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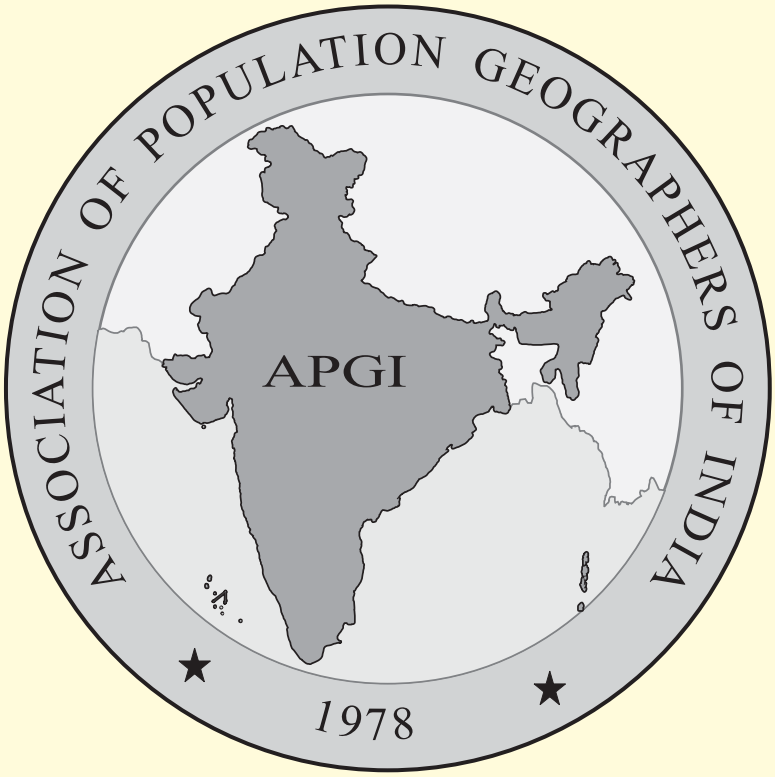

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POPULATION GEOGRAPHY

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From the Editor's Desk

In the first issue of 2025, the *Population Geography* journal features articles focused on various aspects of population, as diverse in thematic connotation, subject treatment, and focus areas as possible. These articles examine the attributes and activities of specific groups of people across different regions of the country. Some studies utilise secondary data, particularly Census data, which is limited to the year 2011.

A study examines the performance of political parties in an assembly constituency in Haryana, as well as the transactional and non-transactional factors that influence voter behaviour. In any election study, it is crucial to understand the elements that shape voting behaviour.

An article explores interstate labour migration to South India, highlighting that younger migrants seek employment, while the labour force is trending towards seasonal and informal work. Another study on Mysuru city examines the impact of migration on individual well-being, suggesting that understanding these dynamics can help policymakers and migrants tackle challenges and promote urban growth and integration.

An analysis of 20 community development blocks in Puruliya district reveals that agricultural workers are increasingly diversifying into non-agricultural jobs. Despite challenges, this trend holds promise for generating resources and creating jobs, which could potentially improve living standards in the rural economy.

One study highlights disparity in maternal healthcare access in Punjab, particularly among scheduled castes, and calls for improved education and outreach. Another one from West Bengal shows higher undernutrition rates in Scheduled Tribe children, underscoring the need for targeted education and better healthcare access.

An assessment of rapid urbanisation in a peripheral area of the Kolkata Metropolitan Corporation (KMC) focuses on changes in land use and predicts trends up to 2040. It highlights the need for detailed micro-level planning, phased implementation, conservation of designated spaces, and continuous monitoring to mitigate negative impacts.

Highlighting disparities in development levels in the Jalpaiguri and Alipurduar districts, a comprehensive approach to human resource development is essential, emphasising the need for proactive measures and diagnostic plans to achieve balanced regional development at the grassroots level.

Haryana has experienced a significant increase in the number of higher education institutions, including colleges and universities, particularly since 1991, largely due to private investment. However, some districts still lack these educational institutions.

An article explores everyday Hinduism and local sacred sites, highlighting that Hindu householders often visit these places throughout their lives. A survey in five villages in Haryana suggests that understanding grassroots Hinduism is crucial for grasping how the religion is practised by the masses in India.

Lastly, we deeply appreciate the reviewers' support in this endeavour. Their keen insights, interventions and timely delivery are gratefully acknowledged and appreciated.

Nina Singh

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Spatio-Temporal Analysis of Electoral Performance of Political Parties in Narnaund Assembly Constituency, Haryana

Krishna Mohan and Deepak Arya[1]

To cite this article: Mohan, K. & Arya, D. (2025). Spatio-temporal analysis of the electoral performance of political parties in the Narnaund assembly constituency, Haryana. *Population Geography*, 47(1), 1–12.

Abstract

The paper is an effort to trace the spatial pattern of support and electoral performance of political parties at a sub-assembly (Narnaund) level in the 2009, 2014 and 2019 state assembly elections. The paper is based on secondary vote share data to the parties compiled from Form-20 (Final Result Sheet) of the Election Commission of India. Descriptive statistics, frequency tables, and maps were used as analysis tools. It was found that the assembly witnessed two tri-polar contests in 2009 and 2014, and a bipolar contest in 2019. Bhartiya Janta Party (BJP) was the only consistent party in the assembly, as it increased its vote share in every election. The spatial pattern of support suggests that the BJP dominated the eastern part of the assembly, while the Indian National Lok Dal (INLD) dominated the southern part. The western part was a direct battlefield for the BJP and the INLD. Both parties had stable support in the assembly. INLD lost much of its support base to the Jan Nayak Janta Party (JJP) in the 2019 elections.

***Keywords*:** Assembly elections, party performance, spatial pattern of support, Narnaund assembly constituency.

Introduction

Political parties contest elections through their candidates. Candidates may contest as party representatives or as independents. Those who contest elections under party symbols seek to promote their party's agenda or ideology within the constituency and aim to connect with the state leadership to secure votes. In contrast, independent candidates focus more on local issues and emphasise localism. Nonetheless, various factors influence voting decisions, which can vary from one place to another. Consequently, it is challenging to ascertain why people vote in a particular manner (Amani,

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1974). Additionally, the level of political office is a significant factor in voting patterns, as voters tend to participate more in assembly elections than in Lok Sabha elections (Chandidas, 1972).

Not only the voting participation but voting behaviour also changed with the level of elections. A study analysed the voters' preferences in assembly vis-à-vis parliamentary elections and also traced the positive correlation between voter participation and urban development. Further, the study finds out the regional and temporal variations in the voting participation of women. The research concludes that secular considerations play a more important role in parliamentary elections than state assembly elections, where local, regional and ethnic issues become more important (Sharma, 1992).

State politics and local issues played an important role in the voting pattern at the assembly level. The state politics interacted with national politics. Haryana is one of the best examples of this phenomenon, as the last four state elections were won by the parties that won the national elections. Thus, state politics or local politics (at the assembly level) are sometimes realigned under national party labels and also under politicians (Wallace, 1980).The assembly elections of 2014 considered a paradigm shift in the state politics. The election was considered a turning point in state politics as a new party grabbed the state's power for the first time (Singh, 2014). This was also an example of the realignment of state politics with national politics. The election was labelled by a party as well as a politician.

Political parties also strive to increase their vote share. Parties try many ways to win voters' support, one of which is to attract voters from competitor parties. However, the potential to attract votes in different ways differs by party and place (Lichteblau, Giebler, and Wagner, 2020).

Electoral geography is concerned with mapping the voting distribution and is explained by non-spatial sociological factors. It also traces the spatial patterns of support for the different parties. This support may vary from place to place and election to election (Agnew, 1996& Sharma, 2006).

Electoral Performance

The Narnaund assembly constituency in Haryana had a tri-polar contest in the 2009 assembly elections as the top three performers secured above 90 per cent of votes, while all other had less than 10 per cent. In 2014, it was again tri-polar as the top three performers secured above 88 per cent of votes, but the others got less than 10 per cent. It was bipolar in the 2019 assembly elections as top two performers secured above 88 per cent of votes, and none of the others secured 10 per cent or above. In terms of parties, it was among the Indian National Lok Dal (INLD),

Bhartiya Janta Party (BJP) and Indian National Congress (INC) in 2009. In 2014, it was among the BJP, INLD, and an Independent. In 2019, it was between the Jan Nayak Janta Party (JJP) and the BJP. Thus, four political parties had their vote bank in the assembly constituency (Table 1).

Table 1

Narnaund Assembly Constituency: Vote Share (%) by Political Parties, 2009, 2014 and 2019.

Political Parties	2009	2014	2019
BJP	29.4	34.91	40.07
INLD	37.4	31.13	3.01
INC	29.57	7.28	5.37
JJP	NA	NA	47.97
Others	3.63	26.68	3.58

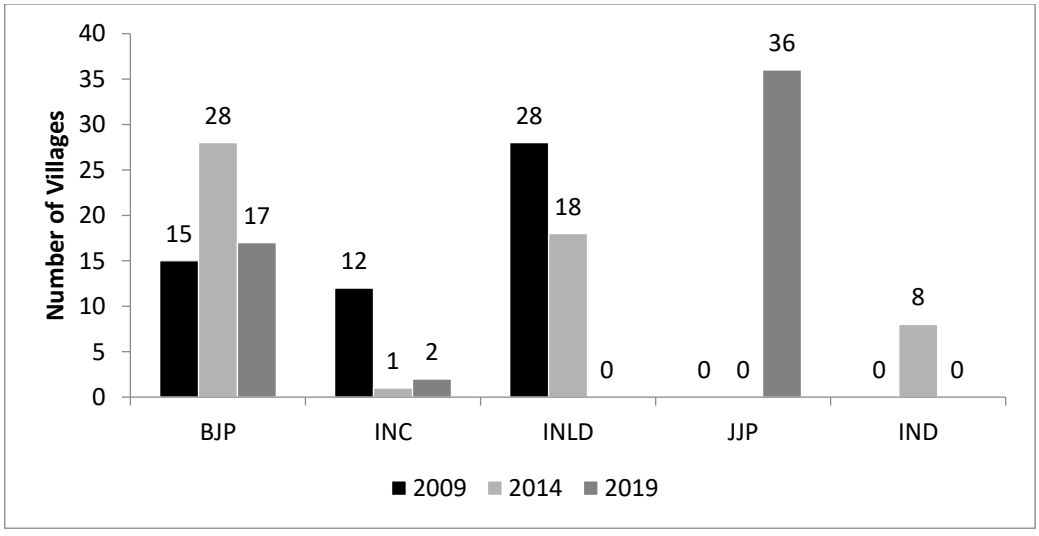
Source: Calculated from Form-20 (Final Result Sheet) of the Assembly.

Village-wise leading and next to leading party status also represents the spatial representation of political parties in the assembly. It is found that the assembly was won by the party that won the maximum number of villages. This was true for all three elections under study. However, the number of winning villages changed, as it was 28 by INLD in 2009, 28 by BJP in 2014, and 36 by JJP in 2019 (Figure 1).

The spatial distribution of political representation suggests that INLD dominated in the northern and southern parts of the assembly. The BJP dominated in the western and eastern parts of the assembly, and a candidate who contested all the three elections but on different symbols,

Figure 1

Narnaund Assembly Constituency: Performance of Leading Political Parties at Village Level, 2009, 2014 and 2019.



*Data is not available at the village level. Polling station-wise data provided by the election commission was recast at the village level. Digits denote the number of villages in which a political party was leading in terms of total votes polled at polling stations of the village.

i.e. on INC symbol in 2009, Independent in 2014 and on JJP symbol in 2019, dominated in the central part. However, INC did not have any specific part, and JJP canvassed almost the entire assembly constituency in the 2019 elections. (Map-1). Further electoral performance and spatial support of these parties will be discussed. Frequency tables and maps of the vote share categories in the assembly present the level of performance. Any party securing above 50 per cent of the vote share in a village is categorised as very high. In the same way, 40 to 50 per cent is high, 30 to 40 per cent is moderate, 20 to 30 per cent is low, and below 20 per cent is very low.

Bhartiya Janta Party (BJP)

BJP is one of the important players in the assembly. The party won the assembly in the 2014 assembly elections. The party's vote share increased continuously from 2009 to 2019. In the 2009 assembly elections, the party secured 29.4 per cent of total valid votes, which increased to 40.07 per cent in 2019 (Table 1). While the distribution of vote share was analysed village-wise, it was found that only two villages were above 50 per cent of the vote share for BJP in 2009, which increased to 10 villages in 2019. Maximum villages voted 20 to 30 per cent of votes to BJP in 2009, 30 to 40 per cent in 2014 and 40 to 50 per cent in 2019. Thus, the party's growth also had its spatial dimensions (Table 2).

Table 2
BJP: Vote Share Category-wise Frequency of Villages

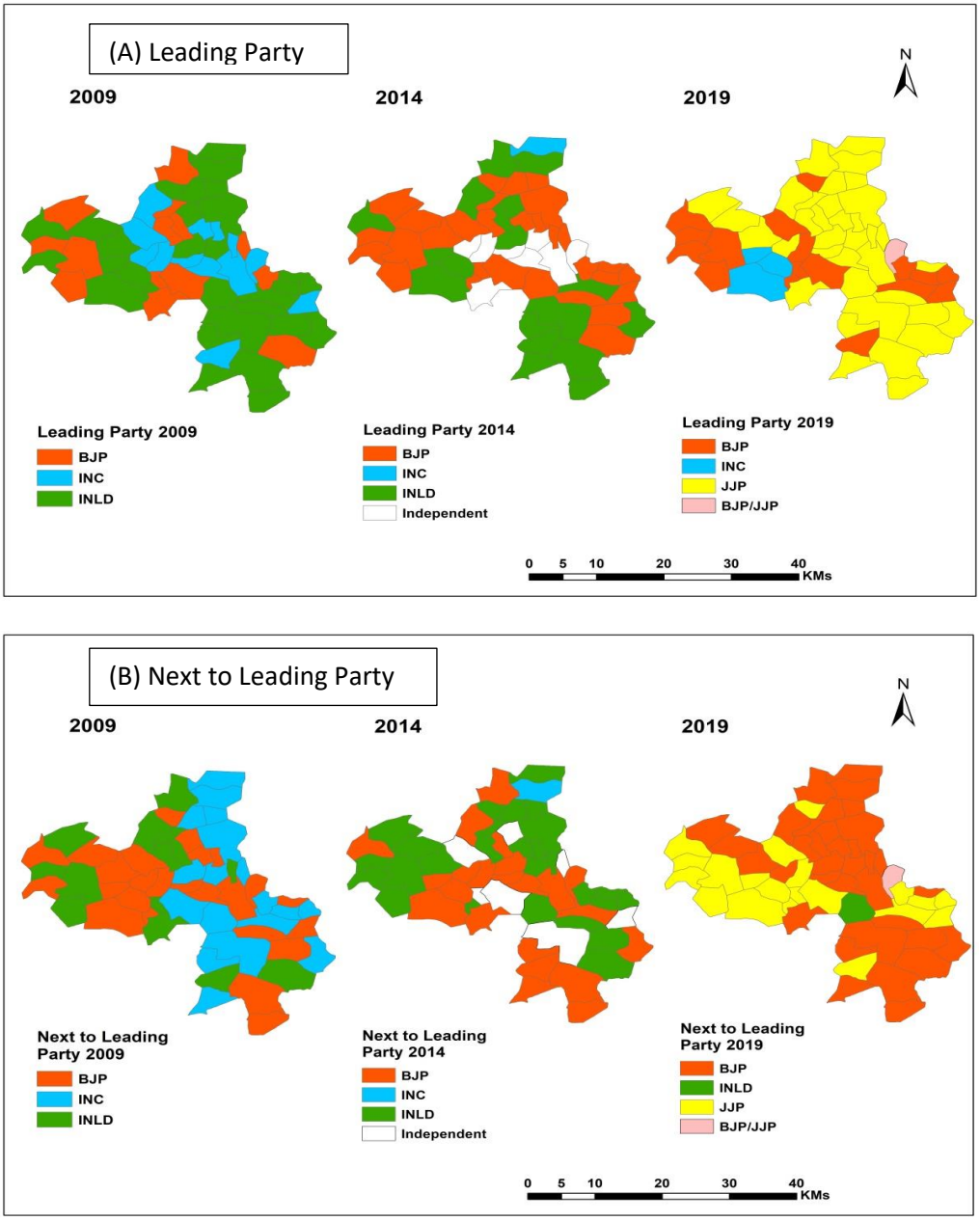
Vote %	BJP 2009	BJP 2014	BJP 2019
	Number of Villages	Number of Villages	Number of Villages
Above 50	2	3	10
40-50	3	14	20
30-40	20	24	20
20-30	22	9	4
Below 20	8	5	1
Total	55	55	55

Source: Computed from Form-20 (Final Result Sheet) by the Election Commission of India for the Assembly

*Polling station-wise data provided by the election commission was recast at the village level. The same holds for subsequent tables.

Map 1

Narnaund Assembly Constituency: Political Representation of Leading Party (A) & Next to Leading Party (B) at Village Level, 2009, 2014 and 2019.



* Data is not available at the village level. Polling station-wise data provided by the election commission was recast at the village level. Maps show the villages in which a political party was leading or next to leading in terms of total votes polled at polling stations of the village.

Note: The Polling station-wise data provided by the election commission was recast at the village level. Further, the Narnaund assembly constituency has 63 census villages, including the urban area of the Narnaund Municipal Committee, which were merged into 55 units/villages for statistical analysis and 51 units/villages for spatial (Maps) analysis (Six Units/Villages represented by two units/villages in map i.e. Bass Badshapur, Bass Akbarpur, Bass Khurd Bejan and Bass Azamshahpur represented by Bass; Sisai Kalirawan and Sisai Bola represented by Sisai).

The vote share distribution was put on the maps for spatial analysis of the party support. In 2009, the party received major support from the western parts of the assembly. Another strong spatial belt was in the eastern part of the assembly. However, the belt of the west also extended towards the central-northern parts of the assembly. Khanda Kheri, Sindher, Gamra, Jamni Khera, and Majod were the villages that voted for the BJP in High and Very High categories.

In the 2014 elections, major support for the party was in the assembly's western, northern and eastern villages. Some new villages in *the High* vote share category were added from the central and south-eastern part of the assembly. Khanda Kheri, Dharam Kheri, Sindher, Khera Rangran, Masudpur, Gamra, Jamni Khera, Bhaklana, Haibatpur, Mohla, Nara, Gurana, Lohari Ragho, Moth Rangran, Sisai Kalirawan, Madha and Puthi Saman were the villages given support to the party in High and Very High categories of vote share.

In the 2019 assembly elections, parties' vote share and spatial support were strengthened, but even after that, the party could not save the assembly. The support was strengthened throughout the assembly, but the major additions came from the central and southern parts. This time, 30 out of 55 villages were voted more than 40 per cent of votes, and ten villages were voted more than 50 per cent to the party. The election was bipolar contest, and the BJP lost to the JJP in the assembly election. Major parts of support for the party were the western and eastern parts of the assembly. However, the central part of the assembly was added in 2014 and also existed in 2019. Thus, a straight belt of major support could be traced from east to west in the very centre of the assembly constituency (Map 2).

Indian National Lok Dal (INLD)

The Narnaund assembly was considered a stronghold of INLD. The party won the assembly in 2009 and was runner-up in 2014. In the last three elections, the party continuously lost its vote share. The party lost almost 34 per cent of the vote share in this period. Thus, the party was in fourth rank in 2019 (Table 1).

The village-wise distribution of votes to the party reflected that 25 villages voted above 40 per cent in

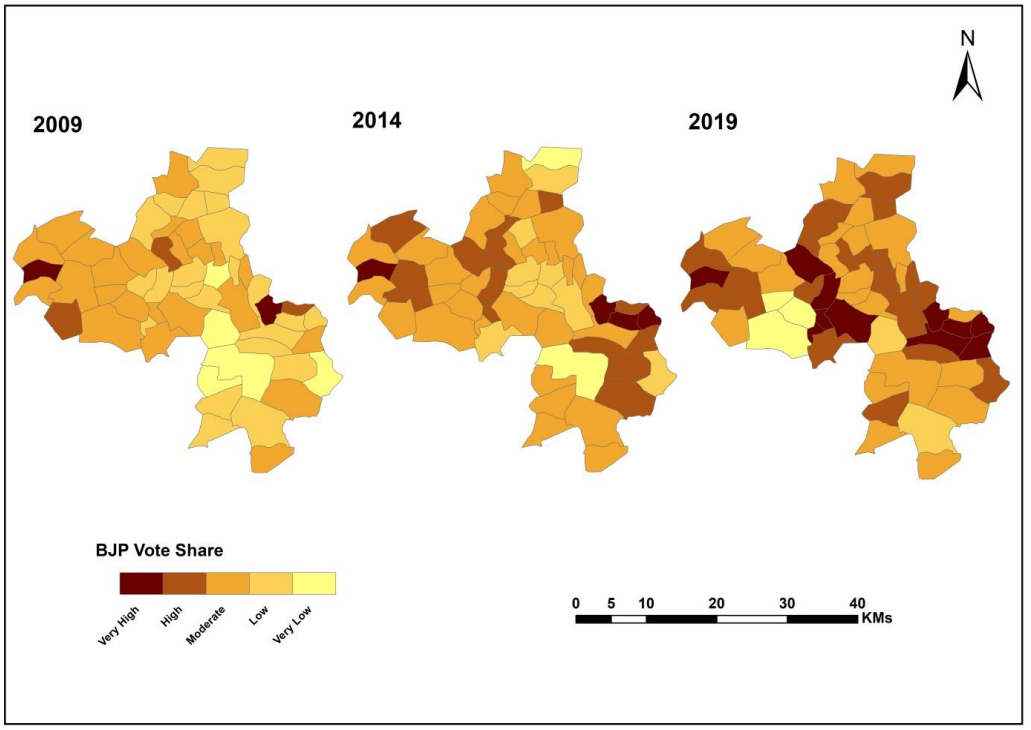
2009, and only six villages voted below 20 per cent. The highest number of villages was found in the 40- 50 per cent of the vote category. In 2014, the maximum number of villages was found in the 20-30 per cent vote category and in the Below 20 per cent category in 2019.

Drastically, 54 villages were in the lowest vote category out of 55 in 2019, and the single village was in the 30-40 per cent category. The only village, Petwar, was the native village of the candidate (Table 3).

Spatial analysis for the party in Narnaund suggested that the southern, northeastern and a belt in the western parts of the assembly were a major part of support for the party in 2009.

Map 2

Narnaund Assembly Constituency: Spatio-Temporal Pattern of Support to BJP in 2009, 2014 and 2019.



*Data is not available at the village level. The Polling station-wise data provided by the election commission was recast at the village level, as is also the case with Maps 3 and 4.
Source: Computed from Form-20 (Final Result Sheet) by the Election Commission of India for the Assembly.

