

Livelihood constraints, opportunities and economic empowerment of the rural households in the dry land areas of West Bengal: A cross-sectional study

 Babita Chatterjee^{1,2}  —  Debayan Koley³ —  Hari Charan Behera⁴

¹Department of Humanities and Social Sciences, Indian Institute of Technology Bombay, Mumbai 400076, India

²Department of Humanistic Studies, Indian Institute of Technology (BHU), Varanasi-221005, INDIA

³Department of Statistics, St. Xavier's University, Kolkata 700160, India.

⁴Sociological Research Unit, Indian Statistical Institute, Giridih Branch, New Barganda, Giridih-815301, India

 babitachatterjeerd@gmail.com

Abstract

The current study explores livelihood patterns constraints, opportunities and the scope for economic empowerment of rural households in the dryland areas of West Bengal. Our work focuses on analyzing the prevalent causes of low income and backwardness among the rural household participants. The present research identifies potential avenues for sustainable resource creation to enhance the economic resilience of the studied people. For quantitative analysis, a Kruskal-Wallis test, a robust generalized linear model, and pairwise Wilcoxon tests are used. The analysis section revealed the variables responsible for vulnerability. Further, this work sheds light on the role of SDG Goal 8 in employment generation communities. The findings section demonstrates that a poor human resource base, limited access to lucrative opportunities, and a weak man-land ratio significantly contributed to the prevalence of poverty by slowing economic growth. Moreover, marginalized people need assistance from government and non-governmental sources to secure their livelihoods.

Highlights for public administration, management and planning:

- Rural households in the dryland regions of West Bengal face persistent poverty driven by limited land access, weak human capital, and inadequate livelihood opportunities.
- The study finds that most households rely on diversified but low-income activities (e.g., agricultural labor, livestock, forest resources), with no single source sufficient for sustainable livelihoods.
- Enhancing economic resilience requires policy support, livelihood diversification, improved resource management, and targeted interventions aligned with Sustainable Development Goal 8.

Keywords

Indigenous communities, Sustainable Development Goal, Man-land ratio, Sustainable livelihood, Rural economy, West Bengal

Received:
2 August 2025

Received in revised form:
26 February 2026

Accepted:
24 April 2026

1 Introduction

Creating sustainable livelihood opportunities is a pressing demand for the developing countries, especially in the Global South. South Asia is one of the most populous regions, also among the most socio-economically vulnerable regions in the world.

It is reported that more than 65% of the working adults who mainly rely on agriculture and allied sector are poor, and they particularly belong to South Asia and Sub-Saharan Africa (Hussain et al. 2024; Gusha et al. 2026). India is among the drought-prone countries, where about 53% of geographical area is either arid or semi-

arid; farmers relying on dry-land for agriculture are particularly vulnerable (Leena et al. 2024). A study by Karamchedu (2024) reported that while there is a marginal increase (1%) in absolute share of wages and salaries as part of agricultural households' income between 2003 and 2019, there is a significant decline in the share of crop income (by 10%) during the same period. Within India, the Eastern Indian region is furthermore vulnerable due to drought-prone, frequent floods or cyclones, lack of economic diversification, poor agri-infrastructure and warehousing, and lack of farm mechanization amongst others. This region is also inhabited by multi-ethnic groups who mainly live in the hilly regions, plateaus and dry regions (Behera et al. 2024). Therefore, livelihood of these communities remains under stress, and therefore, it requires a multi-pronged approach to address the livelihood issues in these regions. This requires a thorough understanding of multiple stressors and livelihoods for achieving sustainable livelihoods (Berchoux et al. 2019).

Dry land areas of West Bengal that spread across undivided West Midnapur, Bankura, and Purulia inhabit a large proportion of rural households including the indigenous tribal communities who are among the poorest and mainly rely on agriculture and allied activities. These dry land areas are part of the Chhotanagpur plateau which spread across the erstwhile *Jangal Mahal* and Manbhum areas of West Bengal and the adjoining Jharkhand state. A majority of the geographical region which includes the drylands of West Bengal are within the Western Plateau and Highlands. These areas lack basic infrastructure, irrigation and poor agricultural extension, which is associated with other social issues and economic constraints that compel people to live under perennial livelihood stress. Some portion of the plateau region is also a part of the Red Corridor, India (Sultan 2014). These neighborhoods are some of the most underprivileged in the nation. The area needs to catch up regarding income, literacy, and health. Furthermore, the geographical terrain is characterized by rolling hills and consists of porous lateritic soil, leading to inadequate moisture in the lower soil layers (Roy & Hazra 2020; Bhattacharjee & Siddique 2016), which makes it difficult for poor farmers to yield desired outcome. One of the major problems that is most visible across the region is persistent poverty and social inequality.

