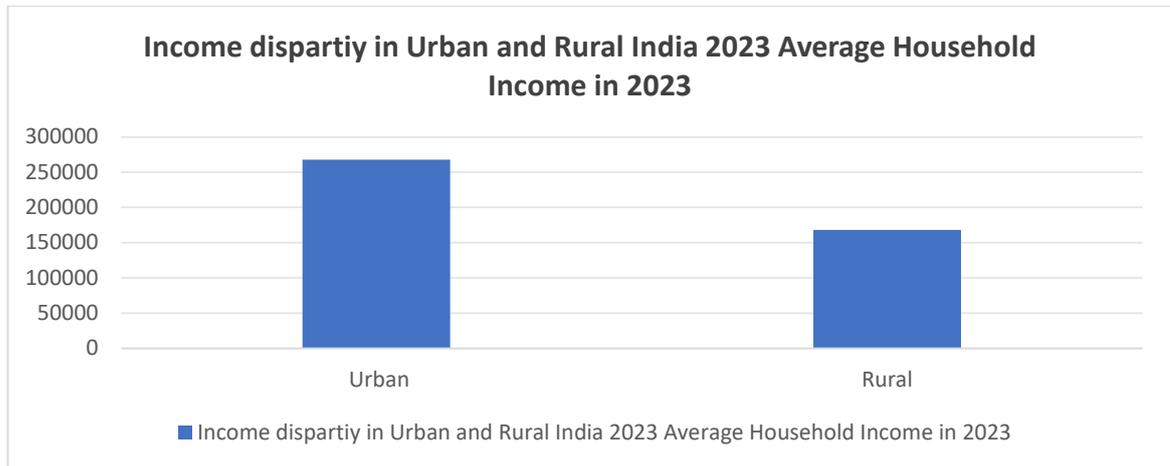
The following findings are based on the analysis of secondary data from various credible sources, including government reports, academic studies, and case examples. These findings provide insights into the discrepancies between rural transformation efforts and the vision of a **Viksit Bharat** (Developed India), highlighting the socioeconomic, infrastructural, and policy-related gaps that persist in rural areas.

1. Socio-Economic Disparities Between Rural and Urban India

One of the most significant findings of this study is the glaring **socioeconomic disparity** between rural and urban areas in India.

- **Income and Employment Disparities:** Rural areas continue to face lower income levels compared to urban counterparts. According to the National Sample Survey (NSSO) data, rural households earn, on average, 30-40% less than urban households. Agriculture, which is the primary source of livelihood in rural areas, remains largely subsistence-based, with limited avenues for diversification and growth.
- **Education and Skill Development:** Rural India has lower literacy rates and lacks access to quality education. The literacy rate in rural areas is approximately **66%**, compared to around **84%** in urban areas. Furthermore, the lack of adequate vocational training and skill development programs in rural regions limits job opportunities and economic mobility, thus hindering rural populations from moving toward self-sufficiency and prosperity.

- **Healthcare Access:** Rural areas face severe challenges in terms of healthcare infrastructure. Data from the Ministry of Health and Family Welfare indicates that nearly **70%** of rural India has limited access to adequate healthcare facilities. The absence of quality healthcare in rural regions leads to higher mortality rates, a lower life expectancy, and a continued dependence on traditional and often ineffective remedies.

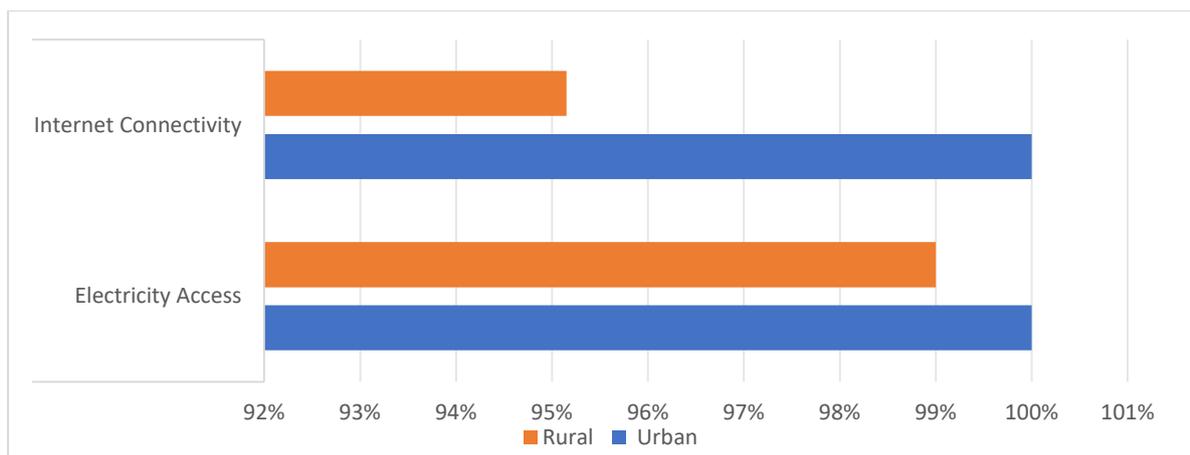


Data Source: Business-Standard.com

2. Infrastructural Gaps in Rural India

A major hindrance to rural transformation is the **insufficient infrastructure** in rural areas. Despite efforts such as the Pradhan Mantri Gram Sadak Yojana (PMGSY), significant gaps remain in key infrastructure sectors:

- **Road Connectivity:** While the PMGSY has successfully built over **1.8 million kilometers** of rural roads, about **40%** of rural villages still lack all-weather road connectivity. This severely hampers access to markets, educational institutions, healthcare centers, and other essential services.
- **Electricity and Digital Connectivity:** Rural areas are disproportionately affected by electricity shortages and limited access to the internet. According to the 2021 Census, **approximately 16%** of rural households still do not have access to electricity, despite government efforts to achieve 100% electrification. Furthermore, rural India suffers from low internet penetration, with only **35%** of rural households having access to the internet, compared to **80%** in urban regions. The situation has improved in 2023 which is depicted in the graphical presentation as below:



Source: factodata.com (2023)

- **Water and Sanitation:** While initiatives like the Swachh Bharat Abhiyan have improved sanitation in many rural areas, access to clean drinking water remains a challenge for a large portion of the rural population. According to a report by NITI Aayog, **about 60%** of rural households do not have access to safe drinking water.

3. Political and Administrative Challenges

The study found that **political and administrative inefficiencies** have significantly hindered the pace of rural development:

- **Policy Implementation Gaps:** Although several rural development schemes exist, including the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Pradhan Mantri Awas Yojana (PMAY), and others, **poor implementation** at the local level, corruption, and lack of monitoring mechanisms have led to suboptimal outcomes. A report by the Comptroller and Auditor General (CAG) noted that many of the rural development projects suffer from poor execution, delays, and budget overruns.
- **Decentralization and Local Governance:** Inadequate empowerment of local governments and village panchayats has limited the effectiveness of rural development initiatives. In many cases, top-down administrative structures fail to adequately address local needs or adapt strategies to specific regional contexts.

4. Gender Inequality and Social Gaps

Despite the government's focus on inclusive development, **gender inequality** and **social divides** remain pronounced in rural India:

- **Gender Inequality:** Women in rural India continue to face significant barriers to education, employment, and economic participation. According to the 2011 Census, female literacy in rural India stands at **56.6%**, compared to **77.5%** in urban areas. Additionally, rural women have limited access to healthcare, financial services, and economic opportunities, which perpetuates cycles of poverty.

- **Caste and Social Discrimination:** Discrimination based on caste and social status remains deeply entrenched in rural society, restricting access to resources and opportunities for marginalized groups. Rural development programs often fail to address these deeply rooted issues, further exacerbating social inequalities.

5. Evaluation of Government Policies and Their Effectiveness

While several policies have been introduced to promote rural development, the **effectiveness** of these policies has been mixed:

- **Positive Impact:** Schemes like MGNREGA, PMAY, and Swachh Bharat Abhiyan have had measurable successes, such as increasing rural employment opportunities, improving rural sanitation, and providing housing for the rural poor.
- **Limited Impact:** However, the overall impact of these policies in bridging the rural-urban divide and achieving the broader vision of a Viksit Bharat has been limited. Inadequate funding, slow bureaucratic processes, and insufficient monitoring mechanisms have constrained the success of many initiatives.

Summary of Key Findings:

1. **Significant socio-economic disparities** exist between rural and urban India, particularly in income, education, healthcare, and employment.
2. **Infrastructural deficiencies**, such as poor road connectivity, limited electricity access, and low internet penetration, remain major barriers to rural development.
3. **Political inefficiencies** and **administrative challenges** undermine the successful implementation of rural development programs.
4. **Social inequalities**, including gender discrimination and caste-based disparities, persist in rural areas and hinder equitable development.
5. Existing **government policies** have had partial success but need further alignment with rural needs, increased accountability, and better implementation strategies to achieve the vision of Viksit Bharat.

These findings provide a clear picture of the gaps that continue to exist in rural India, which not only hinder rural transformation but also delay the realization of a truly **Viksit Bharat**. Addressing these gaps through targeted interventions, improved governance, and inclusive policies is crucial for ensuring that the benefits of development reach all sections of Indian society.

5. Conclusion

The vision of a **Viksit Bharat** (Developed India) aims to transform the nation into a prosperous, inclusive, and globally competitive economy. However, the analysis of rural transformation initiatives reveals significant gaps between the goals of a Viksit Bharat and the reality on the ground in rural India. Despite several government schemes aimed at improving rural livelihoods, such as the Pradhan Mantri Gram Sadak Yojana (PMGSY), Swachh Bharat Abhiyan, and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), rural India continues to lag behind urban areas in terms

of income, education, healthcare, and infrastructure.

Key findings from the study suggest that rural transformation efforts are hindered by **socio-economic disparities, infrastructural deficits, political inefficiencies, and social inequalities**. Rural areas face persistent challenges such as limited access to quality education and healthcare, inadequate infrastructure, underemployment, and poor access to modern technologies. Furthermore, governance issues, lack of decentralized decision-making, and persistent social issues such as gender and caste-based discrimination exacerbate these challenges, impeding progress.

The discrepancies between rural transformation and the vision of a Viksit Bharat underscore the need for more integrated, targeted, and context-specific development strategies that take into account the unique challenges of rural India. Bridging the rural-urban divide is crucial for achieving a more balanced and equitable national development trajectory.

6. Suggestions for Bridging the Gap

To bridge the gap between rural transformation and the vision of a Viksit Bharat, the following suggestions are offered:

1. Strengthening Rural Infrastructure

- **Prioritize Rural Connectivity:** Expanding road networks, ensuring all-weather roads, and improving transportation links between rural areas and urban centres will facilitate access to markets, education, and healthcare.
- **Enhance Electricity and Internet Access:** Accelerating the electrification of rural areas and improving broadband internet connectivity will boost education, business opportunities, and healthcare services. Public-private partnerships should be encouraged for expanding digital infrastructure in rural regions.

2. Improving Education and Skill Development

- **Expand Access to Quality Education:** Ensuring that rural areas have access to quality primary, secondary, and higher education is critical. This includes addressing teacher shortages, improving school infrastructure, and enhancing the curriculum to include digital literacy and vocational training.
- **Promote Skill Development Programs:** More investment is needed in skill development initiatives that cater specifically to rural populations, especially in areas like agriculture, digital skills, and renewable energy. Collaborations with private industry and international development agencies can help in offering certification programs and building marketable skills.

3. Policy Reform and Better Implementation

- **Decentralize Governance and Empower Local Bodies:** Strengthening local governance through Panchayati Raj institutions will ensure that rural development policies are more attuned to local needs. Empowering village councils to make decisions on local issues can improve the efficiency of program implementation.

- **Monitor and Evaluate Programs:** Enhanced monitoring mechanisms should be put in place to ensure that rural development programs like MGNREGA, PMAY, and Swachh Bharat are effectively implemented. Timely audits, transparency, and regular evaluations can help ensure that resources are used effectively and equitably.

4. Fostering Rural Entrepreneurship

- **Encourage Rural Innovation and Entrepreneurship:** Supporting small businesses, rural startups, and local entrepreneurs can create sustainable livelihoods in rural areas. Government and private sector initiatives can provide financial aid, market linkages, and training for entrepreneurs in sectors such as agribusiness, handicrafts, and eco-tourism.
- **Promote Sustainable Agriculture:** Moving towards sustainable agricultural practices, improving irrigation facilities, and introducing smart farming techniques can enhance agricultural productivity and reduce rural dependency on traditional subsistence farming.

5. Addressing Social Inequalities

- **Focus on Gender Inclusion:** Specific policies should target women's empowerment in rural India, providing access to education, healthcare, financial services, and employment opportunities. Promoting women's participation in the decision-making process at both household and community levels is critical for inclusive growth.
- **Combat Social Discrimination:** Government policies must address caste and social discrimination through education, awareness, and targeted welfare schemes that support marginalized groups in rural India. Social welfare programs need to be more inclusive, with a focus on the most disadvantaged communities.

6. Promote Rural-Urban Synergy

- **Integrate Rural Development with Urban Growth:** Rural areas should not be viewed in isolation; instead, policies should promote the integration of rural development with urban growth strategies. This can include creating satellite towns around urban centers, promoting rural-urban linkages, and ensuring that rural populations can access urban markets and services.
- **Focus on Sustainable Development:** Policies should emphasize sustainable development in rural areas, integrating renewable energy solutions, water conservation techniques, and eco-friendly farming practices that align with the goals of both rural transformation and environmental preservation.

Thus, the gap between rural transformation and the vision of a **Viksit Bharat** is not an insurmountable barrier. With concerted efforts, innovative approaches, and effective governance, rural India can be transformed into a thriving, sustainable, and integrated part of the nation's development. Bridging the rural-urban divide requires a holistic

approach that focuses on infrastructure development, education, social equity, political empowerment, and economic diversification. By addressing these core issues, India can realize its vision of becoming a truly developed nation by 2047 where every citizen, regardless of their location, has access to the benefits of growth and prosperity.

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From Grassroots to Growth: Demystifying Rural Development for Viksit Bharat

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Abstract:

Rural development is central to the vision of Viksit Bharat, which aims for a developed India. As more than 50% of the population of India lives in rural areas, there is a need to bridge the urban-rural gap as it is critical for economic growth, social justice, and sustainability. This paper explores the multi-dimensional nature of rural change, focusing on governance, infrastructure, agriculture, and non-farm employment. It points out how changes in structure, technology, and policy shape rural livelihoods and economies. The Indian rural economy has farm and non-farm segments, the latter traditionally weak but augmented now by rural industry. Agricultural productivity is hampered by low levels of mechanization, fragmented ownership, and climate risks. In contrast, the rural non-farm economy plays an important role in income diversification, poverty reduction, and migration reduction. Infrastructure investments in the form of roads, digital connectivity, health, and education are critical drivers of rural prosperity. These sectors, however, are plagued with deficiencies, which limit economic participation and social mobility. Government schemes such as Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), Digital India, and Ayushman Bharat have helped rural development; however, their impact is negated by implementation gaps and access issues. The digital revolution, agritech innovations, and fintech solutions are accelerating rural economic transformation by improving access to markets, financial services, and technology-driven productivity enhancements. The paper argues that a holistic, multi-dimensional approach integrating agriculture, infrastructure, education, and digital transformation is essential for closing rural-urban disparities. By fostering inclusive rural development, India can achieve its goal of Viksit Bharat, ensuring equitable progress for all.

Keywords: Viksit Bharat, Rural, Rural Development, Rural Transformation, Digital India, Technology, Development, Developed India, Agriculture, Infrastructure, Economy, Economic, Vision

Introduction

Rural development is crucial in realizing the vision of Viksit Bharat, or a developed India. As the world's most populous country and a rapidly growing economy, India has more than 50% of its population residing in rural areas. The progress of these regions is essential for the nation's overall economic growth, social equity, and sustainable development. Strengthening rural governance, improving infrastructure, enhancing agricultural productivity, and creating non-farm employment opportunities are key factors that will drive this transformation. Without empowering rural communities, ensuring efficient resource utilization, and fostering grassroots participation, the goal of a fully developed India cannot be realized.

Though there are several government programs and initiatives specifically intended to raise and improve the levels of rural development, there is still a noticeable and apparent economic gap between the urban and rural economies. The rural population is highly dependent on agriculture as its principal source of living, which exposes it and leaves it open to the negative effects of global climate change, market fluctuations, and a chronic shortage of modernization in agricultural activities, as identified by Chand and Srivastava in their 2022 research. Wang, Chen, and Findlay (2023) underscore the challenge of accurately defining 'rural,' despite its broad acknowledgement. This observation by Weisheit et al. (1995) highlights the complexity and fluidity of the concept. Rural areas are often characterized by low population density, agriculture-based economies, and limited access to urban infrastructure, yet their definition varies across disciplines and policy frameworks.

Rural transformation is often linked to technological advancements and industrialization (O'Brien 1977; Johnston 1970). Scholars argue that rural and agricultural reform serves as prerequisites for industrial development (Lewis 1954; Chang 1949), with industrial and agrarian revolutions occurring simultaneously. The ultimate goal is not only to industrialize urban areas but also to modernize agriculture (Zhong 2016). The Industrial Revolution and technical advancements significantly enhance agricultural labour productivity, resulting in farming intensification, production specialization, agrifood commercialization, and rural economic diversification. The disparity in productivity between rural and urban sectors necessitates the reallocation of resources (labour, capital, etc.), leading to substantial structural transformations within the economy (Bartelsman et al. 2013; Page 1996). Trade can expedite this process by strengthening competitive advantages (Bustos et al. 2020; Anderson 2009). Institutions, policies, and investments significantly affect the rate of rural transformation in many countries (Huang and Shi 2021; Huang 2018a; IFAD 2016). Rural transformation is deeply connected to agricultural transformation and broader structural transformation (Berdegúe et al. 2013; Jayne et al. 2018). It involves shifting economic activities from agriculture to industry and services, boosting productivity, increasing trade, expanding urban economies, and reducing agriculture's

share in GDP. Over time, this process leads to rural- urban migration, urbanization of rural areas, lower birth rates, increased female workforce participation, and socio-political changes (FAO 2017). The lack of a universal definition underscores the need for a contextual approach when discussing rural development and its role in achieving Viksit Bharat.

India's rural economy comprises two complementary sectors, namely the agricultural sector and the non-farm sector, which are both key to initiating rural development. The agricultural sector, comprising cropping, animal husbandry, forestry, and fisheries, has traditionally made up the bulk of rural incomes, although its contribution to the country's gross domestic product (GDP) has fallen over the years. There are several issues that still exist, ranging from fragmented ownership of land to dependence on monsoonal rains, low degrees of mechanization, and low degrees of access to modern technology, which are all productivity- and income-volatility constraints. Alternatively, the rural non-farm sector (RNFS), encompassing manufacturing, construction, trade, transport, and many services, is a nascent source of rural employment and income diversification. The RNFS has a significant role to play in rural poverty elimination, stabilizing incomes, and alleviating distress migration through offering livelihood options that are available beyond agriculture. The growth of the two sectors is highly subject to the presence of robust infrastructure, education, and skill development, which are still extensive scale constraints.

The economic challenges and obstacles are also supplemented by an array of infrastructure shortages such as unsupervised and unauthorized roads, low access to digital resources, and unstable access to solid sources of energy, as noted by the Ministry of Rural Development in 2021. Moreover, the education sector within rural settlements is similarly afflicted with acute shortages, despite efforts such as the National Education Policy (NEP) 2020, which seek to enhance the quality of education. Shortfalls like poor access to electronic learning resources, poor teachers' training, and the high rate of dropouts limit the efficacy of such programs.

According to the Annual Status of Education Report (ASER, 2022), nearly 25% of Grade 5 rural Indian children lack the skill to read simple Grade 2 material, which highlights the need for focused interventions in education. Additionally, the absence of vocational training courses also constrains employability, forcing many young people to migrate to urban areas in search of better opportunities. The absence of quality education and skill development not only constrains employment in rural India but also constrains the agricultural as well as non- agricultural sectors from achieving their potential in achieving sustainable economic development. In this regard, an integrated rural development approach—one that enables agriculture, enhances non-farm enterprises, constructs infrastructure, and enhances education and skill development—is required to trigger inclusive economic transformation and close rural-urban gaps.

Understanding the Existence of Rural Transformation

Rural transformation in India has been widely studied through various economic and developmental perspectives. Scholars such as Johnston (1970) and O'Brien (1977) emphasize the role of agricultural reform and industrialization in driving rural transformation. Lewis (1954) and Zhong (2016) emphasize the need to raise agricultural productivity as a prelude to industrialization, whereas Page (1996) explains how structural changes in the economy affect rural labor allocation. The growth of the rural non-farm economy has also been a key driver of rural change, according to Berdegue, Rosada, and Bebbington (2013) and Jayne, Chamberlin, and Headey (2018), who posit that diversification into non-farm employment lessens economic exposure and increases income stability. Moreover, Gollin, Jedwab, and Vollrath (2014) and Hicks et al. (2017) discuss the connection between rural-urban migration and economic growth, highlighting how urbanization speeds up rural change by providing improved employment opportunities and enhancing living standards. The contributions of policy and infrastructure interventions are emphasized by IFAD (2016) and Huang (2018a), which point to how investments in road infrastructure, digital connectivity, and financial inclusion contribute to rural economic integration. In contrast, Timmer (1988) and Tombe and Zhu (2019) examine the larger structural transformation implications, with an emphasis on the diminishing contribution of agriculture to GDP and the increasing dominance of industry and services. Globalization and trade as a factor for rural transformation are also explained by Anderson (2009) and Bustos, Caprettini, and Ponticelli (2020), who are also of the perception that market access and comparative advantages can stimulate rural economic development. The Food and Agriculture Organization (FAO) (2017) is also concerned with emphasizing sustainable agriculture and technology as prerequisites for long-run rural development. Education and training policies, as highlighted by Huang and Shi (2021), are essential to prepare the rural labor force for the needs of the modern economy. Overall, rural transformation is a complex process triggered by agricultural modernization, industrial growth, infrastructure development, migration, and policy intervention, all contributing to the overall economic transformation of India and Viksit Bharat vision.

Key Sectors Driving Rural Transformation

The healthcare sector is the most difficult sector. Rural health infrastructure is weak, with a critical shortage of qualified medical professionals, substandard quality medical facilities, and highcost healthcare services. In spite of government initiatives such as Ayushman Bharat for universal health insurance coverage, rural populations remain unable to access health facilities and its out-of-pocket expenses (Patel et al., 2023). The National Health Mission (2022) indicates rural regions to have very low doctor-population ratios as per global norms set by the World Health Organization, which has also resulted in a high mortality rate and avoidable health emergencies. Thus, enhancing

the health outcomes of rural areas depends largely on enhancing the accessibility of healthcare services, which the integration of telemedicine can help bring about, mobilizing mobile health units, and the development of rural health centres, all funded by strategic investment in these essential areas. Along with that, the full-time presence of the MBBS Doctors in the Primary Health Centres (PHC) and Community Health Centres (CHC) is highly required. At this point, the doctors are recruited with the bond, and they stay in the PHC or CHC for not more than 7 to 10 months, which adds to the lack of healthcare facilities in rural India.

Despite the government's initiation of several development projects, including the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), and the Digital India plan, numerous setbacks have occurred in their execution. Corruption and a significant lack of public knowledge have substantially diminished the overall effectiveness of the schemes intended for societal impact (NITI Aayog, 2023). Although it is a fact that the Digital India initiative has helped increase the internet connectivity of the whole nation, the fact remains that the penetration in rural pockets remains low. This lingering problem continues to limit access to very important digital services that can transform industries like telemedicine, banking, and education (Mehta & Kumar, 2023). With these very real constraints and limitations already being operative, the ambitious vision of achieving Viksit Bharat is made possible through a holistic and multi-dimensional strategy effectively combining rural development and national economic effort. Of paramount importance in ensuring that rural India keeps pace and does not lag behind in the overall direction of national progress are a number of crucial factors like the development of rural entrepreneurship, major improvements in infrastructure development, efficient education sector reforms, and improved healthcare programs. The efficient provision of sustainable alternatives that effectively respond to the special challenge of rural issues demands very strong partnership and cooperation among the government, businesses, and people at the grassroots level so that all important stakeholders are mutually aligned towards a common mission.

This paper explores the socioeconomic disparities between rural India and urban India that present major obstacles to the progress of rural development in India and suggests strategic and strategic measures to overcome these multiple obstacles. Based on a critical examination of prevailing policies, as well as the glaring infrastructure shortfalls and widespread economic disparities, this research attempts to identify some areas that need immediate and effective reforms to bring about holistic national development. In the following chapters, there will be a close examination of the wide range of rural issues, a critical examination of the efficacy of prevailing policies, and the offering of well-reasoned suggestions for the development that is inclusive and equitable, closely in tune with the vision envisioned for Viksit Bharat.

The Narratives of Viksit Bharat

India's 2015 Digitization Plan has played a crucial role in transforming the country into a tech-savvy, knowledge-based economy. Over the past decade, the digital divide between urban and rural areas has significantly narrowed, connecting over 630,000 villages through Bharat Net, a high-speed internet project. This effort, combined with low-cost mobile data and rising smartphone penetration, has brought millions of rural Indians access to education, financial services, and entrepreneurial opportunities. India had 850 million broadband subscribers as of July 2023, the fastest-growing internet market in the world. Internet users have grown by 250% since 2015, demonstrating the country's fast digital growth.

The deployment of 5G technology and India's projected data consumption dominance in the coming five years are further hastening this change. Project Viksit Bharat 2047 aims to make India a developed country by the centenary of independence, propelled by economic growth, social equity, and technology advancement. The digital revolution is not only enhancing connectivity but also transforming the employment landscape and economy of India. The gig economy has also grown, with online platforms supporting millions of freelancers and contract laborers. India is anticipated to have more than 23 million gig workers by 2027, with new job opportunities being created in industries (NITI Aayog, 2023).