Table 3

INLD: Vote Share Category-wise Frequency of Villages

Vote %	INLD 2009	INLD 2014	INLD 2019
	No. of Villages	No. of Villages	No. of Villages
Above 50	7	3	0
40-50	18	11	0
30-40	16	15	1
20-30	8	16	0
Below 20	6	10	54
Total	55	55	55

The villages of Bass Akbarpur, Bass Badshahpur, Bass Khurd Bejan, Bhaklana, Madan Heri, Badala, Koth Khurd, Dharam Kheri, Khanpur, Petwar, Badchapper, Budana, Sisai Bola, Singhwa Khas, Mohla, Sisar, Bass Azamshahpu, Bhaini Amirpur, Rajpura, Nara, Jamni Khera, Singwa Ragho, Datta, Mirchpur, and Kinner received votes in the High and Very High categories for the party.

In 2014, the party lost 11 villages from the High and Very High categories, accounting for a total of 6.27% of its vote share. However, the primary support in this election came from the assembly's southern, western, and northern regions. Bass Badshahpur, Bass Akbarpur, Bass Khurd Bejan, Sisai Bola, Budana, Singhwa Khas, Khanpur, Badala, Ugalan, Madan Heri, Koth Khurd, Nara, Kheri Jalab, and Mohla were the villages within the assembly that voted in the High and Very High categories for the party. The 2019 assembly election was recognised as a game changer in the party politics of Narnaund, as the INLD recorded its lowest vote share. None of the villages cast their vote for the party, even in the High category. The highest vote share came from Petwar village at 32.92 per cent. Consequently, the party lost all its stronghold areas in the assembly. The primary reason for this situation was the division within the INLD party, which was subsequently bifurcated into the INLD and JJP in 2018 (Map 3).

Indian National Congress (INC)

The INC was also a participant in the assembly but did not secure a seat at any time. The party relies on the vote banks of its candidates. In the last three elections, the party has consistently lost its vote share, decreasing to 5.37% of votes in 2019 from 29.57% in 2009 (Table 1).

The village-wise frequency distribution of vote shares for the party revealed that eight villages received more than 40 per cent of the total valid votes in the 2009 elections, whereas only eight villages received less than 20 per cent. However, the highest number of villages fell within the 20-30% vote category. In the 2014 election, only one village, Koth Kalan, received more than 40 per cent. This village was the candidate's native village for the party's election. Additionally, 52 out of 55 villages cast votes below 20 per cent of the total valid votes. The subsequent election in 2019 mirrored the previous outcome. Once again, only one village, Sisai Bola, voted above 50 per cent of the share, and it was also the candidate’s native village. This time, 53 villages out of 55 received a vote share of less than 20 per cent (Table 4).

Table 4

INC: Vote Share Category-wise Frequency of Villages

Vote %	INC 2009	INC 2014	INC 2019
	No. of Villages	No. of Villages	No. of Villages
Above 50	4	0	1
40-50	4	1	0
30-40	16	0	1
20-30	23	2	0
Below 20	8	52	53
Total	55	55	55

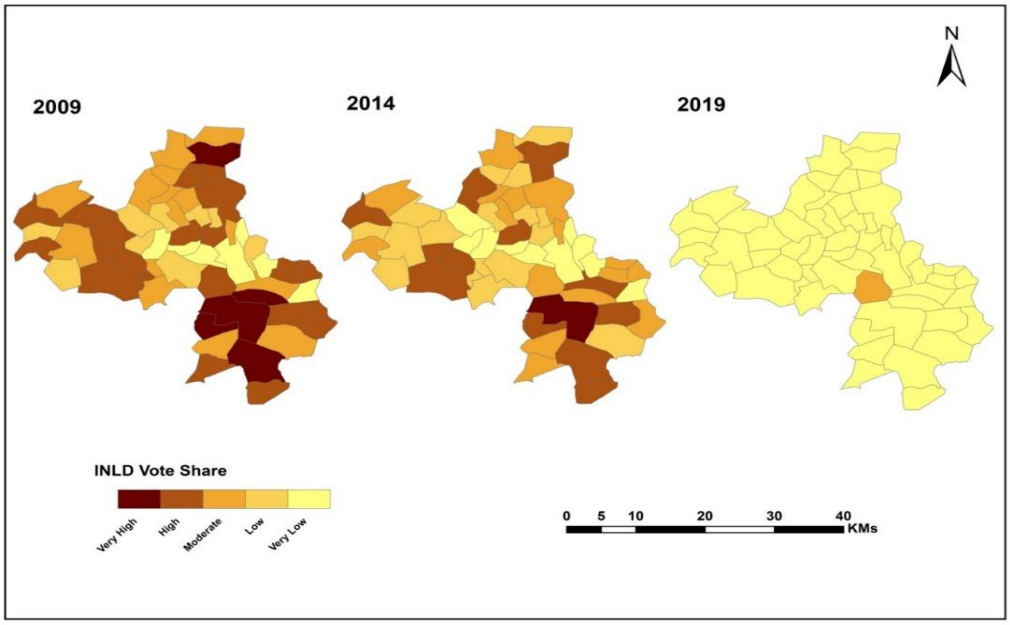
Source: Computed from Form-20 (Final Result Sheet) by the Election Commission of India for the Assembly.

While spatial dimensions of party performance were traced, it was found that the party had no stronghold in the assembly. However, in the 2009 assembly election, a belt from north to south in the centre of the assembly voted more for the party. However, there were no traces of the belt in the next two elections, and the party only performed up to the mark in the candidates' native villages. The effect is known as *localism* or *friends and neighbours voting* in electoral geography. Thus, the 2009 high support belt was also an effect of party the candidate. The candidate was not contested on the party symbol in 2014 and 2019 (Map 4).

It is clear from the maps that the party had no specific part of support in the assembly. However, it should not be concluded that the party was insignificant in the assembly. The INC secured five per cent and above vote share in the elections under study. The vote shares significantly impacted the results of the seats for other parties.

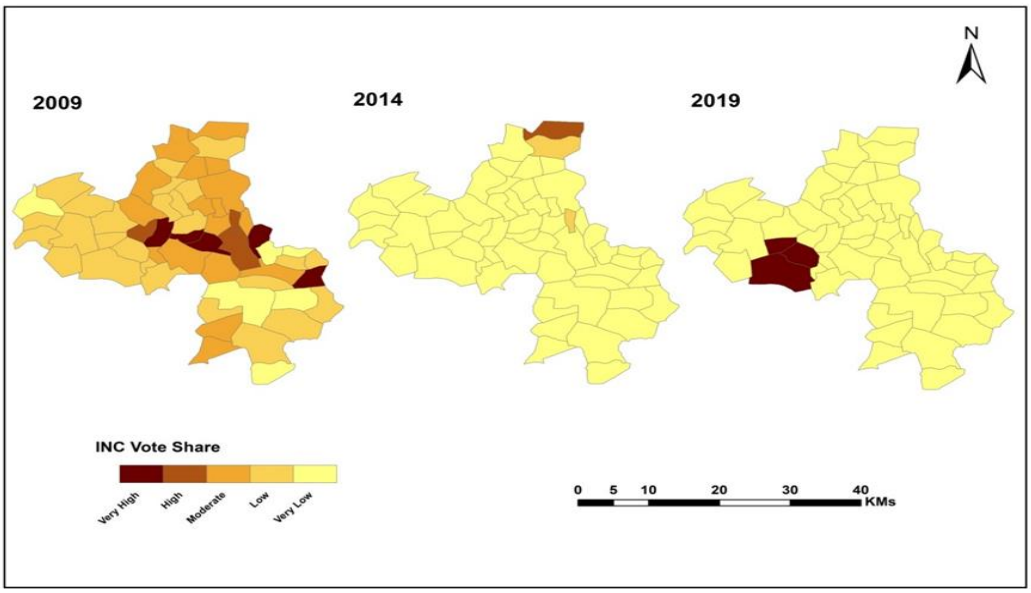
Map 3

Narnaund Assembly Constituency: Spatio-Temporal Pattern of Support to INLD in 2009, 2014 and 2019



Map 4

Narnaund Assembly Constituency: Spatio-Temporal Pattern of Support to INC in 2009, 2014 and 2019



**Data is not available at the village level. Polling station-wise data provided by the Election Commission was recast at the village level.*

Conclusions

The performance of different political parties was different in the Narnaund assembly. Only the BJP was consistent, as the party increased its vote share election after election. In the 2009 elections, the INLD won the assembly in a tri-polar contest between INLD, BJP and INC. In 2014, the BJP won the assembly in another tri-polar contest between BJP, INLD, and the independent candidate. In 2019, JJP won the assembly in a bipolar contest between JJP and BJP. Thus, the BJP was a competitor in all three elections. The INLD as a party lost its support base to the JJP in 2019. The JJP was split from INLD in 2018, a year before the elections.

Another finding suggests that an increasing vote share alone does not guarantee win; the number of parties or contestants in contest is also a deciding factor. It is also a fact that in elections, the party that won the maximum number of villages wins the assembly. In the 2009 elections, the INLD won the assembly with 28 villages. The BJP also won 28 villages in 2014, and JJP won the assembly by winning 36 villages in 2019.

The spatial pattern of the leading and next to leading parties suggests that the western part of the assembly had a direct battle between BJP and INLD. A shift was noted in the central and northern parts of the assembly in the behaviour of the voters. In the southern part, the

INLD in the contest with BJP and the independent, and in the same way, BJP had a close contest against the independent and INLD in the eastern part. However, in the 2019 election, the fight was directly between JJP and BJP across the assembly, as JJP is a faction of the INLD, and represented by the candidate who had the impact in the assembly.

The BJP has a strong support base in the western and eastern parts of the assembly. The northern part of the assembly also supports the party with some deviation. However, the party's support bases in the central and southern regions are weaker.

The INLD has major support in the northeastern and southern parts of the assembly. The party also overlaps a strong support base with the BJP in the western part. The central and eastern parts of the assembly were weaker for the party. However, the INLD lost its entire support base in the 2019 elections after separating one faction, resulting in a new party named JJP.

The INC had no support base in the assembly. In the 2009 elections, the candidate of the party had some influence in the central part of the assembly, which includes the candidate's native village and its surrounding villages. After 2009, the party did not secure moderate vote shares except from the candidates' native villages. The BJP, JJP parties, and the candidate have a support base in the assembly.

Thus, the study presents the spatio-temporal support base and performance of the political parties in the assembly. However, it is also important to know how to vote for a particular party or candidate, as various factors are responsible for voting behaviour.

A study on voting behaviour classified factors for voting into two major categories, i.e., money and meaning. Money stands for the transactional factors and meaning refers to the act of voting in the sense of duty and other values. The study finds that poor people also dislodged the transactional factors over meaningful factors and created a new social order. These non-transactional factors for voting are increased in Indian elections as the specific groups respond to the question of why they vote. However, the study still has not rejected the transactional factors and is still found behind the voting (Banerjee, 2019).

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Changing Pattern of Interstate Labour Migration to South Indian States, 1991-2011

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Abstract

Between 1991 and 2011, India underwent significant economic and social transformations. This study analyses the evolving dynamics of interstate labour migration to South India during this period. It focuses on key aspects of this movement, including its magnitude, origins, demographics (in terms of age, gender, and education), and types of employment, utilising data from decennial censuses. Preliminary findings suggest that the number of migrants relocating to South India increased substantially during this timeframe. There were also notable changes in the age composition and educational qualifications of labour migrants. Additionally, the employment status of migrants in these states experienced significant shifts. The percentage of main workers—those employed for the majority of the year—has decreased since 1991. In contrast, the proportions of "marginal" and "non-workers," which include those engaged in informal or seasonal work or who are unemployed, have increased considerably. This trend indicates a potential decline in the quality of employment opportunities available to migrants in South India. The study reveals a significant rise in interstate labour migration among South Indian states, particularly pronounced in 1991. However, subsequent decades witnessed a shift in migration patterns, with states from other regions of India gaining prominence as origin points. Furthermore, the share of migrants from states with lower Multidimensional Poverty Index (MPI) scores has risen over time. These states are characterised by high levels of poverty, hardship, and restricted access to essential services, prompting individuals to migrate to South Indian states in search of better livelihood opportunities.

Keywords: South India, labour migration, decadal change, demography

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Introduction

India, a nation renowned for its diverse socio-economic landscape, has a long and intricate history of internal migration. Labour mobility has been a cornerstone of the Indian economy for centuries; yet, its patterns and drivers have undergone significant transformations over time. This study examines the evolving dynamics of inter-state labour migration to South Indian states between 1991 and 2011, a period characterised by rapid economic growth and considerable regional disparities.

Interstate labour migration in India is a complex phenomenon driven by the human desire for a better life, work, and living standards (Das & Saha, 2012). Migrant workers aspire to improve their consumption and quality of life by relocating to larger cities and more urbanised states, which offer more resources, better educational facilities for children, and a wider array of employment opportunities. However, the pattern of migration continues to evolve due to fluctuations in the demand (the ageing population of Kerala leaving the state with elderly dependents relying on fewer working individuals) and supply (the abundant young population of states like Bihar and Uttar Pradesh seeking work) of labour across different regions, as significant geographical disparities exist in employment prospects between states, districts, and even within a state (Mukherji, 1991; Deshnigkar & Anderson, 2004; Bhagat, 2009; Deshingkar & Akter, 2009). Furthermore, the unequal development and urbanisation of states serve as key motivators for internal labour migration in India. The central, eastern, and northeastern sections of India exhibit low levels of urbanisation, prompting workers to migrate to the southern and western regions (Bhagat & Keshri, 2018), which boast greater job opportunities. In destination cities or states, this influx of workers from less developed areas meets the short-term demand for low-wage labourers willing to work without long-term benefits, such as tenure security, minimum wage compliance, pensions, or insurance. Additionally, these labour migrants aid numerous industries in sustaining operations in destination areas. They even undertake odd jobs such as rag picking, sweeping, and providing domestic assistance to support themselves and their families (Kusuma et al., 2014; Babu et al., 2017).

The article focuses on interstate labour migration to the South Indian states, which increased significantly between 1991 and 2011. This rise is attributable to various factors, including economic changes, agricultural difficulties, and the expansion of transportation infrastructure. Economic liberalisation measures introduced in the early 1990s led to rapid economic growth and industrialisation in several parts of the country, particularly in the South, resulting in a high demand for a workforce. Meanwhile, the agricultural sector in

many regions of India, particularly in the eastern and central areas, has faced considerable challenges, as evidenced by decreased agricultural production, mounting debt, and limited job opportunities. This situation compelled a significant number of individuals to relocate to other regions of the country in search of better livelihoods (Mishra & Nayak, 2020; Mishra, 2020). Moreover, the development of transportation infrastructure, such as highways and railways, facilitated the movement of people across the country, making it easier for migrants to reach their destinations.

The selection of Andhra Pradesh (including present-day Telangana), Karnataka, Kerala, and Tamil Nadu as the focus of this study on interstate labour in-migration is based on several key factors. These South Indian states are prominent recipients of migrant labour, exhibiting substantial and sustained in-migration flows driven by their diverse and relatively advanced economies. This diversity encompasses strong IT and service sectors (Karnataka and Kerala), a robust manufacturing base (Tamil Nadu), and a mix of agriculture, alongside growing urban and industrial sectors (Andhra Pradesh). Their higher rates of economic growth and rapid urbanisation, particularly the development of major metropolitan centres, create significant labour demand, serving as powerful pull factors. Furthermore, according to NITI Aayog's MPI ranking, these states collectively ranked as the top-performing region. Finally, each state presents unique migration dynamics, such as Kerala's unique case of high out-migration coupled with in-migration, making this region a compelling case study for understanding the complexities of internal migration in India.

Therefore, the study aims to analyse the trends and patterns of interstate labour in-migration to South Indian states (Andhra Pradesh/Telangana, Karnataka, Kerala, and Tamil Nadu) from 1991 to 2011.

Specifically, it aims to (1) identify the primary source regions of inter-state labour migrants to each of the South Indian states; (2) analyse the socio-economic characteristics (e.g., age, sex, education, occupation) of inter-state labour migrants to South India; and (3) compare and contrast the patterns of inter-state labour migration across the four South Indian states. By examining these factors, this research seeks to gain a deeper understanding of the drivers, characteristics, and implications of interstate labour migration within this dynamic region of India.

Data and Methodology

This study employs a quantitative research approach, utilising secondary data analysis. The main data source used is the Census of India for the years 1991, 2001, and 2011. Census data provide information on reasons for migration, as well as the socio-economic and demographic characteristics of the migrants, their last place of residence, and the

duration of their residence, which are used to identify interstate migrants. The analysis focuses on migration flows to four Southern Indian states: Andhra Pradesh (including the present-day state of Telangana), Karnataka, Kerala, and Tamil Nadu. The study period of 1991-2011 allows for a comparative analysis of migration patterns before and after economic liberalisation. The analysis includes:

- Descriptive statistics, including frequencies, percentages, and migration rates, provide an overview of the volume and direction of migration flows.
- Growth rate analysis: Decadal growth rates are calculated to assess changes in migration over time.
- State-wise and labour-type analysis: Migration data is disaggregated by state and by labour-type migration to identify specific trends and patterns.

Key Findings

Understanding the reasons behind interstate migration is crucial for effective policymaking and regional development planning. The Census of India provides valuable data on these motivations, categorising them primarily as work/employment, business, education, marriage, moved after birth, moved with household, and others (Census of India reports). Although self-reported and potentially subject to individual interpretation, these categories offer valuable insights into the primary drivers of migration. Analysis of Census data reveals a clear gendered pattern; economic factors, specifically work and employment, as well as business, are the primary motivators for male migrants, reflecting their role as primary breadwinners. Conversely, marriage and movement with the household are significantly more prominent reasons for female migration, highlighting the influence of socio-cultural norms and patriarchal structures.

The data in Table 1 specifically examine interstate in-migration to South Indian states and the change in the magnitude of inflow over two decades, from 1991 to 2011, based on the reasons for migration. Regarding the overall change in inter-state migration to these four states, it is evident that during the first decade (1991-2001), only Karnataka demonstrated a significant increase in the influx of inter-state migrants by 30 percent; aside from Karnataka, Kerala and Andhra Pradesh recorded a growth of 4 percent, while Tamil Nadu experienced a negative rate of change (-14 percent). Between 2001 and 2011, Tamil Nadu saw a decadal growth rate of 127 per cent in interstate migrant inflow. Alongside Tamil Nadu, the other three states also witnessed substantial growth in migrant inflow: Kerala by 44 per cent, Karnataka by 57 per cent, and Andhra Pradesh by 54 per cent, respectively.

Besides this aggregate change in the magnitude of the flow of interstate migrants to South Indian states, the magnitude of the inflow of migrants based on the reason for migration has also changed over the

two decades. Between 1991 and 2001, as indicated in Table 1, the number of migrants arriving in Kerala, Tamil Nadu, and Andhra Pradesh for business, educational, and family reasons declined significantly. Furthermore, Tamil Nadu and Andhra Pradesh saw a 23 per cent decrease and a 7 per cent decrease, respectively, in the inflow of migrants coming to the states for employment purposes. Meanwhile, Karnataka was the only state to witness positive growth in the influx of migrants, largely due to these factors.

However, during the latter decade (2001-2011), Kerala experienced a decline in the flow of interstate migrants for business and family reasons, while Andhra Pradesh observed a shift in migration patterns after birth. In addition to this, all four states reported significant growth in the flow of interstate migrants for various reasons. However, Kerala recorded a growth rate of three digits, namely, 725 per cent, in the inflow of interstate migrants due to movement after birth, while the growth for all other reasons remained in double digits. Karnataka, on the other hand, registered a double-digit growth rate for all migration reasons. Conversely, Tamil Nadu noted triple-digit growth in education—198 per cent, marriage—129 per cent, family movement—138 per cent, and movement after birth—272 per cent. In comparison, Andhra Pradesh experienced growth rates of 151 per cent and 595 per cent in education and family movement, respectively.

Nevertheless, in absolute terms, employment has consistently been one of the primary reasons for interstate migration. In 1991 and 2001, employment ranked as the second most significant reason for interstate migration to Kerala, following family movement. However, in 2011, employment became the most popular reason for such migration. In Karnataka, employment was the third most common reason for migration in 1991, trailing behind marriage and family reunification; by 2001 and 2011, it had risen to second place. In Tamil Nadu, employment consistently remained the third most popular reason, after marriage and family movement, throughout all the years. In Andhra Pradesh, employment was also the third most popular reason, following marriage and family movement, in both 1991 and 2011. However, in 2001, employment secured the second position, surpassing family movement.

While conducting a detailed analysis of interstate migration for employment purposes across South Indian states, it became clear that Karnataka had the largest proportion of interstate migrants who moved for work-related reasons. The proportion and absolute number of migrants to Karnataka increased significantly, from 38% in 1991 to 52% in 2001 and 53% in 2011. On the other hand, the proportion of migrants to Kerala and Andhra Pradesh has declined over time (Table 2), with the notable exception of Tamil Nadu, where the

ratio fell to 15% in 2001 from 23% in 1991 before rising to 18% in 2011.

Over the years, the educational profile of interstate migrant workers in South Indian states has been steadily increasing. This shift is significant as it indicates a growing skilled workforce migrating in search of better opportunities. This trend has several important implications. Firstly, it suggests a potential for higher productivity and economic growth in destination states, as skilled workers bring valuable human capital. Secondly, it highlights the evolving nature of migration patterns, moving away from purely unskilled labour migration. Finally, this shift emphasises the need for policies that support the integration and utilisation of skilled migrant workers in destination states, such as recognising educational qualifications and facilitating access to professional networks.

Table 1

Absolute and Decadal Change (1991-2011) in Interstate Migration to South Indian States Based on Reasons of Migration

States	Kerala					Karnataka				
Reasons of Migration	1991	2001	Decadal change %	2011	Decadal change %	1991	2001	Decadal change %	2011	Decadal change %
Employment	110923	124292	12	154749	25	300963	489784	63	781998	60
Business	10410	8625	-17	8189	-5	55157	55488	1	74397	34
Education	7980	5756	-28	9953	73	59630	75225	26	102587	36
Marriage	84330	88362	5	121964	38	511966	597406	17	871999	46
Family moved/ Moved with Household	138733	126220	-9	58999	-53	381276	383295	1	650135	70
Moved after birth	-	23381	*	192811	725	-	144424	*	216846	50
Natural calamities	1540	-	*	-	*	17530	-	*	-	*
Others	83171	77623	-7	107758	39	273709	328849	20	549698	67
Total	437087	454259	4	654423	44	1600231	2074471	30	3247660	57
States	Tamil Nadu					Andhra Pradesh				
Reasons of Migration	1991	2001	Decadal change	2011	Decadal change	1991	2001	Decadal change	2011	Decadal change
Employment	179939	138081	-23	263085	91	203014	189031	-7	281141	49
Business	30890	11986	-61	17452	46	36747	28355	-23	44977	59
Education	34160	19842	-42	59162	198	17870	9561	-46	23951	151
Marriage	255067	172833	-32	395024	129	372086	353261	-5	558334	58
Family moved/ Moved with Household	208011	149668	-28	355703	138	238308	46025	-81	319699	595
Moved after birth	-	54551	*	203029	272	-	209814	*	93675	-55
Natural calamities	2000	-	*	-	*	4520	-	*	-	*
Others	132929	180211	36	357316	98	121596	191363	57	270113	41
Total	842996	727172	-14	1650771	127	994141	1032753	4	1591890	54

Source: Census of India & Author's calculation

(Note: No data was available on migration for those who moved after birth in 1991 or for natural calamities in 2001 and 2011.)