1.1 Conceptual Framework of the Current Study

The theoretical framework provides a comprehensive understanding of the diverse factors and dynamics that affect rural livelihoods. In this regard, marginalized people face disparities in terms of caste, gender, social status, and indignity. Additionally, socioeconomic disparities increase the probability of destitution among vulnerable households (Natarajan et al. 2022; Olsson et al. 2014). As a result, the rural economy is experiencing distress due to a low man-to-land ratio and a higher number of dependents, leading to pseudo-employment or unemployment. The impoverished state of the population in terms of income, education, and health is exacerbated by the abundance of forests and uncultivated land, as well as a lack of development initiatives (Mandal 2022). Our article explores different avenues of agrarian livelihood in the context of SDG 8. Sustainable livelihood (SL) aims to move beyond traditional definitions and techniques of poverty reduction (Singh & Hiremath 2010; Henderson & Loreau 2023). These are inadequate or overly limited because they focused solely on specific features or indicators of poverty, such as income inequality, or failed to consider other significant aspects of poverty, including insecurity and societal exclusion (Mahato & Gaurav 2026; Krantz 2001; Subramanian et al. 2023).

1.2 Sustainable Livelihood Approach

Sustainable livelihoods offer a more realistic and integrated strategy to alleviate extreme poverty (Morse 2013; Mahato & Jha 2024). In this paper, the emphasis is on advancing comprehensive and productive employment, enhancing working conditions, and fostering sustainable, inclusive economic growth to achieve a more equitable society. The livelihoods of small rural farmers in the global South are complex and distinctively multi-faceted, necessitating an interdisciplinary (holistic) understanding of the connections between the different sectors and occupations that make up a livelihood, as demonstrated by livelihoods research (Natarajan et al. 2022).

In this regard, the indigenous population requires resilient subsistence sources to meet their fundamental needs and sustain their way of life (Mahato & Gaurav 2026; Ramesh 2013; Banerjee & Ghosh 2015). Furthermore, the current work paid attention to livelihood diversification, which significantly increased well-being, improved health status,

facilitated easier access to services, reduced vulnerability, and increased household financial capital to purchase other household essential goods as outcomes of diversified livelihoods (Dolui et al. 2025; Natarajan et al. 2022; Alamneh et al. 2023; Roy et al. 2023) designed a sustainable livelihood security (SLS) framework to prioritize development and understand sustainability in West Bengal, India. The transition from farm to non-farm, or a combination of farm and non-farm tactics, is necessitated to boost incomes while improving household food security and economic stability (Dolui et al. 2025; Tabares et al. 2022; Gebru et al. 2018).

Our study seeks to answer specific questions: (i) What are the underlying causes of enduring poverty in the focused region? (ii) What are the factors contributing to the historical underdevelopment of the dryland areas? and, (iii) How do people cope with the livelihood risks in their day-to-day lives? Furthermore, this article proposes viable measures to enhance the rural economy. In recent years, some scholars have made significant contributions to this area and have examined the impact of underdevelopment on spatial dynamics. Studies on contemporary social conflicts and the importance of forests in marginal settlements in the region (Mahato & Gaurav 2026; Mondal et al. 2019; Sultan 2014; Dan 2015; Bhattacharjee & Siddique 2016; Dhibor & Siddique 2017) conducted a study identifying inequities in land allocation, unemployment, adverse labor conditions, and limited access to extension services as the primary factors contributing to poverty in the region. It is essential to recognize that previous research has primarily focused on specific concerns without offering viable ways to adequately mitigate and eradicate the related risks. The present study provides an empirical framework for comprehending the advantages and disadvantages of various economic strategies for a resilient rural economy. In this research, we sought to identify the factors contributing to chronic poverty among marginalized groups within the defined area and to investigate possible solutions to mitigate its effects.

Additionally, the present work aims to explore the potential and available resources for enhancing the rural economy in the selected region. Further, special emphasis was placed on examining the historical background and economic factors that influence the relationship among spatial inequality, poverty-related depression, and the geographical characteristics of the selected dryland region. The analysis section exhibits the fundamental causes of the pervasive suffering and poverty experienced by marginalized populations in the research area.

Further guidance on pertinent policies and actionable measures to address local community needs in the current economic context is required. Furthermore, the current research suggests establishing a “resilient economy” based on small-scale land ownership to protect the economically dependent rural population.

