




Indian rural development: a review of technology and society

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Abstract

India has a large population of people who live in rural areas. Regional differences prevent every part of the country from being well developed. Among other factors, there are differences in cultural practices, living standards, and ownership of agricultural lands. Closing the gap requires the adoption of technology and a good education. This study observed that society, technology, and development are interrelated in rural India. Through technology-driven poverty reduction, underprivileged people can obtain education, health care, financial services, and employment opportunities. It is possible to improve agriculture and farmers' economies through technological innovation combined with traditional knowledge.

Keywords Development · India · Rural · Society · Technology

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Introduction

The modern world is heavily reliant on technology. However, societies can gain a greater advantage from technology if they are aware of its progress. The technological revolution has enabled people to gain a better understanding of global issues, values, and cultures once they reach a certain level of usage. A result of mass communication and mass transportation, globalization, embedded values, and population growth, the world appears smaller and smaller (De Haan 2000; Autio et al. 2021). It is estimated that four out of five people who live below the international poverty line live in rural areas (Castañeda et al. 2018). Technology can make poverty reduction more accessible to underprivileged people by increasing access to education, health care, financial services, and government services. Small farmers and artisans can also have better access to markets (Cecchini and Scott 2003). Indian social structures and cultural patterns are both diverse and united. During the last century, India has been the destination of many immigrants from Asian and European countries, which have gradually fused their cultures to create the Indian mosaic (Sahoo and Sangha 2010). After an issue has been identified, politicians, government agencies, pressure groups, NGO's, academics, or think tanks may submit proposals for a policy intervention. By establishing trust between scientists, governments, and the general public, science-policy interfaces could be made more effective (Horton and Brown 2018). Having access to financial services in remote areas is now possible, thanks to the development of information and communication technologies (ICTs) (Bansal 2014). To be sustainable, rural development in India must be technologically advanced at the ground level, and it must emphasize intergenerational equity. Sustainable development is based on ecological, economic, and social dimensions. Education is a primary need, but remote villages still lack basic infrastructures like health care, schools, and technology development centers. The purpose of this study is to establish the current status of basic infrastructure in rural India and prospects for sustainable development. In a study of rural education and rural community development, the researcher concluded that redefining rural education policy, and defining rural development policy, would benefit the rethinking of education, especially in local settings (Schafft 2016). Social justice and addressing social exclusion and poverty in rural areas are among the most significant challenges in India. The challenge of sustainability in today's society is a major one. In order to achieve sustainability, we need to address poverty and social inequality and ensure the well-being of our society (Kalinowski and Rosa 2021). It is estimated that almost half of the Indian workforce still works in agriculture (including forestry and fishing) as a source of livelihood (Yadav and Ahmad 2022). Rural development is now promoted by complementary activities, but the global economy and increasing mechanization have reduced the participation of individuals in such activities. It is therefore impossible for rural populations to survive on agricultural income alone. As a result, other economic activities should also be promoted alongside agriculture, such as rural tourism, revaluing the natural heritage, and promoting agro-ecological products. The use of information and communications technology (ICT) and

internet access can enhance rural communication and teleworking or attract people to settle in rural areas by designing sustainable homes (Masot and Gascón 2021). It is believed that higher education contributes to economic resilience because it gives people more skills to work in industries other than agriculture, and also allows them to access certain resources more easily because of social networks, like government financial assistance or informal loans from friends and family (Bisht et al. 2020).

Material and methods

In evaluating the infrastructure from 2000 to 2023, reports from government and non-government agencies were used, along with research on rural technological advancements. A Boolean search was conducted for information on rural development on Google Scholar and Google. The search terms were India and/or rural development, as well as society and technology.

Result and discussion

It is inevitable that technology will continue to evolve. Technology is based on how it impacts society. India will surpass China's population in 2024. With a birth rate of one person every two seconds, a death rate of one person every three seconds, and a migration rate of one person every two seconds, there will be more than 1.5 billion people there by then (<https://www.populationu.com/india-population>). In India, 65% of people live in rural areas, and agriculture is their primary source of income. From 1965 to 2015, production has multiplied by 3.7 times, while the population has increased by 2.25 times. As a result, India has increased food production by 45%, making it a net food exporter (Chand 2017). The land owned by scheduled castes and scheduled tribes in rural areas is 10.2%, 16.1% by scheduled tribes, and 47.1% by other backward classes (Fig. 1). In agricultural households, SCs account for 16%, scheduled tribes for 14%, and OBCs account for 46% (<https://timesofindia.indiatimes.com>). India's proportion of households of different social groups possessing land and proportion of non-agriculture households by major source of income (Rural) are mentioned in Table 1.