E-commerce and MSMEs have also gained from digital platforms like the Open Network for Digital Commerce (ONDC), which helps small enterprises increase their market size. Rural craftsmen, small businesses, and small entrepreneurs are utilizing online marketplaces to expand their enterprises. Moreover, fintech developments have been instrumental in inclusionary finance with transactions through UPI exceeding 10 billion in a month. Digital banking, instant credit facilities, and AI-based financial services have helped small enterprises and rural entrepreneurs flourish. Farmers nowadays have the latitude to use smart farming technologies, AI-based analytics, and precision farming, which enhance the yield of crops while, simultaneously, minimizing losses. Further, digital platforms offer real-time weather forecasts, soil fertility and health reports, and automatic watering of water, thereby enhancing productivity and promoting sustainable agriculture. Moreover, market linkages have improved through consumer-direct platforms, enabling farmers to avoid middlemen and receive better prices for their produce. Firms such as DeHaat and Ninjacart are transforming farm supply chains by linking farmers with consumers directly at affordable costs. Further, agri-fintech platforms have enabled farmers to access instant loans and insurance at the touch of a button, based on AI-based evaluations, thereby providing them with enhanced financial security. AI-based smart governance has enhanced efficiency, transparency, and decision-making in public administration. Use of AI-based analytics is imperative in tracking migration patterns, forecasting healthcare needs, and

anticipating impending disasters, thereby making governance effective. Efforts of e-governance through the Digital India initiative have automated bureaucratic systems, eliminated unnecessary paperwork, and facilitated greater access to public services through digital platforms. This shift towards paperless governance has made the government more efficient and checked corruption. AI and digital technologies are also transforming rural healthcare and education. Telemedicine platforms are enhancing access to healthcare, while AI-powered EdTech solutions provide personalized learning experiences, bridging the rural education gap.

The vision of Viksit Bharat 2047 is backed by substantial budgetary allocations in key sectors. From 2013-14 to 2025-26 (Table 1), India's education budget nearly doubled (₹65,869 cr to ₹1,28,650 cr), healthcare tripled (₹32,745 cr to ₹1,03,850 cr), and rural development more than doubled (₹80,194 cr to ₹1,90,405 cr). Investments in communication & technology (₹16,783 cr to ₹1,34,131 cr) and infrastructure (₹99,761 cr to ₹5,42,778 cr) highlight the focus on digital expansion and connectivity. The introduction of ₹14,886 cr for skill development further supports a tech-driven economy, making digital transformation the foundation of India's future growth.

Table 1 The Union Budget of the below-mentioned FY

Sr. No.	Areas	Budget (in cr) 2013-14	Budget (in cr) 2025-26
1.	Education	65,869.00	1,28,650.00
2.	Healthcare	32,745.00	1,03,850.00
3.	Rural Development	80,194.00	1,90,405.00
4.	Agriculture	17,095.00	1,37,756.00
5.	Communication and Technology	16,783.00	1,34,131.00
6.	Infrastructure (Road & Railways)	99,761.00	5,42,778.00
7.	Women Empowerment	20,350.00	26,889.00
8.	Skill Development	0.00	14,886.00

Source: National Informatics Center & India Budget

India has instituted various government schemes since the past to promote rural development, social security, and economic growth. One of the very first schemes, the Gram Nyayalayas Act, 2008, was passed to initiate mobile rural courts for speedy delivery of justice at the grassroots level. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), which was initiated in 2005, guarantees rural household employment. In the same vein, the National Rural Health Mission (NRHM) and National Social Assistance Programme (NSAP) are aimed at enhancing healthcare and social welfare in rural India. The Pradhan Mantri Awas Yojana – Gramin (PMAY-G) aims at low-cost housing, whereas the Pradhan Mantri Gram Sadak Yojana (PMGSY) offers connectivity in rural India. The other important schemes are Deen

Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY) for vocational training, Jal Jeevan Mission for safe drinking water accessibility, and Ayushman Bharat – Pradhan Mantri Jan Arogya Yojana (PMJAY) for health service accessibility. India has initiated numerous government schemes during the past 7-10 years for rural development, economic growth, and social security. The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) scheme was introduced in 2019 to provide direct income support to small and marginal farmers. The PM SVANidhi scheme, introduced in 2020, encourages street vendors through collateral-free working capital loans. For strengthening child growth and nutrition, the government launched Saksham Anganwadi & Poshan 2.0 and the Suposhit Panchayat Scheme. The Atma Nirbharta in Pulses and National Mission on High-Yielding Seeds and Makhana Board are aimed at improving agricultural production and self-sufficiency. The Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM-JANMAN) was also launched with the objective of nurturing tribal populations, whereas Mission Amrit Sarovar is working on water conservation and revitalization of water bodies. The Bharatnet Project has been enhancing digital penetration in villages by high-speed internet connectivity. The Jal Jeevan Mission, which was launched in 2019, aims to supply tap water connections to rural households. For social security, the Social Security for Gig Workers program was introduced to protect workers in the informal economy. The Bharatiya Bhasha Pustak Scheme, which is one of the latest schemes, encourages regional languages and literature for the purpose of cultural conservation. These schemes demonstrate the government's continued focus on inclusive and sustainable development in various sectors. Following is the list of major government schemes launched in recent years.

Table 2 List of Government Schemes

Sr. No.	Government Schemes
1.	Aajeevika - National Rural Livelihoods Mission (NRLM)
2.	Atma Nirbharta in Pulses
3.	Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (PMJAY)
4.	Bharatiya Bhasha Pustak Scheme
5.	Bharatnet Project
6.	Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY)
7.	Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM)
8.	Gram Nyayalayas Act, 2008
9.	India Post as a Catalyst for Rural Economy
10.	Jal Jeevan Mission – Har Ghar Jal Scheme
11.	Kisan Credit Card (KCC) Scheme
12.	Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)
13.	Mission Amrit Sarovar

14.	National Health Mission (NHM)
15.	National Mission on High-Yielding Seeds and Makhana Board
16.	National Rural Health Mission
17.	National Social Assistance Programme (NSAP)
18.	PM SVANidhi
19.	Poshan Abhiyaan
20.	Pradhan Mantri Awas Yojana - Gramin PMAY (G)
21.	Pradhan Mantri Garib Kalyan Yojana (PMGKAY)
22.	Pradhan Mantri Gram Sadak Yojana (PMGSY)
23.	Pradhan Mantri Jan Dhan Yojana (PMJDY)
24.	Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM-JANMAN)
25.	Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)
26.	Pradhan Mantri Matru Vandana Yojana (PMMVY)
27.	Prime Minister Dhan-Dhaanya Krishi Yojana (PMDDKY)
28.	Rural Prosperity and Resilience Program
29.	Saansad Adarsh Gram Yojana (SAGY)
30.	Saksham Anganwadi and Poshan 2.0
31.	Scheme for First-time Entrepreneurs
32.	Shyama Prasad Mukherji Rurban Mission (SPMRM)
33.	Social Security for Gig Workers
34.	Suposhit Panchayat Scheme
35.	Swachh Bharat Mission (Gramin)
36.	Vanbandhu Welfare Scheme

In addition to these, several other schemes play a crucial role in rural development. However, their overall effectiveness remains intricately connected to the income and expenditure patterns in rural India. Understanding these patterns is crucial for assessing the impact of policy interventions and identifying areas requiring further support.

Rural Income

Rural income primarily comes from agriculture, non-farm businesses, wage employment, and allied pursuits, including animal husbandry and fisheries in India. Agriculture contributes significantly to rural household income, as revealed in the National Statistical Office (NSO) reports (National Statistical Office, 2021). There has been a diversification trend towards non-farm pursuits in recent times. The main forces behind the shift to non-farm jobs are rural industrialisation, government policies like Skill India and Startup India, and improved infrastructure that has enhanced market access. However, income inequality persists based on variations in landholding size, access to education, and local economic growth.

The augmentation of rural incomes is a key goal in the Viksit Bharat scenario. Incomes can be greatly augmented through policies that are designed to increase productivity, support value addition, and encourage entrepreneurship in rural areas. Schemes like the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) scheme and rural credit facilitation under the Pradhan Mantri Mudra Yojana have played a crucial role in the increase in disposable incomes. In addition, the Digital India scheme has helped increase new income opportunities for rural communities through rural infrastructure investments, i.e., roads, electrification, and digital connectivity.

Rural Expenditure

The socio-economic status of the people and their consumption needs are expressed in the rural spending patterns seen in India. Food, education, and healthcare form the bulk of the spending by rural families. Food forms almost 50% of rural consumption, as per the Household Consumption Expenditure Survey of the National Statistical Office (2021). However, the percentage reduces with a rise in income levels (National Statistical Office, 2021). Engel's Law, which states that the proportion of spending on food reduces with a rise in income, is also seen in rural Indian realities.

Education, health, transport, and housing are non-food spending that have increased consistently. This change mirrors increased access to basic services and increasing aspirations. Ayushman Bharat, a government scheme, has taken the burden of healthcare costs away from poor rural families to a significant extent through insurance coverage. Rural electrification and housing schemes, which are low-cost, like Pradhan Mantri Awas Yojana-Gramin (PMAY-G), have also improved the standard of living, which has consequently influenced expenditure patterns.

Rural Education and Literacy

Education is a principal driver of rural development, influencing the income level, employment, and overall socio-economic development. Rural literacy has been encouraged by government initiatives like the Sarva Shiksha Abhiyan and the National Education Policy 2020, promoting universal education and skill acquisition. Certain of the problems of poor infrastructure, teacher shortage, and digital divide, however, still remain. Rural literacy levels still trail those of urban India, and female literacy remains a problem in most of the states. Elimination of such disparities through rural education investments, vocational education, and e-learning platforms is essential to ensure long-term economic development.

Rural Healthcare

Rural healthcare access has improved with programs such as the National Rural Health Mission (NRHM) and Ayushman Bharat. Yet, inequalities persist in healthcare facilities, medical personnel availability, and service quality. Most rural areas do not

have well-equipped hospitals but are dependent on primary health centers (PHCs) and community health centers (CHCs). Maternal and child healthcare services, vaccination programs, and mobile health units have improved outcomes. Still, more investment in telemedicine, diagnostics, and emergency healthcare is required to bridge the urban-rural divide in healthcare services.

Rural Consumption

As per the Household Consumption Expenditure Survey: 2023-24, the MPCE data highlights a persistent rural-urban disparity, with urban expenditure (₹6,996 in 2023-24) 70% higher than rural (₹4,122), reflecting better income sources and infrastructure in cities. While nominal MPCE growth between 2022-23 and 2023-24 was 9.2% in rural and 8.3% in urban areas, inflation-adjusted growth remained low at 3.5%, indicating that rising costs are eroding real purchasing power. Over 12 years, rural MPCE (2011-12 prices) grew by 45%, while urban grew by 38%, showing slow real income gains. The consumption behavior of rural India has undergone a revolutionary change, shifting from subsistence-level consumption to a diversified pattern influenced by technology, urbanization, and economic growth. Increased use of digital platforms and mobile technology has expanded access to digital financial services and e-commerce, bridging the rural-urban divide. As a result, rural consumption patterns are converging with urban trends, particularly in consumer electronics, packaged foods, and personal care products (NCAER, 2022). To achieve Viksit Bharat 2047, policies must focus on increasing rural wages, boosting non-farm employment, and controlling inflation to enhance real consumption and reduce economic disparity.

Rural Infrastructure (Roads and Railways)

Infrastructure development is a critical enabler of rural economic growth, with roads and railways playing a key role in connectivity, trade, and accessibility to essential services. The Pradhan Mantri Gram Sadak Yojana (PMGSY) has greatly enhanced road connectivity in rural areas, making it easier for people to reach markets, schools, and hospitals. Rural rail connectivity is also growing, enhancing mobility and economic links between villages and cities. Road and rail investments enhance logistics, jobs, and rural health. Investment in such networks under sustainable development will be critical for rural transformation in the long run.

Achieving Viksit Bharat by 2047: The Path Forward

Despite the unprecedented progress that has been made, there are still a few challenges to turning around rural income, expenditure, and consumption trends. Underemployment, farm distress, poor health care, and poor access to quality education are some of the persistent challenges that continue to erode rural development. Climate

change and environmental degradation also compound rural vulnerabilities and have a disproportionate impact on smallholder farmers.

Income inequality, especially inter-regional income inequality, is a major concern. Rural income tends to be lower in states with low industrialization and poor infrastructure development. Even though the digital divide decreases, it acts as a constraint in the equitable allocation of economic opportunities and information. To deal with these problems, an all-around strategy combining economic, social, and environmental policies is needed to ensure inclusive growth. The Viksit Bharat 2047 ambitious dream can be attained through, a multi-faceted strategy with policy overhauls, infrastructural construction, and tech infusion being critical. Eradication of rural poverty and income inequity does not just call for governmental involvement but needs involvement from the private sector, social businesses, and people-centric schemes.

There needs to be a data-based farm revolution. Though India is now self-reliant in producing food, the productivity levels lag much behind world standards. For example, the average wheat productivity in India is 3.4 metric tons per hectare, while China has 7.5 metric tons. Expanding irrigation cover, raising the incentives for organic farming, and increasing access to AI-driven precision agriculture can increase farmers' income two-fold. Investment in climate-resilient crops and post-harvest storage facilities will minimize agricultural wastage, presently at ₹92,000 crore a year.

Rural industrialization needs to be accelerated in order to break the employment stagnation and become less dependent on agriculture. Developing rural industrial clusters, supported by skill training initiatives, will generate employment opportunities sustainably. Increasing the Production-Linked Incentive (PLI) scheme to micro-enterprises in rural areas and agro-processing units will lure private investment. Developing the Rural Non-Farm Sector (RNFS) by enhancing access to digital markets, increasing micro-credit facilities, and promoting women-led enterprises will further enhance economic growth. According to the NITI Aayog, if rural industrialization grows at 8% annually, it could add over 60 million new jobs by 2047.

Closing the digital divide is another important element. Although Digital India has made considerable strides, rural internet penetration remains behind urban regions, constraining access to e-learning, telemedicine, and digital financial services. Expanding BharatNet to every 2.5 lakh gram panchayats by 2030 and making 5G connectivity affordable can close this gap. Digital literacy initiatives, particularly for women and marginalized sections, will facilitate greater economic engagement.

A strong healthcare system will be a pillar of rural transformation. India has just 1.2 doctors per 1,000 population, much less than the WHO-recommended 2.5, despite government initiatives. Full-time deployment of MBBS doctors in Primary Health Centers (PHCs) through improved incentives and increasing telemedicine services can make a big difference in healthcare accessibility. Investment in AI-based diagnostics,

mobile health units, and rural health insurance will lower avoidable deaths and enhance overall well-being.

Training and education have to be coordinated with emerging economic opportunities. By 2047, India will require a very skilled labor force to fuel developing sectors like renewable energy, AI, and green manufacturing. Presently, formal skill training is received by merely 7% of the rural labor force. Developing vocational training courses, introducing coding and AI into school education, and creating rural ed-tech start-ups will close this gap in skills. Scholarships and positive action to help rural pupils at the university level will also help to increase social mobility.

Conclusion: A Roadmap for Viksit Bharat

A developed India by 2047 is not just an economic goal but a vision of comprehensive and sustainable development where rural and urban development go hand in hand. This vision can be achieved through a multi-faceted strategy that combines agricultural modernization, rural industrialization, digital empowerment, and social infrastructure development. Rural India, which accounts for over half of the nation's population, cannot be left behind in the country's economic journey. Rather, special interventions should guarantee that rural populations take an active role and are beneficiaries of India's growth narrative.

To realize Viksit Bharat 2047, India needs to adopt an integrated rural-urban development model. Modernization of agriculture, through precision agriculture, agri-tech technology, and green agriculture, has the potential to improve productivity, farmers' earnings, and food security. At the same time, industrialization, entrepreneurship, and skill development have the potential to improve the rural non-farm sector, increase diversification of jobs, and lower economic vulnerability. Additionally, digital empowerment through increasing internet penetration, fintech services, and e-governance has the potential to narrow the rural-urban divide, thus disseminating education, healthcare, and financial services to the remotest areas.

Social infrastructure—health, education, and rural connectivity—needs to be given top priority to improve the quality of life and economic resilience of rural India. The government, private sector, and civil society must work together at an urgent pace to deliver the last mile of basic services and economic opportunities. India can be poverty-free, have a self-sustaining economy, and experience balanced growth through policy reforms, targeted investments, and people-centric programs. If policies and schemes are implemented effectively, Viksit Bharat 2047 will be a reality and not a dream but India emerging as a global economic and social giant.

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Family Expenditure on the school education in India: An interstate Comparison

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Abstract

This review synthesizes existing literature, official data, and reports on expenditure patterns in school education across Indian states. It analyzes the trends, interstate disparities, the correlation between spending and educational outcomes, and highlights the implications of effective budget resource implementation. Official resources from Indian Government database are examined for current statistics of spending on school, pupil teacher ratio and the overall educational level of child during formal school education in all states. The data, both socio-economic and socio demographic parameters, across all states indicates highly decentralized levels of achievements and further indicate needs to more academic intervention based research at local levels. It draws insights from a comprehensive selection of peer-reviewed articles, reports from governmental organizations, and assessments by NGOs. The study examines expenditure patterns by governments that enables continuity of child formal schooling during government schemes and policy implementation. It explores areas of future scope towards the quality and efficacy, implementation success metrics.

Keywords: School Education, Education Expenditure, Interstate Comparison, India

1. Introduction

Education is a fundamental driver of economic growth and social progress. Despite India's commitment to universal education under the Right to Education (RTE) Act, 2009, significant interstate disparities persist in educational expenditure. Education is indisputably the cornerstone of individual empowerment and societal advancement, playing a central role in the global pursuit of sustainable development and equitable growth (UNESCO, 2015). Investment in education, particularly at the school level, is often perceived as an investment in human capital that yields long-term returns, enhancing productivity, fostering innovation, and driving economic competitiveness (Hanushek & Woessmann, 2008). In the context of developing nations like India, where education is both a fundamental right and a pathway out of poverty, the allocation of public resources to school education assumes critical importance (Tilak, 2017). Government intervention must balance across needs based regions such that children residing even the most remote corners of this nation receive fundamental learning and

teaching which will result to individual contribution in long term societal building efforts. Education system forms and fosters the child, who when grows, gives rise to innovative projects in service oriented workstreams across global avenues(Dreze and Sen,1995) This means an intervention can become much successful if education system receives enough resources and skilled training around various domains of implementation of the curriculum during these growing school years (Glewwe & Kremer, 2006).

India, with its diverse socio-economic fabric and a commitment to universal education, presents a compelling case for studying expenditure on school education (Govinda & Varghese, 1993). Constitutional mandates and national policies have sought to ensure access to quality education for all children, with varying degrees of success across states. India has always invested greatly in school and academic skill sets building endeavors , there still prevails numerous shortcomings , like low girl enrolment in tribal blocks of the countries , the academic performances in government school , and even sometimes student ratio parameters during elementary learning practices. Several reports from academic scholars have showcased grave deficiencies of school systems across states of UP, BIHAR (Tilak 2015, 2019). States which have a long rich historic past of culture building as education centre points faces several limitations despite continuous monetary injections during previous decades. Understanding why and what exact interventions can assist with improving those basic shortcomings remains important towards understanding national improvement projects related to education. These issues require an in depth intervention and analysis and calls upon increased educational focus, government interventions both through spending efforts or through any socio schemes projects.

The current paper intends to comprehensively summarize already existing literature regarding how expenditure policies effect a region. Through examining available authentic literature, the effectiveness level can be mapped up which further assist future researchers. This paper addresses key questions related to government interventions with the overall impact over the system through expenditure policy level decisions. The overall macro aim is to review the existing literature by synthesizing these previous research work.

2. Literature Review

The existing body of literature offers varying perspectives on expenditure patterns, interstate disparities, the correlation between spending and educational outcomes, and overall implications related to effective policy implementations (Sood, 2020). The general aim to have sustainable education developments comes from effective policies but need to go under proper surveillance for identifying if expenditure practices happen in transparent fashion. We try to analyze the review across the existing information that makes better impact upon sustainable level for all children present under this region through equal means. (CARTER, 2002) The existing macro policy is for more

investment on the state's own policy frameworks, rather than having central assistance on school education parameters in several studies from researchers (Ramachandran 2002 and Dreze Sen 1998). Also it's important to be under attention regarding that educational assistance given for primary schooling should undergo better intervention for girls coming from backward tribal regions.

The UNESCO's 2015 also aims to ensure "inclusive and equitable quality education". It emphasizes increased investment into school infrastructures and government policies. Investment may further accelerate developments and progress levels, even though it's an expensive approach yet would provide stable solutions in all domains of concern (CARTER, 2000 and Kingdon, 2007). The steps for improvement and implementations calls in for new research work regarding quality improvements for basic education. Recent school education development research suggests better allocation level to provide academic training based curriculum enhancement drives from highly renowned academicians. (Tilak, 2015 and Carter, 2018).

Most Indian reports points towards needs regarding better allocation of resources to enable primary skill based education more and at remote areas to empower student skill capabilities to achieve educational standards at government primary and middle level grades (PROBE, 1999) More intervention and supervision with academic drives increases basic numerical based skill proficiency as various primary level curriculum needs. Many NGO based volunteer educators works within these areas, these also requires support at budgetary levels from State itself to motivate towards their working attitude in the area. Overall this chapter gives focus on what already prevailing literature exist under review of effective government policies.

3. Data analysis and Discussion

The Table 1 on Monthly Per Capita Expenditure (MPCE) on education in 2023-24 reveals a significant rural-urban divide in educational spending in India. The absolute expenditure on education in rural areas (₹133) is far lower than in urban areas (₹418), and its share in total MPCE is also lower (3.24% in rural vs. 5.97% in urban). This raises critical questions regarding affordability, access, and the prioritization of education in different regions.

**Table 1: Absolute & percentage break-up of MPCE by item groups in 2023-24:
 All-India**

Item group	Average MPCE (Rs.)		Share in MPCE (%)	
	Rural	Urban	Rural	Urban
Education	133	418	3.24	5.97
Non-food total	2,183	4,220	52.96	60.32
All items	4,122	6,996	100	100

Source: Data prepared using data gleaned from the Survey on Household Consumption Expenditure: 2023-24, Ministry of Statistics & Programme Implementation, GoI. page no.31.

https://www.mospi.gov.in/sites/default/files/publication_reports/Final_Report_HCES_2023-24L.pdf (accessed February 20, 2025)

The stark difference in rural vs. urban education spending highlights economic, infrastructural, and social challenges in rural education. While urban families spend more due to accessibility and higher expectations from education, rural households often lack the means or the necessity to invest as much. This disparity in educational spending translates into unequal opportunities, with urban students having a competitive advantage in higher education and employment.

Table 2: Share of education expenditure of total non-food expenditure in 2023-24

Major state	Education (in per cent)	
	Rural	Urban
Andhra Pradesh	5.54	9.26
Assam	3.93	6.08
Bihar	6.76	10.42
Chhattisgarh	1.92	7.45
Gujarat	3.81	11.05
Haryana	9.20	7.88
Jharkhand	5.63	10.77
Karnataka	5.40	10.10
Kerala	3.68	6.71
Madhya Pradesh	5.85	11.07
Maharashtra	5.96	10.83
Odisha	5.12	6.05
Punjab	7.33	9.48
Rajasthan	6.33	12.14
Tamil Nadu	5.90	9.44
Telangana	5.95	12.79
Uttar Pradesh	7.19	10.40
West Bengal	6.81	10.32
All-India	6.11	9.90

Source: Data prepared using data gleaned from Survey on Household Consumption Expenditure: 2023-24, Ministry of Statistics & Programme Implementation, GoI. Page no.39.

https://www.mospi.gov.in/sites/default/files/publication_reports/Final_Report_HCES_2023-24L.pdf (accessed February 20, 2025)

Table 2 presents the percentage share of education-related expenditure in total non-food expenditure for rural and urban areas across major Indian states in 2023-24. At the All-

India level, education accounts for 6.11% of non-food expenditure in rural areas and 9.90% in urban areas. This highlights a consistent trend where urban households allocate a higher share of their non-food spending to education than rural households. In all states, the share of expenditure on education is higher in urban areas than in rural areas. The rural-urban gap is most significant in Chhattisgarh (1.92% rural vs. 7.45% urban) and Gujarat (3.81% rural vs. 11.05% urban), indicating a much lower emphasis on education expenditure in rural households. States with a relatively smaller gap include Haryana (9.20% rural vs. 7.88% urban) and Odisha (5.12% rural vs. 6.05% urban), suggesting a more balanced spending pattern.

Bihar, Jharkhand, and Uttar Pradesh have high rural spending (above 6.5%), possibly due to the prioritization of education in low-income households. Kerala and Assam show low rural and urban education expenditure, which may be due to higher government spending on education, reducing the private burden. Haryana is the only state where rural education expenditure (9.20%) is higher than urban (7.88%), which is an exception to the general trend.

The urban-rural divide in education spending highlights disparities in access and investment in education, which could be linked to income levels, availability of institutions, and state policies. States with high urban education spending (Telangana, Rajasthan, MP, Gujarat) might be experiencing higher private school and coaching expenses, while low rural spending (Chhattisgarh, Kerala, Assam) suggests reliance on government educational support.