2 Methods

2.1 Survey design

The study was conducted in four dryland districts of West Bengal. In the first stage of the research, we selected study sites and households from the four districts: Bankura, Purulia, Jhargram, and Paschim Medinipur, using a multistage random sampling technique (Fig. 2). Further, twelve (12) Community Development Blocks (CDBs) were chosen in the second stage from respective districts, as displayed in Fig. 1. The name and details of the sample selection procedures are depicted in Table 1.

2.2 Case study selection

Sahoo et al. (2023) stated that the marginal households in the region exhibit significant disparities, characterized by dense settlements in specific areas. The region in investigation comprises 15% Scheduled Tribes (STs), are considered the oldest, traditional, economically disadvantaged, socially backwards, and marginalized group in Indian society. And, 22% Scheduled Castes (SCs), who face severe social, educational, and economic disadvantage because of the traditional system of untouchability of the total population (Dolui et al. 2025). According to the 2011 Census of India, the percentages mentioned above represent 6% and 23.5% of the state’s total population. It is observed that the selected demographic groups encounter obstacles in accessing fundamental utility services. A large section of them lacks legal title to the land they possess (Basu & Chatterjee 2014; Bhattacharjee & Siddique 2016). Furthermore, a considerable proportion of the participants perceive forests as essential for their subsistence. Most individuals in the region engage in intensive subsistence cultivation. Various factors, including rainfall, limited subsurface water supplies, rocky soil, constrain agricultural activities in this region (Sahoo et al. 2023). The fluctuating rainfall patterns, including occasional dry monsoon months, significantly affect the crop’s susceptibility and yield. That