According to Chand et al. (2015), 53% of farmers who own less than 0.63 ha do not earn enough from farming to stay above poverty. The size of a farm influences the extent to which it adopts modern management and mechanization methods. This increases productivity, production efficiency, and agricultural income. Studies found that farm holdings were inversely related to the number of people dependent on agriculture, national income from agriculture, and tenure rights (Fan and Chan-Kang 2005; Kareemulla et al. 2021). Agricultural landholdings, food security, and social hierarchy (Caste) are intertwined in rural India. Access to agricultural land and the viability of small and marginal farming on marginal lands are key factors in ensuring food and nutritional security in India. Evidence from Uttar Pradesh

Fig. 1 Category-wise land holding in rural areas

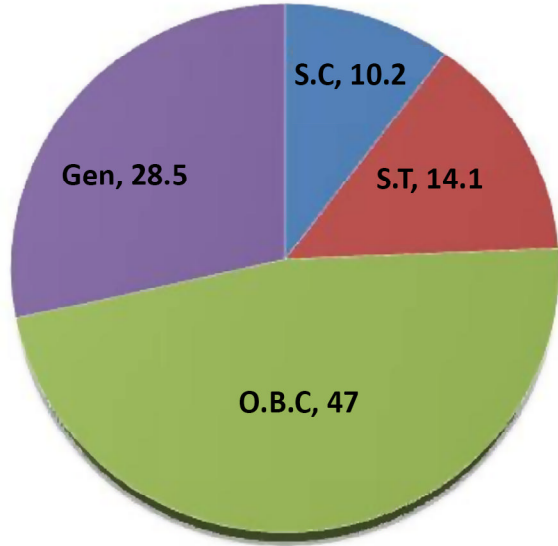


Table 1 All-India proportion of households of different social groups possessing up to one hectare of land (%) and proportion of non-agriculture household by major source of income (rural) (%) (1999–2000, 2004–2005 and 2009–2010)

Social groups	Size class of land possessed (hectares)						Proportion of non-agriculture households (%)		
	Up to 0.40			Up to 1.40			1999–2000	2004–2005	2009–2010
	1999–2000	2004–2005	2009–2010	1999–2000	2004–2005	2009–2010			
OBC	56.5	56.0	62.7	76.7	75.5	79.4	36.1	39.0	42.6
SC	75.0	74.9	80.0	89.7	89.6	92.1	32.2	39.3	46.1
ST	46.3	46.4	56.7	70.6	70.3	76.5	24.2	26.6	29.6
Others	52.1	52.5	58.1	71.2	71.0	75.1	39.8	41.1	44.7
All	58.1	58.2	64.8	77.2	76.9	80.8	35.1	38.3	42.5

Source NSS Report: Employment and unemployment situation among social groups in India (Various rounds: 1999–2000, 2004–2005 and 2009–2010)

highlights the importance of leveraging agriculture for food and nutrition security (Goli et al. 2021). Rural India, which accounts for 65% of the country’s population, has steadily decreased its extreme poverty rate over the last two decades. However, rural income inequality has increased over the same period. Agrarian economies have changed dramatically as rural nonfarm employment has increased faster than farm employment. As a result of non-farm employment growing in rural areas, income opportunities and economic mobility have increased. Agriculture remains India’s largest employer. As Himanshu et al. (2013) demonstrate with a case study in Palanpur, Uttar Pradesh, rural India has been adversely affected by these developments. While most villagers still earn their living through agriculture, fewer are living on non-agricultural wages. Rural India’s most vulnerable segments gained

greater mobility and income from nonfarm activities, but income inequality increased as well.