Table 3: Trend in percentage composition of MPCE since 1999 in India

Item group	% share in total MPCE					
	1999- '00	2004- 05	2009- 10	2011- 12	2022- 23	2023- 24
Education (Rural)	1.93	3.12	3.59	3.49	3.30	3.24
Education (Urban)	4.33	6.67	8.09	6.90	5.78	5.97

Source: Gleaned from the data sourced from this website, https://www.mospi.gov.in/sites/default/files/publication_reports/Final_Report_HCES_2023-24L.pdf (accessed February 20, 2025)

Education expenditure is a fundamental component of human capital investment and plays a crucial role in determining the socio-economic progress of states. States such as Himachal Pradesh and Punjab allocate the highest per capita spending on education, indicating a strong focus on educational investment. Chhattisgarh and Assam show significantly lower expenditure, highlighting gaps in access to quality education and financial constraints. Southern states such as Tamil Nadu and Karnataka exhibit higher spending levels compared to Bihar and Uttar Pradesh, which are part of the traditionally lower-income BIMARU states.

A distinct pattern emerges when comparing urban and rural education expenditure. Urban areas consistently invest more in education than rural areas across all states. On

average, urban education expenditure is three times higher than in rural areas. The gap is particularly stark in states like Himachal Pradesh, Gujarat, and Maharashtra, where urban residents spend significantly more on education compared to rural areas, reflecting better access to educational facilities in cities.

Table 4: Monthly per capita consumption expenditure in 30 days (Rs.)

State/UT	Education		Non-Food		Total	
	Rural	Urban	Rural	Urban	Rural	Urban
Andhra Pradesh	159.68	402.77	2884.16	4349.81	5326.73	7181.54
Arunachal Pradesh	114.10	319.51	2982.82	5481.06	5994.74	9832.05
Assam	69.68	217.45	1774.42	3574.13	3793.27	6794.31
Bihar	117.84	271.07	1741.92	2601.50	3669.83	5080.37
Chhattisgarh	28.05	218.22	1461.61	2930.23	2738.81	4927.33
Delhi	291.08	370.09	4416.40	5157.72	7399.66	8534.46
Goa	133.76	168.01	4114.82	5063.68	8047.68	9725.94
Gujarat	80.05	448.91	2098.39	4063.00	4115.59	7175.17
Haryana	257.46	390.11	2797.09	4947.50	5377.36	8427.46
Himachal Pradesh	234.23	658.11	3219.07	5727.37	5824.67	9223.00
Jharkhand	84.99	343.46	1509.26	3189.80	2946.00	5393.48
Karnataka	145.36	508.44	2692.94	5033.72	4902.98	8075.62
Kerala	145.13	331.54	3944.94	4938.10	6610.61	7782.86
Madhya Pradesh	111.59	379.67	1908.82	3430.97	3440.63	5537.98
Maharashtra	141.34	509.05	2373.43	4701.81	4145.34	7362.56
Manipur	193.98	417.19	2329.45	3350.77	4530.81	5945.15
Meghalaya	116.17	466.77	1914.00	4752.04	3852.17	7839.16
Mizoram	94.25	176.61	3161.98	5117.17	5962.89	8708.86
Nagaland	141.09	275.18	2767.05	4375.24	5154.70	8021.60
Odisha	88.40	209.11	1727.46	3454.00	3357.13	5824.60
Punjab	245.37	409.56	3349.05	4319.85	5817.07	7359.40
Rajasthan	153.68	491.84	2428.76	4051.20	4510.36	6574.16
Sikkim	169.72	376.43	4671.50	7487.09	9377.18	13926.75
Tamil Nadu	187.49	473.64	3177.26	5016.02	5701.02	8165.32
Telangana	183.09	389.72	3076.24	5580.45	5435.15	8977.75
Tripura	263.91	303.91	3338.69	4542.56	6258.84	8033.58
Uttar Pradesh	132.09	275.64	1836.56	3163.13	3481.36	5395.19
Uttarakhand	199.60	398.12	2809.97	4629.20	5002.56	7485.81
West Bengal	119.39	314.98	1754.13	3224.75	3619.96	5775.08
Andaman & Nicobar Islands	103.79	312.45	4211.49	5967.43	7770.94	10452.97
Chandigarh	319.13	591.87	5281.88	8423.66	8857.32	13424.67

Dadra & Nagar Haveli and Daman & Diu	98.40	323.07	2211.70	3646.96	4310.61	6836.89
Jammu & Kashmir	195.79	372.34	2327.29	3637.15	4773.80	6326.79
Ladakh	87.35	236.17	2140.72	3567.98	5009.54	7532.85
Lakshadweep	35.13	45.32	3259.58	2926.92	6350.32	6376.80
Puducherry	492.67	414.46	4324.35	5267.71	7597.79	8637.06
All India	133.42	417.58	2183.38	4219.79	4121.78	6996.26

Source: Data prepared using data gleaned from the Survey on Household Consumption Expenditure: 2023-24, Ministry of Statistics & Programme Implementation, GoI. pages 39-40.

https://www.mospi.gov.in/sites/default/files/publication_reports/Final_Report_HCES_2023-24L.pdf (accessed February 20, 2025)

A strong correlation exists between education expenditure and total non-food consumption. States with higher education spending (e.g., Himachal Pradesh, Punjab, and Haryana) also report higher overall non-food expenditure, indicating that higher-income households prioritize education. In contrast, states with lower non-food expenditure, such as Bihar, Jharkhand, and Chhattisgarh, also report lower education spending, suggesting financial constraints limit educational investments.

High-income states like Maharashtra, Tamil Nadu, and Karnataka allocate significantly higher funds to education compared to economically weaker states like Bihar and Chhattisgarh. Smaller and well-governed states like Sikkim and Himachal Pradesh show high education expenditure despite their small population, likely due to efficient governance and targeted educational policies.

Table 5. Status of Infrastructure in Schools (Management Wise) in India
(Numbers in per cent)

Infrastructure Category	Government	Private	Aided	Others	Total
Girls Toilets	97.1	98.27	96.7	91.09	97.17
Library	92.67	82.01	89.06	56.47	89.02
Library with Books	83.15	78.00	85.5	47.11	81.07
Electricity	92.36	92.25	90.38	76.72	91.77
Drinking Water	98.36	98.83	97.38	95.54	98.33
Handwash	94.84	95.57	93.37	87.32	94.7
Medical Facilities	81.35	59.18	83.58	35.85	75.16

Source: Gleaned from the website, <https://dashboard.udiseplus.gov.in/#/>

Table 5 presents a comparative analysis of infrastructure availability across different types of school management in India—Government, Private, Aided, and Others—based on key facilities. The availability of girls' toilets is generally high, with Government (97.1%) and Private (98.27%) schools performing best, while the "Others" category lags at 91.09%. Library facilities show a surprising trend where Government schools (92.67%) outperform Private (82.01%) and Aided (89.06%) schools, while the "Others"

category struggles at 56.47%. A similar pattern follows for libraries with books, with Government (83.15%) and Aided (85.5%) schools faring better than Private (78%) and Others (47.11%). Electricity availability is strong in Government (92.36%) and Private (92.25%) schools but drops significantly in the "Others" category (76.72%). Drinking water facilities have the highest availability, with Private (98.83%) and Government (98.36%) schools leading, ensuring an overall strong presence (98.33%). Handwashing facilities are also widely available, with Private (95.57%) and Government (94.84%) schools performing best, while the "Others" category is notably lower (87.32%). However, medical facilities remain the weakest infrastructure component, with Private schools lagging significantly at 59.18%, while Government (81.35%) and Aided (83.58%) schools perform better; the "Others" category is critically low at just 35.85%. The overall data suggests that while India has made commendable progress in essential infrastructure like drinking water (98.33%) and girls' toilets (97.17%), gaps remain in medical facilities and library resources. Government schools consistently perform well across most categories, while Private schools show weaknesses in library and medical infrastructure despite excelling in hygiene-related facilities. Schools in the "Others" category face significant deficits across all infrastructure aspects, particularly in library resources and medical support. To ensure equitable distribution of resources, urgent attention is needed to bridge these gaps, especially in private and lesser-regulated schools.

5. Conclusion

The analysis highlights strong disparities in education expenditure across states, with urban areas outspending rural areas significantly. States with higher economic prosperity tend to invest more in education, while economically weaker states struggle with lower spending. To bridge these gaps, policy efforts should focus on increasing rural investment, reducing regional disparities, and integrating education funding with overall economic growth strategies.

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Financial Resilience Empowering Viksit Bharat

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Abstract

The present work is an efforts and experiences of digitization in financial sector of India. The country with relatively low literacy rate (74.04%)¹ and even lesser digital literacy (38%)² it is quite challenging to adapt to digitization and more so in financial sector. Nonetheless the consistent and committed efforts of Government of India (GOI) and Reserve Bank of India (RBI) have brought this burgeoning change. Owing to the introduction of Unified Payment Interface (UPI) in 2016 the economy has worked wonders, and the Gross Domestic Product (GDP) of the country has risen phenomenally making India the fifth largest economy in the world. The Ministry of Finance, GOI alongside other schemes advanced 'Stand Up India' in 2016. The schemes were to promote financial inclusion, especially for tribal and marginalized women entrepreneurs. The present work traces the evolution of digital finance in India, the reason for stupendous growth, robust financial inclusion, green finance, climate concern, digital public infrastructure and economic growth. The success stories and case study is also included towards the end to endorse experience of digitization and inclusiveness of financial sector in the country.

Keywords: Financial resilience, digitization, viksit bharat

Introduction

The chronicles of India's digitization journey is interesting and worth diving. The transformation of the Indian financial sector towards digital finance started in the early 2000s, with banking reforms infused by Government of India (GOI) in 1991, allowing private banking sector to function alongside public banks. These private banks to facilitate customers adopted the best technological practices like online banking, plastic cards and ATMs etc. Owing to GOI's enthusiasm and push to achieve a cashless economy, speed of adoption of digital financial services in India increased substantially, especially after the demonetization drive in 2016. Additionally, 'Digital India'³, the flagship program of GOI contributed immensely towards creating awareness, adoption

¹ Literacy in India means a person can read, write and understand his/her own language

² . In urban areas, digital literacy is relatively higher at 61% as compared to just 25% in rural areas.

³ The program of Government of India with a vision to transform India into a digitally empowered society and knowledge economy. The programme was launched on July 1, 2015 by Hon Prime Minister Shri Narendra Modi.

Social Action Group for Awareness and Research (SAGAR) Foundation

www.sagarfoundation.org

and growth of the digital financial services in the country. Also, the burgeoning penetration of smart phone⁴, usage with low data cost has further prompted digitization in the country. The transformation proved to be double sided benefit alongside more transparency and efficiency of functioning it enhanced security and financial inclusion. It is also imperative to understand the -Digital Public Infrastructure (DPI)- India Stack and GOI provisions when we are analyzing digitization in India, especially financial sector digitization.

Digitization of Finance sector in India - Efforts and Experiences

The GOI played a crucial and catalyst role in transforming India financial sector into digital finance by acting as an anchor to client and establishing institutions to ensure continuity. The consistent efforts of GOI to build the DPI, that consist of three different layers viz. Aadhar Card⁵, UPI and Digilocker- are collectively termed as India Stack. This together not only allows paperless office but has brought revolutionary change in fiscal operations in India. Funds are transferred directly to the beneficiary account by leveraging on DPI. The India Stack is a single window that foster innovations in the country, opened huge markets and reduced gaps in functionalities of financial inclusion. The India's efforts of digitization have embarked as a lesson for other emerging economies to replicate digital transformation. In absence of DPI, the benefit extended by GOI schemes did not reach the beneficiaries for instance, 2012, 36% of total spending under Public Distribution System (PDS)⁶ did not reach the households. To prevent leakage and ensure that benefit reaches to the beneficiaries GOI started Direct Benefit Transfer Mechanism where benefit is directly transferred to the bank of account of the beneficiaries which is linked with Aadhar Card. The India Stack has supported resilient financial sector in the country with its non-exclusive services. The country has two largest brokerages, viz. Zerodha and Upstox that uses the payment layers and identity of DPI, allowing users to trade from their mobile phones. The public Financial Management System (PFMS) is the backbone for managing fiscal operation. The PFMS has both spending side from Government as well as the collection side that is managed through internet banking and credit/debit cards.

In 2012, RBI released a vision that indicated commitment towards building safe, efficient, accessible, inclusive, interoperable and authorized payment system in the country. Under the guidance of RBI, the National Payments Corporation of India (NPCI) in 2016, launched UPI. The UPI not only simplified the process of making payments but has also brought millions of unbanked Indians into the formal banking system. Importantly, it also worked as a green initiative by decreasing use of paper in domestic payment market. Since then, UPI has been used at all levels from street

⁴ 78.0% of Indian population is mobile phone users

⁵ It is 12 digit unique identity issued by Unique Identity Authority of India on behalf of GOI. The number is the proof of identity and address anywhere in India

⁶ The scheme provide rice and grains to the beneficiaries

vendors to shopping malls. Today more than 40% of payments done in India are digital⁷. In India it is very common to see the newspaper advertisement with QR code for any donations. The success of digital payments in India is undoubtedly due to robust DPI and behavioral change that prompted people to change financial transaction from cash to digital. Nonetheless this behavioral change is due to trust, accessibility and convenience contributing to financial inclusion and transparency. The successful interface of UPI has led NPCL to set up NPCL International Payments Limited (NIPL) in 2020 to take this digital payment system outside the boundaries of the country. NIPL and RBI has entered into agreements with 30 nations. The international acceptance of UPI in countries like Singapore, UAE, Bhutan, Srilanka and France proves the extraordinary potential of DPI.

The digital economy has played a phenomenal role in enhancing economic growth in of the country with saving of Rs.5.50 lakhs⁸ approximately in last seven years. From November 2019 to January 2023 the digital transaction increased more than three times in India from 300 crore to 1052 crore. If this amount (300 crore) is transacted through cash or credit/ debit cards it would have costed 5.5 lakhs to 7. 2 lakhs crore. The digital economy's contribution to India's GDP is 11 % as of 2023 and is expected to increase to 20% by 2026.

Turning the focus to financial resilience, India's quest for more inclusive and financial resilient society by empowering more vulnerable individuals and small businesses is brilliant. Financial access allows firms to invest with calculated risk and households to systematize their consumption and accumulate capital. This in turn fosters creation of businesses and improves people's livelihoods. It also helps households and firms protect themselves against shocks and risk. The Micro, Small and Medium Enterprises (MSME)⁹ are the backbone of Indian economy with wide benefits extended by them to the country viz. reduction of poverty, combating unemployment, narrowing income inequality and regional imbalances etc. The government, in order to support, sustain and safeguard these MSMEs extends various loan schemes like Mudra loans- where the main objective is to 'fund the unfunded'¹⁰. This loan is extended to all businesses including proprietary, partnership and private limited companies. All bank branches across India provides this loan. Further, to promote financial inclusion the 'Stand up India' scheme was started by, Ministry of Finance, Government of India in April 2016¹¹. This scheme is particularly to facilitate the dreams of aspiring Schedule caste (SC) and

⁷ India's UPI: A global front-runner in digital payment systems

⁸ <https://www.hindustantimes.com/india-news/digital-economy-playing-major-role-in-boosting-india-s-growth-says-finance-ministry-101695407969166.html>

⁹ <https://msme.gov.in/know-about-msme>

¹⁰ <https://www.lendingkart.com/blog/government-loan-schemes-for-small-businesses/>

¹¹ <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/apr/doc202345178201.pdf>

Schedule tribes (ST)¹² women. Moreover, for quick finance to MSME Lending kart business loans have been introduced. The loan is offered online through website and the applicant has to upload all the documents digitally and within 10 minutes the entire process gets completed while loan gets sanctioned in 3 working days.

Indian financial market is attempting to integrate accelerating climate transition risks in their investment decision making. However, net-zero transition is yet farfetched for India. The government is pressing for such transition with legislative reforms and is targeting to reach the net-zero goal by 2070¹³. The financial arm of the economy is getting charged to achieve this ambitious goal with significant investments in both public and private sector being diverted to green financing. The Small Industries Development Bank India (SIDBI) has developed a special vertical to provide advisory to make MSME climate resilient. The SIDBI has identified 10,000 MSME for energy efficiency loans.¹⁴ The RBI, has also mandated Indian banks to adhere to guidelines of sustainable financing. The RBI also advocate the role of market to shape the direction of green initiative for the companies to follow. With more investors absconding climate risks companies that are slow in adapting to green finance will be in difficulty in accessing capital/loans. The apex bank of India also suggests that alongside the debt market the capital market as well should channelize their investment into green and innovation sector for climate adaption. Capital market should ensure detailed climate risks disclosure by the companies so as to facilitate investors for informed decision. RBI is also looking forward to mandate banks to increase their basic minimum green quantum in their private sector lending.

Further GOI has authorized 100% Foreign direct investment (FDI) for renewable power generation. On January 25th, 2023, GOI issued first sovereign green bond¹⁵ (SGrB) worth of INR 80 billion¹⁶. The proceeds from these SGrB will be used in green projects viz. renewable energy, energy efficiency, clean transportation, climate change adaption etc. (Refer Note on Framework for Sovereign Bonds).

Green power-based fossil fuel is rampantly popularized in transport sector with public transport vehicle being transformed into electric vehicles (EV) in phased but progressive manner. The overall EV sale in India has increased to 6.38% in 2023 as compared to 1.75% in 2021. According to Ministry Road, Transport and Highway, by the end 2026, 100% buses in India will be EV, while 70% of commercial vehicle and

¹²

https://en.wikipedia.org/wiki/Scheduled_Castes_and_Scheduled_Tribes#:~:text=The%20Scheduled%20Caste%20and%20Scheduled,or%20other%20of%20the%20categories.

¹³

<https://www.whitecase.com/insight-our-thinking/investing-india-path-net-zero#:~:text=India%20is%20committed%20to%20achieving,the%20heart%20of%20this%20drive.>

¹⁴ <https://shaktifoundation.in/wp-content/uploads/2022/07/Conference-Takeaways-GIFS-January22.pdf>

¹⁵ The Sovereign Green bond (SGB) enjoys greenium which slightly lower rate of interest due to its noble cause. The 10year SGrB was issued with interest rate of 7.38% .

¹⁶ <https://blogs.worldbank.org/en/climatechange/india->

80% of 2 and 3-wheeler will be EV based. To achieve this target GOI has created policies and program 'The National Electric Mobility and Mission Plan (NEMMP)

Success stories of State Bank of India¹⁷

Below briefed are the efforts and success stories of SBI towards financial inclusion in the country.

1) The SBI Jamshedpur (Jharkhand) -XLRI-branch: The branch open 160 women account who worked as casual labour. The branch in association with XLRI¹⁸ arranged the financial literacy campaign and 90% of these women accounts are active with average balance of INR 2000/-

2) The SBI-Faridabad (Delhi) branch: There is industrial area around this branch and many migrant labourer working in these industries were paid cash. The SBI branch approached these industrial units and oriented them and opened 55000 accounts of industrial workers. The workers were issued RuPay¹⁹ so that they can withdraw money from ATM²⁰.

3) Customer Service Point (CSP) agents is an initiative by the bank to provide services to the customer by third party where bank branches are physically not operative. This initiative is to enhance financial inclusion. These CSP works in the villages and villagers are widely benefited due to formal financial services

Case Study- The Dungarpur Project

The Project is about Financial Inclusion by the Bank of Baroda²¹(BoB). Dungarpur is the district of the state of Rajasthan, India. The district is predominated by tribals with 70% of its population being tribal. The literacy rate is 24.5% in rural areas and women literacy is 12.4%. The district is drought prone and source of livelihood for the tribal household is agriculture and cattle breeding. These tribes take loan from village moneylenders at very high interest rate and if crop fails due to drought they are in the vicious circle of debt. BoB took Dungarpur as pilot district for financial inclusion project. This is how Dungarpur Project came into existence. The project was initiated in collaboration with Center of Micro Finance (CmF) and PEDO (Local voluntary organization).

The project had following key ingredients:

1) Financial Inclusion via No Frills Account- The target was to open bank account for 55000 people in 679 villages who did not have any access to banks

¹⁷ Public sector bank in India with 22405 branches

¹⁸ One of the top business school in India

¹⁹ It is Indian multinational financial service launched by NPCI. It has range of credit and debit cards

²⁰ Automated teller machine which is self service banking outlets

²¹ Public sector bank in India

- 2) Credit through Self Help Groups (SHG) - The total credit INR 220 million was advanced
- 3) Training tribal youths as Micro Finance professionals
- 4) Training villagers in employment-related skills

Conclusion

The digitization of financial sector in a developing country like India has worked wonders. The efforts of GOI, RBI alongside other public sector banks and legislative norms towards the accomplishment of Digital India, though slow but has steady achievements. In 2023 India ranked 49th in World Digital Competitiveness ranking. The ranking is based on knowledge, readiness and technology. Nonetheless the country has long way to go for its envisaged achievement, the race has begun, and the finish line is attainable with countries sustained progress. The robust use of UPI, by street vendors to market traders has worked as double-sided benefit encompassing green initiative with almost zero use of paper and covering millions of unbanked citizens. The quest towards financial inclusion has benefited village dwellers, illiterate citizens and empowered women to take benefit of formal financial sector. 78% of Indian population holds bank accounts as on 2023 and 40% of payments are digital with revolutionary intervention of UPI used by 30 crore individual and 5 crore merchants. The financial arm of the economy is getting charged to achieve this ambitious goal of net zero by 2070 with significant investments in both public and private sector being diverted to green financing. The SIDBI has developed a special vertical to provide advisory to make MSME climate resilient. RBI is also mandating green deposits and the framework for the same has been shared to the banking sector. The FDI for the green initiative receive priority and 100% FDI for green projects are invited. Digitization helped countries to foster systematic decision making and efficient policies for optimal allocation of resources resulting in phenomenal growth with country ranking fifth largest in its GDP among countries of world.

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Governance and Policy Interventions to Reduce CO₂ through Solar Energy: A Comprehensive Review

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Abstract

The adverse environmental impacts of conventional energy sources have prompted policymakers to explore sustainable alternatives, leading to the worldwide adoption of solar energy as a leading solution. This paper provides a comprehensive review of policy frameworks and mechanisms employed at various scales to promote the deployment of solar energy with the aim of reducing CO₂ emissions.

The study highlights the policies and regulations of five renewable energy (RE)-rich states in India, focusing on their role in fostering the growth of the solar energy sector. Key policy parameters such as Installation capacity restrictions, Transmission and wheeling charges, electricity duties and allocation of Government land availability are explored. Additionally, the ease of doing business in implementing solar energy projects is analysed for these states.

Based on the analysis, the paper recommends that to achieve India's Nationally Determined Contribution (NDC) goal of a 45% reduction in emission intensity of GDP from 2005 levels, states should focus on smoothly integration of higher solar energy capacity in the grid.

Keywords: Solar energy, governance, policy interventions, pollution reduction, renewable energy.

Introduction

The 'Viksit Bharat 2047' is a comprehensive vision plan by the Government of India, aiming to transform India into a developed nation by the year 2047, marking the 100th anniversary of its independence. The vision encompasses various aspects of development, including economic growth, social progress, environmental sustainability, and good governance. Implementing sustainable practices and preserving natural resources for cleaner and healthier environment.

For Environmental Sustainability, balancing development with environmental protection is vital. This includes adopting renewable energy sources, mitigating climate change impacts, and promoting sustainable practices.

Gujarat would play a pivotal role in driving India's growth, with an economy almost as large as India's today (in nominal terms) and per capita income of a developed economy. In line with its Viksit Gujarat roadmap will drive strategic transformation across every

aspect of citizen lives, economy and growth. Equitable access to clean environment, breathable air, adequate sanitation, safe drinking water and 24x7 electricity are the key areas of living well.

Rural transformation plays a pivotal role in achieving the ambitious goal of Viksit Bharat and Viksit Gujarat by contributing to environmental sustainability with the help of promoting sustainable practices along with focusing on renewable energy.

Most of the countries, if not all, included reduction in carbon emissions and carbon intensity within their Nationally Determined Contributions (NDCs), as these are the primary metrics used to measure climate action and are considered essential components for achieving the goals of the Paris Agreement, meaning nearly all countries participating in the Paris Agreement would have incorporated these elements in their NDC targets. Also, India stands committed to reduce its carbon emissions by one billion tons from Year 2022 to Year 2030 and will reduce its carbon intensity by 45% by 2030 over 2005 levels [18].

According to NDC's Synthesis report, to be consistent with global emission pathways with no or limited overshoot of the 1.5 °C goal, global net anthropogenic CO₂ emissions need to decline by about 45 per cent from the 2010 level by 2030, reaching net zero around 2050. For limiting global warming to below 2 °C, CO₂ emissions need to decrease by about 25 per cent from the 2010 level by 2030 and reach net zero around 2070.

Along with NDC, sustainable development goals (SDG) are also linked to climate change action. To avert the deleterious effects of climate change, the world is undergoing a major

transition in the energy sector to achieve net-zero targets. Renewable energy occupies a central role in energy transition, and it is evident from the increasing trend of capacity additions, employment, and increasing solar energy investments.

Pollution arising from conventional energy sources poses a significant threat to environmental and human health. Solar energy, being a clean and renewable resource, has emerged as a key solution to mitigate these challenges. Effective governance and targeted policy interventions are essential for the widespread adoption of solar energy. Accepting sustainable practices to reduce pollution and minimize energy consumption will not only create healthier environments but also safeguard resources for future generations.

This paper aims to examine the role of governance and policy mechanisms in advancing solar energy adoption, with a focus on India's renewable energy-rich states. It identifies successful interventions and explores their potential replicability to meet global and national environmental goals.

Empowering a Sustainable Future: Global Insights and India's Progress

135 countries have notified net zero target, covering 88% of global emissions and notified renewable power targets, and 17 countries have solar specific targets. Globally

Countries have implemented various policy frameworks to promote solar energy and achieve net zero targets. These include Renewable Portfolio Standards (RPS) requiring utilities to use renewable sources, Feed-in Tariffs (FiTs) providing fixed payments for solar producers, and tax incentives to reduce installation costs. Net metering allows selling excess solar electricity back to the grid, while National Solar Missions promote solar energy nationally [9].