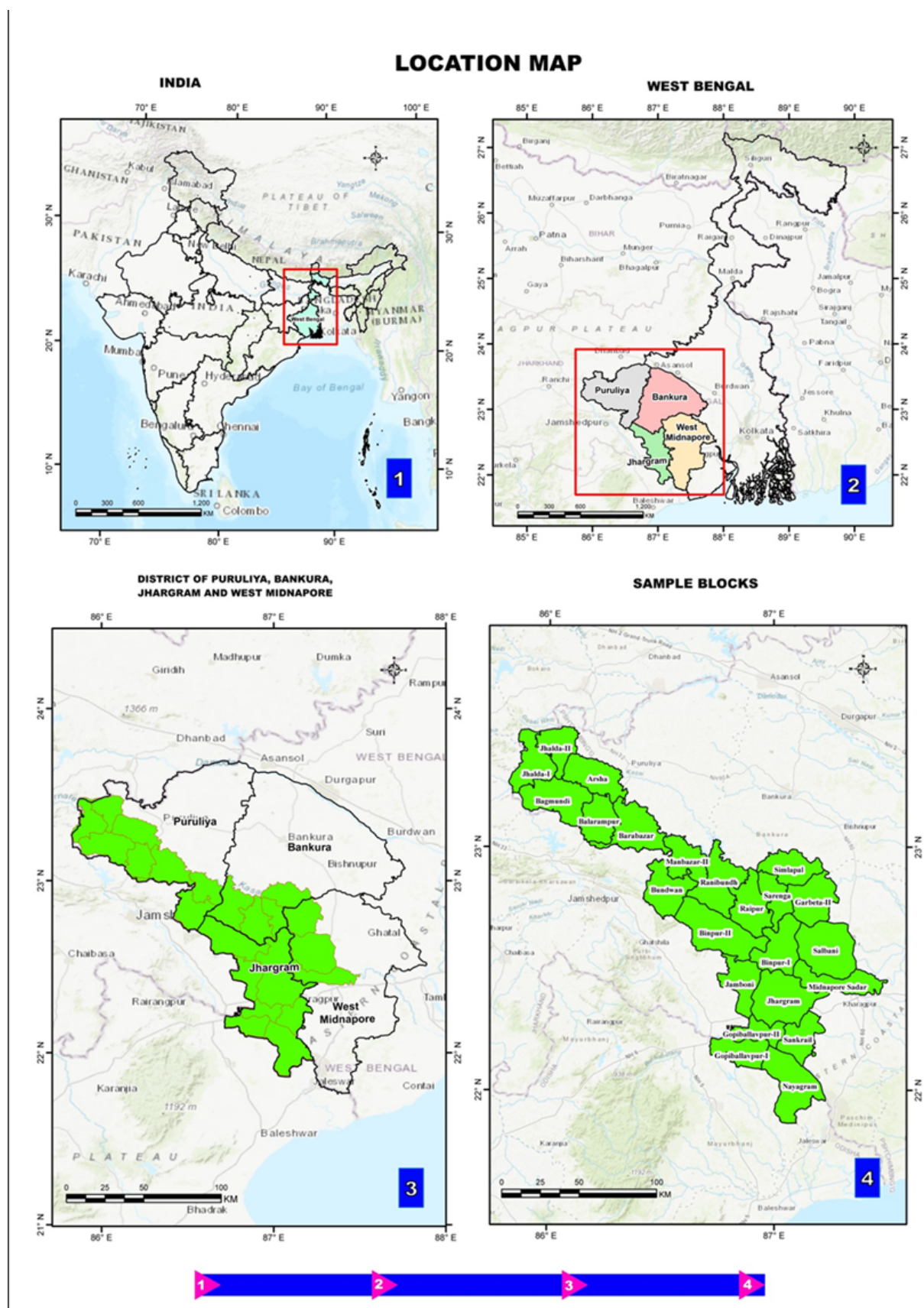


Fig. 1 Location of the study area. Source: Prepared by the authors.

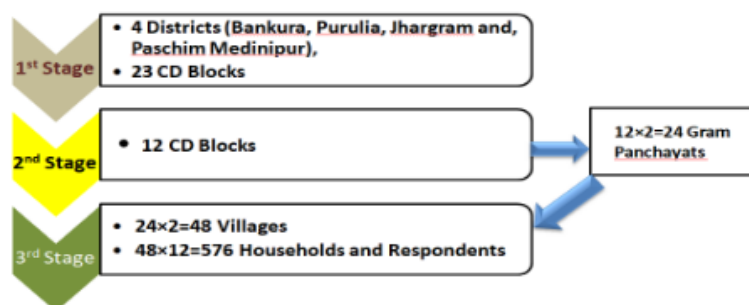


Fig. 2 Multistage sampling framework

leads to reduced productivity and revenue for farmers (Sivakumar et al. 2005; Sudha Rani et al. 2015). In the third stage, twenty-four (24) gram panchayats (GP) have been chosen for fruitful study. Additionally, two villages were selected from each GP. In this process, 48 villages ($24 \times 2 = 48$) were chosen from the CDBs at the third stage (4 villages per CDB). Then we interviewed 576 respondents (one from each household) aged 30 to 60 years as this age group is actively involved in economic activities in the selected region. Each village consisted of 12 households, totaling $12 \times 12 = 144$. The fieldwork was conducted in three phases (Fig. 2) from March 2020 to August 2022.

3 Results

3.1 Descriptive analysis of study data

The results of the current study basically start here. In this section, we have discussed the descriptive features of the results. The fundamental elements that contribute to the problem at hand, while also assessing the importance of SDG 8 in ensuring

the long-term survival and well-being of marginal communities. It has been observed that the research participants possess a wide range of landholdings. Table 2 shows that 34% of the respondents are marginal farmers, as they occupy less than an acre of land.

Land Sizes	Pattern of Landholdings	Percentage Distribution (%)
0	Landless	16
Up to 1 acre	Sharecropper	32
Up to 1 acre	Marginal	34
1-2 acres	Small	18
2.1-4 acres	Medium	0
Above 4 acres	Large	0

Source: Field survey; N=576 (100%)

Table 2 Distribution of land holdings

Moreover, 32% of our research participants are sharecroppers. The proportion of landless respondents is also remarkably significant, i.e., 16%. Furthermore, small farmers comprise 18% of our total of 576 participants. Another interesting find-

CDBs	GPs	Villages	No. of Respondents
Jhargram	Lodhasuli, Radhanagar	Saltoria, Santaldiha, Joykrishnapur, Kuldiha	48
Binpur-I	Baita, Lalgah	Jashpur, Baita, Lalgah, Netai	48
Binpur-II	Belpahari, Banspahari	Belpahari, Bamandiha, Chakadoba, Panchapani	48
Salboni	Shalboni, Shatpati	Bulanpur, Chaktarini, Satpati, Pathri	48
Garbeta-II	Goaltore, Makli	Mahalisai, Bandhi, Peruabad, Amjhore	48
MDP Sadar	Dherua, Shiromani	Shirishdanga, Chandra, Barua, Shiromani	48
Sarenga	Goalbari, Sarenga	Goalbari, Sukhadali, Kuldiha, Sarenga	48
Raipur	Raipur, Dheko	Dharampur, Uparbanda, Baksi, Dheko	48
Ranibandh	Ranibandh, Rautara	Ranibandh, Laldi, Khejura, Rautara	48
Bandwan	Kumra, Bandwan	Harada, Jashpur, Sirsigora, Bandoan	48
Baghmundi	Ajodhya, Baghmundi	Rella, Chorida, Baghmundi, Rangadih	48
Jhalda-I	Jhalda-Darda, Ilu-Jargo	Jhalda, Baghbinda, Ilu, Jargo	48

Source: Most deprived villages were chosen from the Socio Economic Caste Census (SECC) data 2011.