Culture of society in rural India

In the study (Truelove et al. 2023), the main forces of economic change, namely agriculture intensification, land reform, and labor market diversification, are examined from a variety of disciplinary perspectives, taking institutions into account as change agents. Rural India, however, has seen slow and irregular progress. The implications of caste- and ethnicity-based exclusion and discrimination for rural development are rarely discussed, despite their prevalence. A study conducted in two Indian states (West Bengal and Gujarat) suggests that women's labor contributions to agriculture may have increased their autonomy in decision-making. Many women reported not liking farming, despite their lack of interest. More than one-third of them were reluctant to engage in farming labour (Pattnaik and Lahiri-Dutt 2022). The primary official census of the rural population (2011) and selected indicators of human development (2020) are presented in Tables 2 and 3.

The problem of under nutrition is widespread in rural India, especially among women and their children. Many studies have reported that women's empowerment influences children's nutrition, as well as women's health (Smith and Haddad 2015; Ruel et al. 2018). There is no doubt that social innovation has become an accepted concept in management, organizational, and urban studies. Social Innovation research has often neglected rural areas despite their promising research results, despite the fact that they represent a large share of the world's territory and population. Social innovation has the potential to address these challenges in rural areas (de Fátima Ferreira et al. 2021). According to the study, crime rates against lower castes have increased when SC/ST consumption expenditures are compared with upper caste consumption expenditures. It is proposed that the higher the expenditure ratio, the more likely the upper caste will commit crimes against the lower caste. This conclusion is logical given the archaic structure of the caste system. Researchers have shown that violent crime changes in response to changes in economic gaps (Sharma 2015). Vidya (education), Veda (religion) and Varna (caste) in India are interconnected. In the study, religion (Hindu or Muslim) and

Table 2 Primary census of rural population (2011)

S. No.	Indicators	Person	Male	Female
1	Population	833,748,852	427,781,058	405,967,794
2	Child population	121,322,865	63,084,449	58,238,416
3	Scheduled castes	153,850,848	79,118,287	74,732,561
4	Scheduled tribes	94,083,844	47,263,733	46,820,111
5	Literate	482,793,835	281,361,374	201,432,461
6	Illiterate	350,955,017	146,419,684	204,535,333
7	Workers	348,743,092	226,837,013	121,906,079
8	Non workers	485,005,760	200,944,045	284,061,715

Source <https://censusindia.gov.in/census.website/data/data> accessed dated 19/05/2022

Table 3 Selected indicator of HDI in India (2020)

S. No.	Indicator	Value
1	Human development indicator	0.645 (Overall rank 131)
2	Primary school dropout rate (% of primary school cohort)	8.8
3	Inequality in education (%)	38.7
4	Inequality in income (%)	18.8
5	Employment in agriculture (% of total population)	42.4
6	Unemployment youth (% age 15–24)	23.3
7	Youth not in school or employment (% age 15–24)	30.9
8	Internet user, total (% of population)	34.5
9	Mobile phone subscriptions (per 100 people)	86.9
10	Forest area (% of total land area)	23.8
11	Rural population with access of electricity (%)	92.9
12	Use of fertilizer nutrient nitrogen (N) per area of cropland (Kg per hectare)	104.0
13	Use of fertilizer nutrient phosphorus (P ₂ O ₅) per area of cropland (Kg per hectare)	41.1

Source <https://hdr.undp.org/sites/default/files/hdr2020.pdf> accessed dated 12/05/2022

caste (scheduled or unscheduled) are examined as factors influencing school enrollment. It is found that religion or caste have a big impact on a child's development depending on circumstances outside the community where the child lives. A literate parent does not see the community effect as significant, whereas an illiterate parent does (Borooah and Iyer 2005). An investigation into social norms concerning the age parents expect their children to marry was conducted, as well as the factors affecting educational plans, i.e., what parents expect for their children. In addition, parents may aspire to educate their daughters but not their sons due to their perceptions of the ideal marriage age. Further, in boys' aspirations, higher education is perceived as beneficial, but not in girls' aspirations (Maertens 2013). An investigation of seasonal migration and its impact on inequalities in rural India examines both temporary and permanent migration's impact on inequalities within and between groups (Tiwari et al. 2022). The majority of India's rural development strategies focus on reducing rural poverty, but few explicitly target inequality reduction (Ashley and Maxwell 2001; Ravallion 2011; Cozzens 2021). Farmers with poor education and land access, low social status, and limited access to markets may require additional support services to enhance their capacity, skills, and resources (Bizikova et al. 2020).