Table 2

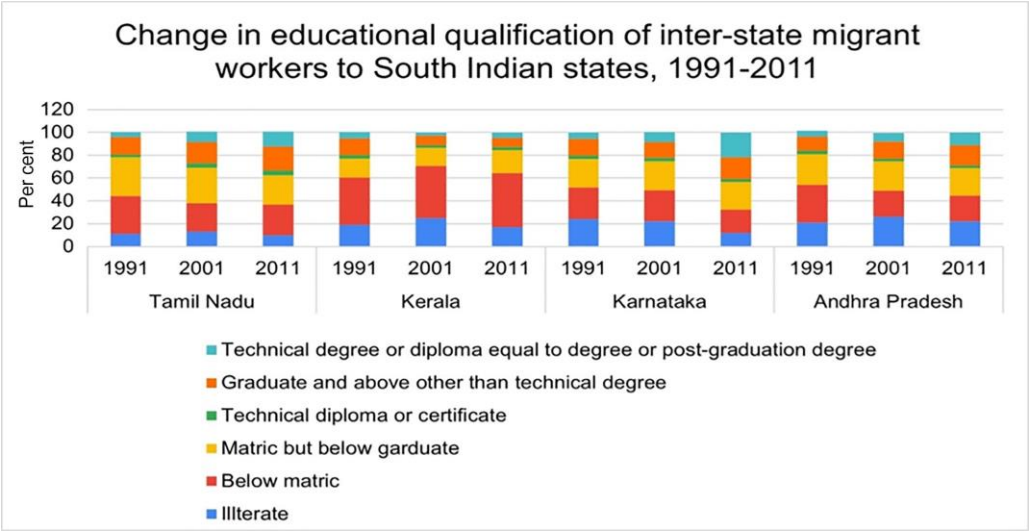
Share of Interstate Labour Migrants in Each South Indian State in 1991, 2001 and 2011

States	1991	% Share	2001	% Share	2011	% Share
Kerala	110923	14	124292	13	154749	10
Karnataka	300963	38	489784	52	781998	53
Tamil Nadu	179939	23	138081	15	263085	18
Andhra Pradesh	203014	26	189031	20	281141	19
Total	794839	100	941188	100	1480973	100

Source: Census of India

Figure 1

Vertical and Horizontal Change in Educational Qualification of Interstate Labour Migrants to South Indian States, 1991-2011



Source: Census of India & author's compilation

Figure 1 illustrates the vertical change in qualification levels of migrants across different years and states. Conversely, horizontal change denotes a shift in the qualification level of migrants within a specific state over several decades. During the period from 1991 to 2001, the percentage of interstate labour migrants who were illiterate increased in all South Indian states but subsequently declined again between 2001 and 2011. In Tamil Nadu, Karnataka, and Andhra Pradesh, the proportion of migrants holding graduation degrees and above, excluding technical degrees and diplomas equivalent to degrees or post-graduation degrees, has increased over time. In Kerala, the majority of inter-state migrants who migrated for employment had below-matric qualifications for all the years.

Over the years, the age composition of interstate migrant workers to South Indian states has shifted towards younger populations. This trend is driven by factors such as increasing educational attainment

Table 3

Age Composition of Inter-State Labour Migrants to South Indian States, 1991-2011

Age composition of migrant workers	Percentage share of males			Percentage share of females		
	1991	2001	2011	1991	2001	2011
0-14	2	1	0	8	3	1
15-19	4	7	5	7	10	6
20-24	9	18	17	13	21	19
25-29	13	21	22	14	21	25
30-34	14	17	18	12	13	16
35-39	14	13	13	12	11	11
40-59	36	21	20	26	18	19
60+	8	3	5	8	3	4

Source: Census of India & compiled by the author

in source states, which leads younger individuals to seek better employment opportunities in more developed regions. This shift in age composition has significant implications for both source and destination states. Younger migrants typically possess higher skill levels and are more adaptable to new technologies, contributing to economic growth in destination states. However, the departure of young, competent individuals from source states may result in a brain drain, which can hinder their long-term development. Policymakers in both source and destination governments must understand this demographic change to design effective policies that address difficulties and maximise the benefits of interstate migration.

Over the years, the age composition of labour migrants to South Indian states has increasingly concentrated within the 20-29 age group, which is also a significant portion of the young population, as per the National Youth Policy, 2014 (Table 3). However, in 1991, the majority of labour migrants were between the ages of 40 and 59, indicating an influx of middle-aged workers to South Indian states. Furthermore, there was notable labour migration among females from the age group of 0-14 years; this illustrates the prevalence of child labour during the pre-liberalisation period. Additionally, with the implementation of the Child Labour Act in 1986, one can observe a considerable decrease in child migration for labour in the years 2001 and 2011. Regarding specific age groups, the majority of female migrants were aged 40 to 59 in 1991, later concentrating in the 20-29 age group in 2001, and by 2011, most female migrants were within the 25-29 age group. Meanwhile, males predominantly fell into the 40-59 age group in 1991, and, in 2001 and 2011, they were represented in both the 20-29 and 40-59 age brackets.

In 1991, the major labourers who migrated for employment were the main workers in all the South Indian states, followed by non-workers, with the share of marginal workers being relatively small (Table 4).

Table 4

State-wise Share of Type of Workers who Migrated for the Reason of Employment, 1991-2011

Years/ States	Main workers	Share of states in %	Marginal workers	Share of states in %	Non-workers	Share of states in %	Total	Share of states in %
1991								
Andhra Pradesh	1990269	77	20056	1	569478	22	2579803	40
Karnataka	1239139	85	12311	1	209304	14	1460754	22
Kerala	504070	83	15030	2	87211	14	606311	9
Tamil Nadu	1475935	80	13748	1	361937	20	1851620	28
Total	5209413	80	61145	1	1227930	19	6498488	100
2001								
Andhra Pradesh	9809060	42	2407758	10	11245077	48	23461895	36
Karnataka	6351786	38	1873521	11	8335070	50	16560377	25
Kerala	2242924	24	558429	6	6389128	70	9190481	14
Tamil Nadu	6530106	41	1256024	8	8038253	51	15824383	24
Total	24933876	38	6095732	9	34007528	52	65037136	100
2011								
Andhra Pradesh	15272056	40	3419805	9	19668783	51	38360644	34
Karnataka	10060989	38	2323839	9	14078342	53	26463170	23
Kerala	4201738	24	1170689	7	12490992	70	17863419	16
Tamil Nadu	11894251	38	2253600	7	17126256	55	31274107	27
Total	41429034	36	9167933	8	63364373	56	113961340	100

Source: Census of India and author's calculation (Note: The data of migrants are from all places to South Indian states, as data for inter-state migration for the type of workers was not available)

Furthermore, 40% of migrants citing employment as a reason for migration were heading to Andhra Pradesh, followed by 28% to Tamil Nadu, 22% to Karnataka, and 9% to Kerala. In 2001, the proportion of main workers declined significantly, while the proportions of non-workers and marginal workers increased considerably. Additionally, the share of total work migrants in Andhra Pradesh and Tamil Nadu decreased, whereas Karnataka's position improved.

Lastly, the proportion of primary worker migrants once again declined in 2011 in Andhra Pradesh and Tamil Nadu, while remaining unchanged in Karnataka and Kerala. The proportion of non-worker migrants increased in all three states except Karnataka. The share of marginal workers also fell in Andhra Pradesh and Karnataka but rose in Kerala and Tamil Nadu. Overall, the total share of both primary and marginal workers decreased, whereas that of non-workers increased.

Thus, this decadal trend indicates a troubling shift in the composition of migrant workers in South Indian states. The proportion of main workers, those employed for the majority of the year, has declined, while the percentage of non-workers who migrated for employment has increased. This change signifies a potential decline in the quality of employment opportunities available to migrants. It raises concerns regarding the long-term economic and social well-being of these workers and could adversely affect both source and destination states.

Table 5, along with Figures 2, 3, and 4, illustrates the six leading origin states that dispatched migrant labourers to the four South Indian states. The data reveal a substantial proportion of interstate migration among the South Indian states.

Table 5

Top 6 Origin States to Send Interstate Migration for Work to South Indian States

Andhra Pradesh					
States/UT	Total interstate migration for work, 1991	States/UT	Total interstate migration for work, 2001	States/UT	Total interstate migration for work, 2011
Tamil Nadu	41950	Tamil Nadu	37454	Karnataka	47106
Karnataka	27005	Karnataka	29640	Odisha	44897
Maharashtra	22840	Maharashtra	29479	Maharashtra	43278
Kerala	14011	Orissa	23935	Tamil Nadu	41517
Orissa	13550	Kerala	14626	Bihar	17236
Rajasthan	6840	Bihar	9840	Uttar Pradesh	16200
Karnataka					
Tamil Nadu	124291	Tamil Nadu	167131	Tamil Nadu	204746
Andhra Pradesh	65456	Andhra Pradesh	121362	Andhra Pradesh	199501
Kerala	55095	Kerala	75215	Kerala	82697
Maharashtra	23731	Maharashtra	36685	Maharashtra	55014
Rajasthan	7460	Rajasthan	15843	Odisha	37178
Uttar Pradesh	4600	Bihar	13124	Bihar	35788
Kerala					
Tamil Nadu	90681	Tamil Nadu	92784	Tamil Nadu	72899
Karnataka	7580	Karnataka	9874	West Bengal	22318
Maharashtra	3450	Maharashtra	5382	Karnataka	12794
Andhra Pradesh	(2052).	Andhra Pradesh	3020	Odisha	7777
Delhi	800	West Bengal	1790	Maharashtra	6865
Uttar Pradesh	680	Orissa	1714	Assam	5780
Tamil Nadu					
Kerala	91123	Kerala	52141	Kerala	77955
Andhra Pradesh	32380	Andhra Pradesh	25814	Andhra Pradesh	44312
Karnataka	18970	Karnataka	16680	Karnataka	38357
Pondicherry	7490	Maharashtra	8339	Rajasthan	16683
Maharashtra	6510	Rajasthan	6504	Maharashtra	14884
Rajasthan	5300	Pondicherry	6373	Odisha	11580

Source: Census of India, compiled by the author.

However, over the years, their position has changed, specifically for Andhra Pradesh. Additionally, in the case of Andhra Pradesh, Odisha's position improved between 1991 and 2011, and Kerala was no longer among the top states in 2011, making

way for states from other regions of the country.

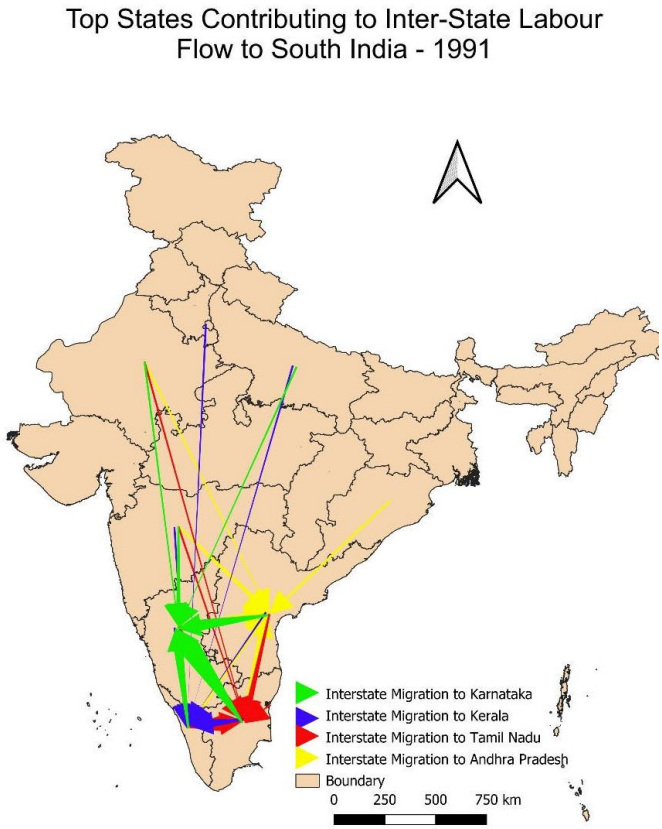
In Karnataka, the top three spots were held by South Indian states. However, there is a shift in the bottom three states: Rajasthan and Uttar Pradesh were replaced in the latter decade, and Odisha became a new entrant in 2011.

Tamil Nadu continued to be Kerala's primary state for sending labour migrants across all three data periods, although the rankings of other states fluctuated. In 2011, Assam entered the top six states, while Andhra Pradesh fell out, and the standings of West Bengal and Odisha improved.

Throughout the decades, Tamil Nadu has received the most labour migrants from Kerala, Andhra Pradesh, and Karnataka, making it the top-ranking state on the list. However, Odisha was a new entry in the top six list in 2011. Hence, it is evident that Tamil Nadu received the most migrants from the southern region of the country itself.

Figure 2

Top Six States Contributing to Interstate Labour Flow to South Indian States, 1991



Data source (Figures 2 to 4): Census of India

Figure 3

Top Six States Contributing to Interstate Labour Flow to South Indian States, 2001

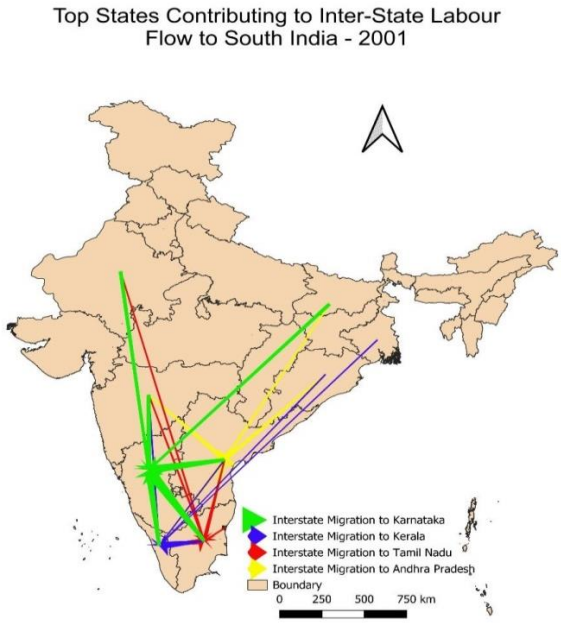
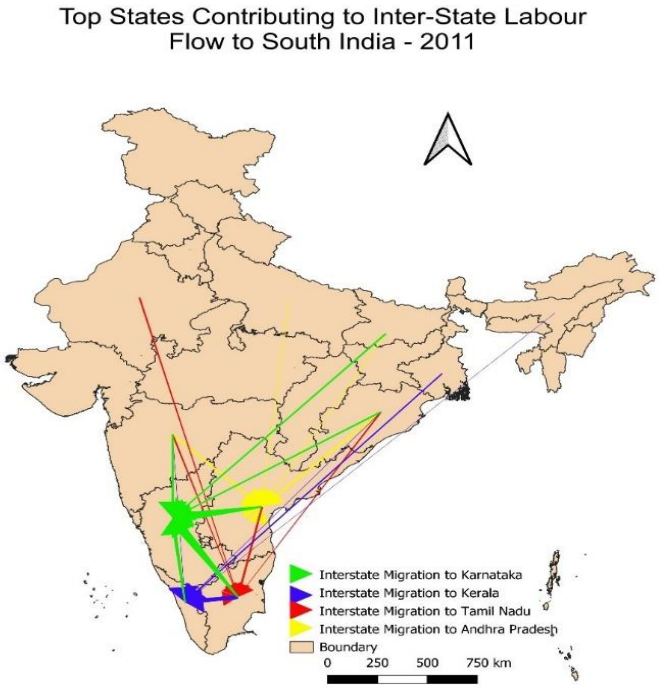


Figure 4

Top Six States Contributing to Interstate Labour Flow to South Indian States, 2011



Note: The thickness of the arrows shows the magnitude of the interstate in-migration flows towards the South Indian States.)

Table 6

Decadal Change in Labour Migration from Worst Performing States in MPI to South Indian States, 1991-2011

Destination/origin states	1991	2001	Decadal change (%)	2011	Decadal change (%)
Andhra Pradesh					
Bihar	7760	9,840	27	17,236	75.16
Jharkhand	*	1,440	-	3,718	158.19
Uttar Pradesh	8470	8,755	3	16,200	85.04
Madhya Pradesh	3860	3,668	-5	4,939	34.65
Karnataka					
Bihar	2630	13,124	399	35,788	172.69
Jharkhand	*	1,975	-	8,828	346.99
Uttar Pradesh	4190	12,946	209	34,920	169.74
Madhya Pradesh	1330	3,074	131	7,869	155.99
Kerala					
Bihar	420	880	110	4,875	453.98
Jharkhand	*	351	-	1,339	281.48
Uttar Pradesh	510	1,555	205	4,402	183.09
Madhya Pradesh	460	711	55	1,339	88.33
Tamil Nadu					
Bihar	1440	3,445	139	10,905	216.55
Jharkhand	*	355	-	2,336	558.03
Uttar Pradesh	2246	2,782	24	7,911	184.36
Madhya Pradesh	1190	1,520	28	2,208	45.26

Source: Census of India, compiled and calculated by the author
(Note: Data for Jharkhand state is not available for the year 1991, as it was part of Bihar, which was later formed on November 15, 2000.)

Interstate labour migration in India is a complex phenomenon influenced by various factors, including economic disparities between states. Individuals from states with lower Multidimensional Poverty Index (MPI) scores, often linked to limited economic opportunities and higher poverty rates, are more likely to migrate to states with higher MPI scores. Migrants from lower MPI-scoring states view these target states, primarily situated in South India, as offering better economic prospects, higher incomes, and more developed infrastructure. This perception draws workers seeking improved livelihoods, prompting them to migrate in search of better opportunities. Moreover, this migratory pattern contributes to economic growth in destination states and remittances sent back to source states, which can potentially alleviate poverty in their regions.

the long term. However, it raises concerns about possible brain drain in source states, as well as the social and economic impacts on migrant communities.

The migration of labour migrants from the worst-performing states in India, including Bihar, Jharkhand,

Uttar Pradesh, and Madhya Pradesh, has increased significantly over the last decade, as shown in Table 6. Andhra Pradesh and Karnataka have witnessed a notable rise in the number of workforce migrants, particularly from Bihar and Uttar Pradesh. In contrast, while the absolute growth in Kerala and Tamil Nadu is relatively modest, the growth rate is considerably higher. Furthermore, when the combined data are analysed (Table 7), it is clear that the share of these states in total inter-state labour migrants has increased over time, from 4.34% in 1991 to 7.06% in 2001 and 11.13% in 2011.

Table 7

Share of Interstate Labour Migrants from the Lowest-Ranking States in the MPI to Total Interstate Labour Migrants to South Indian States, 1991-2011.

Year	Total interstate labour migrants to South Indian states	Total interstate labour migrants from lowest lowest-ranking states in MPI to South Indian states	Percentage share
1991	794839	34506	4.34%
2001	941188	66421	7.06%
2011	1480973	164813	11.13%

Source: Census of India, compiled and calculated by the author

Conclusion

The period from 1991 to 2011 witnessed a dynamic shift in inter-state labour migration to South India. While the region continued to attract significant numbers, the nature of this migration evolved. The age composition is likely skewed younger, with a higher proportion of young adults seeking employment opportunities. Education levels among migrants also improved over the two decades. South India occupied the top positions among inter-state migrant-sending states in 1991. However, their position deteriorated later, particularly in the case of Andhra Pradesh and Kerala, creating more space for states from other regions of the country. Moreover, the share of states with lower Multidimensional Poverty Index (MPI) scores likely increased, contributing a substantial share of labour migrants to South Indian states. However, the composition of migrant workers within these states has changed. The share of main workers, those employed for the majority of the year, has declined since 1991, while the proportion of marginal and non-workers, including those engaged in seasonal or informal work, has increased. This shift could indicate the declining quality of employment opportunities available to migrants in South India. Understanding these evolving trends is crucial for policymakers in both source and destination states to effectively address the needs of migrant workers and promote equitable development across India.

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Multilayer Perceptron Neural Network and Markov Chain Model for Urban Growth Prediction – A Micro Level Case Study

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Abstract

Accurate and reliable forecasting facilitates effective long-term planning and enhanced management. This goal has led to the application of a Multilayer Perceptron Neural Network and Markov Chain model to forecast the future scenario of Ward 109, Kolkata Metropolitan Corporation in West Bengal. This peri-urban area underwent rapid urbanisation in less than 30 years, using vectorised maps created from historical Google Earth images and ground truth data. Following change detection, predictions for 2021 have been made using ten variables. Following validation, a 2040 urban growth simulation was created to corroborate the scenario with census-population data, which is anticipated to be released in 2041. Additionally, population projections for 2021 have been made, showing a fourfold increase. According to National-level planning guidelines, in India, Ward 109 already has a population density comparable to that of a medium to large city; however, the authority's urban structure and amenities are disproportionate to the population. A gap has formed between the population and the resources available in relation to demand and supply. This paper will be helpful in formulating schemes to minimise the gap between government guidelines and the real-world scenario for sustainable development.

***Keywords*:** urban growth prediction, multilayer perceptron neural network model, population projection

Introduction

Unplanned urban growth definitely affects natural resources and the quality of human life (Devendran & Lakshmanan, 2018). Unrestricted urban growth leads to urban sprawl, which demands increased infrastructure and basic services for

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expanding areas, posing a threat to the environment (Garouani et al., 2017).

Machine-learning-based algorithms for land use land cover (LULC) classification, change identification, and urban growth prediction (Jamali, 2021), along with population projection, help planners, environmentalists, and governments endorse optimal arrangements that make the plan more economical and well-structured.

The increased rate of urbanisation makes it extremely challenging and inadequate to monitor changes using conventional surveys (Nath & Acharjee, 2013). Therefore, remote sensing and geographic information systems (GIS) are now the most effective instruments for detecting such changes.

Liu Y (Liu, 2008) reviewed urban development models based on different scales, concepts, and calculations. Cellular automata (CA), introduced by Ulan and Neuman in 1940 (Triantakonstantis & Mountrakis, 2012), are a simulation-based model where a cell evolves through many discrete steps according to a set of rules based on the states of its neighbouring cells (Falah et al., 2020). Though strongest, to overcome the shortcomings of the CA (Vispoel et al., 2022) model, it is integrated with the Markov Chain (Aburas et al., 2016), which is a process consisting of a number of states with transition probabilities (Li & Zhang, 2009) and aim to predict the situation of an object at future times (Dai & An, 2018). A Markovian chain makes predictions using the Land Transformation Model (LTM). An LTM has been presented by Pijanowski (Pijanowski et al., 2002) to predict land use changes using GIS, along with Artificial Neural Networks (ANN). ANN, a method in artificial intelligence (AI), utilises data from remote sensing and GIS, processing it in a manner similar to the human brain. Data are used in interconnected nodes in a layered structure. A Multilayer Perceptron (MLP), also known as a Land Change Modeler (LCM), is a type of neural network that has three or more layers. The input layer receives data, the hidden layers, which serve as the computational engine of the MLP, process the data, and the output layers predict and classify the data (Devendran & Lakshmanan, 2018, 2019; Maithani, 2020; Abirami & Chitra, 2020). GIS has developed driver variables that are responsible for changes. A Multilayer Perceptron Neural Network (MLPNN), trained on training data and reducing error through backpropagation, has been used to generate transition potential maps. These maps represent the potential for transformation of a given Land Use and Land Cover (LULC) category into another. Many researchers used an integrated MLPNN and Markov Chain Model

(MCM) to predict future LULC. This is one of the preferred methods for predicting future land use adopted by scholars (Saeed et al., 2021; Vinayak et al., 2021; Alshahrane & Altuwaijri, 2023). Although MLPNN can handle large and complex datasets, its cost increases, and its accuracy depends on the model's training; efficient training yields efficient prediction, which is crucial for effective planning and improved land management.