Table 1 Details of the Sample Selection Framework

Characteristics	Bankura	Purulia	Paschim Medinipur	Jhargram
Literacy rate of households (%)	55	47	74	60
Average income of households (Rs/year)	120000	60000	180000	80000
Average land size of households (in acre)	1	2	2	1
Households having electricity connection (%)	100	100	95	85
Households having sanitation facilities (%)	45	40	70	25
Households using affordable drinking water (%)	60	45	80	55
Households have irrigation sources in dry months (%)	15	8	75	10
Households practice monocropping (%)	85	95	30	90
Households possess above 1 acre of fallow land year around (%)	85	90	10	60
Households produce paddy below 5 quin/bigha (%)	90	90	10	90
Households produce potatoes commercially (%)	5	0	90	0
Households do not have a permanent income source (%)	90	95	65	95
Households work as agricultural laborers (%)	68	70	80	85
Households work as daily wagers in the unorganized sector (%)	25	65	20	90
Households are recently deprived of 100 Days of work (%)	55	66	78	75

Source: Field survey. Furthermore, our research participants reported that they have not obtained 100 Days of work in the last two years. However, it was not available for all the household(s) members earlier. Participants from Paschim Medinipur and Jhargram reported greater unavailability; however, participants from Bankura and Purulia reported comparatively less, with percentages of 55

Table 3 Socioeconomic Characteristics of Sample Household

ing from this study is that there are no medium and large-sized landholders among our research participants. Table 2 illustrates the various types of land holdings. From there, we can infer that our respondents simultaneously participate in multiple economic functions. The average monthly income from a particular source is inadequate to sustain their way of life.

Table 3 presents socioeconomic characteristics of surveyed households and Table 4 presents the livelihood sources of the selected respondents and their corresponding monthly earnings. The primary data revealed that 75% of the research participants are agricultural laborers, and 92% of the respondents are involved in ranching livestock. Also, 55% of households earn Rs. 2000 monthly, directly or indirectly, from forest products.

Earning Sources	Ave. Earning/ Month (Rs.)	Households in %
Agricultural labourer	2000	75
Factory worker	5000	27
Livestock	3000	92
Forest resources	2000	55
Cottage industry	2000	68
Shopkeeper	5000	12
Farming	2000	85

Source: Field survey

Table 4 Major Sources of Income

From Table 4, we can see that the households' average annual income across the four selected districts.

Moreover, the districts of Purulia and Jhargram are the most disadvantaged, whereas Paschim Medinipur is much better in terms of income standards and job availability. This could be due to the lack of irrigation facilities in the four surveyed districts. This table shows that 75% of the land in the Paschim Medinipur district is irrigated. In contrast, Bankura and Purulia are the least facilitated, with only 8% to 15% of the total land possessed by the research participants (N=576). Moreover, irrigation is directly linked to the cropping pattern of the targeted region. As a result, almost 90% of the land is cultivated only during the monsoon months, while a total of 70% of the land is cultivated as multi-cropped in the Paschim Medinipur district.

3.2 Inferential analysis of data

This section exhibited the statistical inferences from the quantitative analysis performed in this work. A Kruskal-Wallis test was performed, a nonparametric version of one-way ANOVA. Usually, failure to meet the assumptions for parametric ANOVA justifies its use. This can lead to the overuse of Kruskal-Wallis ANOVA because, in many cases, a logarithmic transformation would normalize the errors. When a parametric test meets its assumptions, using a nonparametric test results in an unnecessary reduction in power. Only when one cannot meet the assumption of approximate normality of observations, or when analyzing an ordinal variable, is the Kruskal-Wallis test in Table 5 a more suitable option. The null hypothesis assumes no statistically

significant differences among the average total annual income across CDBs. This study used a robust generalized linear model with a Gaussian family and log link. Because this regression performs better with outliers in the data and a generalized linear model (GLM) in Table 5, it allows the error distribution to be any distribution other than the Gaussian distribution.