Name of the Country	Net Zero and Renewable targets
United States	50-52% reduction in emissions below 2005 levels by 2030, with a net zero target set for 2050 and 100% clean electricity by 2035.
China	Achieve net zero by 2060 and 1,200 GW of wind and solar capacity by 2030.
European Union	Requires all 27 member states to reduce emissions by 55% by 2030, with a net zero goal for 2050. Several EU countries have ambitious renewable power targets. For example, Portugal, Estonia, Denmark, and Austria aim to achieve over 90% renewable electricity by 2030.
India	Net zero target set for 2070 and targets 500 GW of renewable install capacity by 2030.
Germany	Net zero greenhouse gas emissions by 2045 and as part of its "Energiewende" policy. The country aims to source 80% of its electricity from renewable sources by 2030

Countries like Germany, China, India and the United States have demonstrated how comprehensive frameworks and continuous innovation drive large-scale solar deployment. Germany's Energiewende policy, for instance, emphasizes feed-in tariffs and investment in advanced grid systems (BMW, 2024). Germany's greenhouse gas emissions decreased by 10.3% in 2023, with 672 million tonnes released, 77 million tonnes less than in 2022. The decline is attributed to a decrease in coal-fired power generation, growth of renewable energy, and reduced energy consumption [14].

Similarly, China has leveraged manufacturing incentives to dominate global solar module production. China provides various subsidies, tax rebates, and low-interest loans to solar PV manufacturers. These incentives have allowed local companies to invest in advanced manufacturing technologies, helping them stay competitive in the global market. China has contributed to reducing CO2 emissions through economic scale by massively investing in renewable energy production, particularly solar and wind power, which allows them to manufacture and deploy these technologies at a large

scale, significantly lowering the cost per unit of clean energy generated, thus incentivizing wider adoption both domestically and internationally; this large-scale production also helps them dominate global supply chains for low-carbon technologies, further driving down costs for other countries looking to transition to cleaner energy sources.

According to UNFCCC report, the largest growth in CO₂ emissions has come from the power generation and road transport sectors, with the industry, households and the service sector⁶ remaining at approximately the same levels between 1970 and 2004 [18]. By 2004, CO₂ emissions from power generation represented over 27% of the total anthropogenic CO₂ emissions and the power sector was by far its most important source.

According to IEA's report CO₂ Emissions in 2023, Global energy-related CO₂ emissions grew by 1.1% in 2023, increasing 410 million tonnes (Mt) to reach a new record high of 37.4 billion tonnes (Gt). This compares with an increase of 490 Mt in 2022 (1.3%). Emissions from coal accounted for more than 65% of the increase in 2023[19].

Thanks to growing clean energy deployment, emissions are seeing a structural slowdown. In the decade to 2023, global emissions grew slightly more than 0.5% per year, the slowest rate since the Great Depression. Clean energy is at the heart of this slowdown in emissions. Global capacity additions of wind and solar PV reached a record almost 540 GW in 2023, up 75% on the level of 2022. Clean energy is having a significant impact on the trajectory of global CO₂ emissions [19].

According to the International Renewable Energy Agency (IRENA), there has been a consistent increase in renewable power generation capacity over the past decade, and this trend is anticipated to continue [15].

Solar PV and wind power installations are projected to account for 96% of new capacity, with their additions more than doubling by 2028 compared to 2022 levels [16]. This growth is driven by continuous policy support in over 130 countries, lower generation costs compared to fossil and non-fossil alternatives, and the increasing demand for clean energy.

As of 2023 the total installed renewable capacity in the world is 3869 GW [15]. Nearly 50% of the increase in global renewable capacity between 2020 and 2023. 73% is accounted for by ten countries and China alone accounts for over 38% renewable energy [15,16]. The United States, Brazil, India, and Germany are next [15].

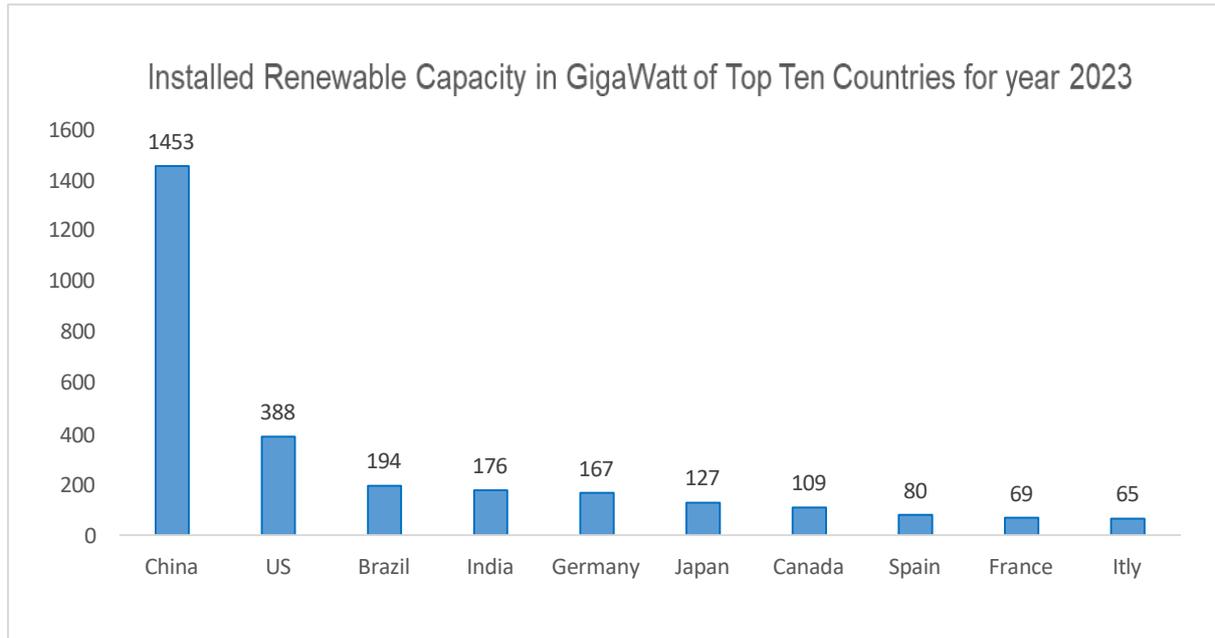


Chart 1: Installed Renewable Capacity of Top Ten Countries

India has a lot of natural resources, a stable political system, and financial incentives that make it a very attractive place to invest in renewable energy. With over 300 sunny days a year, the nation is perfect for solar energy projects. Its extensive coastline and windy weather also make it a promising location for wind energy projects. The industry is further supported by government programs like the National Solar Mission and the National Wind- Solar Hybrid Policy, as well as incentives like up to 100% Foreign Direct Investment (FDI) and production-linked incentives for the manufacture of solar PV. Furthermore, India offers a plethora of investment prospects due to its cost-competitive renewable technologies, expanding energy demand, and aim to achieve 500 GW of renewable energy capacity by 2030 and long-term goal of reaching net-zero by 2070 [17].

India's growth in solar energy is consistent and fast. According to MNRE's Installed capacity report, from 2019-20 to 2024, its solar capacity grew from 35,607 MW to 81,814 MW. This includes adding 15,034 MW in 2023-24. This shows India's strong commitment to renewable energy and lessening its environmental impact.

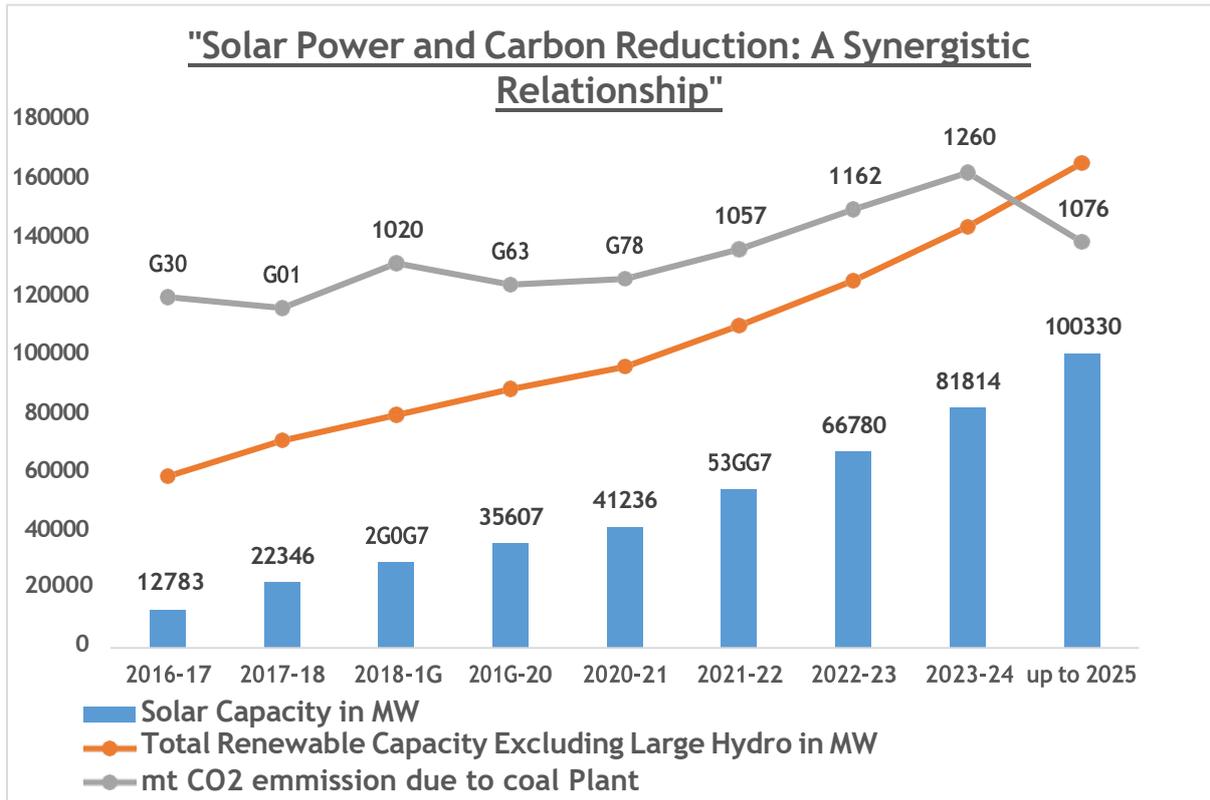


Chart 2: Solar Power and Carbon Reduction: A Synergistic Relationship

It is seen from the Chart 2 that, CO₂ emissions from coal plants, which initially fluctuated but showed a nearly constant trend until 2023, peaking at 1,260 million metric tons. However, a decline in emissions is observed in 2025 (1,076 million metric tons), suggesting that the increased adoption of solar and renewable energy sources is beginning to reduce reliance on coal-based power generation. This trend highlights the crucial role of solar energy in curbing carbon emissions and advancing India’s transition toward a more sustainable energy future.

The year-on-year (YoY) net capacity addition trends shown in chart 3 for coal and solar energy from 2015-16 to 2024-25, highlights a significant shift in India's power generation landscape, with coal capacity additions (represented in grey) showing a steep decline over the years, while solar capacity additions (represented in orange) have steadily increased. In the initial years, coal-based capacity dominated new additions, but after 2016-17, there was a sharp reduction in its expansion. Solar energy, on the other hand, witnessed consistent growth, especially from 2020-21 onward, surpassing coal-based capacity additions. The trend indicates a clear transition toward renewable energy, driven by policy support, declining solar costs, and India's commitment to reducing carbon emissions. By 2023-24 and 2024-25, solar energy additions significantly outpace coal, reflecting the country’s push toward clean energy solutions.

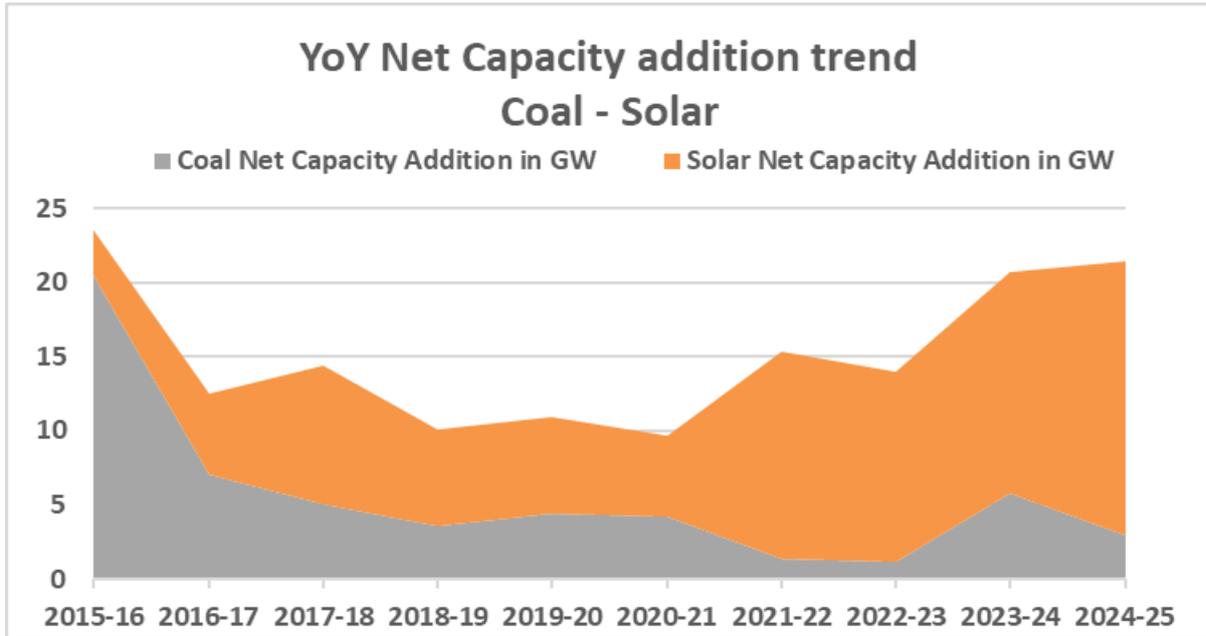


Chart 3: Solar Power and Carbon Reduction: A Synergistic Relationship

Methodology:

Impact of Solar energy in reducing the CO₂ emission intensity of Indian Electricity Generation due to installation of solar plant is have been estimated using the following equation based on the electricity Generation through solar plant in each year, and the weighted average emission factor, unless otherwise specified.

Reduction in CO₂ Emissions (tCO₂) = Weighted Average Emission factor (tCo₂/MWh) X Electricity Generation (MWh) weighted average emission factor shall be considered from official publication of the Government of India using Approved Consolidated Methodology by CDM Executive Board for grid connected large scale renewable project.

For annual electricity generation from the Solar plant, data available from the Niti Ayog Energy and climate dashboard and CEA data archive is used.

Carbon Reduction Through Solar Energy: Five leading Renewable Energy-Rich State’s Governance and Policy Interventions

India has made remarkable progress in renewable energy, with some states leading the way in solar power due to their supportive policies and natural advantages. All the states intend to meet its sustainable development goals by advancing the development of renewable energy in a manner that would position it as the mainstream source of energy as well as substantially contribute to the national RE target of 500 GW by 2030 as part of India’s global commitment and to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level. These efforts not only promote clean energy but also

contribute to significant reductions in carbon emissions, helping to combat climate change.

According to MNRE’s renewable energy statistics, Rajasthan tops in the country in installation of Renewable Energy by installing around 19,814.53 MW during last 6 years achieving a growth of 271.83% followed by Gujarat of 18,122.27 MW capacity installation registering a growth of 194.04%. Tamil Nadu and Maharashtra have also shown commendable progress, each added 8,709.91 MW and 6,010.91 MW with corresponding increase of 64.75% and 52.18% respectively [20].

Rajasthan tops in the country in installation of Renewable Energy by installing around 19,814.53 MW during last 6 years achieving a growth of 271.83% followed by Gujarat of 18,122.27 MW capacity installation registering a growth of 194.04%. Tamil Nadu and Maharashtra have also shown commendable progress, each added 8,709.91 MW and 6,010.91 MW with corresponding increase of 64.75% and 52.18% respectively [20].

Here’s comparison of latest policy of five key states Gujarat, Rajasthan, Tamil Nadu, Madhya Pradesh, and Maharashtra in terms of capacity limitations, feed-in tariffs, banking fees, and electricity duties were examined which have impact in the solar capacity addition and resultantly the CO2 emission.

Parameters	Gujarat	Rajasthan	Tamil Nadu	Maharashtra	Madhya Pradesh
State Policy	Gujarat Renewable Energy Policy - 2023	Rajasthan Integrated Clean Energy Policy, 2024	Tamil Nadu Solar Energy Policy 2019	Integrated Non-Conventional Energy Generation Policy 2020	Madhya Pradesh Renewable Energy Policy – 2022
Control Period	Up to 2028 or till notification of new policy, whichever is earlier	5 years	Valid until modified	Up to March 2025	5 years
Installation Capacity limits	No capacity limit with respect to sanctioned load	Up to 100% of contract demand	Up to 100% of contract demand	Not specified	Not specified

	/ contract demand for all RE.				
Transmission and wheeling charges	As per Regulatory Commission	As per Regulatory Commission	50% of normal OA	Double of normal OA	50% waiver on wheeling charges for a period of 5 years
Electricity Duty	100% exemption for first 10 yrs	100% exemption for first 10 yrs	100% exemption for first 2 yrs	100% exemption for first 10 yrs	100% exemption for first 10 yrs
Allocation of Government Land	The RE project may be set up on private land, or government waste land allotted by the Revenue Department / state nodal agency at Rs 15000 Rs. / Year / Hactor	Allot govt land upon submission of security deposit: Solar: Rs 5 Lac per MW Solar manufacturing : Land allotment at 50% concession rate Land conversion not required for solar project on agriculture land	Not Specified	Land under Revenue Department (on nominal / lease agreement, nominal Rs. 1 at this rate both parties will agree on a 30-year lease)	Government land, if available, shall be provided on a concession a l rate (rebate of 50% on circle rate) to developers.

Gujarat: Gujarat has been a pioneer in solar energy adoption, driven by various policies initiated in time to time. Starting from solar power policy 2009, Gujarat solar power policy 2015 & 2021 followed by latest integrated RE Policy of 2023, which revised various clause and incentives to facilitated land acquisition and incentivized private sector participation. The state has established a strong solar energy ecosystem by offering investor-friendly policies, reducing transmission charges, and simplifying the

approval process for large-scale solar parks. As a result, Gujarat has significantly cut down its reliance on coal-based power, leading to a major reduction in CO₂ emissions. The rapid expansion of solar energy has helped Gujarat avoid millions of tons of carbon emissions annually. Gujarat’s solar energy expansion of 55 GW by 2030 is estimated to prevent 90 billions of tons of CO₂ emissions over the coming years.

FY	Coal based Installed Capacity (MW)	Coal based Generation (MWh)	Solar Installed Capacity (MW)	Solar Generation (MWh)	Weighted Average Emission factor (tCo2/MWh)	Reduction in CO2 Emissions (tCO2)
2020-21	16092	76792410	2987	4633810	0.703	3257568
2021-22	14692	49764620	4470	6774500	0.715	4843768
2022-23	14692	53174210	7180	10335320	0.716	7400089
2023-24	14692	76598490	9255	13468910	0.727	9791898
2024-25	14692	70949160	13545	13414360	0.727	9752240
Total Annual Reduction in CO2 emission						35045562

The above table highlights the impact of solar energy expansion on reducing carbon emissions from coal-based power generation between the financial years 2020-21 and 2024-25. Despite the coal-based installed capacity remaining constant at around 14,692 MW, solar capacity has grown significantly from 2,987 MW in 2020-21 to 13,545 MW in 2024-25. This increase in solar capacity has resulted in a substantial rise in solar power generation, from approximately 4.63 million MWh in 2020-21 to 13.41 million MWh in 2024-25. As a result, the reduction in CO₂ emissions has also increased, peaking at nearly 9.79 million tons in 2023-24. The cumulative CO₂ emission reduction over these five years stands at an impressive 35.04 million tons, emphasizing the critical role of solar power in mitigating climate change and reducing dependence on coal-based electricity generation.

Rajasthan: With some of the highest solar radiation levels in the country, Rajasthan’s Solar Energy Policy has leveraged its natural advantage by introducing large-scale solar parks in its vast desert terrain and high solar insolation levels. The Bhadla Solar Park, with a capacity exceeding 2 GW (expanded to 3.25 GW in 2024), exemplifies successful implementation. These initiatives have enabled large-scale adoption of solar energy, replaced fossil fuel-based electricity and reduced carbon emissions on a large scale. The state’s vast solar parks contribute to cutting down thousands of tons of CO₂ every year.

FY	Coal based Installed Capacity (MW)	Coal based Generation (MWh)	Solar Installed Capacity (MW)	Solar Generation (MWh)	Weighted Average Emission factor (tCo2/MWh)	Reduction in CO2 Emissions (tCO2)
2020-21	9820	44732520	5925	10384240	0.703	7300121
2021-22	8900	49534580	12565	17219880	0.715	12312214
2022-23	8900	55946350	21347	34474430	0.716	24683692
2023-24	9200	60188350	21347	38365210	0.727	27891508
2024-25	9200	53789840	27347	35950780	0.727	26136217
Total Annual Reduction in CO2 emission						98323752

The above table shows a steady rise in solar installed capacity, growing from 5,925 MW in 2020-21 to 27,347 MW in 2024-25. This expansion has led to a significant increase in solar power generation, from approximately 10.38 million MWh in 2020-21 to 35.95 million MWh in 2024-25. Consequently, the reduction in CO₂ emissions has grown from 7.3 million tons in 2020-21 to over 26.1 million tons in 2024-25. The total cumulative reduction in CO₂ emissions over these five years stands at an impressive 98.32 million tons.

Tamil Nadu: As a leader in renewable energy, Tamil Nadu has implemented policies like “Tamil Nadu solar energy policy in 2012” followed by revised Solar Energy Policy 2019, promoting decentralized solar systems and focusing on agricultural applications, Tamil Nadu has reduced dependency on fossil fuels while addressing rural energy needs [4]. Policy prioritized grid integration and minimizing curtailment risks for solar power that promote solar power through subsidies, lower electricity taxes, and incentives for rooftop solar systems. The increased adoption of solar energy in industrial and residential sectors has significantly reduced the state’s dependency on coal and thermal power, thereby preventing a substantial amount of carbon emissions from entering the atmosphere.

FY	Coal based Installed Capacity (MW)	Coal based Generation (MWh)	Solar Installed Capacity (MW)	Solar Generation (MWh)	Weighted Average Emission factor (tCo2/MWh)	Reduction in CO2 Emissions (tCO2)
2020-21	13160	48150360	4527	6115480	0.703	4299182
2021-22	10045	59215190	5067	7172880	0.715	5128609

2022-23	10045	65360470	6736	9419390	0.716	6744283
2023-24	10459	73130320	8211	11737480	0.727	8533148
2024-25	10459	60289850	9542	11034720	0.727	8022241
Total Annual Reduction in CO2 emission						32727464

Figures in the table highlight the vital role of solar energy in reducing reliance on coal-based power, thereby supporting India's clean energy transition and climate goals. Table over this period shows, solar installed capacity increased from 4,527 MW in 2020-21 to 9,542 MW in 2024-25, leading to a significant rise in solar power generation from approximately 6.11 million MWh to 11.03 million MWh. This transition has contributed to a steady reduction in CO₂ emissions, which grew from 4.29 million tons in 2020-21 to a peak of 8.53 million tons in 2023-24 before slightly declining to 8.02 million tons in 2024-25. The total cumulative reduction in CO₂ emissions over these five years stands at approximately 32.72 million tons. These.

Maharashtra: Maharashtra has taken a balanced approach to solar energy by promoting both rooftop and utility-scale projects. Maharashtra's solar initiatives cater to urban and industrial energy demands. The state's Renewable Energy Policy of 2015 followed by Integrated Non- Conventional Energy Generation Policy 2020 introduced subsidies for rooftop solar installations and preferential tariffs. As of 2024, Maharashtra has achieved over 9 GW of installed solar capacity includes 3 GW from Solar roof top under PM surya ghar muft Bijali yojna, supported by robust net metering and energy banking mechanisms [20].

Urban solar growth is a focus area, with rooftop installations share of 17% in 2024. Maharashtra's solar energy expansion is estimated to prevent millions of tons of CO₂ emissions over the coming years.

FY	Coal based Installed Capacity (MW)	Coal based Generation (MWh)	Solar Installed Capacity (MW)	Solar Generation (MWh)	Weighted Average Emission factor (tCo2/MWh)	Reduction in CO2 Emissions (tCO2)
2020-21	24966	93669320	2324	3089460	0.703	2171890
2021-22	23856	113862850	2631	3187180	0.715	2278834
2022-23	23856	124157670	4723	4387850	0.716	3141701
2023-24	24006	132867690	6250	5814130	0.727	4226873
2024-	24006	107774380	9337	5193710	0.727	3775827

25						
Total Annual Reduction in CO2 emission						15595124

Above table shows, during financial years 2020-21 and 2024-25, solar installed capacity expanded from 2,324 MW in 2020-21 to 9,337 MW in 2024-25, leading to a significant rise in solar power generation from approximately 3.08 million MWh to 5.19 million MWh. This shift has resulted in a steady increase in CO₂ emission reductions, growing from 2.17 million tons in 2020-21 to a peak of 4.22 million tons in 2023-24 before slightly decreasing to 3.77 million tons in 2024-25. The total cumulative CO₂ emission reduction over these five years amounts to approximately 15.6 million tons.