The physical expansion of Kolkata, West Bengal, India, occurred in a south-easterly direction (Majumder & Sivaramakrishnan, 2020). From 1991 to 2011, the city core of Kolkata Municipal Corporation (KMC), West Bengal, experienced negative population growth, as reported in the 1991, 2001, and 2011 Censuses of India. In contrast, the outer areas, or peri-urban fringes, gained momentum due to lower land prices and the expansion of arterial roads. Ward 109 of KMC, chosen as a study area, is located at the eastern boundary of KMC. Once unattractive and covered by agricultural and vacant land in the 1980s, it has become a liveable area. The unplanned new construction and amenities in the Ward, following its inclusion in 1984, caused significant stress in the delivery of transportation infrastructure, as well as social and environmental services.

This work predicts the land use of Ward 109 for the year 2040 based on the land use data of 2002 and 2010. In the first step, a prediction for 2018 has been made. The result has been compared with the LULC map of the real-world situation. Following the accuracy assessment, a map for 2040 has been predicted, along with a population projection for 2021.

Following India's independence, rapid urban growth created a need for developing infrastructure and other essential services. Hence, the Urban Development Plan Formulation and Implementation (URDPFI) guidelines were prepared in 1996 (UDPFI, 1996), modified as needed, and implemented at the regional level (URDPFI, 2014, 2016). It classified urban centres according to their population (small, medium, large cities, metro cities) and provided guidelines for the proposed land use structure under different land use categories. After predicting future land uses in Ward 109, population projections helped compare the parameters with those of URDPFI. This paper can be implemented in other likely areas, and sustainable planning can be developed holistically. Several studies have already been conducted to understand urban dynamics and forecast futuristic urban growth. This study differs from others in that it has examined the spatiotemporal dynamics of a peri-urban area, predicted land use changes, and sought to identify the gap between national guidelines and the actual scenario for KMC Ward 109.

Materials and Methods

In Step I, the study area, KMC Ward 109, has been identified. Step II shows urban growth prediction and comparison with the actual scenario. In step III, the predicted map was accurately assessed against the actual scenario. Lastly, Step IV involves comparing the guidelines of URDPFI with the ground-level situation in KMC Ward 109.

The Eastern Metropolitan Bypass (EM Bypass), connecting north Kolkata and south Kolkata, divides Ward 109 into east and west, passing through the north and south of the Ward (Fig. 1). Both sides of this road have become focal points of development. The vicinity of the EM Bypass, its connection to the City of Kolkata, and the suburban railway's connectivity attracted people to KMC Ward 109, as the situation prompted them to move outward from the city core. Hence, the real estate boom and later hospital-centric developments led to unplanned urban growth in this area.

Rapid urbanisation at the ward level created first-level development along both sides of the EM Bypass. However, it hindered growth at the interior level, resulting in congested traffic movement, roadside parking, the absence of footpaths, and disproportionate multi-storied houses to the road width, as well as effluent sewerage, a scarce potable water supply, and waterlogging. This individual ward-level study, showing development in one part and deterioration in the other,

will help other municipalities keep provisions for providing facilities in their boundary areas before problems start to arise. The driving forces incorporated into the study, responsible for LULC changes in such a boundary Ward, will provide an estimation of the future scenario, which involves the exhaustion of natural resources.

The Calcutta Municipal Corporation Act of 1980 came into effect in January 1984. As KMC expanded its boundaries, wards 100 to 141 came under its jurisdiction. Thus, Ward 109 came under the authority of KMC. This Ward is located in the south-eastern part of KMC (Fig. 1) and is positioned approximately between 22°30’N and 22°28’N, and 88°23’E and 88°25’E, covering an area of 7.05 sq. km. East Kolkata Wetland (EKW), located in the eastern part of Kolkata – a Ramsar site - absorbs contaminants drained from Kolkata (Mondal et al., 2022), situated in the eastern and northeastern part of the Ward.

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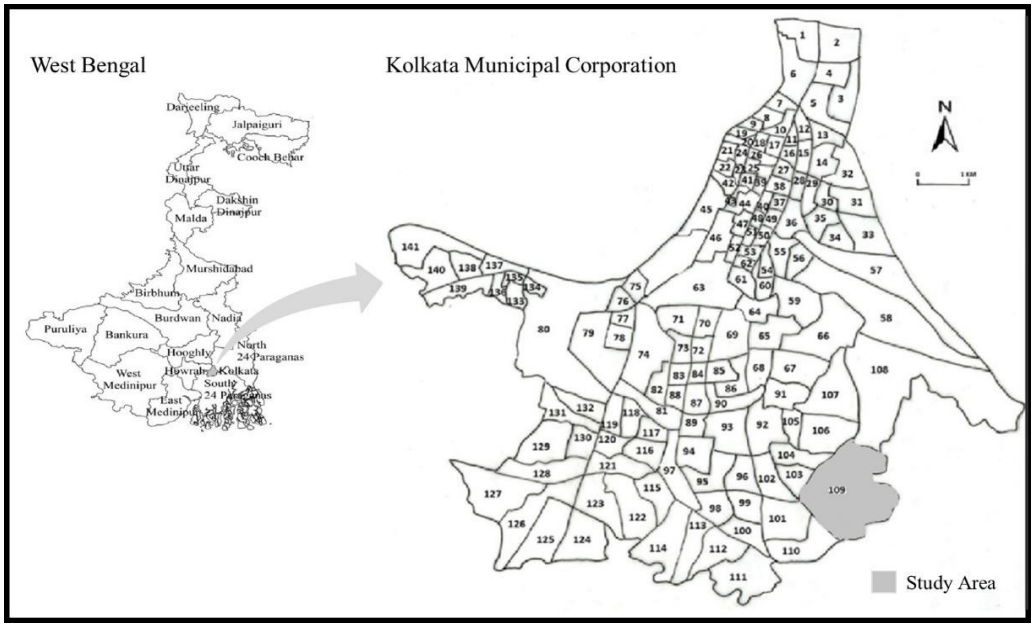
Figure 1

Location map, Ward 109, Kolkata Municipal Corporation

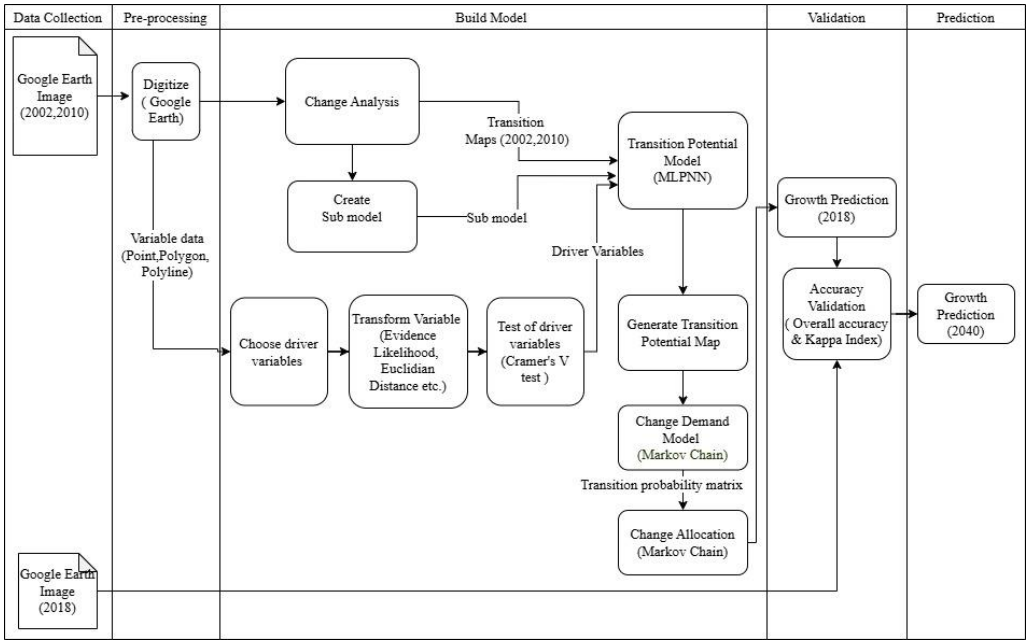


For land planning, the LCM is a method for predicting changes in land use. It maps future change scenarios using historical land cover change maps and empirically models the relationship between land cover transitions and explanatory variables (Eastman & Toledano, 2017).

The growth prediction computation consists of five stages, as depicted in Figure 2: data collection, pre-processing, transition potential and changes demand modelling, building the model, validation, and prediction.

Figure 2

Proposed Methodology for Growth Prediction



As shown in Figure 2, images of two base years are selected for the study area during the data collection stage. To enhance the accuracy of predictions, multitemporal land-use maps for 2002 and 2010 have been developed from Google Earth images. Five land use classes have been identified: Built-up Area, Vacant Land, Vegetation, Waterbody, stadium, and Open Space. CartoDEM has been downloaded from the National Remote Sensing Centre, BHUVAN website (bhuvan.nrsc. gov.in) to generate the slope map.

A Digital Elevation Model (DEM) map has been extracted from Cartosat satellite data. A slope map generated from a digital elevation model (DEM) in ArcGIS shows the rate of elevation change for each cell. Roads and railway lines in polyline features, rail stations, hospitals, and nearest working places as point features, as well as built-up areas, water bodies, and other land use classes as polygon features, have been digitised in Google Earth and converted from a KML file to a .shp file in ArcGIS. Euclidean distance maps for the variables calculate Euclidean distance from the centre of the source cell to the centre of the closest cell of the variables, which are generated in ArcGIS. Maps are exported to an ASCII file and imported into IDRISI 17.0 SELVA Edition. However, time is required for this kind of extensive work to ensure proper planning and prediction.

The growth prediction begins with transition maps, which display the changes in land cover over time between two different years, generated by the change analysis

process in IDRISI Selva. Sub-models are created from the transition maps. The driver variables (Eastman, 2012) need to be selected based on prior experience and data availability, then transformed and tested repeatedly before being imported into the sub-model structure. The Euclidean distance of each variable has been computed and extracted from the point or polyline features of the digitised images. For the chosen variables, transformation using the evidence likelihood method (Eastman, 2009), which evaluates the strength of the association of variables with the hypothesis, has been found to yield better outcomes. Each variable is tested using Cramer's V test (Cramer, 1946; Eastman, 2009), which represents the association between the variable and the distribution of land covers in the future land cover map to select useful driver variables. This test has been incorporated into the transition sub-model evaluation structure. Once the transition sub-model structure is formed, it is executed using the MLPNN procedure. The model is tuned, built, and run to generate transition potential maps that represent the pressures on each land use for potential changes.

The "change demand model" (Eastman, 2009) uses transition potential maps (Eastman, 2012) for the prediction year. The model utilises MCM to calculate the probability of transitioning from one category of LU to another, referred to as the transition probability matrix (Eastman, 2009). The change allocation module uses transition potential maps and a transition probability matrix to generate the prediction maps (Eastman, 2009) for a recent prediction year for which actual images are available.

The predicted results are compared with the actual image, and an accuracy assessment is performed by computing the overall accuracy and the kappa index (Liu & Mason, 2016).

Once the accuracy is established at 91%, a prediction for the year 2040 has been made to compare it with the census population, which is expected to be released in 2041.

Population projection is a way of estimating the population for future dates. Based on past and present decadal data collected from the Census of India (1991, 2001, 2011), the population of 2021 has been forecasted. The arithmetic increase method, geometric increase method, incremental increase method, and declining growth method are the methods used for estimating future population growth.

The arithmetic increase method follows the formula:

$$P_n = P_0 + nc \quad (1)$$

Where the prospective population P_n after n decades, P_0 is the last known population, and c is the rate of population growth.

In the Geometrical increase method, the formula is

$$P_n = P_0 \left(1 + \frac{r}{100}\right)^n \quad (2)$$

Where population P_n after n decades, P_0 is the latest known population, *and* r is the geometric mean.

In the Incremental increase method, the population after the nth decade

$$P_n = P_0 + nc + \frac{n(n+1)}{2}x \quad (3)$$

Where, estimated population P_n after n decades, P_0 is the last known population, c is the average increase, and x is the incremental increase.

In the Declining growth method, the formula is

$$P_n = P_0 + \frac{r-r_1}{100} * P_0 \quad (4)$$

Where, estimated population P_n after n decades, P_0 is the last known population, r is the percentage increase of the population, r_1 is a decrease in the percentage of the population

the average of the arithmetic increase, geometric increase, incremental increase, and declining growth methods has been taken as the projected population for Ward 109, KMC, for the year 2021 to avoid the biases inherent in the results of any single method,

Planners and policymakers can utilise this study to inform land use changes that support sustainable development.

Discussion and Results

Two digitised base year maps for the years 2002 and 2010, developed in Google Earth and processed in ArcGIS 10.2, have been exported to IDRISI Selva 17.0, which uses an MLPNN-based (Jensen, 2015) land change modeller (LCM) and Markov chain algorithms (Eastman, 2009).

The land use distribution of KMC Ward 109 for the years 2002 and 2010 reveals that, within 8 years, the built-up area more than doubled, while the vegetation area decreased by over twice (Table 1). Accessibility to the city and the expansion of metro railways are the root causes of the growth in the built-up area.

Table 1
Land Use Distribution in KMC Ward 109 (in per cent)

Classes	2002	2010
Built-up Area	21.13	45.17
Vacant Land	61.02	41.37
Waterbody	16.00	11.87
Vegetation	1.50	0.68
Stadium and Open Space	0.35	0.90

The conversion of vacant land, vegetation, and water bodies into built-up areas. Transitioning the water body to vacant land is also the first step in the expansion of the built-up area. The depletion of vegetated land to built-up areas and vacant landmarks is a change in the land character of the Ward. 7.28 ha of waterbody has been transformed into a built-up area, and more alarmingly, another 21.01 ha of waterbody has been converted to vacant land, highlighting a lack of governance. The intrusion of new urban areas and the introduction of high rises often require the demolition of older

construction sites. Hence, built-up areas are often found to change to vacant land LU (11.39 ha in the transition matrix (Table 2).

Furthermore, sub-models derived from transitions identify the potential of five land use (LU) classes: built-up areas, vacant land, vegetation, water bodies, stadiums and open spaces. These sub-models are later grouped to drive the underlying determinants of prediction (Table 3).

Table 2
Land Use Transition Matrix in KMC Ward 109 (in hectares)

		Land cover (LC) in 2010 (ha)				
	Classes	Built-up area	Stadium and open space	Vacant land	Vegetation	Waterbody
LC in 2002 (ha)	Built-up area	**136.82**	00.68	11.39	0	0
	Stadium and open space	0	**2.30**	0	2.3	0
	Vacant land	173.32	2.93	**250.48**	3.3	0.43
	Vegetation	1.2	0	8.80	**0.48**	0
	Waterbody	7.28	0.37	21.01	0.92	**83.24**

Table 3
Sub-models Generated From Transition Maps

Sub-model	Changes from	Changes to
Change_to_built	Vacant land, Vegetation, Waterbody	Built-up area
Change_to_vacant	Built-up area, Vegetation, Waterbody	Vacant land
Change to_veg	Waterbody, Vacant land	Vegetation
Change_to stad	Waterbody, Vacant land, Built-up area	Stadium and open space

Table 4
The Driver Variables for Growth Prediction for KMC Ward 109

No.	Variable Category	Variable	Distance method	Evidence Likelihood	Cramer's V test
1	Socio-economic	Distance to built-up area	Euclidian distance	Yes	0.4001
2		Distance to schools	--do--	Yes	0.1180*
3		Distance to workplaces	--do--	Yes	0.1700
4		Distance to hospitals and health services	--do--	Yes	0.1330
5	Utilities	Distance to roads	--do--		0.2027
6		Distance to the railway	--do--	Yes	0.1300

7		Distance to railway stations	--do--		0.1800
8	Physical area	Digital Elevation Model (DEM)	No	No	0.1805*
9		Slope in per cent	No	No	0.0552
10	Environmental	Distance to water body	--do--	Yes	0.4505
11		Distance to vegetation	--do--	Yes	0.4541
12		Distance to vacant land	--do--	Yes	0.4683
* These variables are not included in the Transition Sub-model structure.					

The driver variables have been considered based on similar research works, including stakeholder interviews and the ease of data availability. Twelve variables are selected (Table 4) and quantified for Euclidean distances, transformed using evidence likelihood and tested with Cramer's V before being included in the transition potential model structure. Cramer's V values of 0.15 or larger indicate that the potential explanatory value of the variable is acceptable, and those exceeding 0.4 are considered good (Hasan et al., 2020). The maps generated by the evidence likelihood transformation method are also tested before being included in the model.

Transition potential maps are generated for each sub-model and each land transition. They are used by the 'change demand model' to predict changes for the prediction year. The Markov Chain Model (MCM) produces the probability of transition from one category to another. MCM generates a transition probability matrix, which is used by the 'Change Allocation Model' to derive changes for the prediction year and generate prediction maps.

The prediction map for 2018 has been generated (Fig. 3) and validated against the actual image through accuracy assessment in Table 5. The actual map for 2018 was generated through digitisation from Google Earth, and an accuracy assessment was performed using GPS real-world data and Google Earth.

The accuracy assessment in Table 5 shows an overall accuracy of 95% and a kappa index of 0.93, which is acceptable for further simulation. Likewise, accuracy in individual categories yields satisfactory results, as indicated by 'User's accuracy' and 'Producer's accuracy'. The Kappa index also shows a high degree of accuracy.

Figure 3

Predicted LU of 2018 and Actual LU for 2018(in ha and per cent) for KMC Ward 109

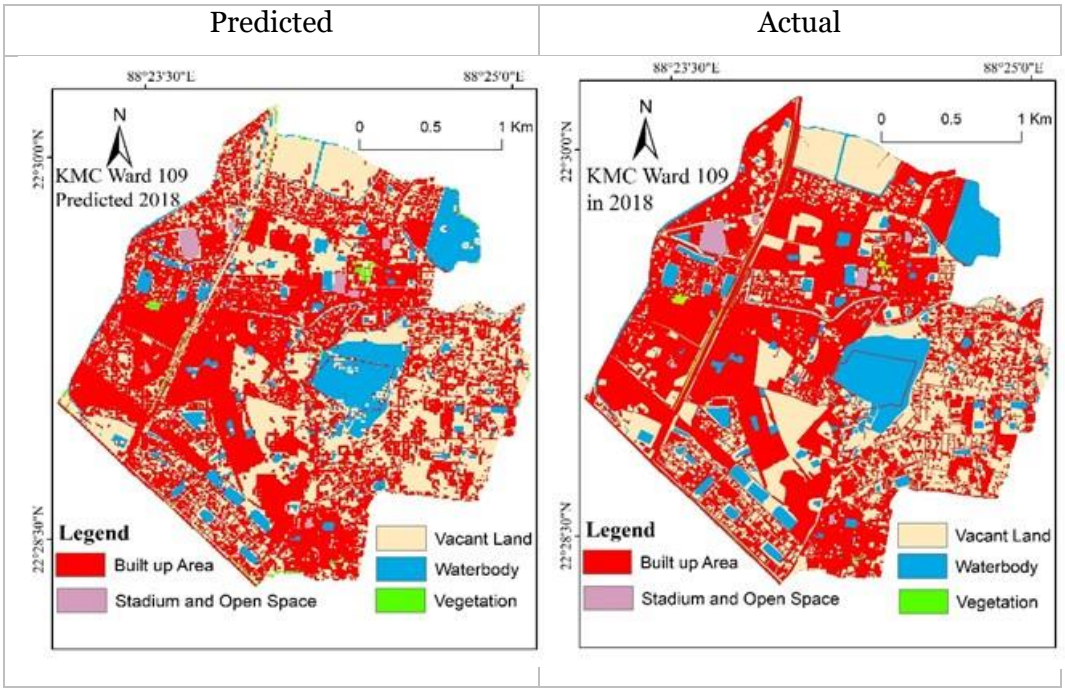


Table 5

Accuracy Assessment for the Predicted Map of 2018 for KMC Ward 109

		Reference data						
Classified data		Built-up area	Vacant land	Water body	Vegetation	Stadium and Open Space	Total	User's accuracy
	Built-up area	**101**	4	0	1	0	106	95%
	Vacant land	1	**33**	1	0	0	35	94%
	Waterbody	0	0	**33**	0	0	33	100%
	Vegetation	0	0	2	**14**	0	16	88%
	Stadium and Open Space	0	1	0	0	**14**	15	93%
	Total	102	38	36	15	14	205	
	Producer's accuracy	99%	87%	92%	93%	100%		

$Overall\ accuracy\ = 195/205\ = 95\%$

$$Kappa\ Index = \frac{205*(101+33+14+14+195)-\{106*102+35*38+33*36+16*15+14*15)\}}{205^2-\{(27*23)+(22*24)+(22*24)+(15*13)+(16*14)\}} = 0.93$$

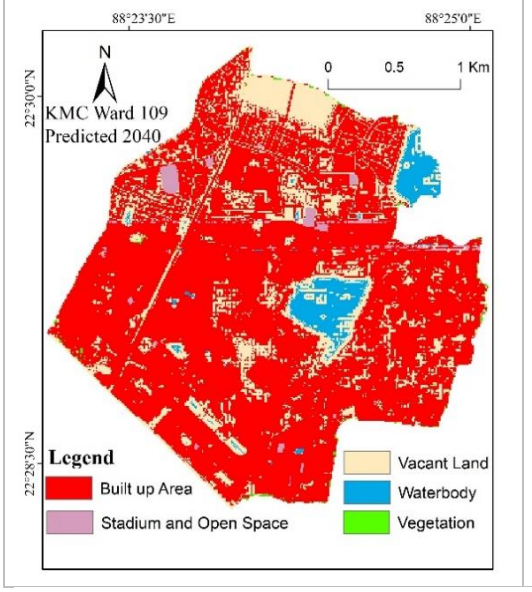
Accuracy assessment (Table 5) shows the model's acceptability. Hence, after validation, forecasting was done for the year 2040 (Fig. 4).

The predicted map of 2040 in Fig. 4 shows an increase in built-up area, with large patches of water bodies drying up. Hence, in 2040, other significant patches might also be challenged if not intervened upon now. Increasing built-up area from 21.13% in 2002 (Table 1) to 74.63% in 2040 (Fig 2) and diminishing vacant land (61.02% in 2002 to 19.56% in 2040), waterbody (16% in 2002 to 5.13% in 2040) and vegetation (1.50% in 2002 to 0.38% in 2040) will heavily affect the environment, necessitating immediate vigilance and planning. The conversion of vegetation and water bodies to built-up areas during urban expansion can still be stopped by proper governance.