Response: average total annual income; Factor: CDBs
Kruskal-Wallis chi-squared = 127.56, df = 11, p-value 2.2e-16

Source: Compiled by the authors

Table 5 Kruskal-Wallis rank sum test

The average total annual income for the different CDBs is statistically different (p-value) as shown in Table 5. This is shown by a Kruskal-Wallis test (non-parametric one-way ANOVA). After detecting a substantial difference, we perform pairwise comparisons for each block with a p-value correction for type-I error in Table 6. Table 6 used pairwise Wilcoxon tests with Holm's p-value correction method to determine whether there are significant differences in average total annual income between any two CDBs. Where the p-value is less than 0.05, there is a significant difference (0.00024, 0.01846, 0.02862, 0.00312, and others). It shows that there is significant differences between the CDBs Baghmundi and Binpur-I, Jhaldai and Baghmundi, and Garhbeta-II and Bandwan CDBs. This indicates that the livelihood means of these CDBs in terms of average total annual income differ from those of other CDBs, as evidenced by their statistical significance (p-value is <0.05). The multiple linear regression model is a particular case of GLM with a Gaussian distribution and an identity link.

Since we took the log link, we cannot interpret regression coefficient estimates like we do for multiple linear regression. Table 7 shows significant correlations between the number of dependents, total unemployed members, total earning members, daily wages, daily expenses, and the production of paddy and potatoes, on average annual income (Rs.). The level of significance is set to 0.05.

3.3 Synthesizing the results

In this section, we focused on synthesizing the results from the whole analysis. Insufficient human resources, limited access to lucrative opportunities, and an unfavorable population-to-land ratio (in Tables 2, 3, and 4) have collectively hindered economic development in the region. The

scarcity of irrigation facilities led to a large portion of our respondents' land being fallow. Due to monocropping, at least 65% of the total population remains engaged in agriculture as daily wage earners. All these factors impact the annual per unit yields of staple crops, mainly paddy (5 qin/bigha), and commercial crops, mainly potato, in Bankura, Jhargram, and Purulia districts. The Paschim Medinipur district's scenario is satisfactory because irrigation and multiple-crop production facilities are higher in this district. This has significantly contributed to the widespread impacts of poverty, as shown in Tables 3 and 4. Furthermore, the overall proportion of households relies on all these economic activities for sustenance. The research participants relied on diversified sources for their livelihoods, as shown in Table 3. However, the MGNREGA (100 Days work programme) plays a crucial role in financially supporting the residents of our study area. Because no single profession is sufficient to sustain a livelihood or fulfill basic human needs. Therefore, the participants rely on multiple informal sources of income, among which livestock, agricultural labor, cottage industry, and farming account for the largest share. And these are 92%, 75%, 68% and 85% of the total 576 participants. Individuals require support from governmental and non-governmental organizations to assess potential threats to their livelihoods and to establish a sustainable, reliable source of financial assistance.

The current study has outlined the existing challenges and emphasized the need to reduce the associated risks. Therefore, we evaluated the diverse opportunities and resources available to boost the rural economy. The results of the multiple linear regression model, a robust GLM with a Gaussian distribution in Table 7, examined the impact of various factors, including economic activities, job types, arable land, migration types, commercial crops, and education, on three dependent variables, while also taking other factors into account. The analysis indicates that each variable has a statistically significant effect on the dependent variables. Considering additional factors, we find a statistically significant difference in the dependent variables across various types of economic activity, with financial activity as the most critical. Fig. 2 illustrates the key livelihood constraints present in the area.

Our participants hailed from a socioeconomically underprivileged region. Their possessed land is insufficient to support their livelihoods. The findings showed that a poor human resource base and an unfavorable man-land ratio significantly affect household income, expenditures, and savings,

	Baghmundi	Bandwan	Binpur-I	Binpur-II	Garhbeta-II	Jhalda-I	Jhargram	MDP Sadar	Raipur	Ranibandh	Sarenga
Bandwan	1.00000	-	-	-	-	-	-	-	-	-	-
Binpur-I	1.30e-09	2.6e-11	-	-	-	-	-	-	-	-	-
Binpur-II	0.00024	2.7e-05	1.00000	-	-	-	-	-	-	-	-
Garhbeta-II	1.00000	1.00000	2.8e-06	0.00215	-	-	-	-	-	-	-
Jhalda-I	0.61960	0.02862	3.6e-07	0.02295	0.91397	-	-	-	-	-	-
Jhargram	0.01846	0.00312	0.17012	1.00000	0.01834	1.00000	-	-	-	-	-
MDP Sadar	1.00000	0.94640	0.00510	0.67868	0.813470	1.00000	1.00000	-	-	-	-
Raipur	1.00000	1.00000	1.1e-05	0.03288	1.00000	1.00000	0.45637	1.00000	-	-	-
Ranibandh	0.18654	0.59664	3.5e-12	3.0e-07	1.00000	0.00015	1.10e-05	0.01452	0.03405	-	-
Sarenga	0.21879	0.36484	6.0e-10	4.3e-06	1.00000	0.00272	2.7e-05	0.03010	0.06003	1.00000	-
Shalboni	1.00000	1.00000	0.00080	0.15931	1.000	1.00000	0.68618	1.00000	1.00000	0.339960	0.54506