Madhya Pradesh: establish the state as a renewable energy hub by creating an ecosystem for renewable energy equipment manufacturing and facilitating large-scale adoption and deployment of renewable energy. Its policies encourage both large-scale projects and decentralized solar generation, allowing industries to shift towards cleaner energy sources by offering incentives such as concessional rates for government land, tax exemptions, and subsidies for renewable energy equipment manufacturers. Madhya Pradesh's policies focus on large-scale project development while also encouraging smaller solar installations for commercial and industrial users. By replacing coal-generated electricity with solar power, the state is making a meaningful impact in reducing greenhouse gas emissions.

FY	Coal based Installed Capacity (MW)	Coal based Generation (MWh)	Solar Installed Capacity (MW)	Solar Generation (MWh)	Weighted Average Emission factor (tCo2/MWh)	Reduction in CO2 Emissions (tCO2)
2020-21	21950	123021050	2545	4202030	0.703	2954027
2021-22	21950	129233980	2718	4006700	0.715	2864791
2022-23	21950	135750270	2802	3839300	0.716	2748939
2023-24	22000	148660650	3995	4025190	0.727	2926313
2024-25	22000	120645210	5000	4630060	0.727	3366054
Total Annual Reduction in CO2 emission						14860123

The table above presents the impact of increasing solar power install capacity. from 2020-21 to 2024-25, solar installed capacity rose from 2,545 MW to 5,000 MW, leading to an increase in solar power generation from 4.2 million MWh to 4.63 million MWh. This transition contributed to a reduction in CO₂ emissions, with annual reductions ranging from 2.95 million tons in 2020-21 to 3.36 million tons in 2024-25. The cumulative CO₂ emission reduction over these years amounts to approximately 14.86 million tons.

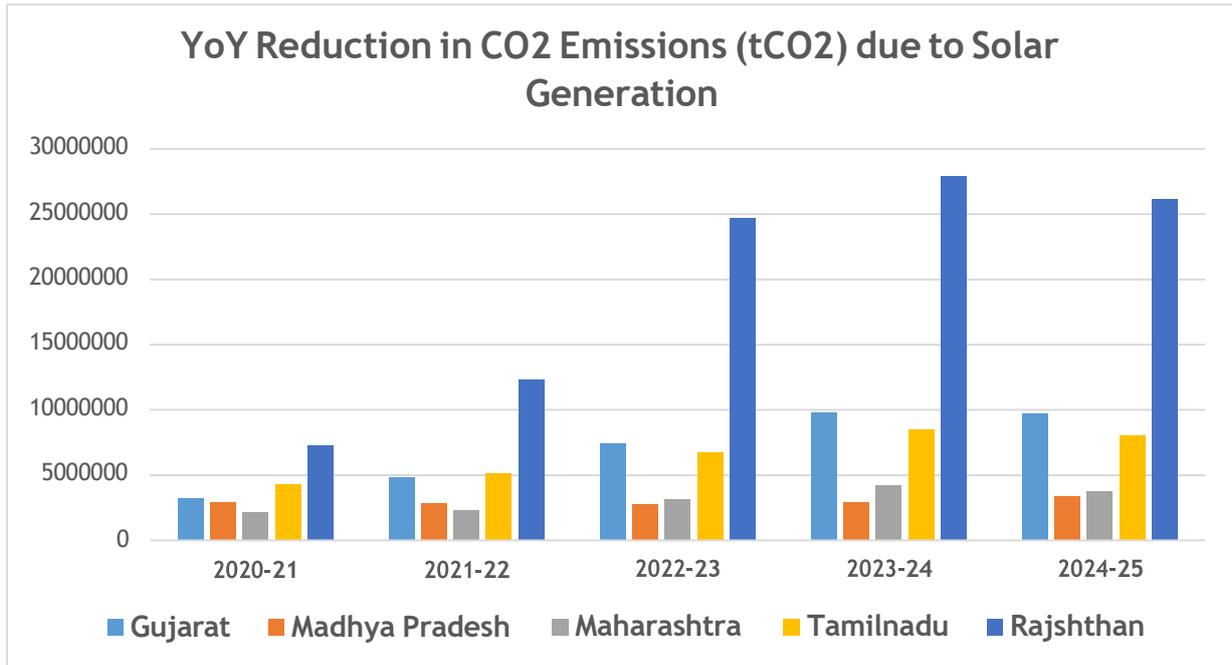


Chart 3: State wise comparison of CO2 emission reduction

The impact of expanding solar power capacity in different states on lowering CO₂ emissions from coal-based power generation is highlighted by the analysis conducted over the last five fiscal years. Apart from the above discussion some key findings are: In every state, the installed capacity of solar power has steadily increased, ranging from roughly 2,300 MW to 27,000 MW. Solar power generation has increased in tandem, with Rajasthan states recording the highest yearly results at 35,950 GWh.

Reduction of CO₂ Emissions: States have seen yearly reductions in CO₂ emissions ranging from 15 million tons to 98 million tons as a result of the switch from coal to solar power. Over a five-year period, the combined cumulative reduction in CO₂ emissions from all states under analysis reaches 325 million tons.

The increasing solar capacity significantly offsets coal-based power generation, leading to notable CO₂ reductions. Large-scale adoption of solar energy can play a crucial role in meeting climate commitments and reducing dependency on fossil fuels. Continued investments in solar infrastructure will be essential to achieving further emissions reductions and fostering a more sustainable energy future.

Policy Implications - Consistent policy support across all States and strategically designed financial mechanisms are necessary to sustain this transition. figures highlight the importance of sustained investment in solar infrastructure and policy support to enhance India's transition towards a cleaner and more sustainable energy future.

Conclusion

Governance and policy interventions are pivotal in driving the adoption of solar energy to reduce pollution. India's shift to solar energy comes with financial challenges,

particularly the high upfront costs to lower income family and limited access to affordable funding at lower interest rate for utility scale projects. To address this, states need to tap into international financial resources and strengthen domestic financing options. Beyond financial hurdles, socio- economic factors like land acquisition also play a crucial role. Ensuring fair compensation for landowners and creating job opportunities for locals can help to gain public support. Technological advancements, such as bifacial solar panels with battery energy storage systems and AI-driven grid management systems, can improve efficiency and reliability, making solar power more viable. However, policy consistency across states and streamline approval processes is essential, as differences in regulations can discourage investors. India's solar policies are often compared with global leaders, and maintaining a stable, investor-friendly environment will be key to accelerating the country's clean energy transition.

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The Environmental Effects of Traditional Fuels: Assessment and Policy Implications of Clean Cooking Technology

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Abstract

Clean cooking fuels are a critical global concern, directly linked to Sustainable Development Goal (SDG) 7 (Affordable and Clean Energy) and indirectly to SDG 13 (Climate Action). This study examines the patterns of clean cooking fuel usage across different regions, focusing on South Asian countries, high- and low-income nations (based on GNI per capita), and their adoption of clean cooking technologies. Utilizing secondary data from reputable sources such as the International Energy Agency (IEA), International Renewable Energy Agency (IRENA), United Nations Statistics Division (UNSD), and World Bank, the study reveals significant disparities in clean cooking fuel adoption. The findings indicate that South Asian countries lag behind global averages, with Bangladesh having the lowest adoption rate at 28% of its population. In contrast, regions like Europe, North America, and Middle East-North Africa (MENA) have achieved nearly 100% adoption of clean cooking fuels. High-income countries (based on GNI per capita) also show universal adoption, while low-income countries struggle, with Somalia having the lowest adoption rate at 4.8%. Alarming, some countries are experiencing a decline in clean cooking fuel usage, posing a significant challenge for future progress. The study highlights the detrimental effects of traditional fuels, including greenhouse gas emissions, air pollution, economic costs, and environmental degradation. It also identifies key barriers to adopting clean cooking fuels, such as high costs, lack of infrastructure, and limited awareness of health and environmental benefits. Despite these challenges, the study emphasizes the urgent need for governments and policymakers to prioritize clean cooking solutions to mitigate environmental pollution and improve public health. Without widespread adoption of clean cooking fuels, a significant portion of global environmental pollution will persist, undermining efforts to achieve sustainable development goals. This research underscores the importance of multi-sectoral collaboration, policy interventions, and global cooperation to ensure universal access to clean cooking fuels, thereby contributing to a healthier and more sustainable future.

Key Words: Clean Cooking Fuels, Sustainable Development Goals (SDGs), Air Pollution, Energy Transition, Adoption Barriers

Introduction

Billions of people die every year prematurely due to household air pollution from cooking with traditional fuels such as wood, charcoal, and dung, it's a component of a bigger disaster that is biodiversity loss and climate change (BBC, 2016; UNO, 2024). Despite most advancements in developing regions depending on clean energy solutions, several households still rely mostly on conventional fuel (Akash, & Monir et. al. 2024). This ongoing reliance presents serious issues about economic barriers, lack of bad quantity stoves and risk associated with customary cooktops, and finally policy effectiveness in promoting clean cooking alternatives (Vigolo, Sallaku, & Testa, et. al. 2018; Adams, Jumpah & Dramani, 2023) but in rural areas traditional stoves is causing respiratory issues and it's affecting women due to their cooking role with stoves throw out higher levels of particulate matter, carbon monoxide, and carbon dioxide (González-Pedraza et. al. 2024; Jaiswal et.al. 2024; Banerjee et. al. 2024).

Its effect on health and climate change is greenhouse gases (Wathore, Mortimer & Grieshop et. al. 2017). In urban economic nations, people are priority of daily use of wood and charcoal (Pivot, 2024), and the losses of trees from the forest (Kaputo & Mwanza et.al. 2024), and in China and Indian people lack entrance to advanced cooking systems (WBG, 2019). Globally 40% of the population is based on conventional renewable organic energy which covers 9% of use and 55% of the wood harvest from global sources in South Asia and East Africa 300 million rural people have faced harm from environmental degradation, finally, bioenergy contributes 18–30% of black carbon emissions but has a smaller overall climate effect 2–8% from wood fuel dependence (Masera, et. al.2015). The world health organization's yearly reports shows that approximately 3.2 billion deaths are due to household air pollutions and women and children are face several of diseases such as respiratory and cardiovascular, stroke, chronic obstructive pulmonary, and lung cancer health (WHO, 2024). The health impacts of air pollution are exacerbated by variations in temperature and precipitation (Ayejoto et. al. 2023).

However, cooking fuels have the largest effect on economic sectors and an enhanced GDP (Li, Shi, &Su et. al. 2017). The 504,000 employments in 2030 and 4.18 million jobs in 2050 can be created by bioenergy (Farghali et. al. 2023). Traditional cooking fuels such as wood, and charcoal are budget friendly than modern fuels and it's affordable for lower-income households (Adeeyo et. al. 2022; Awuor, Olajide, & Evans et. al. 2022). The lower level of income people depends on conventional fuels which indicates that households are switching to cleaner fuels as wealth rises (Kariuki, et.al. 2021). The health effects of fuel use in their family have a lack of education and awareness of the dangers associated with indoor air pollution (Akintan, Jewitt, & Clifford, et. al. 2018). Moreover, in urban households, an enhancing income and awareness of the environment in the modern economy have been shown to easy way to

shift to clean cooking fuels (Dai et. al. 2025) and it is the substitute adjustment of tangible changes to clean fuel policies and recovery to the green (Ravindra, Kaur-Sidhu, & Mor et. al. 2021).

The study will analyze the environment effect of traditional cooking fuels such as wood, charcoal, and dung which contribute to household air pollution, biodiversity loss, and climate change. In rural nations economic barriers, shortage of efficient stoves, and policies all contribute to depending on those fuels, despite advancements in clean energy alternatives. This study emphasizes the need for awareness campaigns and regulatory changes to support the shift to sustainable cooking methods, guaranteeing advantages for the environment and public health.

The study focuses on examining the causes and consequences of traditional cooking fuel usage across different regions globally. It aims to explore the patterns of clean cooking fuel adoption in various areas, highlighting regional disparities and trends. Additionally, the research assesses the environmental sustainability of traditional cooking fuels, emphasizing their impact on ecosystems and climate change. Another key objective is to evaluate the effectiveness of policies designed to encourage the shift toward clean cooking solutions. By addressing these aspects, the study seeks to provide insights into the challenges and opportunities associated with transitioning to sustainable cooking practices. Ultimately, it aims to contribute to the development of strategies that promote cleaner, healthier, and more environmentally friendly cooking methods worldwide.

Literature Review

Clean cooking fuels and energy poverty are important issues worldwide, especially for low- and middle-income countries. Theoretical literature on the relationship between energy poverty and health is lacking (Shobande, 2023). The use of fossil fuels and solid fuels for cooking is responsible for air pollution and health hazards. This review will discuss the effects and acceptability of fuels in the light of various studies.

1. Environmental Effect

Burning fossil fuels produces greenhouse gases and harmful air pollutants, which increase respiratory disease, cardiovascular disease, and neonatal mortality (Welsch & Biermann, 2017). The use of wood and coal increases the rate of deforestation which is one of the main causes of climate change (Aro, 2016). Relying on the use of clean and renewable energy such as solar energy, biogas, and bioethanol can be considered as long-term sustainable solutions.

Improving the adoption of clean cooking fuels is important, especially for low- and middle-income countries. Reducing health risks and achieving the Sustainable Development Goals (SDG 3 and SDG 7) requires the active participation of governments and non-governmental organizations. Further research and policy making to develop clean cooking technology can make it accessible and affordable. However,

the acceptance of clean cooking still faces many barriers and is expanding slowly (Bonan & Pareglio, 2017). A greater emphasis on renewable energy in the future may address this challenge.

2. Energy Poverty and Cooking Fuel

Energy poverty is mainly caused by lack of electricity and clean cooking fuel and is associated with economic underdevelopment (Eguino, 2015). Many developing countries rely on solid fuels such as wood, coal, dung, etc. for cooking, which cause high levels of indoor air pollution (WHO, 2018).

About 2.5 billion people in the world depend on solid biofuels, while 5 billion depend on fossil fuels such as coal, natural gas, kerosene, LPG and electricity (Wright et al., 2020). The use of solid fuel not only causes air pollution but also increases the health risk of people involved in cooking, especially women.

3. Energy and Health Risk

The theoretical connection between energy consumption is explained by Gary's production theory, where health is considered as an output that enters the utility function and, on the other hand, acts as an input to the production function (Hartwig & Sturm, 2018). Burning fuels during cooking releases carbon monoxide, nitrogen oxides, and other harmful gases that cause respiratory problems (Fullerton et al., 2008). Around 4 million people die prematurely worldwide each year (WHO, 2021). Household pollution during cooking increases the risk of lung cancer, pneumonia, cardiovascular disease, and other health problems.

4. Adoption of clean Fuels

Although the use of clean energy is important from health and environmental points of view, its acceptance is still quite slow. Research shows that the definition of energy poverty is still a matter of debate and consensus has not been reached (Eguino, 2015). Benefits of using clean fuels for cooking include lower carbon emissions, reduced health risks, and reduced reliance on fossil fuels (Rosenthal et al., 2018).

Many countries have successfully increased the acceptance of LPG and clean fuels. For example:

LPG usage has increased tremendously in countries like Brazil, Ecuador, Ghana, Indonesia and India (Wright et al., 2020; Martínez-Gomez et al., 2016; Thoday et al., 2018)

The use of clean energy not only provides health benefits but also reduces greenhouse gas emissions (**Rosenthal et al., 2018**)

Research Gap

However, there is a dearth of research on the regional disparities in the adoption of clean cooking fuels, particularly in low-income and South Asian countries (IEA, 2023; World Bank, 2023), despite the extensive examination of the environmental and health impacts of traditional cooking fuels and the barriers to the adoption of clean cooking

technologies (WHO, 2023; Wathore, Mortimer, & Grieshop, 2017). Adams, Jumpah, and Dramani (2023) and Kariuki (2021) have both noted that the majority of studies concentrate on high-income regions or global averages, neglecting the distinctive socio-economic, cultural, and infrastructural challenges that South Asia and Sub-Saharan Africa encounter. In addition, there is a dearth of exhaustive analysis regarding the efficacy of policy interventions in these regions, particularly in relation to the decreasing adoption rates of clean cooking fuels in certain countries (Ravindra, Kaur-Sidhu, & Mor, 2021; Thoday et al., 2018).

Additionally, the potential of gender-inclusive methodologies (WHO, 2022) and digital technologies (Dai et al., 2025) to encourage the adoption of clean culinary practices is still incompletely investigated. It is the objective of this study to address these deficiencies by offering a comprehensive regional comparison, assessing the efficacy of policies, and suggesting innovative solutions to expedite the transition to clean culinary fuels.

Methodology

Data Sources

This study based on secondary data from global data sources; World Bank (WB), International Energy Agency (IEA), The International Renewable Energy Agency (IRENA) and the United Nations Statistics Division (UNSD).

Table 1: Data Sources with the Obtained Year

Data Name	Data Source	Obtained Year
Clean Cooking Adoption in South Asia (% of Population)	IEA, IRENA, UNSD, World Bank, 2023	2000-2022
Global Clean Cooking Adoption by Region (% of Population)	IEA, IRENA, UNSD, World Bank, 2023	2000-2023
Clean Cooking Adoption in High-Income Countries (% of Population)	IEA, IRENA, UNSD, World Bank, 2023	2000-2022
Clean Cooking Adoption in Low-Income Countries (% of Population)	IEA, IRENA, UNSD, World Bank, 2023	2000-2022
List of Highest Income Countries in the world (GNI per Capita)	World Bank	2024
List of Lowest Income Countries in the world (GNI per Capita)	World Bank	2024

Source: IEA, IRENA, UNSD, World Bank, 2023

Tools and Techniques: The study made extensive and precise analysis using a range of tools. Among these instruments were calculation using graphical representations and tabulation. A synopsis of these facts is given in Table 2.

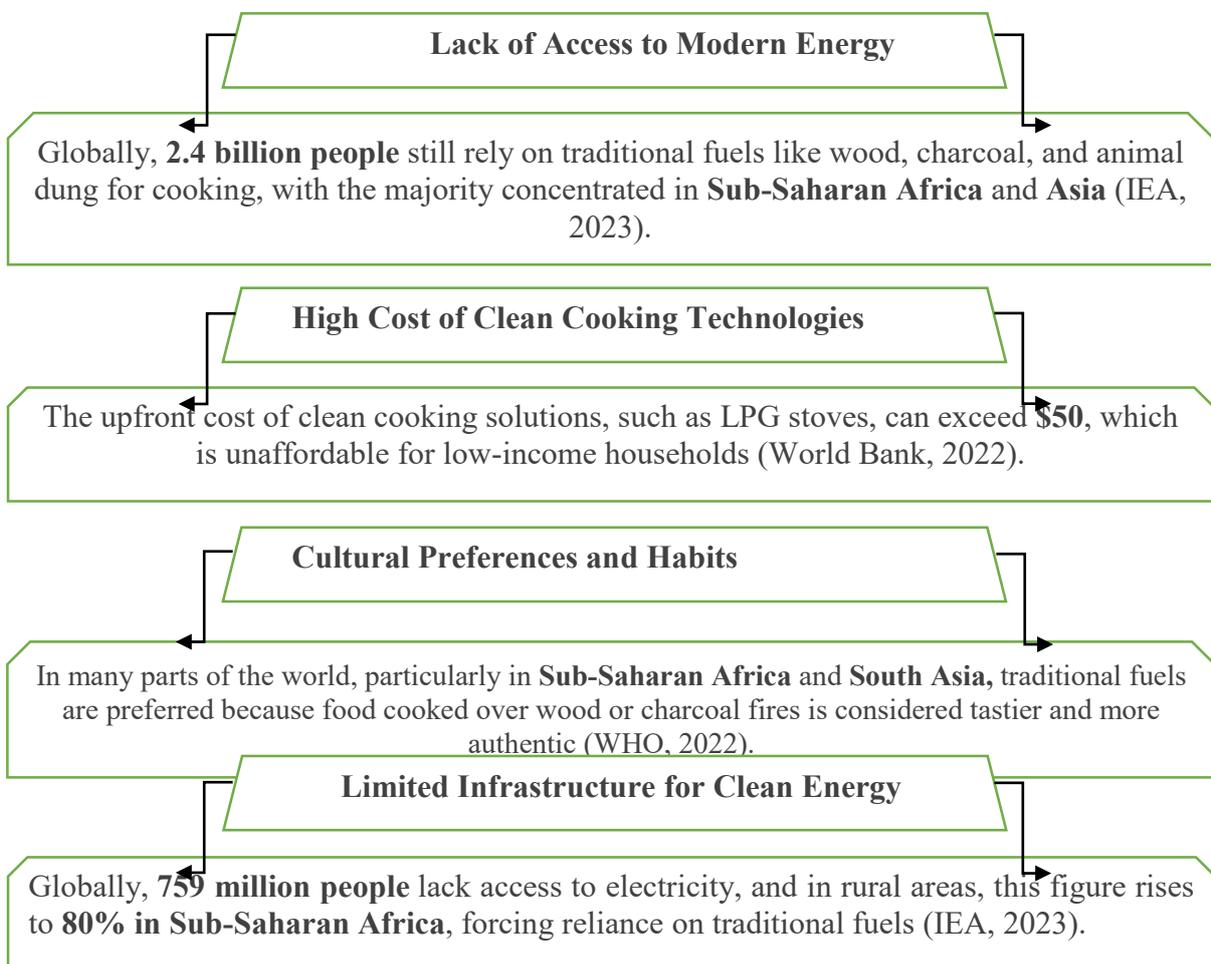
Table 2: Name of Tools, Purpose and Used software

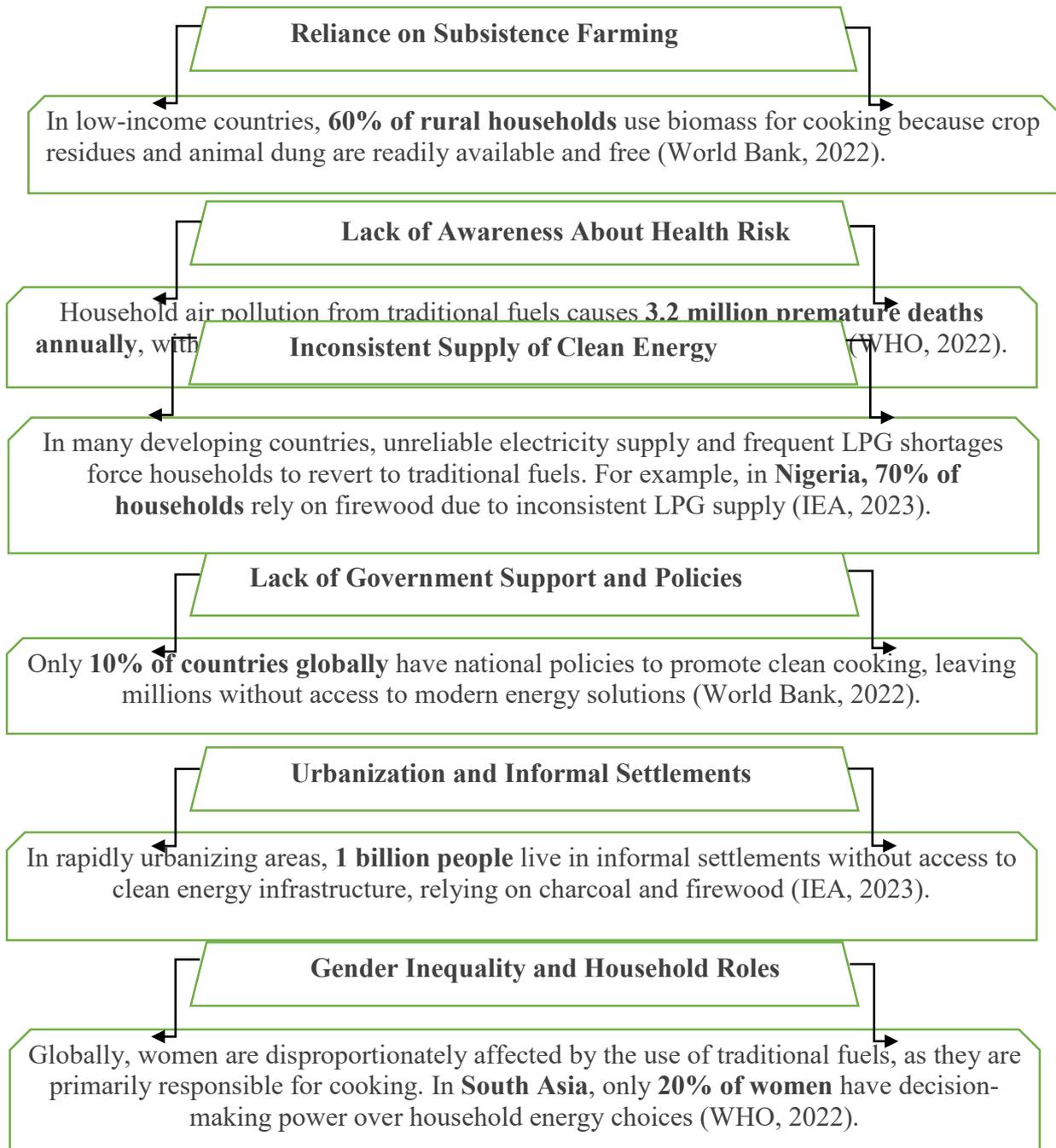
Statistical tools	Purposes	Software used
Data Shorting	To make the data as research requirement	MS Excel
Cause Effect Chart	To represent the cause-effect relationship of using traditional fuels and Challenges of adopting CCF	Microsoft Word
Pie Chart	Comparison of Cooking Fuel Usage Across Different Regions	Microsoft Excel, Google Sheets, Google Data Studio
Column chart	To demonstrate the data	Lucid

Source: Author’s Compilation, 2025

Results and Discussion

Why People Still Use Traditional Fuel (Global Context)





Source: Author's Compilation, 2025

The study reveals that **economic barriers, lack of infrastructure, and cultural practices** are key reasons why people continue to rely on traditional fuels like wood, charcoal, and dung. In low-income regions, such as **South Asia and Sub-Saharan Africa**, the high upfront costs of clean cooking technologies and limited access to modern energy sources perpetuate the use of traditional fuels (Adams, Jumpah, & Dramani, 2023; Kariuki, 2021).