In the arithmetic increase method, geometric increase method, incremental increase method, and decreasing rate of growth method, the projected population for Ward 109 in 2021 is 85,215, 107,476, 97,857, and 117,512, respectively. For the year 2021, the projected population, which is the average of all the said methods, will be 102015 (Fig. 5).

Figure 4

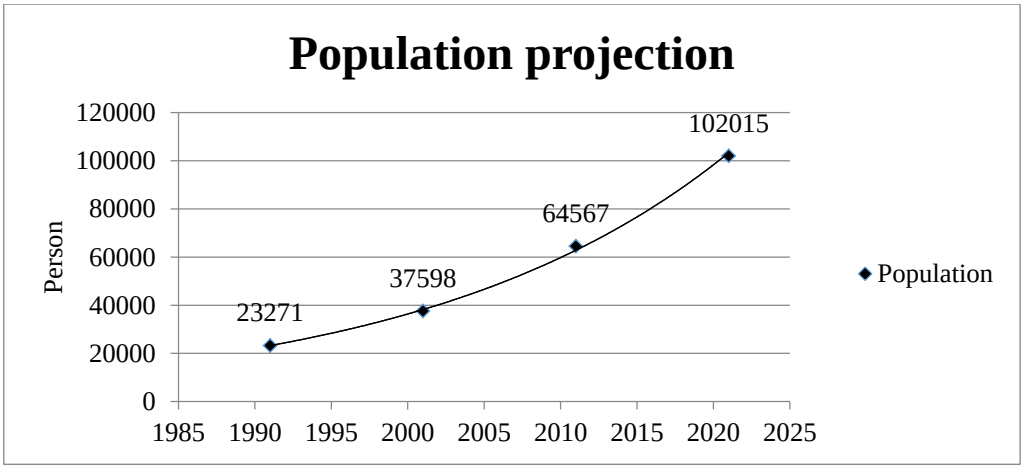
Predicted Land Use of 2040 for KMC Ward 109



Land uses	2040	
Vegetation	2.7 ha	0.38%
Built-up Area	526.73 ha	74.63%
Waterbody	27.9 ha	5.13%
Stadium and other open spaces	10.08 ha	1.73%
Vacant Land	137.93 ha	19.56%
Total	705.34 ha	100%

Figure 5

Population projection for the KMC Ward 109



The Ministry of Urban Affairs and Employment, Government of India, published Urban Development Plan Formulations and Implementation in 1996. It has established advanced guidelines for making cities and towns sustainable by generating sufficient resources with the assistance of State Town and Country Planning departments, urban development authorities, urban local bodies, planning schools, and various research institutions.

The paper compares the real-world situation with the guidelines for 2021, which would help to develop sustainable planning for other likely areas. Table 6 presents the guidelines of URDPFI (Government of India, 2014), which do not prescribe a minimum quantity for agricultural and water bodies.

According to URDPFI (Table 6), KMC Ward 109 could be considered a small town for 1991, with a population of 23,271, although it had 32.99 persons per hectare (pph), which falls below the specified range of 75-125 pph. In 2011, it approached a medium-sized city with a population of 64567. However, the density was 91.55 persons per hour (pph), against the stipulated range of 100-150 pph, and was projected to increase to 102,015 persons with a density of 144.65 pph in 2021. It can be considered a full-fledged, medium-sized town.

KMC Ward 109 has a higher density of residential areas (Table 7), at 45.54% (321.19 ha), derived from Google Earth imagery and real-world locations. The facilities and vicinity attract people, and thus, the residential areas are spreading wider. A ground survey reveals high rises in many areas. The residents of these high-rises primarily rely on water from the borewell. Large housing complexes often have their water treatment plants, but standalone flats typically do not. A few congested slum areas are also present, and no layout plan is available for the

residential zone. Sufficient light and air in the buildings, as well as soil water outlets, are lacking, along with protection from noise, dust, and local hazards, in these slums. Although URDPFI has suggested that there should be 4-5% commercial and 10-12% industrial land use in Ward 109, the actual figures are 3% and 0.1%. Government, semi-government, and government-owned land, as well as land for educational and research purposes, medical and health facilities, and social, cultural, and religious purposes, all fall under the public and semi-public land use category. Any large city should have 12-14% of its land designated as public and semi-public, but Ward 109 has only 2.0% of its land allocated for this purpose. As the said Ward is part of a large city, it has very low public and semi-public land. Lands for recreational purposes are also very low, which should be noted in future planning.

Table 6

According to URDPFI, the Land Use Structure of any Urban Centre

Proposed LU structure of Urban Centres by URDPFI				
	Percentage of developed area			
Land use category	Small town	Medium town	Large cities	Metro cities
Population	5k to 50k	50k-5 lakh	5 to 50 lakh	10 lakh -1 crore
Density (persons per hectare)	75-125	100-150	125-175	125-175
Residential	45-50	40-45	35-40	35-40
Commercial	2-3	3-4	4-5	4-5
Industrial	8-10	8-10	10-12	12-14
Public and Semi-Public	6-8	10-12	12-14	14-16
Recreational	12-14	18-20	18-20	20-25
Transport and Communication	10-12	12-14	12-14	15-18
Agriculture and Water bodies	balance	balance	balance	balance

Source: Urban and regional development plans formulation and implementation guidelines, URDPFI, Vol 1, 2014, Tables 5.1 and 5.2

Table 7

LU Structure of KMC Ward 109 in 2021

Ward 109					
LU Category	%	ha	LU Category	%	ha
Residential	45.54	321.19	Transport and Communication	12.29	86.71
Commercial	3.32	23.4	Agriculture	3.11	22
Industrial	0.12	0.83	Water bodies	3.97	28
Public and Semi-Public	2.13	15	Vacant land	29.07	205.01
Recreational	0.45	3.2	Total	100	705.34

The above discussion indicates that comparing the URDPFI Guidelines, 2014, reveals that built-up areas are increasing disproportionately, leaving a smaller share of vegetation, agricultural land, and waterbodies, thereby widening the gap between the provided and proposed percentages. Hence, stringent controls should be implemented to prevent unplanned growth by 2040. In the days to come, the impact of urbanisation will be aggravated if the crisis and demand are not addressed with adequate infrastructural support, considering the driving forces.

Conclusion

This paper aims to assess the problems of rapid urbanisation in a peripheral area of KMC. Attempts have been made to generate land use changes, analyse the changes, and predict future LULC if the process continues uncontrolled till the horizon year 2040. Comparison with the government guidelines urges for meticulous planning at the micro level, following certain guidelines and recommendations of the URDPFI guidelines, 2014, stated by the Ministry of Urban Development, Government of India and implement them in phases, conserve the allocated spaces for the future use, and monitor the changes regularly and redress any untoward shift.

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Utilisation of Maternal Health Care Services by Scheduled and Non-Scheduled Caste Women: Evidence from Punjab

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Sharma, P. K. & Gaur, N. (2025). Utilisation of maternal health care services by scheduled and non-scheduled caste women: Evidence from Punjab. *Population Geography*, 47(1), 47–72.

Abstract

The study examines maternal healthcare utilisation in Punjab, focusing on the differences between Scheduled Castes (SCs) and non-Scheduled Castes (Non-SCs), using disaggregated data from the National Family Health Survey-5 (2019-2021). It employs descriptive, bivariate, and multivariate analysis techniques. Non-scheduled caste women have slightly better access to maternal health services than scheduled caste women, who experience more economic, social, and educational challenges. While both groups have similar antenatal care practices, non-scheduled caste women are more likely to use natal and postnatal care. Despite these disparities, overall maternal health care utilisation between SC and non-SC women remains broadly comparable. This parity may be influenced by the egalitarian ethos of Sikhism, which promotes equality and social justice. However, Punjab's maternal mortality rate of 105 remains high compared to Kerala's 19 and Maharashtra's 33. The state government is making efforts to improve access to maternal health for all, particularly for vulnerable populations from the scheduled castes.

Keywords: maternal health, caste disparities, natal care, postnatal care, Punjab

Introduction

The maternal mortality ratio, which is the proportion of maternal deaths per 100,000 live births due to causes related to pregnancy or within 42 days of termination of pregnancy, has declined by 34.3 per cent between 2000 and 2020. India's maternal mortality rate (MMR) was 103 in 2020, a significant improvement from 384 in 2000 (WHO, 2023). The risk of maternal death for a 15-year-old girl in 2020 is estimated to be 1 in 210, which is roughly half of what it was in 2000 (1 in 120).

However, it is disheartening to observe India's estimated 24,000 maternal deaths, which rank second only to Nigeria. India accounted for 8.3 per cent of global maternal deaths.

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The burden of maternal mortality varies significantly across regions and income groups. Generally, maternal deaths at the global level are inversely proportional to a country's economic development. Global experience has shown that quality obstetric care — encompassing efficient antenatal services, the prevention and treatment of anaemia, safe natal care, and postnatal support — has led to a reduction in maternal mortality. Maternal deaths worldwide result from factors such as obstetric haemorrhage, pregnancy-related infections, unsafe abortion, hypertension, delivery complications, and anaesthetic issues (Montgomery et al., 2014). Over half of maternal deaths stem from haemorrhage, hypertensive disorders, and sepsis (Say et al., 2014). Timely access to maternal and reproductive health services could have significantly reduced the number of maternal deaths in these areas (Dunn et al., 2017). The situation in India mirrors this trend. According to UNICEF, two-thirds of maternal deaths in India arise from severe bleeding (mostly postpartum), infections (typically after childbirth), high blood pressure during pregnancy (pre-eclampsia and eclampsia), delivery complications, and unsafe abortions. In India, a significant barrier to care is inadequate infrastructure, high costs involved, and a preference for home births. The increase in maternal deaths is also tied to cultural norms that promote early marriage and childbearing. As a result, women are likely to experience frequent pregnancies, face complications, and are disproportionately affected by these challenges.

India has made significant efforts to reduce maternal mortality and improve access to maternal healthcare. Although progress has been made, it remains uneven and inequitable, with many women still lacking access to these services. The national average maternal mortality ratio (MMR) stands at 103 per 100,000 live births, which is considerably higher than in neighbouring countries such as Thailand (29) and Sri Lanka (29) (WHO, UNICEF, UNFPA, and World Bank, 2023). The Government of India, under the National Health Mission (NHM), is actively pursuing the goal of reducing maternal mortality by focusing on key strategies for essential antenatal, natal, and postnatal care services across various states. However, notable disparities exist among the states of India as revealed in the SRS data (Table 1). The MMR ranges from a low of 19 in Kerala to a high of 195 in Assam. Compared to the national average of 97, Assam (195), Madhya Pradesh (173), Uttar Pradesh (167), and Chhattisgarh (137) exhibit higher maternal mortality ratios. In contrast, Kerala (19), Maharashtra (33), Telangana (43), and Andhra Pradesh (45) show lower maternal mortality ratios. Haryana (110) and Punjab (105) are less favourably positioned compared to the states with the lowest MMRs mentioned above.

There has been a notable decline in maternal mortality rates across all major states. Rajasthan, Jharkhand, Assam, and Bihar experienced the largest drop in MMR in absolute numbers from 2007-09 to 2018-20, with Rajasthan and Jharkhand each seeing a decrease of 205 points. Assam and Bihar experienced

declines of 195 points and 143 points, respectively. During the same period, Punjab fell from 172 to 105, and Haryana decreased from 153 to 110. This persistent decline has enabled India to meet the National Health Policy (NHP) goal of 100 per 100,000 live births by 2020. It is certainly on track to achieve the Sustainable Development Goal (SDG) target of 70 per 100,000 live births by 2030.

Maternal mortality is not only a health disadvantage; it is also a matter of social injustice. Significant disparities exist in this regard between the wealthy and the poor, as well as between rural and urban areas. Furthermore, these disparities vary between the scheduled castes (SCs) and non-scheduled castes (non-SCs). Numerous studies have documented that SCs have traditionally been a disadvantaged group in Indian society. They represent a deprived section of society that typically lacks economic resources, social status, and personal motivation to access reproductive health care services, resulting in higher rates of morbidity and mortality.

Table 1

Maternal Mortality Ratio and Lifetime Risk in India and Selected States, 2007-09 to 2018-20

Major states	2007-09		2015-17		2018-20	
	MMR	Lifetime risk *	MMR	Lifetime risk *	MMR	Lifetime risk *
Assam	390	1.0	229	0.5	195	0.42
Madhya Pradesh	269	1.0	188	0.6	173	0.53
Uttar Pradesh	194	1.4	216	0.7	167	0.50
Chhattisgarh	269	1.0	141	0.4	137	0.35
Odisha	258	0.7	168	0.4	119	0.25
Bihar	261	1.0	165	0.6	118	0.39
Rajasthan	318	1.2	186	0.6	113	0.33
Haryana	153	0.5	98	0.3	110	0.28
Punjab	172	0.4	122	0.2	105	0.19
Uttarakhand	194	1.4	89	0.2	103	0.22
West Bengal	145	0.3	94	0.2	103	0.18
INDIA	**212**	**0.6**	**122**	**0.3**	**97**	**0.21**
Karnataka	178	0.4	97	0.3	69	0.12
Gujarat	148	0.4	87	0.2	57	0.14
Jharkhand	261	1.0	76	0.2	56	0.15
Tamil Nadu	97	0.2	63	0.2	54	0.09
Andhra Pradesh	134	0.3	74	0.1	45	0.08
Telangana	-	-	76	0.1	43	0.08
Maharashtra	104	0.2	55	0.1	33	0.06
Kerala	81	0.1	42	0.1	19	0.03
Other states	149	0.4	90	0.2	76	0.15

Source: Office of the Registrar General of India, compiled from various volumes of Special Bulletins on Maternal Mortality in India (2007-09, 2015-17, and 2018-20), SRS Bulletins, Vital Statistics Division, Office of the Registrar General, India.

Note: * - Lifetime risk – Here, it is calculated as the probability that at least one woman of reproductive age (15-49) will die due to childbirth or puerperium.

Review of Literature

Caste plays a significant role in Indian society, influencing women's access to healthcare. For women from poorer, marginalised, and disadvantaged groups, accessing healthcare services is more challenging than for those from wealthier, non-marginalised, and advantaged groups. Social structures in India, as in many other contexts, hinder women's access to maternal and reproductive healthcare. The distribution of health inequities results not only from unequal access but also from unjust or insufficient social arrangements (Linda et al., 2013). Mishra et al. (2021) reported significant disparities in access to healthcare benefits within and across socioeconomic groups. Research indicates that women 's socioeconomic status and caste often influence their ability to utilise maternal health care services (Ali et al., 2021). Caste-based exclusion and discrimination are primary determinants of socioeconomic inequities across nearly all aspects of well-being in India, including maternal healthcare (Baru et al., 2010). The two most socially disadvantaged groups in India are the scheduled castes (SCs) and scheduled tribes (STs), both of which experience comparatively poorer health outcomes. Scheduled caste women face discrimination based on their caste when accessing maternal and reproductive health services (Patel et al., 2018). The caste identity of patients plays a crucial role in determining access to maternal health benefit schemes such as Janani Suraksha Yojana (Mishra et al., 2021). Compared to those from lower castes, women from upper castes demonstrate higher utilisation of reproductive health services due to their better socioeconomic status, which influences their reproductive choices. Women from scheduled castes experience more complications as a result of caste influences on healthcare provisions (Raj & Gupta, 2022). Although they represent a small proportion of the general population, women in the vulnerable SC/ST group have a disproportionately high rate of maternal deaths (Tanzin et al., 2013). Among the 1103 identified maternal deaths across Orissa, Rajasthan, Jharkhand, and Bihar, it was discovered that two-thirds occurred within the SC/ST groups. Additionally, 63 per cent of the maternal deaths transpired in families living below the poverty line.

The use of maternal health services helps reduce maternal morbidity and mortality; however, the utilisation of these services is influenced by various factors (Jat et al., 2011). Roy's (2004) analysis of health and nutrition inequities in select states revealed that socio-economic differences between the scheduled and other castes have resulted in disparities. Maternal mortality rates are higher among women living in rural areas and poorer communities, demonstrating significant differences between states and social classes. Despite this, most maternal deaths are preventable, as

healthcare solutions for preventing, diagnosing, and managing complications are well recognised. Basic maternal services, such as antenatal care (ANC), skilled birth attendance, and postnatal care (PNC), are essential for decreasing and managing pregnancy complications and alleviating the burden of these preventable deaths (Adam et al., 2005).

The persistently high rates of maternal mortality and morbidity among historically marginalised social groups, such as adolescent SCs and STs in India, can be partly attributed to the low utilisation of comprehensive antenatal healthcare services. Despite efforts by the Indian government, the uptake of full antenatal care (ANC) remains low among this population (Singh et al., 2023).

In comparison to other population groups, the population of scheduled castes and tribes is more likely to suffer from preventable diseases, have a lower life expectancy, and experience higher maternal and infant mortality rates. Furthermore, women from scheduled castes and tribes are more vulnerable to maternal morbidity and mortality than those from other social groups. Most maternal deaths are preventable through adequate and timely antenatal, delivery, and postpartum care for mothers (Radkar et al., 2007).

According to Keefer (2004), the social process of discrimination systematically excludes disadvantaged groups from accessing public services in India. The evidence indicates a significant disparity in health, access to education, and achievement within villages. The privileged castes in these villages attain higher achievements, while the deprived castes within the same areas experience lower utilisation. Furthermore, it was discovered that districts with a higher proportion of traditionally disadvantaged groups, in terms of caste, had lower public investment in the health and education sectors. Srinivasan (2004) found that instances of abject and moderate deprivation were more prevalent among society's scheduled caste members compared to other castes, despite a noticeable decline in the deprivation index level in both categories. Mishra (2006) noted the ongoing injustices in Indian society and the deprivation resulting from the market economy, which contributes to poor health conditions for disadvantaged social groups. Women from these groups are more likely to experience moderate to severe anaemia as access to resources becomes restricted and purchasing power increasingly dictates their well-being. The poor health status of scheduled caste women is attributed to financial constraints and limited access to healthcare services. Bajpai and Goyal (2004) investigated the extensive disparities in poverty, health, and educational outcomes across various segments of society. They found that caste and class are systematically linked to disparate outcomes in well-being. Even after 50 years of independence, the caste divide persists in the social

landscape, despite the Government of India's affirmative policy in favour of scheduled castes. Poverty is concentrated in areas with a higher proportion of backward castes and low female literacy rates. Caste remains a significant social determinant, with those belonging to the scheduled caste community lagging in access to healthcare services.

Socioeconomic inequalities in mother and child health represent a significant concern for achieving the Millennium Development Goals established by the United Nations (Kruk, Prescott, & de Pinho, 2011). Women and children from SC and ST backgrounds often experience poorer health outcomes compared to those from other castes (Jungari & Bomble, 2013). Numerous studies have highlighted the role of discrimination in limiting access to healthcare; indeed, public healthcare service providers tend to discriminate more than their private counterparts. Poor SC and ST households frequently cannot afford private healthcare, leading to a higher likelihood of discrimination (Selvaraj & Karan, 2009). The utilisation and accessibility of healthcare services are significantly affected by various inequalities, including social, economic, political, and geographical factors (Das et al., 2022). Consequently, social exclusion and deprivation greatly influence healthcare accessibility and overall health.

The WHO recommends that a safe motherhood programme in a country like India should involve three key elements: four or more antenatal care (ANC) visits, delivery assisted by skilled birth attendants (SBAs), and three postnatal check-ups. Based on the existing evidence, Yadav et al. (2020) suggest that utilising maternal healthcare services is strongly related to socioeconomic and demographic factors. To mitigate the health risks associated with maternal healthcare, it is crucial to examine the differences between scheduled and non-scheduled castes. This is particularly critical for scheduled caste women, who have historically faced disadvantages in various aspects of their lives.

Although caste-based inequalities in maternal health care have been extensively studied at the national level, much research still needs to be done to understand the various aspects of caste-based health inequalities at the state level, particularly in Punjab. To address this gap, this study investigates the utilisation of maternal healthcare services by SCs and non-SCs in Punjab, using nationally representative data from NFHS-5.

Objectives

This paper analyses the disparities in maternal health care utilisation in Punjab across two caste groups: scheduled castes and non-scheduled castes. Maternal health care differentials are examined using specific parameters such as ANC (mothers who had antenatal check-ups in the first trimester, mothers who had at least four antenatal care visits, and mothers who received full

antenatal care), natal care (institutional births), and postnatal care services (mothers who received postnatal care from a doctor, nurse, lady health visitor, auxiliary and midwife, or other health personnel within two days of delivery). This study examines the factors influencing maternal healthcare utilisation between the two caste-based groups.

In the health policy context, the use of maternal healthcare services by two communities is likely to lead to a more effective use of evidence, especially if there are significant differences in their usage.

Data and Methods

The study utilised unit-level NFHS-5 data conducted under the auspices of the Ministry of Health and Family Welfare, Government of India, in New Delhi. The nodal agency, the International Institute for Population Sciences, coordinated NFHS-5. This nationally representative survey was carried out between 2019 and 2021. The NFHS provides reliable assessments of national, state, and regional indicators across various parameters, including maternal and child health care services.

The representative sample size for Punjab comprised 18,824 households and 21,771 ever-married women aged 15 to 49. All 22 districts of Punjab were surveyed during the NFHS-5 fieldwork, which took place from January 5 to March 21, 2020, before the lockdown, and from December 6, 2020, to March 31, 2021, after the lockdown due to COVID-19. Among the 4,570 women in Punjab who had given birth in the five years prior to the survey, 49.7% identified as belonging to the Scheduled Caste (SC) category, while the remaining 50.3% were from the non-SC category.

The differences between SCs and non-SCs were identified by analysing their background characteristics using the disaggregated NFHS-5 data. These characteristics included place of residence, mother's educational level, religion, and the household wealth index. Urban and rural categories were employed to classify places of residence. Women's education levels were categorised into four groups: no education, primary, secondary, and higher. Religion was categorised into Hindu, Muslim, Sikh, Christian, and other groups. The wealth index for women's households was divided into five categories: poorest, poor, middle, richer, and richest. Data analysis was conducted using SPSS.

Descriptive statistics, alongside bivariate and multivariate techniques, have been employed for analysis. The disparities in maternal health care utilisation between non-SCs and SCs have been examined using a decomposition technique within multivariate analysis. The independent variables used for this purpose include type of residence, education level, religion, and wealth quintile. The dependent variables comprise first-trimester registration, receipt of four antenatal care visits, two doses of tetanus toxoid injections, institutional births, and postnatal check-ups.

The paper’s discussion is organised into three sections—

antenatal care, natal care, and postnatal care— which represent three successive chronological phases of pregnancy. Access to various preventive and curative services at each stage is crucial for a safe delivery. The parameters discussed in antenatal care include the status of pregnancy registration during the first trimester, a minimum of four antenatal care (ANC) visits, two or more tetanus toxoid (TT) injections, and at least 100 iron-folic-acid (IFA) tablets. For natal care, the key parameter is institutional delivery, differentiated between the public and private sectors. In postnatal care, the focus is on postnatal check-ups following delivery. The parameters related to antenatal, natal, and postnatal care services aim to prevent neonatal and infant deaths, thereby reducing the likelihood of maternal deaths associated with pregnancy exposure.