P value adjustment method: holm; source: Compiled by the authors

Table 6 Pairwise comparisons using the Wilcoxon rank sum test with continuity correction

	Estimate	Std. Error	z value	p-value
(Intercept)	1.15E+01	3.24E-06	3544013	0.000
No of dependents	2.10E-02	5.57E-07	37670	0.000
Total unemployed members	-4.42E-02	4.55E-07	-97212	0.000
Total earning members	-9.50E-03	3.19E-07	-29772	0.000
Daily Wages	-2.75E-04	8.32E-09	-33100	0.000
Daily Expenses	5.13E-04	1.42E-08	36140	0.000
Paddy production (Quin/bigha)	2.68E-02	3.13E-07	85697	0.000
Potato production (Quin/bigha)	-1.92E-04	2.41E-08	-7980	0.000

Source: Compiled by the authors

Table 7 Robust generalized linear model with Gaussian family and log link. Response: Total average annual income (Rs.)

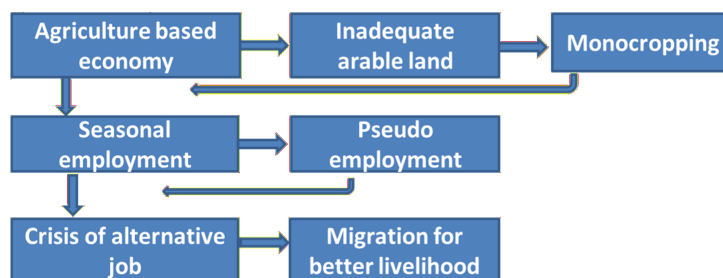


Fig. 3 Main factors behind the challenges

contributing to the region's chronic underdevelopment. However, increasing resource productivity through increased access to specialized training to develop competence is critical. Their socioeconomic disadvantage is connected to their lack of formal education. Food security, health, and education are among the basic livelihood constraints in the region. The current employment conditions in West Bengal and India have led to a lack of motivation among the young population to pursue education beyond school completion. This situation forces

many male members to drop out from the school or college education in search of livelihood through migration. Additionally, women need to commute regularly to daily-wage jobs. In this area, there is a disparity between those who earn income and those who rely on others for financial support.

4 Discussion

The inhabitants of the specified research area experience profound effects from persistent disparities, which intertwine with multiple forms of unjust treatment related to caste, economic standing, and indigenous identity. The livelihood crisis is a complex issue encompassing interconnected and overlapping economic, political, and social inequalities (Mahato & Gaurav 2026; Hemmasi & Prorok 2002). Unjustified land distribution, unemployment, inadequate working conditions, and limited access to extension facilities are the primary causes of the livelihood crisis in the region. According to Chada & Pulla (2014), the issue is associated with resource scarcity, prejudice, seasonal work, exclusion, and the consequent decline in quality. This perpetuates a cycle of poverty from which the rural inhabitants find it difficult to escape. The area marked by drought and semi-arid conditions sees a substantial decrease in annual rainfall. Moreover, this climatic situation has negative consequences for the agricultural sector. Most farmers are small marginal holders who are reliant on their meagre landholdings for self-cultivation and lack investment. This hinders the effective implementation of measures such as adopting new agricultural management practices. Lack of finances in rural areas hinders the smooth advancement of agricultural and rural modernization (Janker et al. 2021; Yin et al. 2022). Agriculture primarily generates the district's gross domestic product (GDP) revenue. Furthermore, climatic conditions influence the agricultural productivity of rural areas. The current volatility of climatic factors has increased complexity. As a result, residents in the designated geographic region implemented a monocultural strategy that involved cultivating the Kharif crop exclusively from June to November. There are no such alternative income opportunities. Firstly, agriculture, factories, and construction sites employ the majority of migrant laborers. Secondly, they continue to work within a radius of fifty kilometers of their residence.