Technology in rural India

In addition to facilitating new facilities and infrastructures and influencing people's mindset towards a sustainable economy, an integrated study of rural development, which integrates social, economic, and technological perspectives, has made a significant contribution to rural development (Muhardi et al. 2022). Human development trends of India are shown in Table 4. Farmers who participate in

Table 4 Human development index trends in India (2000–2021)

Indicator/year	2000	2010	2015	2018	2019	2020	2021
HDI value	0.491	0.575	0.629	0.645	0.645	0.642	0.633
HDI rank	115	119	130	129	131	130	132

contract farming have access to a variety of markets and financial resources, as well as technical assistance and special inputs. In addition to reducing crop price variation, contracts can also help farmers bear the risk associated with nontraditional crops. Through the partnership of farms with smallholders, contract farming promotes rural development and raises the income of smallholders (Ton et al. 2018; Ray et al. 2021). As part of rural development, rural roads play an important role because they boost agriculture productivity, nonagricultural employment, and non-agricultural productivity. The increase in agribusiness income and growth opportunities for locals reduces agricultural poverty (Shamdasani 2021). Inability to access services is a significant disparity between urban and rural communities. In spite of extensive documentation that technology interventions help financial institutions reduce costs and increase customer reach, rural residents rarely receive notice from them (Agwu 2021). A discussion of the impact of new innovative agriculture technologies on society and rural development is presented in Table 5.

The Zero Budget Natural Farming (ZBNF) initiative was launched in Andhra Pradesh in 2016. Its goal is to promote an agro environment in order to reduce the cost of production, increase yields, increase incomes, reduce risk, and protect the agriculture sector from climate change uncertainties. As ZBNF cultivates different types of crops on small holdings, it produces chemical-free agricultural products including leafy vegetables, other vegetables, fruits, pulses, oil seed crops, and cereals rich in micronutrients (Galab et al. 2020). It has been observed that these ‘local innovations’ were considered regressive and dangerous to food security. Science and progress are seen as antagonistic to agro ecology due to the dominant industrial socio-technical system (Dorin 2022). Agricultural supply chain management can be improved by utilizing digital extension services such as decision support systems, databases, Agri-based apps, etc. As a result of these advanced approaches, not only will agribusiness and extension personnel be assisted, but their skill levels will also be improved, contributing to the growth of the national GDP (Naika et al. 2021). It is possible to categorize ICT solutions for rural development into the following categories: providing analytical support to public administrators for better planning and monitoring of development programs; providing better services to citizens and improving transparency; and providing citizens with access to knowledge and information (Bhatnagar and Schware 2000). Rural improvement should go beyond economic, social, or environmental policy; it must be a commitment to improve the lives and livelihoods of rural residents.

Society technology interface in rural India

A variety of reasons have influenced the adoption of new technologies, but all in all, they present new opportunities and offer hope for the future. We are living in the

Table 5 Agriculture technology and their impact on rural development

Agriculture technology	Key features	Advantages	Challenges	Evidence of impact	Ref.
Drones	Encompasses a range of technologies that are relatively new and small-scale	Helps improve farmer knowledge and labor productivity	Difficulty in scaling up multiple micro experiments	Can support both farm and non-farm development	Ayamga et al. (2021)
Robots	Irrigation management, crop yields	Less manpower requirement, farmer productivity increases, and ensures food sustainably	Complex technology, skilled manpower required	Boost farm economy	Sparrow and Howard (2021) and Lowenberg-DeBoer et al. (2020)
Sensors	Weather prediction, and new machinery	Easy to access crop diseases, weather condition, etc.	Costly technology, skilled manpower required	Productivity increased	Poblete-Echeverría and Fuentes (2020) and Kumar and Ilango (2018)
3D printing	Used in soil science	Benefited to larger farmers	Costly technology	Impact on productivity	Arrieta-Escobar et al. (2020)
Data analytics	Befitted small- and large- scale farmers	Low cost technology	Difficult, needs advance skill	Useful in prediction of crop	Ryan (2020)
Artificial intelligence	New technologies with applications	Supply chain management, easy in decision-making	High cost	Farm productivity increased	Jha et al. (2019)
Biotechnology	Enhance farm productivity	Low cost technologies	Skilled manpower requirement	Boost productivity and farm economy	Hesham et al. (2021)