Results and Discussion

Antenatal Care Differentials

A woman's health condition is influenced by the socio-economic environment in which she lives, her awareness of health facilities, and her willingness to utilise health services. Socioeconomic characteristics, such as locality, religion, education, and wealth index, significantly impact the accessibility, affordability, and awareness of maternal health services, as well as individuals' attitudes towards utilising these services.

The antenatal period, which spans from conception to the onset of labour, consists of three trimesters of pregnancy. During this time, it is essential to identify and manage pre-existing factors that contribute to a high risk of complications to ensure safe delivery. Timely referral to a facility for professional care is crucial. Antenatal care services have been examined regarding (i) first-trimester registration, (ii) four or more ANC visits, (iii) the administration of two doses of tetanus toxoid, and (iv) the provision of at least 100 iron and folic acid tablets.

Table 2 presents the percentage of women who received a first-trimester ANC check-up during their last pregnancy, categorised by background characteristics and caste groups in Punjab. Table 2 displays the percentage of women who received a first-trimester ANC check-up during their last pregnancy, categorised by caste groups in Punjab, based on their background characteristics. The analysis shows that nine out of every ten women in Punjab, regardless of caste, registered themselves in the first trimester. Rural Punjab's first-trimester registration rate was slightly higher among non-SCs (92.9 per cent) than SCs (90.7 per cent). Registration in the first trimester of pregnancy is not significantly affected by women's educational attainment, regardless of whether they belong to the SC or non-SC category. In Punjab, the two main religious groups are Hinduism and Sikhism. The first-trimester registration among non-SC Hindus and Sikhs was slightly above that of their counterparts.

The use of first-trimester registration among both population segments yields intriguing results based on wealth status. As wealth status increases, the differences in first-trimester registration between SC and non-SC women have narrowed.

Substantial differences were observed in first-trimester registration for women with the lowest wealth status, with SC women being more inclined to register. In Punjab, nearly 94 per cent of SC women registered during the first trimester, compared to 83 per cent of non-SC women. This difference of about 10 per cent or more between the two segments of the population decreased to less than one per cent among women in the richest categories.

The sociocultural practices in some areas of the state influenced the timing of women's access to ANC services. Religious leaders affiliated with *Deras* have been observed to exert influence on families by instilling fear and discouraging them from disclosing pregnancy to other family members or healthcare personnel in some communities. Subsequently, these religious leaders suggested a suitable time for utilising the ANC facilities. As a result, ANC services were typically accessed after the first trimester. This challenge can be addressed by focusing on community-based health education to raise awareness, especially among adolescents, and prevent traditional beliefs from negatively affecting the community's access to ANC services.

Table 2

Pregnancies Registered in First Trimester among SCs and Non-SCs in Punjab, 2019-21

Background characteristics	SC (%)	Non-SC (%)	Total (%)
Type of residence			
Urban	91.6	90.1	90.8
Rural	90.7	92.9	91.7
Schooling			
No education	91.6	90.7	91.4
Primary	90.0	89.5	89.9
Secondary	90.8	93.1	91.9
Higher Secondary	92.1	90.3	90.7
Religion			
Hindu	89.2	91.0	90.2
Muslim	100.0	80.0	86.7
Christian	92.9	83.8	87.7
Sikh	91.8	93.2	92.5
Others	80.0	100.0	85.7
Wealth quintile			
Poorest	93.3	83.3	90.5
Poorer	86.6	90.0	87.4
Middle	87.4	91.9	88.5
Richer	90.8	90.1	90.6
Richest	93.2	92.4	92.7

Source: Computed from NFHS-5 disaggregated data.

Table 3

Women who Received Four or More ANC Visits during Pregnancy for their Most Recent Live Birth among SCs and Non-SCs in Punjab, 2019-21

Background characteristics	SC (%)	Non-SC (%)	Total (%)
Type of residence			
Urban	58.2	62.5	60.7
Rural	57.4	59.8	58.5
Schooling			
No education	53.6	43.2	50.6
Primary	54.2	56.0	54.6
Secondary	58.7	61.1	59.8
Higher Secondary	63.5	64.9	64.6
Religion			
Hindu	56.9	61.0	59.1
Muslim	29.2	40.0	36.5
Christian	57.1	61.0	59.4
Sikh	58.5	61.7	60.0
Others	100.0	100.0	100.0
Wealth quintile			
Poorest	44.7	28.6	39.0
Poorer	55.1	56.2	55.4
Middle	50.3	54.7	51.4
Richer	56.4	52.7	55.1
Richest	62.5	63.7	63.3

Source: Computed from NFHS-5 disaggregated data.

However, the Government of India's strategy to reach out to vulnerable SC groups and register them as soon as possible is yielding the desired outcomes.

The percentage of women who received four or more antenatal care (ANC) visits during their most recent pregnancy among Scheduled Castes (SCs) and non-Scheduled Castes (non-SCs) in Punjab is presented in Table 3. In this regard, it is evident that Scheduled Castes lag behind their counterparts in both urban and rural areas of Punjab. Women from Scheduled Castes were 4.3 per cent less likely to attend four or more ANC visits compared to their non-SC counterparts in urban Punjab and 2.4 per cent less likely in rural Punjab.

Women from SC and non-SC backgrounds are influenced by their educational attainments regarding the number of four or more ANC visits. The increase in educational attainment has resulted in a higher proportion of SC and non-SC women receiving four or more ANC visits. The rate of ANC visits for SC women in Punjab without education was 53.6 per cent, while 63.5 per cent of those with higher secondary education received four or more ANC visits. Non-SCs had corresponding figures of 43.2% and 65%, respectively. Within the same group of women with the same educational backgrounds, differences emerged in how SC and non-SC segments in the state utilised these services. A greater proportion of SC women with no education received four or more ANC visits compared to

illiterate non-SC women. Approximately 54 per cent of SC women with no education in Punjab received four or more ANC visits, compared to nearly 44 per cent of non-SC women. The distinction between SC and non-SC women diminished with higher educational attainment. The disparity between SC and non-SC women holding secondary school education in Punjab was 1.4 per cent.

The level of wealth influenced how women from both SC and non-SC communities utilised these services. In simple terms, the proportion of SC and non-SC women in the state who received four or more ANC visits increased with their wealth status. In Punjab, 44.7 per cent of SC women in the lowest wealth category received these services, compared to 62.5 per cent of women in the highest wealth category. The corresponding figures for non-SC women were 28.6% and 63.7%, respectively. Notably, non-SC women in the state with the poorest wealth status fell behind SC women with the same level of wealth. The difference between these two segments of the population narrowed as wealth status increased to the richest categories. The non-SC women outnumbered SC women when receiving four or more ANC visits in the richest category. Overall, non-SC women outperformed SC women in the state by 1.2 percentage points.

Pregnant women in both communities within the state are receiving nearly equal treatment regarding full doses of TT. Table 4 clearly shows that only marginal disparities existed between SC and non-SC women in Punjab concerning those fully vaccinated with tetanus toxoid. The percentage of non-SC women (84.7%) was slightly higher than that of SC women (82.2%) who had received full vaccination against tetanus toxoid. In rural Punjab, SC women had a 3.1 per cent higher vaccination rate for TT compared to non-SC women. Additionally, non-SC women in urban areas of Punjab were in a more favourable position than SC women concerning access to vaccines for TT.

Vaccination against TT is influenced by women's educational attainment, regardless of their SC or non-SC backgrounds. The proportion of women vaccinated against TT in the state increased due to higher educational attainments among SC and non-SC women. In Punjab, 79.7 per cent of illiterate SC women received TT, compared to 81.3 per cent of those with higher secondary education. The corresponding figures for non-SCs were 76.6% to 87.3%, respectively.

There was hardly any disparity among women belonging to SC Hindus in Punjab regarding the incidence of getting vaccinated against TT. However, the vaccination rate for TT among SC Sikh women was 3.4 percentage points lower than that among non-SC Sikh women. Women in both the SC and non-SC communities received TT vaccines differently based on their level of wealth. In brief, the proportion of SC and non-SC women in the state who received the TT vaccine increases with their wealth status.

Notably, women from non-SC backgrounds in Punjab with the

lowest wealth status were behind those from SC backgrounds with the same wealth status. Non-SC women in Punjab with the lowest wealth status trailed SC women by 15.9 % points. Interestingly, SC women with poorer and middle-wealth status were ahead of non-SCs with varying degrees. As wealth status advanced to the richest categories, the difference between these two population segments narrowed.

The consumption of IFA can help prevent anaemia during pregnancy. The administration of IFA tablets to the women in both communities is depicted in Table 5. In this regard, non-SC women in Punjab were found to be better off than SC women. In Punjab, the non-SCs (58.2 per cent) had a 5.5 percentage point advantage over the SCs (52.7 per cent) in administering IFA tablets. In urban areas, 53.0% of SC women were administered IFA tablets, compared to 59.2% of non-SC women. The administration of IFA tablets among non-SC women in rural areas was slightly more effective for non-SC women than for SC women.

The proportion of women receiving 100 IFA tablets increased consistently due to increased educational attainment among both communities. IFA tablets were administered to 34.9 per cent of illiterate SC women in Punjab, compared to 66.8 with higher secondary education levels.

Table 4

Women who Received Two or More TT injections during Pregnancy for their Most Recent Live Birth among SCs and Non-SCs in Punjab, 2019-21

Background characteristics	SC (%)	Non-SC (%)	Total (%)
Type of residence			
Urban	81.8	83.7	82.9
Rural	82.4	85.5	83.8
Schooling			
No education	79.7	76.6	78.8
Primary	80.3	76.7	79.4
Secondary	83.4	85.1	84.2
Higher Secondary	81.3	87.3	86
Religion			
Hindu	84.5	85.2	84.8
Muslim	66.7	82.0	77.0
Christian	82.8	92.5	88.4
Sikh	81.0	84.4	82.7
Others	100.0	100.0	100.0
Wealth quintile			
Poorest	77.8	61.9	71.9
Poorer	80.1	71.9	78.0
Middle	80.4	75.4	79.0
Richer	81.5	84.3	82.5
Richest	83.9	86.3	85.4

Source: Computed from NFHS-5 disaggregated data.

Table 5

Women Who Received at Least 100 IFA Tablets during Pregnancy for their Most Recent Live Birth among SCs and Non-SCs in Punjab, 2019-21

Background characteristics	SC (%)	Non-SC (%)	Total (%)
Type of residence			
Urban	53.0	59.2	56.6
Rural	52.5	57.4	54.8
Schooling			
No education	34.9	39.7	36.3
Primary	48.1	39.7	45.9
Secondary	56.4	56.4	56.4
Higher Secondary	66.8	67.6	67.5
Religion			
Hindu	51.2	56.1	53.9
Muslim	26.1	54.9	45.9
Christian	31.0	46.3	40.0
Sikh	54.6	60.5	57.3
Others	0.0	100.0	28.6
Wealth quintile			
Poorest	33.3	9.1	24.1
Poorer	40.0	40.6	40.2
Middle	43.3	51.8	45.6
Richer	52.6	42.7	49.2
Richest	59.6	63.2	61.9

Source: Computed from NFHS-5 disaggregated data.

Non-SCs in the state saw an increase from 39.7% to 67.6%. This difference is 10% among women from SC and non-SC backgrounds with secondary and higher levels of education. The administration of IFA tablets was better among non-SC Hindu and Sikh women compared to SC Hindu and Sikh women in the state. Wealth influenced how women from the Scheduled Caste (SC) and non-SC communities utilised these services. IFA tablets were administered more efficiently among SC women in the poorest category than non-SC women in the same category. The poorest SC women in Punjab received IFA tablets at a rate of 33.3 per cent, compared to 9.1 per cent of non-SC women. The difference between the two population segments narrowed as wealth advanced to the relatively richer categories.

To narrow the gap in the utilisation of ANC services between the two groups, health staff need to be flexible in scheduling services to accommodate the work schedules of SC women who do not want to lose their daily wages, particularly in areas with a floating population of SC women.

Generally, the use of antenatal care services has created a solid foundation for safe deliveries among non-SC women. However, women from both castes exhibited a fair degree of equity, especially regarding first-trimester registration. Let us

examine the situation concerning natal care services.

Natal Care Differentials

In clinical terms, the natal period is defined as the duration from the onset of labour until delivery is complete. Home deliveries were a traditional practice in Punjab, and the prevailing belief was that this was a natural process that did not require medical intervention. The presence of family members made women feel more comfortable. However, several risks are associated with giving birth to a child. Deliveries conducted in a hospital are safer. Over the past two decades, there has been a dramatic rise in the proportion of institutional deliveries.

In Punjab, institutional deliveries increased significantly from 25% in 1992-93 to 94.3% in 2019-21, representing a 69.3 percentage point increase. Among Scheduled Castes (SCs) in Punjab, the proportion of institutional deliveries increased from 21.8% in 1998-99 to 93.1% in 2019-21. For non-Scheduled Castes, this increased from 43.4% to 96.1% during the same period. Overall, the percentage increased from 26.6% to 94.6% during this period.

Approximately 95% of deliveries in Punjab took place in health facilities (Table 6). Institutional deliveries were more common among non-SCs in Punjab compared to SC women. Additionally, evidence indicated variations between rural and urban areas in this regard. SC women in urban regions lagged behind their counterparts by 6.5 percentage points in terms of institutional delivery rates. In contrast, this difference was relatively minimal in rural areas.

Also, institutional deliveries were more common among women in SC categories with varying levels of literacy compared to their peers, including those with primary school education and illiterate women. However, this difference decreased as women's educational attainment increased.

The SC women belonging to the Hindu religion were left behind their counterparts in Punjab in terms of the prevalence of institutional deliveries. However, among Sikh women, there was a fair degree of equity among SC and non-SC women regarding the prevalence of institutional deliveries.

Interestingly, poverty was not a significant factor affecting the prevalence of institutional deliveries. Women in the lowest socioeconomic stratum performed well in both states regarding institutional deliveries. In Punjab, 91.2 per cent of SC women from the poorest wealth quintile delivered a baby at a health facility, compared to 54.4 per cent of non-SC women from the same category. Welfare programmes designed to uplift the vulnerable group of SCs are achieving their intended outcomes. The increase in wealth status has narrowed the gap between scheduled caste (SC) and non-scheduled caste (non-SC) women.

Table 6

Births in the Five Years Preceding the Survey Delivered in a Health Facility among SCs and Non-SCs in Punjab, 2019-21

Background characteristics	SC (%)	Non-SC (%)	Total (%)
Type of residence			
Urban	88.4	94.9	92.0
Rural	95.3	96.2	95.7
Schooling			
No education	82.2	75.0	80.2
Primary	94.0	91.4	93.4
Secondary	95.5	97.1	96.2
Higher Secondary	99.5	98.7	98.2
Religion			
Hindu	89.6	94.6	92.2
Muslim	50.0	97.1	80.4
Christian	100.0	91.8	95.1
Sikh	96.1	96.6	96.3
Others	75.0	100.0	80.0
Wealth quintile			
Poorest	91.2	54.5	77.8
Poorer	89.0	77.1	86.2
Middle	89.2	93.8	90.4
Richer	92.8	91.3	92.3
Richest	96.5	98.3	97.6

Source: Computed from NFHS-5 disaggregated data.

SC women used public health facilities more often to give birth than their counterparts in the state. This is apparent from the fact that 62.7 per cent of the SC women had delivered a baby in public health facilities as compared to 43.7 per cent of non-SC women. The delivery event at private health facilities was costly, particularly for SC women, as it exceeded their financial capacity. The government has comprehended this situation and provided financial incentives for delivery in a health facility. The Scheduled Castes (SCs) in Punjab had a slight advantage over the non-SCs in terms of government incentives received. The implementation of various schemes to uplift SCs and incentives for delivering services in public health facilities have positively influenced their uptake of natal care services, as evidenced by this.

The expected population hypothesis suggests that non-SC women utilised private health facilities more for giving birth than their counterparts. The proportion of deliveries in private health facilities among non-SC women was 21.4 percentage points higher than that of SC women in Punjab. A similar pattern was observed in urban and rural areas. As the educational level and wealth status of non-SC women increase, their deliveries in private

health facilities tend to rise. However, the proportion of deliveries among SC women in private health facilities was slightly higher among those with relatively lower education and wealth status than their counterparts in Punjab. However, this gap increased in favour of non-SC women as the level of education and wealth increased.

Regarding the place for delivering a baby, it is typical for non-SC women in Punjab to prefer private health facilities over public health institutions. Even though a higher proportion of deliveries among the SC and non-SC women were being conducted under hygienic conditions in health facilities, the fact that a lower status of living conditions among the SCs exposed them to post-delivery infections could add to the seriousness of the situation. This has made the SC women more susceptible to infection and subsequent ailments for both mother and child.

Postnatal Care Differentials

Technically, the postnatal period begins with the delivery of the placenta and lasts for 42 days thereafter. Once a baby is born, the primary concern is providing postnatal care services to both the mother and child to ensure their well-being and survival. In addition to being responsible for their children, mothers face a new set of health risks during this period. To recognise danger signs, women must undergo regular check-ups. Erstwhile Punjab (including Punjab and Haryana) followed the practice of seclusion, not allowing the woman and her child to go out of the house for the first 42 days after childbirth for fear of infection and the evil eye. This inhibits complete health care of both mother and child, as their requirements are not met, and underlying health problems are not being personally communicated to the health staff, which may remain undiagnosed and untreated.

A larger proportion of maternal and neonatal deaths occur within 48 hours after delivery. Safe motherhood programmes have increasingly emphasised the importance of postnatal care, recommending that all women receive a health check-up within two days of delivery. Contrary to popular belief, there is no disparity between SC and non-SC women regarding postnatal check-ups within 42 days of birth in the state. Approximately 91 per cent of women from both SC and non-SC categories had a postnatal check-up within 42 days of giving birth. The proportion of women who had a postnatal check-up within two days of birth did not differ between women in SC and non-SC categories in Punjab. Approximately 88% of women from both SC and non-SC categories have received these services.

Table 7 illustrates the proportion of women with SC and non-SC backgrounds who received a postnatal check-up for their most

recent live birth in Punjab. The differences between SC and non-SC women in this context were insignificant, yet slightly favoured SC women in the state. This is evident from the fact that 90.8 per cent of SC women in the state received this postnatal check-up, compared to 89.5 per cent of non-SC women. A similar pattern was evident in rural areas. Likewise, these disparities in urban and rural areas were nearly insignificant.

Women from scheduled castes (SC) with lower status were more likely to have postnatal check-ups compared to their counterparts. Non-SC women with higher secondary education showed a greater prevalence of postnatal check-ups than SC women. The utilisation rate of postnatal check-ups was higher among SC women belonging to the Hindu religion than among non-SC women. The disparity was minimal among Sikh SC and non-SC women in the state.

As wealth status increases, the prevalence of postnatal check-ups among SC and non-SC women becomes more similar. In Punjab, 86 per cent of the SC women with the lowest status had a postnatal check-up compared to 71.4 per cent of non-SC women, a difference of 14.7 percentage points. This difference decreases as one progresses from the lowest to the highest category of wealth status.

Table 7

Percentage of Women who Received a Postnatal Check for their Most Recent Live Birth among SCs and Non-SCs in Punjab, 2019-21

Background characteristics	SC	Non-SC	Total
Type of residence			
Urban	88.2	87.3	87.7
Rural	92.0	91.0	96.5
Schooling			
No education	84.4	75.0	81.6
Primary	86.2	81.2	84.8
Secondary	93.6	90.1	91.9
Higher Secondary	90.6	92.5	92.2
Religion			
Hindu	90.8	88.3	89.5
Muslim	-	100.0	100.0
Christian	80.4	87.2	88.3
Sikh	90.9	90.5	90.7
Others	100.0	100.0	100.0
Wealth quintile			
Poorest	86.1	71.4	80.7
Poorer	82.8	67.2	79.1
Middle	89.0	82.0	86.9
Richer	90.8	86.4	89.3
Richest	93.3	91.7	92.3

Source: Computed from NFHS-5 disaggregated data.

Decomposition Analysis

The Blinder–Oaxaca decomposition technique is commonly used to identify and quantify factors associated with inter-group differences in mean outcome levels.

The Oaxaca decomposition breaks down variations in outcomes into two components. This technique explains intergroup differences in outcome variables by employing a set of predictors. Maternal healthcare utilisation services differ between SCs and non-SCs due to their distinct background characteristics, which impact their healthcare utilisation (Bansod, Salve, & Jungari, 2022).

Table 8 illustrates the significance of the effects in analysing the disparity in the average z-score of first-trimester registration for SCs and non-SCs in Punjab. The average natural log of first-trimester pregnancy registration was 0.919 for non-SC women and 0.910 for SC women. Thus, it is evident from this that there is hardly any difference between these two population segments regarding first-trimester pregnancy registration.

Table 8

Decomposition of Pregnancies Registered in the First Trimester among Non-SCs and SCs in Punjab, 2019-21

Contributing factors	Coef.	Level of significance	[95% confidence interval]	% contribution
Differentials				
Prediction_Non-SC	0.919	***	(0.904, 0.933)	
Prediction_SC	0.910	***	(0.894, 0.925)	
Difference (Non-SCs - SCs)	0.009	***	(-0.011, 0.030)	
Explained				
Type of residence	-0.001	***	(-0.003, 0.000)	-15.40
Wealth index	0.014	***	(0.006, 0.021)	152.08
Schooling	-0.008	***	(-0.014, -0.000)	-81.71
Religion	0.000	***	(-0.000, 0.001)	-1.19
Total	0.005			53.77
Unexplained				
Total	0.004			46.23

*** P < 0.01, ** P < 0.05, * P < 0.10

However, wealth played the most significant role in explaining this marginal difference in first-trimester pregnancy registration between non-SC and SC women.

The z-score contribution in first-trimester pregnancy registration by wealth quintile was 152.08%. A negative z-score contribution was observed for the place of residence (-15.40%), schooling (-81.71%), and religion (-1.19%). This difference between these two segments of the population in Punjab state is narrowing due to the negative impact of factors such as type of residence, schooling and religion. These four socio-economic and demographic factors have the potential to account for up to 53.77% of the overall variation in first-trimester pregnancy registration.

The mean predicted value for women who received four ANC visits during pregnancy is 0.610 for non-SC women and 0.577 for SC women, resulting in a disparity of 0.033 (Table 9). This disparity of 101.59 arose from the different distribution of socio-economic and demographic predictors, including type of residence, wealth quintile, education, and religion. Among these factors, the wealth quintile had the largest impact (56.47%), followed by education (44.95%) and type of residence (4.86%). In other words, reducing the education gap between non-SCs and SCs could decrease the disparity by nearly 45%. The difference in the average predicted value for women who received two or more TT injections was 0.026, as illustrated in Table 10. The likelihood of receiving at least two doses of tetanus toxoid for non-SC women compared to their counterparts is obvious. The differences in the observed covariates (the explained component) between the two population segments accounted for approximately 65.03% of the total disparity. The wealth quintile was the most significant predictor of its contribution, at 47.24 per cent, followed by schooling at 26.23 per cent. The disparity can be reduced by approximately 47 per cent by reducing the difference in their wealth status.