To cope with the livelihood risks, the male population is migrating to urban areas to address economic challenges and ensure sustenance in rural areas (Natarajan et al. 2022). In light of the previous discussion, it is prudent to implement strategies to enhance livelihood diversification and alleviate the associated risks, as illustrated in this study. Off-farm diversification, defined as expanding economic activities beyond the source location, has attracted significant attention in the scholarly literature (Marchiori et al. 2012; Ellis 2000). Paavola

(2008) argues that migration has been the subject of arguments that imply its potential to generate remittances through waged employment, thereby offering a means to alleviate the poverty trap.

As a result, it is imperative that policy instruments effectively address the decline in demand while also accounting for the intricate social factors (Mustapha et al. 2025; Sen & Himanshu 2004). There are additional ways they can generate income and develop a greater capacity to manage the crisis (Guha & Das 2013). Implementing long-term mitigation strategies in conjunction with local execution would produce beneficial results. Furthermore, based on the results and discussions, it is recommended to promote forestry growth through small-scale plantations and to implement sustainable management practices to increase productivity and financial stability. Additionally, the potential to expand the forestry and forest product industries is highly promising for the long-term health of rural economies and the people in the region. Prioritizing efficient resource use through effective land management for agroforestry and related activities is essential for enhancing livelihoods and promoting the development of small landholders (Natarajan et al. 2022; Tabares et al. 2022). From this perspective, Wani et al. (2017) argued that, to alleviate rural poverty and achieve targeted outcomes effectively, entrepreneurs should collaborate with small-scale growers as co-investors. It is necessary to prioritize farm forestry practices that address the fundamental needs of small landholders, thereby improving rural economies by optimizing resource use and enabling practical learning opportunities at no cost.

Moreover, these pathways sought to educate rural residents on how to build a more resilient agricultural community. It is essential to improve resource utilization efficiency by implementing specialized educational courses that develop expertise and practical skills. This strategy will contribute to the comprehensive advancement of the region. Implementing land zoning and management practices is essential in agrarian regions. Moreover, supporting small-scale enterprises engaged in pomiculture, market gardening, agroforestry, and forest products is crucial to a comprehensive commitment to sustainability. Furthermore, providing low-interest loans to small-scale enterprises involved in farm forestry and livestock is vital, with a focus on enhancing productivity. This innovative approach involves actively engaging local community members and providing suitable training programs. Stakeholders can efficiently advance financial inclusion by focusing on sectors such as food processing,

horticulture, medicinal plant cultivation, and mixed farming.

This study considered primary data from a field investigation. A cross-sectional survey design was followed to collect information from the research participants. During the ground-level in-depth field survey, I needed to handle many sensitive aspects, like participants' identity, their family history issues regarding caste and untouchability, and problems due to early marriage. Therefore, I kept all the research participants anonymous. Another important thing to note is that all participants' incomes are self-reported for this paper. Therefore, these are some limitations of this study.

5 Conclusion

The issue of marginalization has affected participants' economic well-being and overall human well-being. The study has noted that a considerable number of respondents experience financial hardships, with their distress further exacerbated during crises. Heightened marginalization, discrimination, and social inequality exemplify adverse externalities in an interior location. Therefore, it is essential to implement measures to strengthen communities by fostering the area's knowledge economy. The administration should prioritize promoting diverse alternative economic activities that foster comprehensive growth. Meticulous planning and implementation of small family farms provide financial stability and a sense of self-esteem to individuals. A greater number of social enterprises should assume leadership in advancing agroforestry through private partnerships. Policies, monitoring, and evaluation must be intentionally incorporated into the response. An exemplary society would possess advanced annexations and infrastructure, the capacity to implement transformative reforms, and a stable future for rural inhabitants. Further research is required to determine how sustainable management strategies enhance financial prospects and environmental benefits across different temporal and spatial scales.

Acknowledgement

The authors would like to express sincere appreciation to the residents of the chosen region for their cooperative efforts throughout the survey and interview. This manuscript is written by the first author, including drafting, field survey, analysis, reviewing. The second author has helped in statistical analysis. The third author has added valuable comments and suggestions to give the final shape of the manuscript. All the authors are thankful to the reviewers for their ideas, comments and suggestions, which immensely improved the quality of this research ar-

ticle. The first author is thankful to her doctoral thesis supervisor to allow her to work on this subject.

Availability of data and material

The datasets generated and analyzed during the study are not publicly available to protect participants' confidentiality. However, one can access it from the corresponding author, upon reasonable request.

Author Contribution Statement

The first author is collected primary data, analyzed the data, prepared the tables figures, drafted the manuscript, the second author helped in statistical analyses and third author was responsible for the final editing of this article.

Ethics approval

The author worked on primary data. Before recording the responses of the respondents, we took their consent. All the participants and respondents are anonymous. However, this study does not require ethical approval.

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