midst of an era of technological revolution that is not only influencing all aspects of our lives, but also affecting social and political change. Due to the fact that technology affects different groups differently, it is difficult to define what constitutes a “negative outcome”. Moreover, technology may not have enabled us to eradicate diseases, harness new energy sources, or provide rapid transportation. Some groups may benefit, while others may have to bear the burden (Johnson and Wetmore 2021). It is essential to consider the relationship between technology and society when trying to influence technology in any way (Deguchi et al. 2020). Several literature reviews on society and technology led to the development of a sociotechnical model of technology, which is illustrated in Fig. 2.

Telecommunications, broadcasting, computer hardware, software, and related technologies are among the key sectors driving social and economic change in India. The use of communication and information technology can reduce distances and spaces in rural areas (Wang et al. 2021). The developing world is plagued by corruption, ethnic tensions, and weak markets. Women with low incomes have unique opportunities to create livelihoods in the energy sector, despite having low

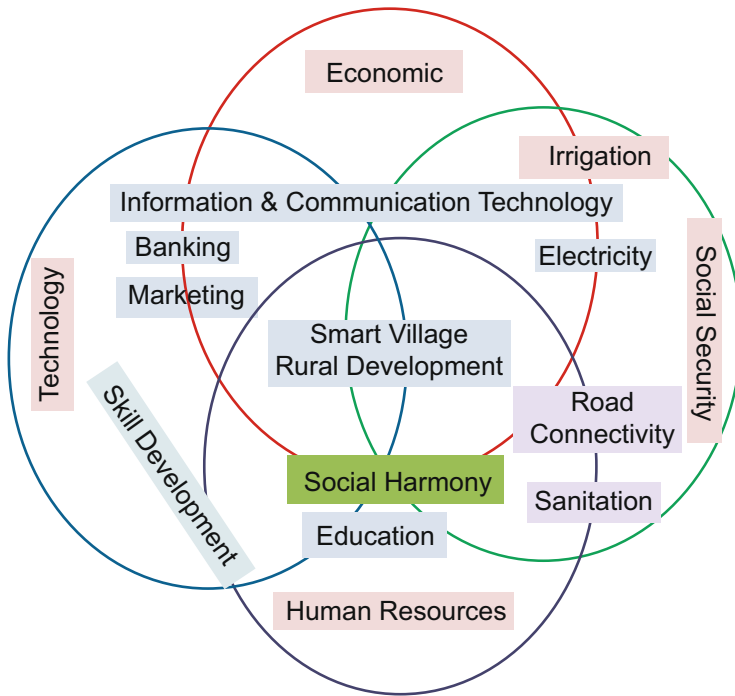


Fig. 2 Relationship between society technology and rural development

purchasing power and social status. While women face many challenges in the energy supply chain, studies have shown that there is significant potential to create livelihoods for them. Developing a robust social welfare infrastructure with high-quality public services is needed to achieve optimal employment for women in the energy sector (Baruah 2015; Haldar 2021). A complex and multidirectional relationship exists between society, technology, development, and economic structures. Sustainability and social issues further complicate this relationship (Aghion et al. 2009; Allain et al. 2022).

Conclusion

Rural development must include economic, social, and environmental initiatives. Therefore, programmes that promote multiple objectives must be prioritized. It is important to invest in basic infrastructure (roads, electricity, clean water, sanitation), human capital development (education, healthcare, cultural facilities), public administrative services, and the deployment of broadband Internet and other information technology as part of a comprehensive public investment program. It is important to understand the relationship between society and development in order to understand how changing social inequality affects poverty. A lack of social development in rural India is due to the lack of awareness of the latest technologies.

The villagers still rely on labor instead of technology, despite complex cultures and social statuses. School education is a major problem in many villages. Some villages lack electricity, road access, primary health centers, and skilled professionals. Policy planners should focus on technology-driven social development to benefit all people.

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