Additionally, **lack of awareness** about the health and environmental benefits of clean fuels further hinders adoption (Akintan, Jewitt, & Clifford, 2018). These challenges

highlight the need for targeted policies and financial incentives to accelerate the transition to clean cooking solutions.

Global and Regional Comparison of Traditional vs. Clean Cooking Fuel Usage

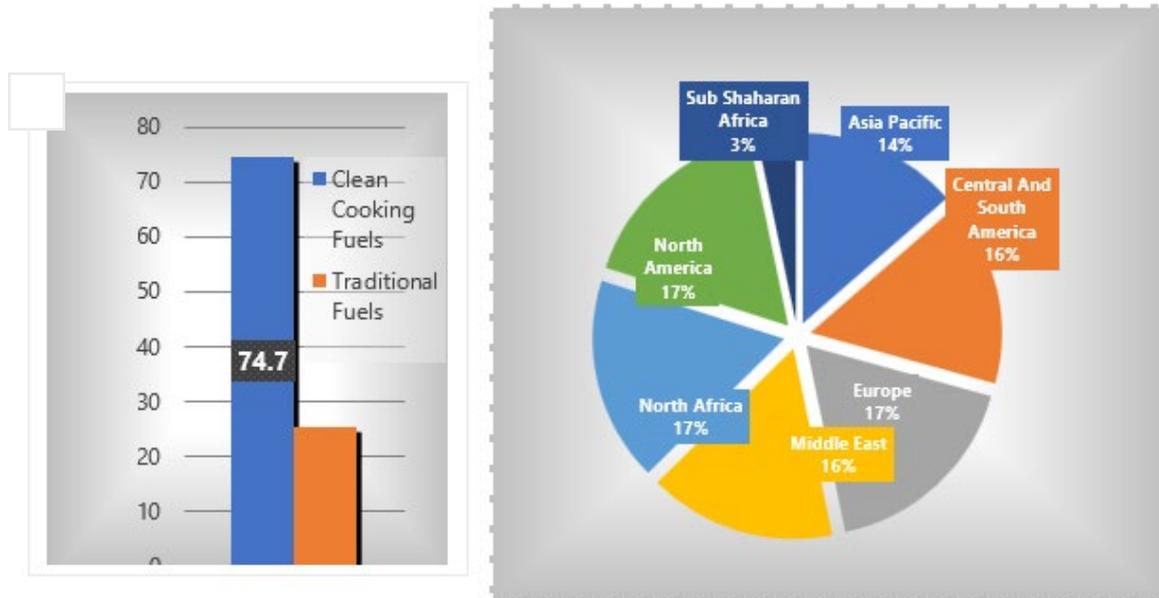


Figure 1: Comparison of Cooking Fuel Usage Across Different Regions

Source: International Energy Agency, 2025

Figure: 1, compares global and regional usage of traditional vs. clean cooking fuels. The bar chart shows that 74.7% of households use clean fuels, while a smaller portion relies on traditional fuels. The pie chart highlights regional variations, with Sub-Saharan Africa having the lowest clean fuel adoption (3%), while Europe and North America lead (17%). Data is sourced from the International Energy Agency (2025).

South Asia vs. Global Clean Cooking Adoption (% of Population)

Table 3: Access to Clean Fuels and Technologies in South Asian Countries (% of Population) vs. Global Averages

Access to clean fuels and technologies for cooking (% of population)- South Asia																							
Country Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Afghanistan	5.5	6.6	7.7	9	10.5	11.9	13.5	15.1	16.6	18.3	19.9	21.3	22.9	24.5	26.1	27.6	28.8	30.3	31.4	32.6	33.8	34.9	36.1
Bangladesh	8.3	8.4	8.5	8.6	9	9.3	9.6	10.2	10.8	11.6	12.6	13.6	14.6	15.7	16.8	18.2	19.4	20.7	21.9	23.5	24.9	26.4	28
Bhutan	26.2	29.9	34.3	38.2	42.6	47	51	55.4	58.9	62.3	65.7	68.5	71.2	73.8	76.2	78.1	80	81.9	83.3	84.7	86	86.8	88
India	22.6	23.9	25.1	26	27.3	28.1	29.3	30.65	31.9	33.4	35.3	37.2	39.2	42	44.4	47.4	50.9	54.3	58.6	62.2	66.8	70.5	74.5
Maldives	22.7	30.8	40.4	51.3	61.8	70.9	78.3	83.8	88	91.1	93.4	95	96.3	97.2	97.9	98.4	98.8	99.1	99.3	99.5	99.6	99.7	99.7
Nepal	5.3	6.7	8.1	9.8	11.4	13	14.9	16.5	18.1	19.7	21.4	23	24.7	26.4	28.1	29.7	31.3	32.8	34.3	35.5	36.9	38.4	39.6
Pakistan	23.5	24.4	25.8	27.1	27.9	29.2	30.2	31.6	32.8	34	35.3	36.5	37.95	39.1	40.4	42	43.3	44.5	46.3	47.8	49.4	51	52.6
Sri Lanka	16.7	17.3	17.7	18.2	18.6	19.2	19.7	20.4	20.6	21.3	21.8	22.7	23.3	24	24.9	26	27.3	28.7	29.9	31.1	32.6	34.1	35.5
Versus																							
World	50.4	50.9	51.4	52	52.6	53.2	54	54.9	55.9	56.9	58	59.2	60	61.7	63.1	64.4	65.9	67.4	68.9	70.3	71.7	73	73.8

Source: International Energy Agency, 2025

The above Table: 3, shows the percentage of population of South Asian countries having the access to clean cooking fuels and technologies against that of the world. The data ranges from the year 2000 to 2022. There is an increasing tendency of adopting the clean cooking fuels and technologies among the people of South Asian nations. The Maldives (Green Circle) being the most prominent one with 99.7% of people having access to clean cooking fuels followed by Bhutan and India with 88% and 74.5% respectively.

While Bangladesh (Red Circle) having lowest percentage of 28% followed by Sri Lanka and Afghanistan 35.5 & 36.1 percentage, respectively. Although there is gradual increase in the percentage of population adopting clean fuels among the South Asian nations, they are far behind compared to world population percentage. The percentage access to clean cooking fuels among overall world population was 50.4% in the year 2000 whereas all of the South Asian nation had percentage access below 30%. And by the year 2022, apart from Maldives; Bhutan and India, the other South Asian nations have less percentage of population having access to clean cooking fuels compared to overall world population. Though the number is in increasing order, apart from the abovementioned three countries the increase in access to clean cooking fuels is relatively slow in the other South Asian countries. This indicates the existence of some hindrance in these countries in adopting clean cooking fuels and technologies.

Clean Cooking Adoption by Region vs. Global Averages (% of Population)

Table 4: Access to Clean Fuels and Technologies by Region (% of Population) vs. Global Averages

Access to clean fuels and technologies for cooking (% of population)- Region Based																								
Region/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
AsiaPacific	33.7	34	35	36.3	37.4	38	39.4	41	43.1	45	47	49.1	51	54	56	58.8	61.6	64	67	69	70	74	76	78
Central And South Amrica	80	81	81	81.9	82.5	83	83.5	84	84.6	85.1	86	86.1	87	87	88	87.9	88.2	89	89	89	89	90	90	90
Europe	99.8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Middle East	85.6	87	88	89.2	90.1	91	91.7	92	92.8	93.1	93	93.4	94	94	93	93.3	93.2	93	93	92	91	92	91	91
North Africa	87.9	90	92	93.8	95.2	96	97.1	98	98.2	98.5	99	99	99	99	99	99.5	99.5	100	100	100	100	100	100	100
North America	95.8	96	96	96.2	96.3	96	96.4	96	96.4	96.4	96	96.2	96	96	96	96.1	96.1	96	96	96	96	96	96	96
Sub Saharan Africa	5.4	5.6	5.9	6.1	6.4	6.6	7	7.3	7.6	8	8.5	8.9	8.9	9.4	10	10.8	11.7	13	14	15	16	17	18	19
Versus																								
World	50.4	51	51	52	52.6	53	54	55	55.9	56.9	58	59.2	60	62	63	64.4	65.9	67	69	70	72	73	74	75

Source: International Energy Agency, 2023

The Table: 4 shows region-based access to clean fuels and technologies to that of the overall world data. Here it can be seen that Europe regions have hundred percent of population access to clean fuels since 2001. In the Asia Pacific region this percentage has increased from 33.7% in 2000 to 77.7% in 2022. In case of Central and South America, it has increased from 80% in 2000 to 90.2% in 2022. In the North Africa, percentage access has increased from 87.9% in 2000 to 99.5% in 2022. Meanwhile, the

Middle East and North America demonstrate different pattern.

In the Middle East, the percent access increased from 85.6% in 2000 to 93.5% in 2013. But since then, it is in decreasing order with 90.7% of population have access to clean fuels in 2023. In the North America, the data shows gradual increase in percentage from 95.8% in 2000 to 96.4% in 2009. From there it decreased to 96.1% in 2016. While again showing increasing order from 2009 to 2023 with 96.3% people having access to clean fuels in 2023. The Sub-Saharan region shows the lowest percent access with 5.4% in 2000 to 18.7% in 2022. The Sub-Saharan Africa is the only region with lower percent access to clean fuels compared to overall world. It indicates that people of Sub Sahara are still preferring traditional fuels over clean fuels while people of other regions are adopting the clean fuel technologies.

Clean Cooking Access in Top 10 High-Income Countries (% of Population)

Table 5: Clean Cooking Access in High-Income Nations (% of Population)

Access to clean fuels and technologies for cooking (% of population)- Highest GNI per capita	
Country Name	2000 - 2022
Switzerland	100
Norway	
Luxembourg	
United States	
Ireland	
Denmark	
Iceland	
Qatar	
Singapore	
Sweden	

Source: International Energy Agency, 2023

The data represents the percentage of the population with access to clean fuels and technologies in the top 10 highest GNI per capita countries in Table: 5. These countries have achieved 100% adoption rates for clean cooking fuels since 2000, maintaining this level consistently through 2022. This universal adoption reflects the strong economic capacity, advanced infrastructure, and effective policy frameworks in high-income nations. The data underscores the stark contrast between high-income and low-income regions, where access to clean cooking solutions remains limited. It highlights the importance of economic development and targeted investments in achieving sustainable energy transitions globally.

Clean Cooking Adoption in South Asia vs. Global Averages (% of Population)

Table 6: Clean Cooking Access in Low-Income Countries (% of Population) vs. Global Averages

Access to clean fuels and technologies for cooking (% of population)- Lowest GNI per capita																							
Country Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Burundi	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
South Sudan	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Somalia	0.4	0.4	0.4	0.5	0.5	0.55	0.6	0.7	0.8	0.9	1.1	1.2	1.4	1.6	1.7	2	2.4	2.7	3	3.3	3.9	4.2	4.8
Mozambique	2.1	2.1	2.2	2.3	2.4	2.4	2.6	2.6	2.8	2.9	3.1	3.3	3.4	3.5	3.7	3.9	4.2	4.5	4.6	4.9	5.2	5.6	6
Central African Republic	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.9	1	1
Madagascar	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1	1	1	1	0.9	1	1	1	1	1	1	1	1.3	1.35	1.45	1.5
Sierra Leone	0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	1
Congo, Dem. Rep.	0.9	1.1	1.3	1.5	1.8	2.1	2.3	2.6	2.8	3.1	3.2	3.4	3.5	3.6	3.8	3.8	3.9	3.9	3.9	4	4.1	4.3	4.3
Niger	0.8	0.9	0.9	0.9	0.9	0.9	1	1.1	1.1	1.2	1.2	1.4	1.5	1.7	2	2.2	2.6	2.9	3.3	3.7	4.3	4.9	5.7
Malawi	2.05	2.1	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.4	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.4
Versus																							
World	50.4	50.9	51.4	52	52.6	53.2	54	54.9	55.9	56.9	58	59.2	60	61.7	63.1	64.4	65.9	67.4	68.9	70.3	71.7	73	73.8

Table 6 illustrates the percentage of the population with access to clean cooking fuels and technologies (CCF) in the ten countries with the lowest Gross National Income (GNI) per capita, compared to the global average. The data reveals a concerning trend, with many of these nations lagging significantly behind the world average of **73.8%**. Notably, some countries have shown a decline in CCF adoption since 2000, as highlighted by the red line in the table.

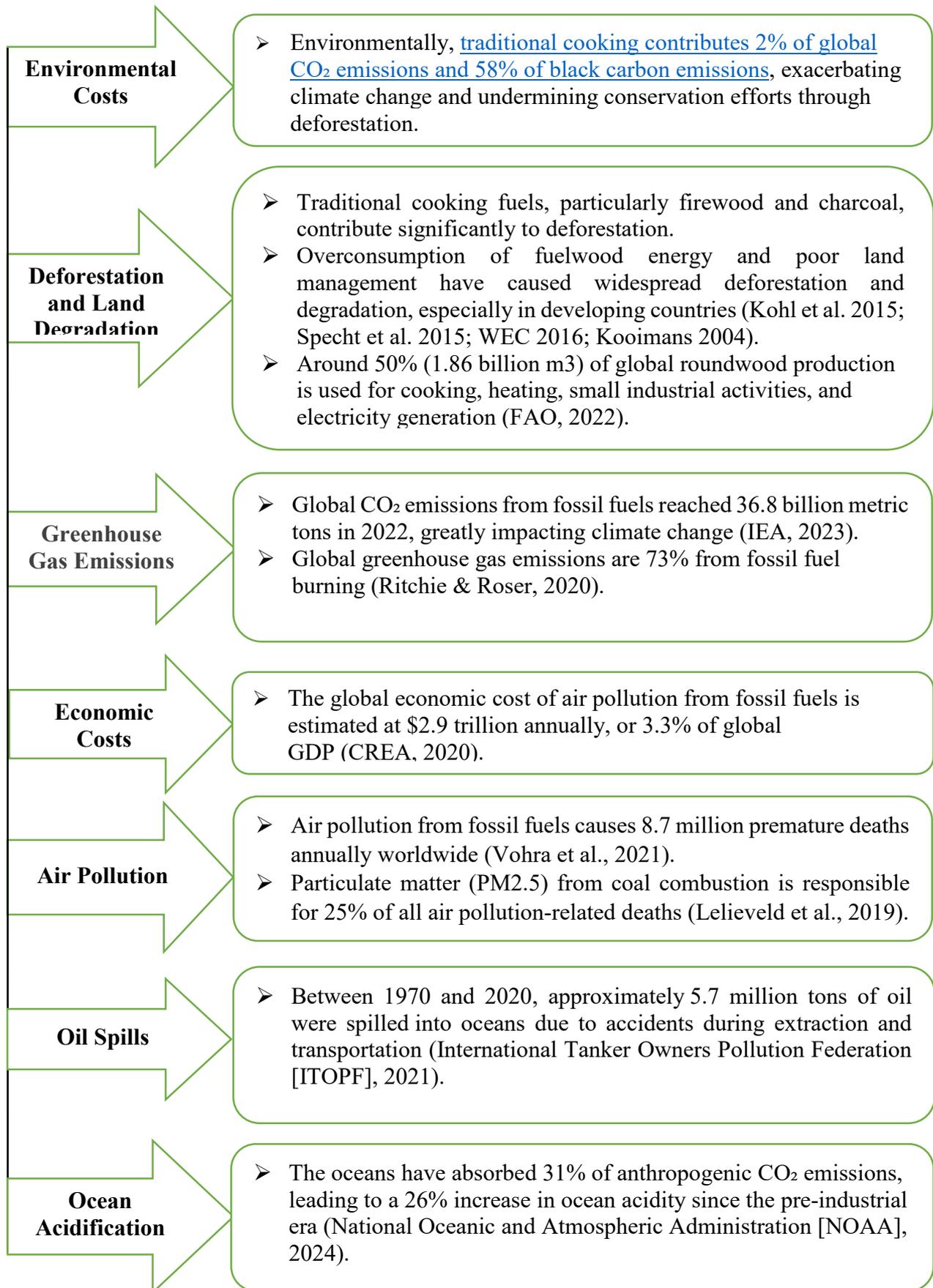
- **Burundi:** Access to clean cooking fuels declined steadily from **0.3% in 2000** to **0.1% in 2022**, reflecting a persistent lack of progress in transitioning to cleaner energy sources.
 - **South Sudan:** The situation is even more dire, with access dropping from **0.4% in 2000** to **0% in 2008**, where it has remained stagnant through 2022.
- In contrast, some countries have shown modest improvements after initial declines:
- **Central African Republic:** Access decreased from **0.6% in 2000** to **0.5% in 2012**, but it has since risen to **1% in 2022**.
 - **Madagascar:** A similar pattern is observed, with access dropping from **1.3% in 2000** to **0.9% in 2012**, followed by a gradual increase to **1.5% in 2022**.

However, other nations have experienced a reversal in progress:

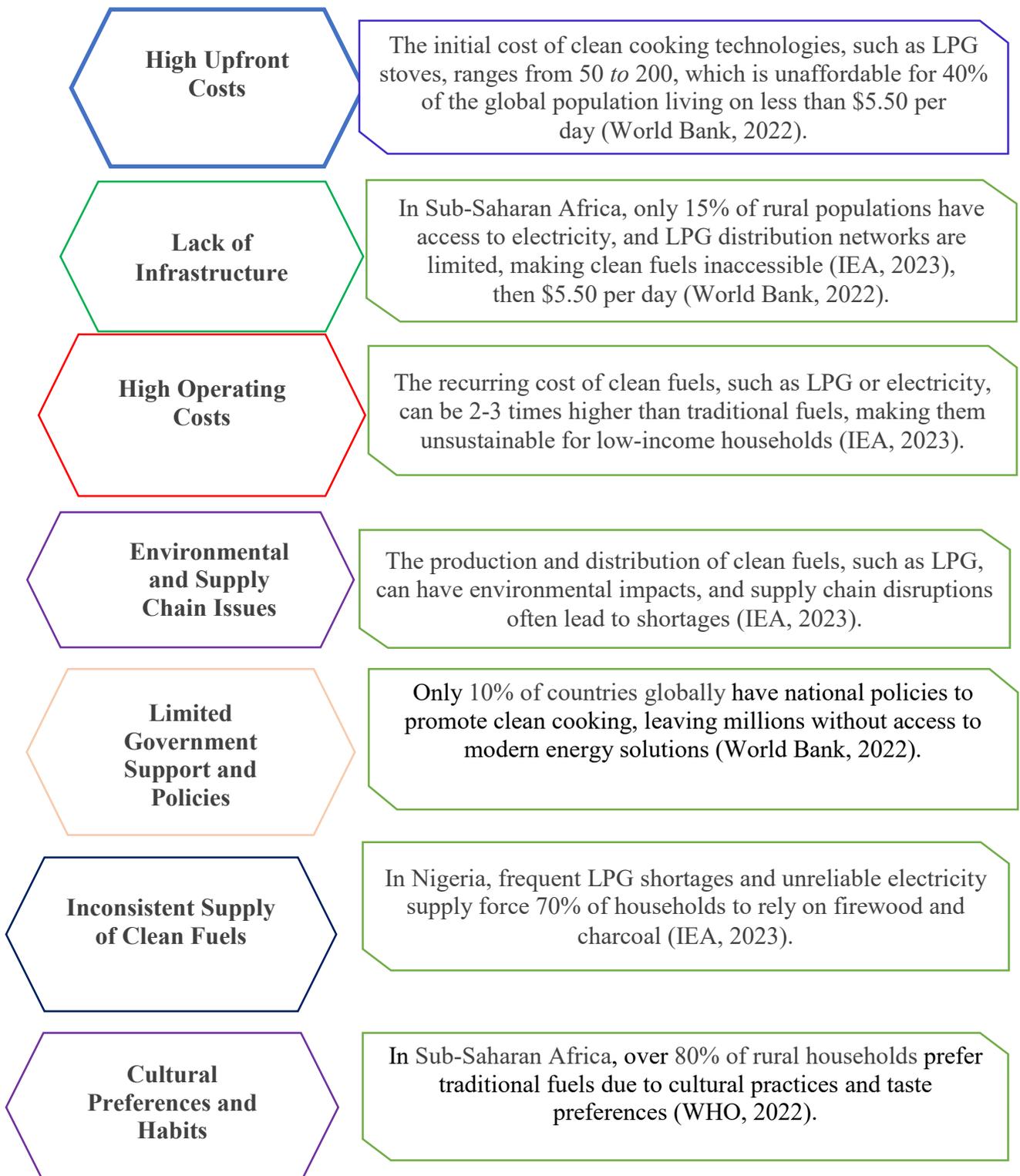
- **Malawi:** After an initial increase from **2.05% in 2000** to **2.4% in 2011**, access has declined steadily, reaching **1.4% in 2022**.

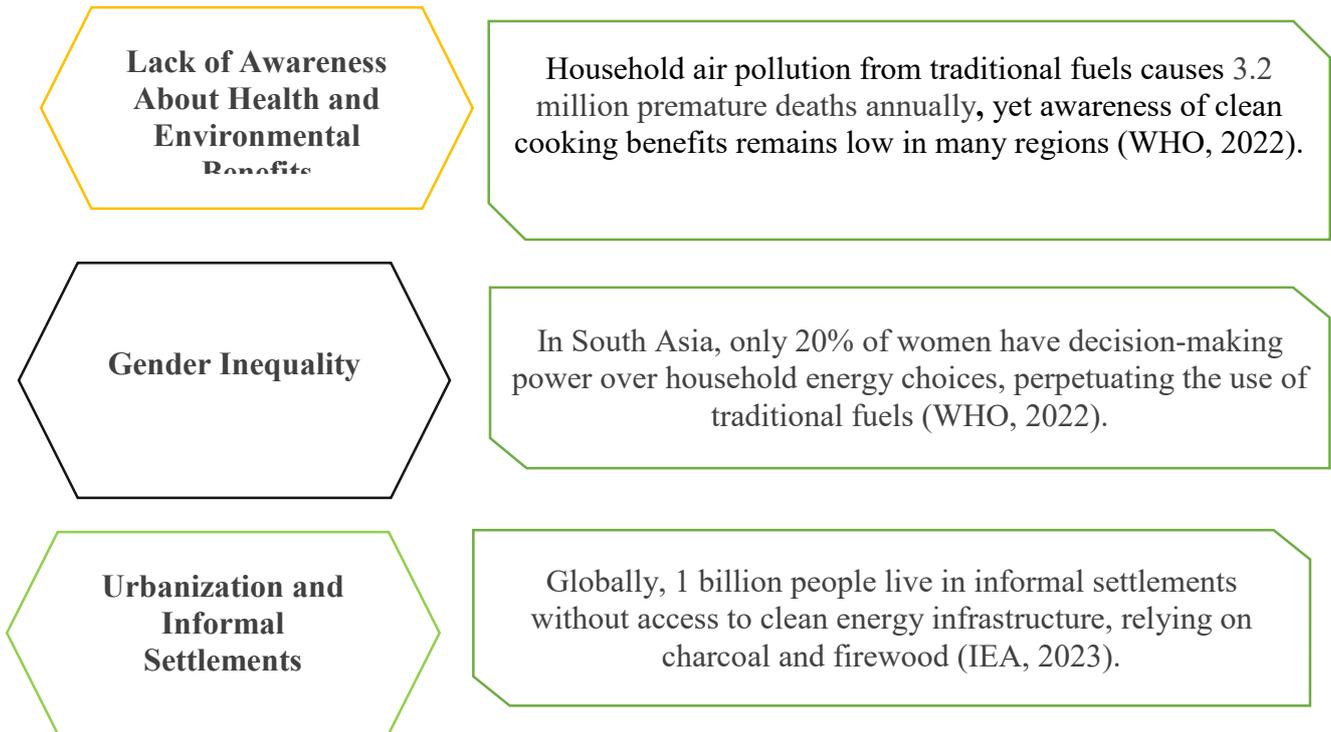
The remaining countries in the group have shown gradual improvements in CCF adoption, but their access rates remain critically low, with none exceeding **4%**. This starkly contrasts with the global average, underscoring the significant challenges faced by low-income nations in transitioning to clean cooking solutions. The data highlights the urgent need for targeted policies and interventions to address barriers to adoption and ensure equitable access to clean energy worldwide.

Effect of Traditional Fuel on Environment



Challenges of Adopting Clean Cooking Fuels





Solutions for Promoting Clean Cooking Adoption

Table 7: Strategies for Promoting Clean Cooking Fuel Adoption

Strategy	Description	Data Example
Subsidies and Financial Incentives	Reducing upfront costs of clean cooking technologies through financial aid.	PMUY program in India provided 80 million LPG connections, increasing adoption by 30%.
Infrastructure Development	Investing in clean fuel distribution networks, especially in rural areas.	In Sub-Saharan Africa, only 15% of rural populations have access to electricity.
Awareness Campaigns	Educating the public about health and environmental benefits of clean fuels.	Awareness campaigns in Bangladesh increased adoption by 20% over five years.
Policy Interventions	Implementing policies like tax exemptions and clean energy mandates.	Only 10% of countries have national policies promoting clean cooking.
Carbon Financing	Using carbon credits to make clean cooking solutions more affordable.	Carbon financing in Kenya reduced emissions by 1.5 million tons of CO ₂ annually.
Public-Private Partnerships	Collaboration between governments and private companies for large-scale adoption.	Ghana's partnerships increased LPG adoption by 25% over three years.
Renewable Energy	Promoting alternative cooking	In Nepal, 400,000 households

Integration	solutions such as solar cookstoves and biogas.	adopted biogas systems.
Gender-Inclusive Approaches	Empowering women through education and decision-making opportunities.	In South Asia, only 20% of women have decision-making power over household energy choices.
Monitoring and Evaluation	Establishing frameworks to track clean cooking adoption.	The Clean Cooking Alliance tracks progress in 50 countries.
Global Cooperation	Strengthening international collaboration for knowledge-sharing and funding.	The Clean Cooking Alliance mobilized \$2 billion for clean cooking initiatives.