The mean predicted value for women who received at least 100 IFA tablets during pregnancy is 0.582 for non-SC women and 0.527 for SC women, yielding a disparity of 0.055 (Table 11). The disparity (121.74) was due to the different distribution of socio-economic and demographic predictors, including the type of residence, wealth quintile, schooling and religion. Among them, schooling contributed the most (74.04%), followed by the wealth quintile (48.36%). By reducing the educational attainment gap between women from non-SCs and SCs, a 75% reduction in the disparity is expected.

Table 9

Decomposition of Women who Received Four ANC Visits during Pregnancy among Non-SCs and SCs in Punjab, 2019-21

Contributing factors	Coef.	Level of significance	[95% confidence interval]	% contribution
Differentials				
Prediction_non-SC	0.610	***	[0.583, 0.633]	
Prediction_SC	0.577	***	[0.552, 0.601]	
Difference (non-SCs - SCs)	0.033	***	[-0.002, 0.067]	
Explained				
Type of residence	0.002	***	[-0.003, 0.006]	4.86
Wealth index	0.018	***	[0.007, 0.030]	56.47
Schooling	0.015	***	[0.002, 0.0276]	44.95
Religion	-.002	***	[-0.003, -0.000]	-4.69
Total	0.033			101.59
Unexplained				
Total	-.001			-1.59

*** P < 0.01, ** P < 0.05, * P < 0.10

Table 10

Decomposition of Women who Received Two or More TT Injections during Pregnancy among Non-SCs and SCs in Punjab, 2019-21

Contributing factors	Coef.	Level of significance	[95% confidence interval]	% contribution
Differentials				
Prediction_non-SC	0.848	***	[0.829, 0.866]	
Prediction_SC	0.822	***	[0.802, 0.841]	
Difference (non-SCs - SCs)	0.026	***	[-0.001, 0.052]	
Explained				
Type of residence	-0.002	***	[-0.005, 0.001]	-7.89
Wealth index	0.012	***	[0.003, 0.021]	47.24
Schooling	0.007	***	[-0.003, 0.017]	26.23
Religion	0.000	***	[-0.001, 0.000]	-0.56
Total	0.017			65.03
Unexplained				
Total	0.009			34.97

*** P < 0.01, ** P < 0.05, * P < 0.10

Table 11

Decomposition of Women Who Received at Least 100 IFA Tablets During Pregnancy Among Non-SCs and SCs in Punjab, 2019-21

Contributing factors	Coef.	Level of significance	[95% confidence interval]	% contribution
Differentials				
Prediction_non-SC	0.582	***	[0.558, 0.606]	
Prediction_SC	0.527	***	[0.502, 0.551]	
Difference (non-SCs - SCs)	0.056	***	[0.021, 0.099]	
Explained				
Type of residence	-0.001	***	[-0.005, 0.004]	-0.83
Wealth index	0.027	***	[0.015, 0.038]	48.36
Schooling	0.041	***	[0.027, 0.054]	74.04
Religion	0.000	***	[-0.001, 0.001]	0.17
Total	0.067			121.74
Unexplained				
Total	-0.012			-21.74

*** P < 0.01, ** P < 0.05, * P < 0.10

The difference of 0.026 in the mean predicted value for institutional births among the non-SC (0.965) and SC women (0.939) demonstrates that its prevalence was almost equitable (Table 12). The socio-economic and demographic predictors could explain up to 115.32% of the total variation in institutional births. Among these predictors, schooling contributed the most (82.51%), followed by wealth quintile (52.20%). By reducing the educational attainment gap between women from non-SCs and SCs, the disparity is expected to decrease by 82.5%.

The difference in the average predicted value for women who

received a postnatal check-up for the most recent birth was 0.014, as illustrated in Table 13. It is evident that non-SC women have a slightly higher chance of receiving this check-up than their counterparts, although the margin is very small. The differences in the observed covariates (the explained component) between the two population segments accounted for approximately 191.88% of the total disparity. In this particular case, the type of residence emerged as the most significant predictor of its contribution, accounting for 38.6%. The negative contributions from the wealth quintile (- 121.58%) and schooling (- 108.90%) tend to narrow the difference in receiving a postnatal check-up.

Table 12

Decomposition of Births Delivered in a Health Facility Among Non-SCs and SCs in Punjab, 2019-21

Contributing factors	Coef.	Level of significance	[95% confidence interval]	% contribution
Differentials				
Prediction_non-SC	0.965	***	[0.955, 0.974]	
Prediction_SC	0.939	***	[0.926, 0.951]	
Difference (non-SCs - SCs)	0.026	***	[0.010, 0.042]	
Explained				
Type of residence	-0.005	***	[-0.008, -0.002]	-19.68
Wealth index	0.0137	***	[0.007, 0.020]	52.20
Schooling	0.0216	***	[0.013, 0.299]	82.51
Religion	0.0001	***	[-0.001, 0.001]	0.30
Total	0.0301			115.32
Unexplained				
Total	-0.004			-15.32

*** P < 0.01, ** P < 0.05, * P < 0.10

Table 13

Decomposition of Women who Received a Postnatal Check-up for their Most Recent Live Birth among Non-SCs and SCs in Punjab, 2019-21

Contributing factors	Coef.	Level of significance	[95% confidence interval]	% contribution
Differentials				
Prediction_Non-SC	0.908	***	[0.894, 0.922]	
Prediction_SC	0.894	***	[0.878, 0.910]	
Difference (Non-SCs - SCs)	0.014	***	[-0.007, 0.035]	
Explained				
Type of residence	0.005	***	[0.002. 0.008]	38.60
Wealth index	-0.017	***	[-0.025, -0.008]	-121.58
Schooling	-0.015	***	[-0.024, -0.006]	-108.90
Religion	0.000	***	[-0.001, 0.001]	-0.01
Total	-0.027			-191.88
Unexplained				
Total	0.041			291.88

*** P < 0.01, ** P < 0.05, * P < 0.1

Conclusions

Maternal health care services for non-scheduled castes in Punjab are slightly more accessible than scheduled castes, who are relatively less advanced economically, socially and educationally. Non-scheduled caste women had a slight advantage when it came to using natal care and postnatal services, but they still had the same level of antenatal care practices. This was a case of a fair degree of equity in Punjab. It is apparent that there has been a noticeable improvement in access to maternal health services among both segments of the state population.

What is the rationale behind the relative equality between these two segments of the population in Punjab? It is worth noting that there is no significant social divide between these two segments of the population in Punjab. This can be attributed to Sikhism's egalitarian influence, as there is no strong adherence to caste hierarchy. Due to the higher literacy rates among the scheduled castes compared to their counterparts in other states, they are becoming increasingly aware of their health status and rights. Lastly, the scheduled castes, which constitute over one-third of the state's population, continue to be a political force to be reckoned with. Their presence cannot be overlooked.

Socio-economic factors, such as wealth and educational attainment, were found to be the primary drivers of this small disparity between non-scheduled caste and scheduled caste women. To address these disparities, the government should ensure that educational attainment for SC women is equal to that of non-SC women. The state has lacked the impetus to support private sector healthcare facilities for scheduled caste women. The government is already offering financial incentives for deliveries in healthcare facilities to tackle this situation.

Key measures to improve maternal healthcare, particularly among SCs, include targeted outreach programmes that address socioeconomic barriers, implementing government schemes specifically designed for the SC community, offering flexible appointment timings, and dispelling myths related to access to maternal healthcare. To ensure adequate maternal healthcare, medical and paramedical staff should receive training on cultural sensitivities and practices prevalent in both communities. Enhancing maternal healthcare in the state necessitates ensuring the geographical reach of healthcare facilities and transportation support for women, particularly in remote areas. In other instances, despite being easily accessible in most locations, the higher utilisation of maternal healthcare services in the state was impeded by the mindset of women

and their family members, regardless of caste.

The government's efforts to improve the welfare of SC women through various schemes have been effective. To enhance the effectiveness of reaching the target group, it is essential to strengthen these initiatives further. It becomes crucial that community leaders and influencers are encouraged to motivate women to access maternal healthcare services by addressing the specific needs of women from SC.

Punjab has a maternal mortality ratio of 105, significantly higher than Kerala's 19 and Maharashtra's 33. The state government is grappling with this challenge. By addressing barriers, the government must ensure that all segments of the population, including the vulnerable group of scheduled castes, have access to maternal health care, resulting in healthier mothers and fewer maternal deaths.

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Cultural Melting Pot: An Analysis of Mysuru City, India

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Abstract

Internal migration, driven by the desire for a better life, has been a longstanding phenomenon. Migrants and policymakers would benefit from understanding whether migrants' outcomes align with their aims and prospects. Migration involves a series of stages and is, therefore, regarded as a process. Often, a lack of awareness, challenges in adapting to the new environment, the complexity of the local system, language barriers, cultural differences, and negative experiences can cause distress to migrants. Furthermore, it can have either a negative or positive impact on the mental well-being of this population. Due to globalisation, modernisation, advancements in technology, and progress across various domains, migration and its effects on human well-being have become pressing issues. Therefore, this study aims to explore the impact of migration on the happiness of migrants, drawing on research conducted in the heart of Mysuru city. The study reveals that migrants are content in their new locations and are hesitant to return to their places of origin.

***Keywords*:** migration, employment, poverty, happiness, development, internal migration

Introduction

Ever since man has existed on this earth, he has moved from one place to another. People migrate for numerous reasons, but the primary motivation for changing residences is to improve their living conditions or escape debt and poverty. Migration is also a social phenomenon that stimulates human life and the environment. Although the reasons for this movement have evolved, individuals are sometimes forced to leave their place of residence due to natural disasters, terrorism, poverty, unemployment, overpopulation, wars, or social and religious conflicts. In such situations, they are compelled to relocate. Migration can

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be broadly characterised into two types: international and internal migration, the latter involving movement within a state, country, or continent. Internal migration affects the economic, social, and psychological aspects tied to this transition phase. It impacts poorer segments but also has ramifications for the economy as a whole, while sending and receiving regions, as well as the migrants and their families, are arguably more affected by migration than international migrants (Srivastava, 2011a).

Internal migration in India: With the exponential rise in population, millions of people migrate each year. As India is the second-most populous country in the world, approximately 450 million people are reported to migrate within India, according to the 2011 census. Village studies supported by Deshingkar, Start, and Farrington (2006) reveal a high level of outmigration from poor, drought-prone

areas of backward states, such as Andhra Pradesh, Orissa, Bihar, Jharkhand, Rajasthan, and Madhya Pradesh, to industrialised states due to opportunities in the informal sector. Migration consists of a series of stages and is, therefore, considered a process. Often, a lack of awareness, difficulties in adjusting to the new environment, the complexity of the local system, language barriers, cultural disparities, and hostile experiences can cause distress for migrants. Furthermore, this has an adverse effect on the mental well-being of such populations. This paper focuses on the internal movement of people in India, specifically comparing the non- migrant and migrant populations residing in Mysuru, Karnataka. It also illustrates how migration impacts the community and its individuals, and vice versa. Mysuru district is an administrative district in the southern part of Karnataka, India, and serves as the administrative headquarters of the Mysuru division. According to provisional reports from Census India, the total population of Mysuru City in 2011 was 8,93,8,93,062, while its urban/metropolitan population was 9,90,9,90,900. Primary data was collected using a pre-defined, well-structured questionnaire for the present study. The survey was conducted around the Mysuru Royal Palace, located in the heart of the city. The core of the city is the most vibrant area in terms of economic activities. Migrants, upon arriving in the city, can readily find jobs in this core area. The core is characterised by frequent land-use changes, encompassing industrial, residential, commercial, administrative, and consumption areas. Thus, an attempt has been made to study the factors affecting the happiness of both migrants and non-migrants in Mysuru.

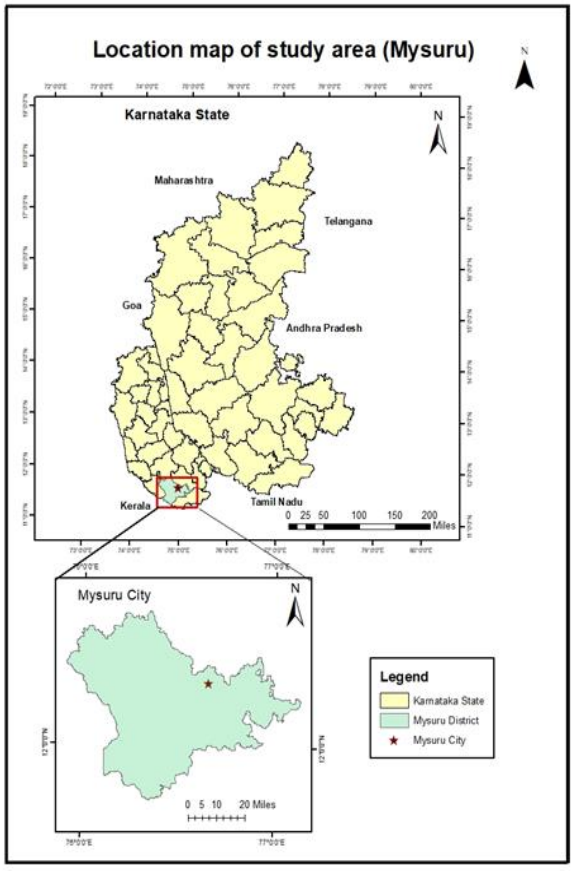
Study Area

Mysuru is the southernmost city of Karnataka, situated at an altitude of approximately 770 metres above mean sea level, at a longitude of 76° 39’ East, and a latitude of 12° 39' North. The total area measures

128.42 sq. km. According to the 2011 census, it is home to a population of around 938,386. Mysuru is a diverse and vibrant city, boasting marvellous architecture that includes palaces and gardens, alongside its significant historical importance, making it a centre of attraction. In contemporary times, it has preserved its pride by remaining one of the most culturally stable and economically vital cities, with a diverse population that consistently lives in harmony. Therefore, it was chosen as the study area as it exemplifies cultural assimilation and attracts people from all over the country seeking opportunities.

Figure 1

Study Area



Objective

To analyse the factors affecting the happiness of migrants and non-migrants in the study area.

Hypothesis

Null Hypothesis (Ho): There is no correlation between the happiness and income of respondents.

Need for the Study (Significance)

The study was conducted to assess a comparative analysis of migrants and non-migrants in the central business district (CORE) area of Mysuru city, Karnataka. According to a UNESCO report entitled 'Social Inclusion of Internal Migrants in India,' three out of ten Indians are internal migrants (UNESCO, 2013). As per the Census of India migration tables, the population of internal migrants in India increased from 309 million in 2001 to 400 million in 2011. Therefore, it is necessary to examine the issue of internal migration. Often, migration histories reveal records of integration, assimilation, and acculturation — a two-way exchange between recent migrants and the native, dominant society. These are the frequently unexamined issues behind the gradual changes in our customs, foods, and language (Khairkar, 2008). Migration has

never been considered an important demographic phenomenon, such as fertility and mortality, due to the small volume of internal migration relative to the total size of the population (Bose, 1983). Only a few researchers and government departments have undertaken studies in the form of projects and reports on migration. This study is a modest attempt to solve issues related to the conditions of migrants and non-migrants in the study area.

Materials and Methods

The survey was conducted to collect primary data in the core area of Mysuru city in January 2023. We gathered population data on residents and migrants. In the questionnaire, we included questions on both qualitative and quantitative aspects. We collected information regarding educational qualifications, basic amenities, transportation facilities, climate information, internet access, family size, sanitation and drainage availability, and medical and healthcare conditions of respondents in Mysuru city. A total of 22 locals and 18 migrants were considered. Preference was given to migrants who moved in the last five years, while non-migrants willing to provide information were considered for the study.

The data collected shows that most respondents are residents of Mysuru city, accounting for around 55 per cent of the total respondents. However, it cannot be denied that the remaining 45 per cent are migrants, mostly internal migrants. The migrants are from various regions of India, including Bihar, Rajasthan, Uttar Pradesh, and many more.

Sample Design

This study compares migrants and non-migrants in Mysuru city regarding their socio-economic aspects, including living standards. A well-structured questionnaire was employed in this study. Subsequently, the population and sample ratio were finalised.

According to the provisional reports of Census India, the population of Mysuru city in 2011 was 89,062. With its urban/metropolitan population at 990,000, this study considered 7.6042 samples per lakh people. Migrants and locals often face social issues, such as conflicts over land and employment (occupation), as noted by Sons of Soils (Weiner, 1978). The samples collected included both migrant and local residential information, facilitating the comparison of primary data from migrants and local people in Mysuru city. In Bengaluru, the capital city of Karnataka and an international IT hub, immigration has influenced the city significantly, leading to considerable social assimilation (Sen & Nagendra, 2020). In contrast to Bengaluru, Mysuru is the cultural capital of Karnataka, maintaining a traditional setup. The Mysuru Royal Palace, located at the heart of the city, is one of its most renowned international tourist attractions. In addition to preserving Kannada's cultural heritage, the palace area serves as a commercial hub, providing numerous employment opportunities within the city. Therefore, conducting comparative studies concerning migrants and non-migrants is more effective in Mysuru than in Bengaluru or any other city.

Table 1

Background of Respondents

Variable	Obs	Mean	Std. Dev.	Min	Max
Gender	40	1.92	.27	1	2
Age	40	34.47	13.52	12	64
Family Members	40	2.77	1.46	1	8
Female Members	40	2.55	1.62	1	10
Occupation	40	2.2	.648	1	4
Income (000)	40	45.52	22.60	20	90
Basic Amenities	40	1	0	1	1
Plan to Return	40	.17	.38	0	1
Tourists Season	40	1.47	.51	1	2
Disaster faced	40	1.97	.16	1	2
Allied Activities	40	.05	.22	0	1
Name of Crops	40	.15	.58	0	3
Irrigation Type	40	1.22	.70	0	3
Govt. schemes	40	.42	.50	0	1
Happiness	40	.87	.33	0	1

Family Size

In the present study, family size and male-female structure have been taken into account. This study observed that the sex ratio of local families is 107 males for every 100 females, while the ratio for migrant families is 113 males per 100 females. The overall sex ratio for this study sample is 109 males per 100 females, indicating a higher male population than female in the region. Moreover, this study demonstrates that the presence of local people exceeds that of migrants in the Mysuru market region, although the number of migrants is also substantial.

Place of Origin of Respondents

Concerning the origin of the respondents, the majority are local residents of Mysuru, which is well-known for its rich legacy of businesses and stable commercial activities in the Central Business District (CBD). Specifically, 28 respondents hail from Mysuru. Recognised as the cultural capital of Karnataka, Mysuru is also one of the major commercial cities in the state, renowned for its educational institutions, universities, and boards. Consequently, many students migrate to Mysuru primarily for educational purposes.

In addition to local respondents, individuals from various districts in Karnataka, including Bellary, Kotte, Hassan, and Mangalore, have also participated in the survey, with each district represented by one respondent. Furthermore, skilled and non-skilled workers from different parts of the country have migrated to Mysuru. In regions with high population densities and limited economic opportunities, such as Northern India, many residents face issues related to low per capita income. States like Uttar Pradesh, Bihar, and Rajasthan have notable push factors that contribute to this migration.

In contrast, South India, particularly Karnataka, offers better job opportunities and a higher per capita income, serving as a pull factor that attracts skilled and unskilled workers to Mysuru. The survey includes four respondents from Bihar, three from Rajasthan, and two from Uttar Pradesh, illustrating the migration patterns observed in this sample.

Educational Qualifications of Respondents

Educational qualifications refer to the official confirmation, typically in the form of a certificate, diploma, or degree, that certifies the successful completion of an educational program or stage. Achievement of an education program denotes the victory of specified learning objectives, typically validated by assessing acquired knowledge, skills, and competencies.

The Indian education system faces several issues, the most significant of which is inadequate education stemming from poverty.

Statistics show that children living below the poverty line have considerably lower chances of succeeding in school compared to their peers. Without a proper education, many individuals remain unemployed and are compelled to live in poverty for the remainder of their lives. Conversely, education is frequently out of reach for the impoverished.

The observations from the collected samples are interpreted as follows: out of four illiterate individuals, one is a migrant, which constitutes 25 per cent. Of 16 individuals, 87 per cent of locals are educated up to SSC. Of 6 individuals, 33.3 per cent of migrants have completed their education to HSC, whereas 66.67 per cent of locals have done HSC. From the data on 13 individuals who have completed their undergraduate degrees, 76.92 per cent are locals, while the remaining 23.08 per cent are migrants. In total, four individuals have completed their education to the level of post-graduation, of which 77.5 per cent are locals and the remaining 22 per cent are migrants.

An overview of the study of educational qualifications in Mysuru reveals that the locals are highly educated compared to migrants. This may be attributed to financial circumstances. Migrants, primarily acting as breadwinners, are mostly here to earn money for their livelihoods, leaving them with very little time for education, and they often engage in business activities from a young age.

Reasons of Migration

There are numerous causes of migration from rural to urban areas. The following are the key factors identified in various studies: influences from friends and family, income maximisation, rapid industrialisation, inadequate rural infrastructure, cultural disparities, equitable distribution of economic benefits, residential satisfaction, the desire for a better lifestyle, personal fulfilment, social mobility, aspirations for social status, and others.

It has been noted that there are two major reasons for migration: economic and educational. From the data collected, 9 out of 40 respondents are from outside of Mysuru city in Karnataka state, making up around 22.5 per cent.

Regarding the economic reasons for migration, several factors come into play, particularly employment opportunities. Employment opportunities represent the most significant driving force. Approximately 83.4 per cent of all migrants are drawn to the city for its job prospects. The promise of better employment has spurred migration. Individual relocations often follow. Employers across different sectors are influenced by frequent transfers, choosing to settle in the city where they have opportunities to relocate.

The transfers of parents also impact migration, resulting in entire families relocating to urban centres. Other key drivers of migration include education and business. Roughly 16.6 per cent of migrants are primarily attracted to the city for educational opportunities, as it provides excellent educational facilities and lucrative business prospects that draw people to the city centre. However, the factors related to marriage are not particularly significant among the causes of migration.

Age Structure

The Royal Mysuru Palace served as the focal point of the research study. This area lies at the heart of the city and is considered its core. Understanding the population's age structure can provide insights into the country's future condition. This phenomenon is known as a demographic dividend. A larger proportion of individuals under 15 years of age is currently regarded as a demographic dividend; this population will eventually become part of the workforce, contributing to an economic boom for the country. Based on the collected data, of the forty respondents included, one was below the 15-year age group, 37 respondents within the 16- to 59-year age group, and two respondents above the 60-year age group. This indicates that 92.5 per cent of the total respondents were in the working-age group, 5 per cent were aged 60 and older, and 2.5 per cent were below the age of 15. These results clearly show that the majority of the population in the core area comprises wage earners or economically active individuals who work to earn a living. Such jobs typically require minimal skills or none at all, and often necessitate physical strength. Generally, working-class jobs demand less education. Unemployed individuals or those supported by a social welfare programme are frequently included in this labour category. Occasionally, they earn a meagre wage, sufficient for themselves and their families. At the core, the respondents share the same intention to work, facilitating their interaction. Consequently, they lead their lives peacefully.