Sources: Author's Compilation, 2025

Conclusion

Clean cooking fuel adaptation is a very critical achievement of SDG Goal 7, ensuring affordable, reliable & sustainable development, and SDG 13 (Climate Action). South Asia's 28% clean cooking fuel adoption is low compared to Europe and North America's near-universal adoption. Somalia has the lowest adoption rate at 4.8%, highlighting the challenges faced by low-income populations. Alarmingly, several countries are using less clean cooking fuel, threatening global development.

Traditional fuels, including wood, charcoal, and animal dung, cause 3.2 million early deaths due to home air pollution, greenhouse gas emissions, and high economic and environmental expenses. Despite these obstacles, high upfront expenditures, lack of infrastructure, and low health and environmental awareness restrict the switch to clean cooking fuels.

Key Findings of the Study

- 1. Regional Differences:** Due to economic and infrastructural hurdles, low-income nations like South Asia and Sub-Saharan Africa still use traditional fuels, while high-income countries have nearly universally adopted clean cooking fuels.
- 2. Health Impact:** Home air pollution from traditional fuels is a primary cause of respiratory and cardiovascular disorders, disproportionately impacting women and children.
- 3. Environmental Costs:** Traditional fuels cause deforestation, black carbon emissions, and climate change, hurting global environmental sustainability.
- 4. Economic Barriers:** Clean cooking methods and fuels are expensive upfront and ongoing, making them difficult for low-income households.

Policy advice

This study suggests the following evidence-based solutions:

- 1. Financial Incentives:** Governments and international organizations could provide subsidies or micro-loans to low-income households to afford clean cooking

technologies. Such programs work, as shown by India's Pradhan Mantri Ujjwala Yojana (PMUY), which connected 80 million LPG users.

2. Infrastructure Development: Rural and underprivileged communities need electricity grids and LPG distribution networks to provide clean cooking fuels.

3. Campaigns: To modify behavior, public education should emphasize clean cooking's health and environmental benefits. Effective Bangladeshi initiatives have improved clean cooking acceptance by 20%.

4. Carbon financing: Carbon credits make clean cooking projects cheaper and more scalable. Kenya's carbon finance has lowered CO₂ emissions by 1.5 million tons per year.

5. Gender-Inclusive Approaches: Women are the primary users of cooking fuels; thus, empowering them via education and decision-making can hasten the shift to clean cooking.

6. Global Cooperation: Worldwide collaborations like the Clean Cooking Alliance can mobilize resources, share best practices, and scale up clean cooking solutions.

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The Effectiveness of Caste Reservation Policy in India: Reality and Prospects for VIKSIT Bharat (2047)

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Abstract

The caste reservation policy in India is a form of affirmative action designed to address historical injustices and promote social justice for marginalized communities, specifically Scheduled Castes (SCs), Scheduled Tribes (STs), and Other Backward Classes (OBCs). This research paper analyzes secondary data from various sources and evaluates the effectiveness of this policy in achieving its main goal of ensuring adequate representation in government jobs and higher education. Without ensuring social justice, the journey of VIKSHIT Bharat would be difficult and might be impossible.

Current national-level reservation percentages are set at 15% for Scheduled Castes (SCs), 7.5% for Scheduled Tribes (STs), and 27% for Other Backwards Classes (OBCs). (For the Union Government, local state governments have their own proportions or quotas for reservations based on their population composition. Additionally, there is a provision of 10% for Economically Weaker Sections (EWS), which is a horizontal reservation for the general category, and 4% for Persons with Benchmark Disabilities. Data on actual representation shows a mixed picture. In central government jobs, representation for SCs and STs generally aligns with or slightly exceeds their quotas, while the representation of OBCs varies. However, all reserved categories face challenges in reaching higher-level positions. In higher education, student enrolment from reserved categories has improved significantly, with OBC enrolment even surpassing its designated quota. Nonetheless, faculty representation from these categories, especially at senior levels, remains considerably lower than expected. Persistent socio-economic barriers, implementation challenges, and varying awareness levels among beneficiaries affect the effectiveness of these policies.

Diverse perspectives and debates surround the policy's impact on social justice and equity, highlighting both its successes in increasing access and its limitations in achieving complete parity. A specific focus on Gujarat and Ahmedabad reveals state-specific reservation percentages, a history of social movements related to reservation, progress in SC/ST higher education enrolment, but also continued issues of social exclusion. Ultimately, the "effective rate" of the caste reservation policy is complex, demonstrating both advancements in representation and ongoing limitations in achieving comprehensive social justice.

At last paper deals with contributing to discourse on the evaluation of caste reservation

policy to make the policy more effective, which can ensure social harmony. A socially inclusive environment ensures a conflict-free society, which would be the primary condition for political stability, which can lead the VIKSHIT Bharat (2047).

I. Introduction

The caste system in India, a deeply entrenched social hierarchy spanning centuries, has historically been a significant determinant of social inequality and discrimination. This system imposed rigid social stratification, denying fundamental rights and opportunities to individuals belonging to lower castes. (Ambedkar, 1948) .The consequences of this historical oppression have been profound, resulting in severe socio-economic backwardness and limited social mobility for a substantial portion of the population. Recognising the enduring impact of this historical injustice, the caste reservation policy was implemented as a form of affirmative action in India. This policy is rooted in the fundamental need to rectify centuries of social exclusion and discrimination, aiming to establish substantive equality that extends beyond mere legal equality. The core idea behind reservations is to provide preferential treatment to marginalized communities in crucial sectors like education and employment, thereby promoting inclusivity and ensuring a more equitable distribution of resources and opportunities. (D.D.Basu, 2023)

The primary objective of the caste reservation policy is to ensure adequate representation of Scheduled Castes (SCs), Scheduled Tribes (STs), and Other Backward Classes (OBCs) in government jobs and higher education institutions. This goal extends beyond merely providing employment or educational slots; it is fundamentally about empowering these historically disadvantaged communities and ensuring their meaningful participation in the decision-making processes of the state and the intellectual development of the nation. Adequate representation in government services is intended to give marginalised groups a voice in shaping policies and their implementation, while increased access to higher education is aimed at improving their overall social and economic standing, enabling them to contribute more fully to all spheres of society. The underlying principle driving this policy is the creation of a more inclusive and just society where individuals are not limited by their caste at birth but have genuine opportunities for advancement and self-realisation. (Govinda, Year: 2002)

This paper undertakes a comprehensive analysis to determine the "effective rate" of this policy. The scope of this analysis includes a detailed comparison between the intended reservation quotas and the actual representation achieved in both government employment and higher education. Furthermore, this research paper will explore the various factors that influence the policy's effectiveness, such as persistent socio-economic barriers, challenges in its implementation, and the level of awareness among the intended beneficiaries. Finally, it will consider the diverse perspectives and ongoing

debates surrounding the policy's impact on social justice and equity, including a specific focus on the implementation and impact of caste reservation policies in Gujarat.

II. Current Reservation Policy Framework

The current reservation policy in India operates at the national level, stipulating specific percentages of seats and positions to be reserved for various categories in both government jobs and educational institutions. For Scheduled Castes (SCs), a reservation of 7.5%. Scheduled Tribes (STs) are entitled to a reservation of 15%. Other Backward Classes (OBCs) benefit from a 27% reservation, a figure recommended by the Mandal Commission in 1980, which estimated that OBCs constituted approximately 52% of the country's population. In a significant development in 2019, the 103rd Constitutional Amendment introduced a 10% reservation for Economically Weaker Sections (EWS) from the general category. Additionally, a 4% reservation is provided for Persons with Benchmark Disabilities, applicable across the SC, ST, and OBC categories. (Nandu, 2005).

The implementation of the EWS quota has brought the total reservation percentage to 59.5%, exceeding the 50% cap established by the Supreme Court in the landmark Indra Sahney case of 1992¹. While the Supreme Court had previously capped total reservations at 50% to maintain a balance with merit-based selection, the government argued that the EWS reservation, being based on economic criteria for individuals within the general category, was distinct from caste-based reservations and thus did not violate this cap.

For OBC reservations, the concept of the 'creamy layer' plays a crucial role. Introduced by the Indra Sahney case, this concept excludes economically advanced individuals and families within the OBC category from availing the benefits of reservation. The rationale behind this exclusion is to ensure that the reservation benefits reach the truly disadvantaged within the OBC community and prevent the concentration of these benefits among the more affluent sections. While caste serves as the primary identifier for OBC reservation, the 'creamy layer' exclusion introduces an economic dimension to refine the beneficiary pool. (<https://indiankanoon.org/doc/1363234/>, 2025).

It is important to note that the specific reservation percentages can exhibit slight variations from state to state due to the enactment of local laws and regulations. For instance, the state of Tamil Nadu has a significantly higher total reservation of 69%. This reflects the autonomy granted to states in implementing and adapting reservation policies to suit their unique demographic and socio-political contexts. While the central government provides a broad framework, states have the authority to legislate on this matter, often leading to differences in the percentages allocated to various categories and the inclusion of other specific groups. (Madhav, 2006)

¹ Supreme Court on **16 November 1992**. This case is pivotal in the context of affirmative action and public employment in India.

The legal foundation for the reservation policy in India is firmly established within the Constitution, particularly through Articles 15 and 16, as well as various subsequent amendments. Article 15 addresses the prohibition of discrimination on grounds of religion, race, caste, sex, or place of birth, while also allowing the state to make special provisions for the advancement of socially and educationally backward classes, including SCs and STs. Similarly, Article 16 guarantees equality of opportunity in matters of public employment but also enables the state to make provisions for the reservation of appointments or posts in favour of any backward class of citizens, which, in the opinion of the state, is not adequately represented in the services under the state. Over the years, numerous constitutional amendments have been enacted to introduce, expand, and safeguard the reservation policy, reflecting its evolving nature and the continuous commitment to affirmative action in India. (Thorat, 2012)

III. Representation in Government Employment

The effectiveness of the caste reservation policy can be judged by examining the actual representation of the intended beneficiaries in government employment. This section analyses the available data on the representation of SC, ST, and OBC employees in both central and state government jobs, the analysis described in this paper is with a specific focus on Gujarat.

Central Government Jobs: Recent data provides visions into the representation of reserved categories in central government employment. For simply we focus only on All India Services, which is appointed by UPSC. As of January 1, 2024, the number of employees belonging to Scheduled Castes was 5.47 lakh, Scheduled Tribes 2.82 lakh, and Other Backward Classes 8.55 lakh. The government reported that the representation (for central government.) of SCs (15%) and STs (7.5%) was in accordance with the prescribed limits, and the representation of OBCs in direct recruitment has consistently been more than 27% over the past decade. This suggests that, in terms of overall numbers, the representation of these communities in central government jobs is largely aligned with the reservation quotas. However, data from an earlier period, specifically 2016, indicated a slightly different picture, with SC representation at 17.49%, ST at 8.47%, and OBC at 21.57%. This earlier data shows that OBC representation was below the 27% mark at that time, highlighting potential fluctuations in representation over time for UPSC-appointed All India Services.

Table 1: Reservation Quotas vs. Reported Representation in Central Government Jobs (Illustrative)

Category	Prescribed Reservation Percentage	Reported Representation (Year)
SC	15%	15% (Jan 2024), 17.49% (2016), 7.65% (Mar 2023 - AIS)
ST	7.5%	7.5% (Jan 2024), 8.47% (2016), 3.80% (Mar 2023 - AIS)

OBC	27%	>27% (Jan 2024), 21.57% (2016), 15.92% (Mar 2023 - AIS)
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Source: Various AIS representation reports. (All India Services); AIS reports mainly the Indian Administrative Service (IAS), Indian Police Service (IPS), and Indian Forest Service (IFS)-Officers are recruited through the UPSC Civil Services Examination.

This table provides a consolidated view of the intended reservation quotas at the national level and the reported actual representation of SC, ST, and OBC categories (in central government top position jobs of AIS) based on the available data from various sources and timeframes. The variations in reported representation across different years and services underscore the dynamic nature of the policy's impact.

A more understanding emerges when examining representation in specific services. Data presented in Parliament around March 2023 revealed a significant underrepresentation of reserved categories in direct appointments to the All India Services (IAS, IPS, IFoS). OBC candidates constituted only 15.92% of appointments, SC candidates 7.65%, and ST candidates a mere 3.80%, falling significantly short of their respective reservation provisions of 27%, 15%, and 7.5% -respectively. This stark contrast between the overall representation and that in higher-level services suggests potential barriers to entry or progression for candidates from reserved categories in these prestigious positions. Furthermore, a 2023 parliamentary report pointed out that SCs and STs exceed their prescribed quotas only in lower-level Group C jobs (excluding sanitation workers) and among sanitation workers. In contrast, their representation in Group A jobs was considerably lower, with SCs at 13% and STs at 5.5%. This indicates a possible concentration of individuals from these communities in the lower rungs of government employment and a challenge in achieving equitable representation at senior levels.

State Government Jobs (with focus on Gujarat): The implementation of reservation policies in state government jobs is subject to variations based on state-specific regulations. In Gujarat, the reservation rates for state-level recruitment in Class-I to Class-4 vacancies are set at 7% for Scheduled Castes, 15% for Scheduled Tribes, and 27% for Socially and Educationally Backward Classes (SEBC), which is often considered synonymous with OBC. Notably, the reservation percentage for SCs in Gujarat is lower than the national average of 15%. While recent comprehensive data on the actual representation of SC, ST, and OBC employees in Gujarat state government jobs was not readily available, the central government's report that OBC representation in direct recruitment has consistently been above 27% for the last decade might suggest a similar trend in Gujarat, although this requires state-specific data for confirmation.

The Gujarat government employs a structured Roster System to implement and monitor the reservation policy in employment, with the system operating based on the number of vacancies in government service. This system outlines the specific

reservation percentages for different categories and the procedures for filling reserved positions. Additionally, the state has a dedicated Scheduled Castes Sub Plan aimed at accelerating the socio-economic development of SCs, which includes efforts to improve their representation in government jobs and enhance their overall status within the state. This indicates an ongoing commitment by the Gujarat government towards addressing the historical disadvantages faced by the Scheduled Castes.

IV. Representation in Higher Education

Examining the representation of reserved categories in higher education is another critical aspect of assessing the effectiveness of the caste reservation policy. This section presents data on enrolment trends at the national level and specifically in Gujarat.

National Level: Data from the All-India Survey of Higher Education (AISHE) provides valuable information on the representation of SC, ST, and OBC students in higher education institutions across India. According to the year: 2020-2021 AISHE report, there has been a significant increase in the gross enrolment ratios (GER) for SC and ST communities, with a rise of 28% and 47%, respectively, compared to the figures from year:2014-2015. The overall enrolment of OBC students also saw a substantial increase of 31.67% during the same period. More recent data from the AISHE year:2021-22 indicates that out of the total 4.33 crore students enrolled in higher education, 15.3% belonged to Scheduled Castes (66.23 lakh), 6.3% to Scheduled Tribes (27.1 lakh), and 37.8% to Other Backwards Classes (approximately 1.63 crore). These figures suggest that the reservation policies have contributed to improved access to higher education for students from these historically marginalised communities.

However, when considering the representation of these categories among faculty members in higher education institutions, a significant disparity emerges. As of the year: 2020-2021 data, only 9% of teachers in Indian universities belonged to the SC category, and a mere 2.5% were from the ST community. The representation of OBC teachers was comparatively higher at around 32%. This stark contrast between student enrolment and faculty representation, particularly at senior levels, points to potential challenges in the career progression of individuals from reserved categories within academia. Data from Central Universities for the academic year 2022-23 further illustrates this issue. While SCs and STs constituted 11% and 10%, respectively, of the overall student body in higher education, their representation dwindled significantly at the professor level, with only 5.42% being SC and 1.38% being ST. This trend of decreasing representation at higher academic ranks suggests that systemic barriers might be hindering the advancement of faculty members from reserved categories.

Table 2: Reservation Quotas vs. Reported Enrolment in Higher Education (National Level - Illustrative)

Category	Prescribed Reservation Percentage	Reported Enrolment Percentage (AISHE 2021-22)
SC	15%	15.3%
ST	7.5%	6.3%
OBC	27%	37.8%

Source: Various reports of All-India Survey of Higher Education (AISHE)

This table presents a comparison between the national reservation quotas for student admissions in higher education and the actual enrolment percentages for the academic year 2021-22, based on data from the All-India Survey on Higher Education. The data shows that while SC and OBC enrolment is close to or exceeds the prescribed percentages, ST enrolment is slightly below the quota.

In the state of Gujarat, the representation of SC and ST students in higher education has shown a positive trend. The share of SC students in total enrolment increased from 7.2% in year: 2011-12 to 9.5% in year:2021-22, while the share of ST students rose from 7.4% to 11.4% during the same period. Furthermore, the Gross Enrolment Ratio (GER) for SC students in Gujarat doubled between year: 2011-12 and year:2021-22, and for ST students, it more than doubled. These figures indicate a substantial improvement in access to higher education for Scheduled Caste and Scheduled Tribe students in Gujarat.

A significant development in Ahmedabad is the recent decision by the Indian Institute of Management (IIM) Ahmedabad, a premier business school, to introduce a reservation policy for its PhD admissions starting from the year 2025 (academic year). This marks a notable shift for the institution, which had not historically implemented reservations in its doctoral program. The new policy will reserve seats for candidates from Scheduled Castes, Scheduled Tribes, Other Backward Classes, and persons with disabilities, aligning with government guidelines and reflecting a move towards greater inclusivity at a high-profile educational institution in Ahmedabad. However, a study conducted in Ahmedabad revealed that students tend to underreport the extent to which caste and academic ability influence the formation of study groups, suggesting the continued, albeit sometimes, relevance of caste dynamics within academic environments.

V. Comparative Analysis of Intended and Actual Representation

A comparative analysis of the intended reservation percentages and the actual representation achieved in both government employment and higher education sectors at the national level reveals a complex picture. In central government jobs, the representation of Scheduled Castes and Scheduled Tribes in overall employment appears to be largely in line with their stipulated quotas, and in some instances, even slightly exceeds them. However, the data also highlights significant variations

depending on the specific service and level of employment, with underrepresentation in higher-level positions and an over-representation in lower-grade jobs for these categories. The representation of Other Backwards Classes in central government jobs shows more variability across different data sources and job levels, sometimes falling short of the 27% quota.

In the realm of higher education, there has been a notable improvement in the enrolment of students from all three reserved categories (SC, ST, and OBC) over the past decade. In fact, the enrolment of OBC students in higher education as of year: 2021-22 even surpasses their prescribed quota of 27%. However, the enrolment of Scheduled Tribe students remains slightly below their allotted percentage. A persistent area of concern across all reserved categories is their significant underrepresentation in faculty positions within higher education institutions, particularly at the senior levels of Associate Professor and Professor. This disparity between student enrolment and faculty representation suggests potential systemic barriers hindering the career progression of individuals from marginalised communities within academia.

The trends observed for each category in both employment and education indicate that while the reservation policy has had a positive impact on increasing access and representation in certain areas, it has not yet fully translated into equitable outcomes across all sectors and levels. The reasons for these discrepancies are likely multifaceted, encompassing issues related to the effective implementation of the policy, the persistence of socio-economic barriers that limit the ability of individuals from reserved categories to compete for and succeed in higher-level positions, and potential biases within the recruitment and promotion processes in both government and educational institutions.

VI. Factors Influencing the Effectiveness of Reservation Policy

The effectiveness of the caste reservation policy in India is influenced by a complex interplay of socio-economic factors, implementation challenges, and the level of awareness about the policy among its intended beneficiaries.

Socio-economic Barriers:

Persistent socio-economic disadvantages continue to pose significant hurdles for individuals from reserved categories in accessing and fully benefiting from reservation policies. The quality of education received by many students from these communities, particularly in rural and underserved regions, often falls short compared to their more privileged counterparts. This disparity in foundational education places them at a considerable disadvantage when competing in the highly competitive entrance examinations for higher education and government jobs. Furthermore, economic constraints frequently limit their access to essential resources such as private coaching, quality learning materials, and a supportive academic environment, further widening the gap. Beyond academic disadvantages, individuals from underrepresented categories often face social stigma and discrimination within educational institutions

and workplaces. These elusive and obvious forms of casteism can lead to feelings of alienation, social exclusion, and ultimately contribute to higher dropout rates in education and delay career progression in employment. The historical denial of land ownership and the consequent lack of economic power within lower-caste communities also play a crucial role in perpetuating a cycle of disadvantage, making it challenging for them to leverage reservation policies for substantial upward mobility.

Implementation Challenges:

The effective implementation of the caste reservation policy across the vast and diverse landscape of India is troubled by numerous challenges. One of the primary hurdles lies in the accurate identification and classification of socially and educationally backward classes, a process that is often hampered by the lack of updated and reliable socio-economic data. The policy also faces resistance and opposition from certain segments of society who express concerns about meritocracy and perceive it as a form of reverse discrimination. Administrative inefficiencies, bureaucratic complexities, and instances of corruption in the allocation of reserved seats and positions can further undermine the policy's intended benefits and create frustration among both beneficiaries and non-beneficiaries. A persistent challenge is the significant number of reserved vacancies that remain unfilled despite the provision of relaxations in qualifying criteria, suggesting a disconnect between the policy's provisions and the availability of suitable candidates, potentially due to the socio-economic barriers discussed earlier. Furthermore, the ongoing debates and complexities surrounding the sub-categorization within Scheduled Castes and Scheduled Tribes highlight the difficulty in ensuring that the benefits of reservation reach the most marginalized subgroups within these broader categories.

Awareness Levels:

The level of awareness about the caste reservation policy among its intended beneficiaries is a crucial factor influencing its effectiveness. While the policy has been in place for a considerable period and is a subject of public discourse, detailed awareness about the specific provisions, eligibility criteria, and the procedures for accessing the benefits might vary significantly, particularly among individuals residing in remote and rural areas. Public awareness campaigns and targeted outreach programs have the potential to play a vital role in educating eligible individuals about their rights and the opportunities available to them through the reservation policy, which could lead to a greater utilisation of these benefits. A lack of sufficient awareness can involuntarily prevent deserving individuals from availing the policy's advantages in education and employment, thereby limiting its overall effectiveness in achieving its intended social justice goals.

VII. Perspectives and Debates on Policy Effectiveness

The caste reservation policy in India is a subject of extensive debate and diverse perspectives regarding its effectiveness in achieving social justice and equity.

Supporters of the policy argue that it has been a crucial instrument in addressing historical injustices, fostering social inclusion by ensuring representation of marginalised communities in various sectors, facilitating social mobility for individuals from disadvantaged backgrounds, and upholding the constitutional principles of social justice and equality. They point to the increased enrolment rates in education and the enhanced representation in government jobs as tangible outcomes of the policy.

Conversely, critics voice concerns that the reservation system may unintentionally reinforce caste-based identities and divisions within society, hindering the progress towards a truly egalitarian society. They also raise questions about the potential compromise of meritocracy and efficiency in institutions if preferential treatment based on caste outweighs merit-based selection. Furthermore, some critics argue that the benefits of reservation are often disproportionately gained by a smaller, more privileged segment within the reserved categories, while the most marginalised continue to struggle, thus not fully serving the intended purpose of uplifting the most disadvantaged. The debate regarding the basis of reservation, whether it should be merely on caste or also include economic criteria, remains a significant point of argument. The introduction of the EWS quota has further fuelled this debate. Additionally, there are ongoing discussions about the applicability of the "creamy layer" concept to SCs and STs, similar to its existing application to OBCs, to ensure that the benefits reach the most deserving. The question of whether the reservation policy should have a time limit and undergo periodic reviews to assess its continued relevance and effectiveness in the context of evolving socio-economic conditions is also a prominent aspect of these debates.

VIII. Recent scenario: Gujarat and Ahmedabad

The implementation and impact of caste reservation policies in Gujarat and its major city, Ahmedabad, offer a specific regional perspective on the broader national scenario¹³. Gujarat has established its own reservation percentages for state government jobs and educational institutions, allocating 7% for SCs, 15% for STs, and 27% for SEBCs, totalling 49% of the available seats and positions. This total reservation is slightly lower than the national figure before the introduction of the EWS quota, and the SC reservation is notably lower than the national average.

Gujarat has a history marked by significant social and political movements concerning caste reservation. The anti-reservation agitation in 1985 and the more recent Patidar reservation agitation (Year: 2015-2019), where the Patidar community demanded OBC status, underscore the intense social tensions and complex dynamics surrounding the issue of reservation within the state. These movements reflect the socio-economic aspirations and worries of various communities in Gujarat regarding access to education and employment through reservation policies.

Research conducted within academic settings in Ahmedabad has shed light on the continued influence of caste in student interactions and perceptions. Studies have

indicated that caste plays a role in the formation of study groups and that there might be underlying biases in how students perceive the academic abilities of their peers based on their caste identities. Data on higher education enrolment in Gujarat shows a positive trend, with an increase in the Gross Enrolment Ratio for both SC and ST students between 2011-12 and 2021-22, suggesting improved access to higher education for these communities in the state. Furthermore, Gujarat has reportedly achieved high national rankings in employing SC and ST youth through its employment exchanges in 2022, indicating a potentially positive impact of reservation in facilitating job placements at the state level.

Despite these advancements, reports and studies also highlight the persistent issue of caste-based social exclusion and residential segregation in Ahmedabad, particularly affecting Dalit and minority communities, suggesting that reservation policies alone have not been sufficient to eradicate all forms of caste-based discrimination. Additionally, the Gujarat government's recent rejection of a demand for a caste-based census in the state assembly in year:2025 indicates a cautious approach towards comprehensive data collection on caste demographics, which could have implications for fully understanding the reach and impact of reservation policies within the state.

IX. Assessing the "Effective Rate" of Caste Reservation

Assessing the "effective rate" of the caste reservation policy in India is a complex endeavour, as it requires considering a multitude of factors and perspectives. The policy has undoubtedly achieved some notable successes, particularly in increasing the representation of marginalised communities in certain sectors and at specific levels. For Scheduled Castes and Scheduled Tribes, overall representation in central government jobs appears to be largely in line with their prescribed quotas, and access to higher education has significantly improved for all reserved categories, with OBC student enrolment even exceeding expectations. These achievements signify a step forward in providing opportunities to historically disadvantaged groups and fostering a more inclusive society.

However, the effectiveness of the reservation policy is also constrained by persistent limitations and challenges. Underrepresentation in higher faculty positions across all reserved categories, as well as in higher-level government jobs, remains a significant concern. These disparities suggest that while the policy might be effective in facilitating entry-level access, systemic barriers might still exist that delay career progression and representation in leadership roles. Furthermore, the deep-rooted socio-economic inequalities that precede and persist alongside the reservation policy continue to impact the ability of many individuals from marginalised communities to compete for and fully benefit from the reserved slots. Implementation issues, ranging from accurate identification of beneficiaries to social resistance and administrative hurdles, also play a crucial role in limiting the policy's overall effectiveness. The diverse and often conflicting perspectives and debates surrounding the policy

underscore the complexities and trade-offs inherent in affirmative action in a society as diverse and historically stratified as India.

In conclusion, the "effective rate" of the caste reservation policy in India is multifaceted and cannot be reduced to a simple metric of success or failure. While it has undeniably contributed to increased representation and social empowerment for many, it has not yet fully achieved the overarching goals of social justice and equity. The continued existence of disparities, the impact of socio-economic barriers, and the ongoing debates highlight the need for a more comprehensive approach that goes beyond reservation alone. The ultimate aim of creating a truly egalitarian society requires sustained efforts to address the root causes of inequality and discrimination, alongside a continuous evaluation and adaptation of the reservation policy itself.

X. Recommendations to build Harmonious VIKSHIT Bharat

Based on the analysis presented in this paper, the following recommendations are proposed to enhance the effectiveness of the caste reservation policy in India:

Targeted Support Programs: Implement comprehensive programs that specifically address the socio-economic barriers faced by individuals from reserved categories. This could involve providing financial assistance for coaching and study materials, establishing mentorship programs with successful professionals from their communities, and offering career counselling services to guide them towards relevant opportunities.

Improve Implementation Efficiency: Streamline and enhance the transparency and efficiency of the implementation process for reservation policies at all levels of government and in educational institutions. This includes ensuring strict adherence to guidelines, simplifying application processes, and addressing any administrative bottlenecks or instances of corruption that might hinder the fair allocation of reserved seats and positions.

Regular Policy Evaluation: Establish robust mechanisms for the regular and comprehensive evaluation of the reservation policy's impact. This should involve the systematic collection and analysis of data on representation across various sectors and levels, as well as qualitative assessments of the experiences of beneficiaries and non-beneficiaries. The findings from these evaluations should be used to inform necessary adjustments and reforms to the policy.

Address Faculty Underrepresentation: Develop targeted strategies and initiatives to improve the representation of individuals from reserved categories in faculty positions within higher education institutions, particularly at senior levels. This could include special recruitment drives, relaxation of certain criteria where appropriate without compromising quality, and mentorship programs specifically designed to support their career advancement in academia.

Enhance Awareness and Outreach: Conduct nationwide awareness campaigns to ensure that eligible individuals, especially those in remote and marginalized

communities, are fully informed about the provisions of the reservation policy, the eligibility criteria, and the application procedures for both education and employment opportunities.

Review Sub-Categorisation: Undertake a thorough review of the existing criteria for sub-categorisation within Scheduled Castes and Scheduled Tribes to ensure a more equitable distribution of reservation benefits to the most marginalised subgroups within these broader categories, addressing the issue of benefits being disproportionately accessed by relatively better-off sections. But subcategorization will create some more serious social and political issues.

Conclusion: Reservation alone is not a solution for social injustice. Prioritize and invest in complementary measures aimed at actively combating caste-based discrimination in all its forms, promoting social inclusion, and fostering a more equitable society where opportunities are not determined by caste. This includes the strict enforcement of anti-discrimination laws, the promotion of inter-caste dialogue and understanding, and initiatives to challenge and dismantle deeply ingrained social stigmas and prejudices.

The inspection of sub-castes within the Scheduled Castes (SC) category highlights substantial disparities in socioeconomic and educational outcomes. Although affirmative action policies are designed to uplift SCs as a whole, general observations indicate that the benefits are mainly enjoyed by more progressive sub-castes, which leaves the backward sub-castes even more marginalised. Census data from Gujarat shows that sub-castes such as Valmiki, Nadia, and Shenva consistently fall behind others in terms of educational achievement and vocational opportunities. In contrast, sub-castes like Vankar, Garoda, and Turi exhibit greater levels of development.

This discrepancy emphasises the need for a targeted policy-mix that respond to intra-caste inequalities. While the Supreme Court's ruling on subcategorisation offers a framework to ensure fair distribution of affirmative action benefits, this paper advocates for a horizontal reservation approach instead of a vertical one for marginalised communities. Horizontal reservation, which factors in various dimensions of disadvantage, including urban-rural differences, would more effectively support the most vulnerable segments within each sub caste.

Moreover, implementing a "creamy layer" concept within the SCs could enhance the reservation system, ensuring that assistance reaches those who truly need it. The study stresses that subcategorisation should not lead to further divisions but should instead foster a unified strategy to uplift all SC members equitably. As India progresses towards social justice, policy development must be adaptable, inclusive, and reflective of the complex realities of caste and subcaste disparities. To build VIKSHIT Bharat, we must have political, social stability. To build a harmonious society, we must address the issue of effective reservation policy.

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Financial Behavior and Well-being among Graduate Level Rural Female Students- A Comparative Study of Anand and Petlad Talukas of Anand District

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Purpose: The purpose of the present study is to compare financial behavior and financial well-being among rural female students of Anand and Petlad talukas.

Methodology: In the present study, two talukas, Anand and Petlad, of Anand district were selected, from which 62 samples of female students studying at the graduation level were selected. A total of 6 villages were selected from Anand taluka: Mogari, Meghva, Gana, Bakarol, Karamsad, and Jod. A total of 5 villages from Petlad taluka, namely Shahpur, Jogan, Bandhani, Dantali, and Lakkdpura, were selected. In the present study, an interview schedule was used for data collection. The available data were analyzed using the Mann-Whitney U test in SPSS.

Findings: The findings of the present study are as follows: Through the questions on financial behavior, it was found that out of a total of 15 questions asked, 13 questions show differences in the financial behavior of rural female students of Anand and Petlad talukas. It was found that the average rank of students from Anand taluka was 2 in questions related to financial behavior. In Petlad taluka, out of 11 questions on financial behavior, rural female students were found to behave more rationally financially than those in Anand taluka. In nine questions on financial well-being, out of which eight questions showed similar financial well-being in both Anand and Petlad talukas and there was a difference in 1 question regarding financial well-being. Based on the average rank of the study, the average rank of students from Anand taluka was better and they gave more logical answers regarding financial well-being.

Keywords: Financial Literacy, Rural Female College Student, Financial Behavior, Financial Well-being.

- **JEL Code: G, G5, G53**

Introduction

As India moves toward becoming a developed country in 2047, the development of human capabilities is too important condition. Financial literacy is an essential human capability. According to the (OECD, 2019) report, only 23 percent of rural women are financially literate. Therefore, it is necessary to study financial literacy among rural women. If rural women are knowledgeable and provided with financial education from an early age, they will become financially literate. Considering this, the present paper examines financial literacy among rural female students through financial behavior and financial well-being. It has looked at aspects such as the financial behavior of rural female students, their awareness of their financial transactions, and the students' views on financial management in their families.

The family's financial condition can be improved through Wisely economic management. Knowledge of family financial management is primarily found among women. They will be able to manage the family finances in a well-organized manner. Hence, this study includes adult rural female students to ensure that, if they become financially literate in adulthood, they can manage their families' finances smoothly later in life. Hence, in this study, financial literacy has been examined through financial knowledge, behavior, and attitudes among rural female students in Anand and Petlad talukas of Gujarat State.

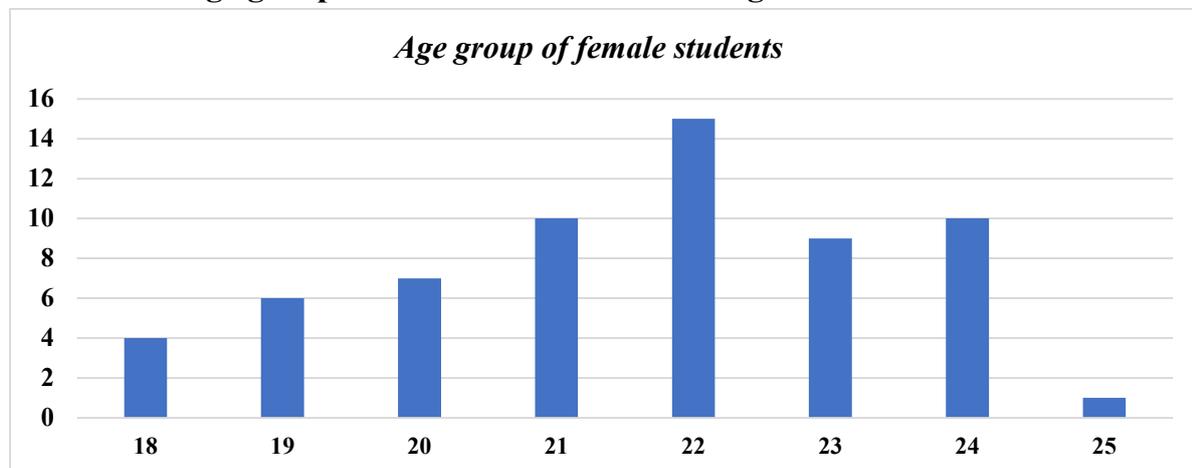
Importance of the Study

Financial literacy plays an important role in the economic development of a country, especially among rural people. It is essential to promote financial literacy among rural residents, particularly rural female students of adult age, as they can express their opinions on family financial management.

- Understanding of concepts like income, savings, and investment can be gained through financial literacy.
- Better understanding of financial products and services.

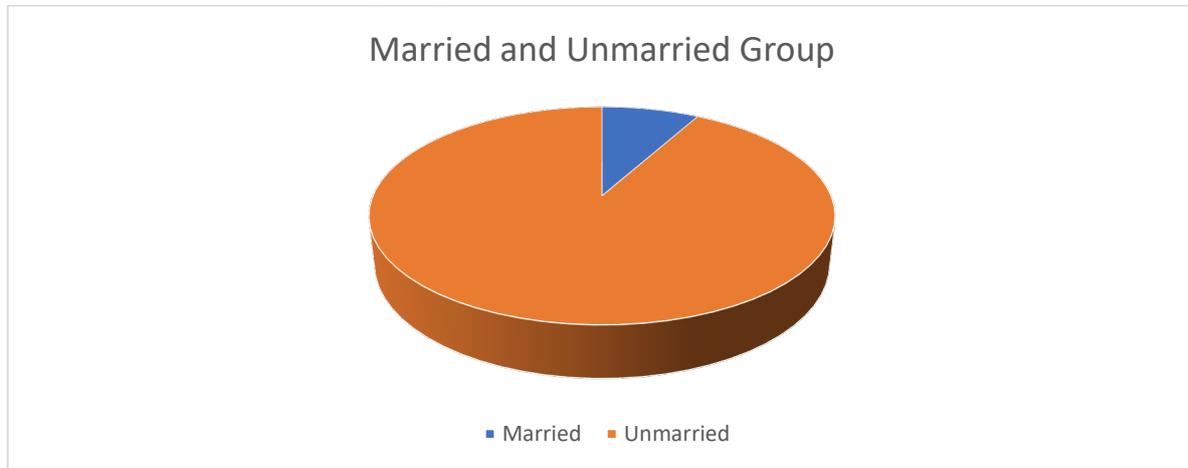
Demographic information

Age group of rural female students at graduation level



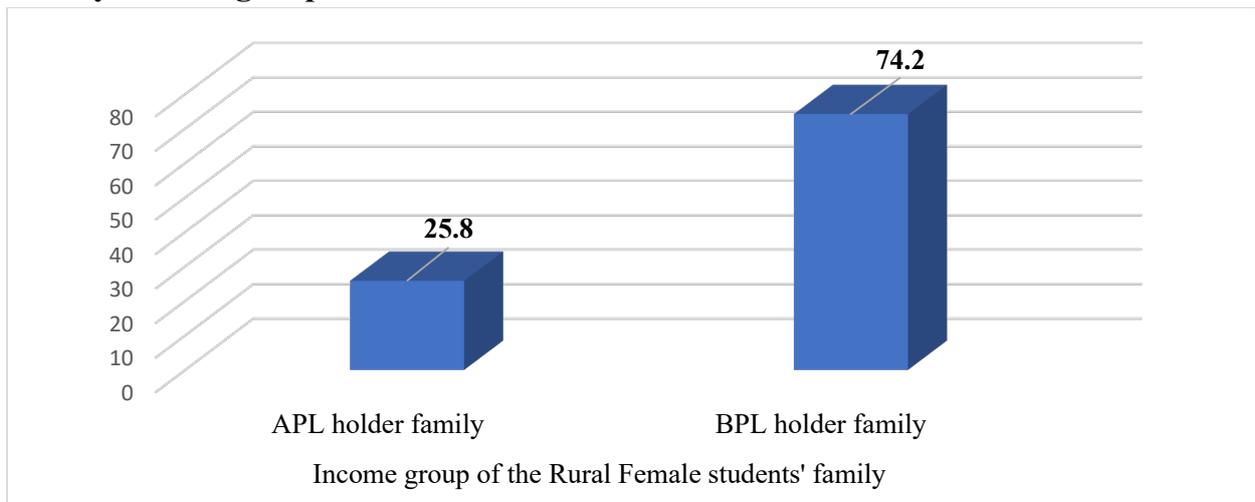
The chart above shows the rural female students of graduation level between 18 and 25 years who were selected for this study. It shows that the proportion of female students above 22 years is highest and the proportion of female students above 25 years is lowest.

Married and unmarried group



The above chart includes married and unmarried groups of female students, out of which 57 out of 62 female students are unmarried and only 5 female students are included in the married group.

Family income group of rural female students



As per the above table, the percentage of BPL card holder families in the family income group among rural female students was 74.2% and the number of APL card holder families was 25.8%. The percentage of BPL cardholder families was higher, while the percentage of APL cardholder families was lower.

Review of Literature

Financial behavior among college students

Calamato (2010) examined financial literacy, parental financial literacy, and parental support among adult college students in the United States. The results of the present study show that most students fail the financial literacy test. Also, only a small proportion of students (9%) were able to answer almost all the questions correctly. Seventy-three percent of American adults aged 23 to 28 do not understand basic

economics and financial investments, so the future of that group is quite unpredictable. Factors such as literacy standards, financial attitudes, motivations, and behaviors affect financial literacy within a family. Xiao et al. (2014) examined the association between early financial literacy and later financial behavior among college students. The study found consistent differences for two of the control variables: Financial behavior was found to be less logical female student in terms of gender by higher Grade Point Average (GPA). Ninan & Kurian (2021) conducted a study on financial literacy and financial behavior among college students in Kerala. The study found the effect of gender, education, type of study, and financial behavior among students on financial literacy. It also found that family and friends were the primary influences on college students' financial management. The study by Vaidya and., G.C. (2021) was conducted to examine the impact of financial attitudes and financial behavior on financial literacy among micro-debtors in the Tharu District. The study found that Women in the Tharu district Were not aware of the concept of financial literacy. They viewed the income received in only two ways: spending and saving. Most of the women were involved in financial activities solely to repay loans. Razak and P (2022) examined financial literacy and the saving behavior of Rural women. The study found that rural women did not invest their income in mutual funds or the stock market because they were not aware of these investment options.

➤ **Financial literacy among college students and factors affecting it**

Sabri et al. (2010) examined the impact of personal and family background, academic ability, and childhood consumer experiences on the financial literacy of college students in Malaysia. The study found a significant positive correlation between students' discussions of family finances with their parents and financial literacy. Students living on campus and studying in private colleges were found to be more financially literate. Flaherty and Paim (2011) conducted a study on differences in financial literacy based on gender among college students. The findings showed that financial literacy was lower among female students than among male students. As a result, female students may experience higher levels of financial problems due to a lack of adequate financial skills and literacy. In their study,

A study by Rajan et al (2020), conducted on the investment patterns of Rural women examines how they follow conventional investment practices. Furthermore, most of the investors prefer financial investment institutions due to familiarity. Increased financial literacy has increased, the propensity to invest and save. Ghai and Singh (2020) conducted a study examining the sociodemographic factors affecting the financial literacy of Indian youth. A special case of college students was conducted in this study to analyze the socio-demographic factors affecting the financial literacy of the Indian youth in the Himalayan region. The study found that various socio-demographic variables such as age, education, family income, parents' education, parents' occupations, parents' financial behavior, and parents' financial education, significantly

affect financial literacy. The youth aged 22-25 years scored more on financial literacy than the students in the age group of 20-22 years, which demonstrated that exposure to financial concepts increased with age. Post-graduates scored higher than professionals, as professionals do not have the opportunity to study financial concepts. Family income also played a role in affecting financial literacy.

Research Methodology

In the present study, two talukas, Anand and Petlad, of Anand district were selected, from. A total of 62 samples were selected, which included graduate level students from all three streams: Arts, Commerce and Science. Proportionate villages were selected from both Anand and Petlad talukas. A total of 6 villages were selected from Anand taluka, including Mogari, Meghva, Gana, Bakarol, Karamsad, and Jod. A total of 5 villages from Petlad taluka, namely Shahpur, Jogan, Bandhani, Dantali, and Lakkdapura, were selected. The Mann-Whitney U test was used for data collection, and SPSS was used for analysis of the available data.

Objectives of the Study:

1. Comparison of financial behavior among college-going female students of Anand and Petlad talukas
2. Comparison of financial well-being among college-going female students of Anand and Petlad talukas

Hypothesis of the Study

- 1) H^0 = There is no difference in the financial behavior of rural female students at the graduation level in Anand and Petlad talukas.
- 2) H^0 = There is no difference in the financial well-being of rural female students at the graduation level in Anand and Petlad talukas

Statistical Analysis

Table No. 01: Table of financial behavior among college-going female students of Anand and Petlad Talukas

Sr No.	Statement	Mean Rank		Mann-Whitney U	P-value
		Aanad	Petlad		
1	You create and adhere to specific spending rules to maintain your household budget	24.74	38.26	271.00	0.001*
2	Check the financial risk before making a financial decision	37.27	25.73	301.500	0.006*
3	You keep track of your personal finances	27.61	35.39	360.000	0.062
4	You try to stay informed about the financial affairs prevailing in the economy	38.10	24.90	276.000	0.002*
5	You buy anything by comparing the	37.79	25.21	285.500	0.003*

	price of that item with the price elsewhere				
6	You regularly keep a portion of your monthly income as savings	38.61	24.39	260.000	0.001*
7	You are always in control of your unnecessary expenses	41.21	21.79	179.500	0.000*
8	You only invest your earned income in income-generating activities	37.11	25.89	306.500	0.010*
9	You are always involved in your household's financial decisions	38.60	24.60	260.500	0.001*
10	You have financial planning for your retirement	42.89	20.11	127.500	0.000*
11	You feel that it is essential in your family's financial decisions	38.31	24.15	252.500	0.001*
12	You insist on handling the money in your savings account yourself	38.13	24.69	269.500	0.002*
13	You have a membership in your village self-help group	38.24	24.87	275.500	0.003*
14	Keep track of where the money coming in at the end of the month is spent in your family	32.02	30.98	426.500	0.436
15	You always think about your budget before spending on any hobby	32.02	30.98	464.500	0.817

Source: own calculation (* and ** indicate 1 % and 5 % percent significant level)

The above table shows the results of a comparative study on financial behavior among rural female students studying at the graduation level in Anand and Petlad talukas. The Mann–Whitney U test was used to examine whether there is a statistically significant difference in financial behavior between female college students from Anand and Petlad Talukas. Mean ranks indicate which group demonstrates relatively stronger agreement or practice for each statement, while the p-value indicates statistical significance. Regarding the rules of making a household budget, where the mean rank is higher in Petlad than Anand, where it is 24.74 in Anand and 38.26 in Petlad, it is strongly supported by the p value obtained by the Mann-Whitney U test of 0.001, which shows that financial behavior is better in Petlad than Anand among undergraduate students. The Mean Rank in financial behavior regarding risk assessment before taking financial decisions shows that Anand taluka has better financial behavior, with Anand scoring 37.27 and Petlad 25.73. In support of this, the mean rank shows that there is a difference in the financial behavior of both the talukas. In terms of keeping track of personal finances, it can be seen from the mean rank that better financial behavior is seen in Petlad taluka than in the talukas, in which the Mean Rank is 27.61 in Anand taluka and

35.39 in Petlad taluka. The P-value is 0.062, which indicates that there is no difference between the two talukas. Regarding the effort of graduate level students to be informed about the financial matters prevailing in the economy, the mean rank was found to be 38.10 in Anand and 24.90 in Petlad. The P-value of 0.002 is found to be higher in Anand, which shows that both show differences in the talukas.

Similarly, rural graduate students also compare the purchase price of goods with the price elsewhere, they regularly save a part of their monthly income as savings, they always control their unnecessary expenses, they invest the earned income only in income generating activities, they always involve themselves in the financial decisions of their household, they make advance plans for retirement, they feel that they are important in the financial decisions of the family, they insist on managing the money in the savings account themselves, they have membership in the self-help group of their village. In all these financial matters, the mean rank of Anand taluka is higher which shows that the behavior of the students of Anand taluka is better than that of Petlad and the p-value obtained by Mann-Whitney U test is < 0.05 which shows that there is a difference in all these financial behavioral matters.

Overall Interpretation - Out of 15 statements, 12 statements show statistically significant differences ($p < 0.05$) between students of Anand and Petlad Talukas.

Table No. 02: Table of Financial Well-being among college-going female students of Anand and Petlad Taluka

Sr No.	Statement	Mean Rank		Mann Whitney -u	P-Value
		Anand	Petlad		
1	You are satisfied with your family's current standard of living.	31.56	31.44	478.5	0.976
2	You have enough money to buy your necessities.	31.42	31.58	478	0.971
3	You always have money left over at the end of the month.	30.37	32.63	445.5	0.611
4	You can overcome your sudden problem.	31.08	31.92	467.5	0.848
5	You are confident in your financial decisions.	32.71	30.29	443	0.588
6	You believe that your finances allow you to enjoy life	29.97	33.03	433	0.488
7	You can manage all the financial matters of your Family	30.9	32.1	462	0.788
8	You believe that you can control your family's Finances	30.52	32.48	450	0.657

Source: own calculation (* and ** indicate 1 % and 5 % percent significant level)

The above table shows a comparative study of financial well-being among rural female graduate students of Anand and Petlad talukas. The Mann–Whitney U test was used to examine whether there is a statistically significant difference in financial Well-being between female college students from Anand and Petlad Talukas. The P-Values for the given statements are much higher than the significance level of 0.05 (they range from 0.488 to 0.976). This indicates that there is no statistically significant difference between the financial well-being levels expressed by the respondents from Anand and Petlad. There is no significant difference in the results regarding financial well-being when viewed through the Mean Rank. Therefore, similar results regarding financial well-being are seen in Anand and Petlad talukas, and no significant change is seen in them.

Findings

The study finds differences in financial behavior among rural female students in the Anand and Petlad talukas. Financial behavior includes making a household budget to maintain the family, assessing financial risk, monitoring personal finances, trying to stay informed about changes in the economy, comparing prices of other things while shopping, keeping some part of the monthly income as savings, controlling unnecessary expenses, investing earned income in income-generating activities, participating in household financial decisions, and planning for retirement. Differences are observed between rural female students' status in Anand and Petlad talukas with respect to financial and economic behavior. Compared to Petlad taluka, female students attending rural colleges in Anand taluka showed better understanding of financial behavior and financial well-being.

In addition, two other financial issues, such as where the family keeps money at the end of the month and thinking about the cost before buying entertainment items, similar financial practices have been found among rural female students of Anand and Petlad talukas.

Also, in terms of financial well-being, factors conserved included, satisfaction with the standard of living, having enough money to buy necessities of life, the ability to face problems, in addition, confidence in one's financial decisions, whether one gets joy in life through financial management, and the ability to manage the financial situation of the family. Female rural students in Anand and Petlad talukas similar. In addition, there is a difference in the responses to the question of financial well-being, meeting basic needs when the family's income stops, in both talukas, with female students from Anand taluka receiving more positive responses regarding financial well-being.

Suggestions

The study suggests that graduate-level curricula should consist of financial literacy programs or issues that improve financial literacy so that the financial knowledge of female rural students increases.

Conclusion

In this study conducted among rural female students, especially in Anand and Petlad talukas, a significant observation was that the financial behavior of students responsible for managing household finances was found to be less rational as despite some families being financially well-off, financial behavior among female students yielded less than expected results

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