Age Composition of the Migrants and Locals in Mysuru City

Migration is age-selective. People are most likely to migrate when they are young; an increasing share of older individuals in the region's population may lead to a decline in migration. (Zaiceva et al., 2008). The group below 15 years old is entirely represented by the migrant community, constituting 2.5 per cent of the entire population sample. In contrast, 100 per cent of older respondents come from local communities, making up 5 per cent of the total sample population, while the working-age group includes both migrants and locals. The results indicate there are no migrants in the

above-60 age group. Therefore, it can be interpreted that older individuals are hesitant to migrate. Of the total migrants, 88.89% belong to the working-age group. This is primarily because migration occurred for economic (unskilled) jobs and higher education in Mysuru city.

Out of the total respondents, 88 per cent are happy, and only 12 per cent are unhappy with their situation in Mysuru city. A two-sample T-test was conducted on 40 individuals to examine the effect of income and happiness on migrants and non-migrant respondents. There was no significant interaction between the effects of income and happiness on migrant and non-migrant populations (p-value = 0.99). There was no significant interaction between the effects of income on migrants and non-migrant respondents (p-value = 0.32) (Table 2).

Table 2

Two-Sample T-test With Equal Variances

Number of obs. = 40 R-squared = 0.3224

Root MSE = .50795 Adj R-squared = -0.0164

Source	Partial SS	df	MS	F	Prob>F
Model	3.1916667	13	0.24551282	0.95	0.519
Income	3.1610544	10	0.31610544	1.23	0.321
Happiness	0.00038941	1	0.00038941	0	0.969
Income # Happiness	0.00119048	2	0.00059524	0	0.998
Residual	6.7083333	26	0.25801282		
Total	9.9	39	0.25384615		

Table 3

Pearson Correlation Coefficient

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Happiness	1.000					
(2) Age	-0.145	1.000				
(3) Gender	-0.108	0.060	1.000			
(4) Occupation	-0.118	0.100	-0.059	1.000		
(5) Income	-0.211	-0.049	-0.142	0.185	1.000	
(6) Disaster experienced	-0.061	0.269	-0.046	0.050	0.154	1.000

There was no significant effect of happiness on migrants (p-value = 0.97). Here, we accept the null hypothesis: there is no correlation between the happiness of respondents and their income. Pearson's correlation was employed to analyse the relationship between respondents' happiness and the factors influencing people's happiness, such as age, gender, occupation, income, and natural calamities experienced in the study area. Results indicated a strong negative correlation at a 95% confidence level (Table 3) between respondents' happiness and the aforementioned factors. Based on the results of the correlation coefficient, the null hypothesis has been accepted.

Preferred Season by Tourists

In Mysuru City, numerous tourists visit the palace throughout various seasons. Sample analysis revealed that 20% of tourists prefer the winter season. In summer, most schools across the Indian subcontinent observe holidays, yet only seven per cent of people opt for summer tourism, despite schools and colleges being closed. In southern India, summer prevails, resulting in a lower percentage of tourists during that season. During spring, 13 per cent of tourists favour this time for travel. Those who earn their wages from tourist activities tend to experience better earnings during the winter season.

The government needs to increase the number of facilities for tourists to attract more tourists in the summer season. This will boost the economy for businesses that are directly or indirectly dependent on tourism.

Conclusion

This study sheds light on the complex process of migration and its effects on the well-being of individuals in Mysuru City, India. Internal migration, driven by the pursuit of a better life, remains a significant factor in shaping the socio-economic landscape of urban centres like Mysuru. While migrants often face various challenges such as adjusting to new environments, overcoming language barriers, navigating intricate local systems, and dealing with cultural differences, these obstacles do not overshadow the positive outcomes they experience. The study reveals that, despite initial difficulties, migrants in Mysuru report high levels of happiness and satisfaction with their new lives. This satisfaction is largely due to the opportunities presented by globalisation, modernisation, and advancements in technology. As a result, many migrants are unwilling to return to their native places, indicating that the benefits of their migration outweigh the challenges they face. The findings emphasise that migration, although a multifaceted process, can have a positive impact on migrants' overall

well-being, enhancing their quality of life and providing them with better prospects for the future. Policymakers and migrants themselves can gain valuable insights from these results, which highlight the importance of addressing the challenges faced by migrants while also capitalising on the opportunities for growth and integration in urban environments. Ultimately, the study highlights the importance of migration as a catalyst for social and economic mobility in contemporary society.

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Sacred Local Ritualistic Mobility of Population: A Case of Select Villages in Haryana

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Abstract

The most cohesive aspect of Hinduism consists of a set of place-specific rituals occurring at the grassroots level in villages distant from the pilgrimage circuits. Many of these rituals have been practised since antiquity, passed down through generations, and remain largely overlooked in existing literature. This paper examines the relationship between a major caste and the local sacred sites within each of the five selected villages. Extensive primary data (from 980 households) has been gathered, including numerous narratives and oral histories related to faith in local village deities. The history of a village's origin largely determines the presence of certain sacred locations within it. By examining the frequency of visits to these sites on specific occasions, we find that these village deities rank among the most revered in Hinduism. For many individuals, such everyday visits represent the only pilgrimage they may undertake in their lifetime. This study examines the connection between people and village temples, including Pachvir, Bhaiyan, Chogan Mata, Saiyad, and Pitr Madhi, as well as the number of households (HH). The grassroots level of Hinduism still requires broader coverage and exploration to better understand the religion of the masses in India under the expansive canopy of Hinduism.

***Keywords*:** religion, local sacred places, rituals, pilgrimage, village godlings, Hinduism.

Introduction

Religion permeates nearly every aspect of its adherents' lives. The word "religion" has its roots in the Latin word "ligare," meaning to bind. It is defined as a set of fundamental ideas and practices that unite people within a cosmos, an ordered world, and connect them within the community (Eck, 2012). Hinduism is the oldest religion to emerge among the peoples of the Indo-Gangetic plains, dating back approximately 4,000 years (Knox & Marston, 2015). All religions worldwide possess unique rituals and sacred practices. Hinduism is a fusion of various religions, with different cultural

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regions of India practising specific rituals (Ramachandran, 2015). This results in Hindu rituals being highly contextual and place-specific. In this study, five caste villages from Haryana have been selected to investigate their local patterns of religious mobility to various sacred places.

The most cohesive aspect of Hinduism, characterised by a set of place-specific rituals, is found at the grassroots level in villages well removed from the pilgrimage circuits. Many rituals have been practised since antiquity, passed down through generations, and are often overlooked in literature. Hardly any works are dedicated to grassroots Hinduism in villages, except for "Everyday Hinduism" by Joyce Flueckiger (2015). Pilgrimage serves as a broader term for this religious movement, which involves travelling from one place to another in search of the Almighty and is not compulsory in Hinduism. Bharati (1963) maintains that pilgrimage is highly meritorious but not essential for spiritual welfare. Numerous generations of Hindus have passed away without undertaking any pilgrimage, and many, to this day, have not embarked on one. However, at the village level, they engage in a full circuit of ritualistic visits. Their religiosity revolves around local sacred places that have existed in or near their residences for generations. Their transpositions of national and regional gods and goddesses in the village fulfil their sacred aspirations for all causes. This paper explores the richness of grassroots Hinduism in five select caste villages, namely Isherheri, Shidipur, Balaur, Naya Gaon- Sainiyan (Bir Barkatabad), and Gangarwa, which have majority households of Jats (54 per cent), Brahmans (53 per cent), Ahirs (74 per cent), Sainis (34.5 per cent), and Chamars (28 per cent) respectively in the Jhajjar district of Haryana state (Table 1).

Materials and Methods

This work is grounded in a humanistic perspective. Here, places are on the central agenda.

To explore the essence of a sacred place in the eyes of the people inhabiting it, the identities attached to these places for various life cycle events were the central concern of this study.

A field survey was conducted to collect household-level primary information on people's religious connections in the study villages on a census basis for select castes to minimise any biases. The study was conducted from January 2020 to March 2021, with a three-month hiatus due to the COVID-19 pandemic. Exploration was the primary driving force behind it. A door-to-door survey was conducted using a pre-designed questionnaire with theme-based inquiries. A total of 980 households (Table 1) were part of the enquiry. Narratives and focus group discussions laid the groundwork for visualising the history of local sacred places and their origins. Visits to local sacred places were tabulated to facilitate

caste-wise population studies from the study villages.

The selection of villages was guided by the local saying, "Char kos pe badle paani, aath kos pe vaani," which means that natural and human traits change at a distance of approximately 12 and 24 kilometres, respectively. To maintain physical and cultural homogeneity, all selected villages were chosen within a 12-kilometre radius of each other to assess the similarity or dissimilarity of place-specific rituals.

Study Area

The geographic coordinates of the selected village, Isherheri, are 28°37'48″ N and 76°56'6″ E, located in the Bahadurgarh Tehsil of Jhajjar district in the state of Haryana. The village's relative location is interesting, as it is bordered on three sides by the National Capital Territory of Delhi. Bahadurgarh, a border town in Haryana with the status of a block and tahsil, lies 9 km north. En route to Delhi, it is connected to Najafgarh town, just 6 km to the east. It lies 250 km south of Chandigarh, the capital city of Haryana. In regional terms, it forms part of the southeastern Bhangar belt of the Punjab-Haryana plains. All five study villages are situated in close proximity (Fig.1).

Results and Discussion

Sacred Places

Religion is a powerful cultural trait that pervades human existence. It is revealed in tangible and intangible forms. One manifestation of religion is the sacred place. India's cultural landscape is rich in religious or sacred places of various hierarchical levels, ranging from local to national. These seats of divine presence have always been an integral part of human life. Places hold significance for us because they have meaning. Places mean different things to different people and perhaps even different things at different times (Turbshaw, 2005).

Table 1

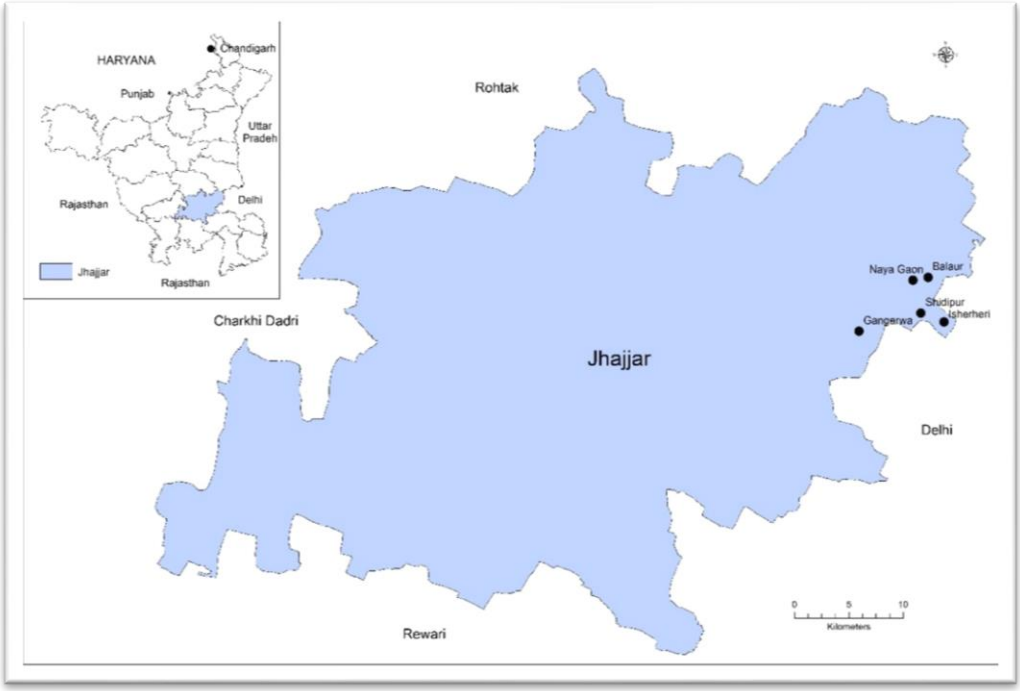
Select Caste Population Under Study in Five Select Villages

Name of the village	Select Caste	No. of Households (HH)	Population		
			Male	Female	Total
Isherheri	Jat	214	629	577	1206
Shidipur	Brahman	177	580	506	1086
Balaur	Ahir	295	1040	918	1958
Naya Gaon (Bir Barkatabad)	Saini	234	975	864	1839
Gangarwa	Chamar	60	172	176	348
Total		**980**	**3396**	**3041**	**6437**

Source: Primary Survey, 2020-21

Figure 1

Location of the Select Study Villages



As places with sacred identities transform into pilgrimage routes connecting various tirthas, dhams, and temples associated with different Gods and Goddesses, sacred rivers and groves become an integral part of Hindu culture, creating a distinctive cultural landscape that weaves 'Tirtha' as a place of spiritual crossing, where the Gods are close and the benefits of worship generous, and 'Dham' as the home of God or the dwelling place of God (Eck, 2012).

The repetition and transposition of nearby places may be a quest to minimise distance by human choice in order to feel the presence of God. Therefore, the core concern is to explore and understand the essence of Hindu ritualistic places and the meanings conveyed by these locations at the grassroots level.

Local Sacred Places of the Study Area

The term "local" refers to sacred places within the village or near the village (within the village's boundaries or nearby) where only the people of a particular village worship. Each village, since its inception, has a local sacred place dedicated to the *gram-devata* within or close to its boundary (Table 2). These sacred Hindu local deities

are tangible in almost all Hindu villages, often with only minor changes in their local nomenclature.

Table 2

Consecrated Local Sacred Places of the Five Study Villages (Jhajjar district, Haryana)

Sacred Place	Village Name
Pachvir	Isherheri, Balaur,Gangarwa
Chogan Mata	Isherheri, Shidipur, Balaur, Naya Gaon (BB), Gangarwa
Bhaiyan	Isherheri, Shidipur, Balaur, Gangarwa
PitrMadhi	Isherheri, Shidipur, Balaur, Naya Gaon (BB), Gangarwa
Mata Sati Madhi	Isherheri, Shidipur, Balaur
Saiyad	Isherheri, Shidipur, Balaur, Naya Gaon (BB), Gangarwa
Shiva Temple	Isherheri, Shidipur, Naya Gaon (BB), Gangarwa, Balaur*
Hanuman Temple	Isherheri, Shidipur, Balaur
Shani Dev Temple	Shidipur, Naya Gaon (BB)
Dada Budha Temple	Naya Gaon (BB)
Kali Mata Temple	Naya Gaon (BB)
Paal Wala Baba Temple	Shidipur
Balaknath Temple	Shidipur
Radha Krishan Temple	Balaur
Shri Ram Temple (U/C)	Gangarwa

Note: * Balaur has Shiva and Radha-Krishan temples in the same complex; BB- Bir Barkatabad

Source: Primary Survey, 2020-21

These places are sequenced in Table 2 according to the order of their origin on the villages' landscape.

Pachvir. Pachvir, as the village guard, is symbolised as an iconic hero who protects the village, circumambulates the village on a blue horse every night, and keeps the ill spirits at bay outside the village. It ranks first in origin and reverence within the village's sacred landscape. "In central India, a typical village guardian is a male deity Thakur Dev riding a horse, with a protective ritual role but no extensive narrative" (Flueckiger, 2015, p. 33). It is the first shrine to come into existence on the very day a new settlement was established.

There are two conceptual bases for the presence of Pachvir in Hindu villages. One establishes its religious base in Hinduism with the concept of an aggregate connotation of five saints revered in the region, known for the welfare of people during their lifetime.

The Panchpir concept in the Rajasthan region supports this. These five Pirs are Pabu Ji, Hadbu Ji, Ramdev Ji, Mangaliya Ji, and Meha Ji (https://www.rajasthangyan.com/Rajasthan? nid=35).

It suggests that Panchpir was part of the Hindu tradition, under the influence of the great Hindu Pir Goga Ji of Medi. However, the oppressive nature of Muslim invaders significantly affected the

nomenclature. The second concept involves the Muslim origin of Panchopir. Pir is an Urdu term used to describe a holy man or spiritual leader.

Besides Hindu saints, Muslim Pirs (Saints) and Saiyads (Heroes) were also revered by a large section of the Hindu community. The Panchpir (Panchopir), or the five saints, had the largest number of adherents among Hindus in the North-West Province of British India from 1801 to 1856. They were worshipped by some 53 castes, of whom 44 were definitely Hindus, and about 16 were of good social standing. The original five *Pirs* were the Prophet, Ali, Fatima, Hasan, and Husain. However, there was a considerable variation in their names and numbers from place to place" (Jain, 1986, pp. 164-165).

Ibbetson (1919) remarked about *Panchpir* (*Pachvir*):

> "...each village has its *Panchpir* in addition to its *Bhaiyan*. Often this is no more than a mud pillar with a flag on the top or similarly marked spot and generally seems to be near a tank or under a *Jaal* (Salvadoro Oleoides) tree and away from the village, but at Asauda village (near Bahadurgarh) it is much more like a *Bhaiyan* in appearance. In Nayabas village (near Sampla), it is said that the first man to die in a village after its foundation becomes Panchpir, and the second is *Bhaiyan*. Little seems to be known about the worship of this deity" (Ibbetson, 1919, Vol. 1, p. 195).

The concept of Pachvir is as old as the Indian villages themselves, serving as a local guardian and Deity of the settlement. However, its name may be influenced by the Islamic vocabulary of *Panchopir*. Still, some pronounce it Pachvir, Pachpir, or Pachbir (in Hindi, Bir; in Sanskrit, Vir, and in Urdu, Pir, which have the same meaning). The second thought that justifies it as a Hindu shrine is its archetype; facing east is not a common feature in Muslim archetypes; a Saiyad is typically found in a south-facing shrine. *Pachvir* is possibly a misnomer derived from Panchopir or distorted from the Hindu concept of Gramdevta to Panchopir during Muslim rule. However, today, it exists in three out of five study villages in the Hindu archetype style, where Hindus revere it ritualistically (Figure 2).

Only three study villages, namely Isherheri, Balaur, and Gangarwa, possess a Pachvir shrine (Table 2). Shidipur and Naya Gaon (Bir Bakatabad) do not have Pachvir, as Shidipur is a double village located near Lowa Kalan (Kheda of Maan gotri Jat), separated only by a narrow street or lane. At the same time, historically, Naya Gaon was a Beed (forested area) belonging to Barkat Ali, the Nawab of Kharkhoda, around 200 years ago. Consequently, these two villages were not settled in the same manner as the other three. This suggests that the history of a village's origin has a significant impact on its sacred sites.

Figure 2

Shrine of Pachvir in the Village Isherheri

This sacred place is visited by the entire village, regardless of caste, during festivals such as Holi and Diwali, which are celebrated for birth and marriage rites, as well as to offer the first milk from cows and buffaloes. The month of '*Jyestha*' (May-June) is ritually special for bathing *Pachvir devta* (Table 3).

Chogan Mata- the Mother Goddess. The omnipotent form of Shakti, locally known as 'Chogan Mata' (a symbolic representation of the Mother Goddess's presence at a crossroads where four lanes meet), is a local sacred site in every village. *Chogan Mata* ranks second, as it is consecrated after the creation of *Pachvir/Khera*. As a transposition of the Mother Goddess, it has been present in every Hindu village since its inception. It is locally known as '*Mata*.' The Mata is situated in the wilderness on the outskirts of the settlement (Figure 3). However, the ever-increasing population has encircled it within the ambit of settlements. "The village goddess makes the primordial association of *Shakti* with the earth concrete" (Eck, 2012, p. 275).

On any auspicious day, festival, or family function, and when a family member is affected by a disease such as measles, typhoid or chickenpox, unique offerings are made to *Mata*.

Table 3

Reverence of Pachvir as a Local Sacred Place in the Study Villages

Village Name (No. of HH)/ Frequency to visit *Pachvir*	Isherheri (214 HH)	Balaur (295 HH)	Gangarwa (60HH)
Daily	11 (5.1)	02 (0.7)	0
Weekly	14 (6.5)	0	0
Fortnight (*Amavasya or Poornima*)	07 (3.3)	04 (1.4)	0
On festivals such as Holi and Diwali, etc.	213 (99.5)	292 (99)	09 (15)
On special occasions, such as weddings, births, and other significant events.	213 (99.5)	294 (99.7)	59 (98.3)
On fasting days, such as Mondays, etc.	04 (1.9)	02 (0.7)	0
During Jyestha Month for *Bheli** and *Cheed-Peed* **	213 (99.5)	243 (82.4)	15 (25)
To offer the first milk of a cow/buffalo (HH who keep domestic milking animals at present)	157 (73.4)	200 (67.8)	19 (31.7)
Do not visit	01 (0.5)	01(0.3)	01 (1.7)

Note: Figures in parentheses indicate the percentage; Villages Shidipur and Naya Gaon do not have *Pachvir*

**Bheli* denotes the distribution of jaggery in a fixed quantity of 4.25 Kg.

***Cheed-Peed* offers jaggery-sweetened wet flour cooked in mustard oil or ghee. **

Source: Primary Survey, 2020-21

Table 4

Reverence of Mata Chogan, a Local Sacred Place in the Study Villages

Village Name (No. of HH)/ Frequency to visit *Mata Chogan*	Isherheri (214 HH)	Shidipur (177 HH)	Balaur (295 HH)	Naya Gaon (BB) (234 HH)	Gangarwa (60 HH)
Daily	24 (11.2)	11 (6.2)	75 (25.4)	37 (15.8)	13 (21.7)
Weekly	05 (2.3)	14 (7.9)	03 (0.3)	03 (1.3)	0
Fortnight (*Amavasya/Chaturdashi* or *Purnima*)	09(4.2)	01(0.6)	02(0.7)	01(0.4)	01(1.7)
On festivals such as Holi and Diwali, etc.	213(99.5)	177(100)	294(99.7)	234(100)	60(100)
On special occasions, such as weddings, births, and other significant events.	213(99.5)	177(100)	294(99.7)	234(100)	60(100)
On fasting days, such as Mondays, etc.	03 (1.4)	0	02(0.7)	0	0
During Jyestha Month for *Bheli** and *Cheed-Peed* **	213(99.5)	164(88.7)	217(73.6)	231(98.7)	60(100)
To offer the first milk of a cow/buffalo	0	11(6.2)	64 (21.7)	165(70.5)	02(3.3)
During diseases such as chickenpox and typhoid, etc.	213(99.5)	177(100)	287(97.3)	234(100)	60(100)
Do not visit	01(0.5)	0	01(0.3)	0	0

Note: Figures in parentheses indicate the percentage; BB- Bir Barkatabad
**Bheli* denotes the distribution of jaggery in a fixed quantity of 4.25 Kg.
***Cheed-Peed* offers jaggery-sweetened wet flour cooked in mustard oil or ghee.**
Source: Primary Survey, 2020-21

The unique role ascribed to Mata is linked to the health of family members. According to the elderly folk of these villages, particularly women, Mata's small shrines serve as the focal point for daily, weekly, monthly, and annual rituals (Table 4).

Figure 3

Image of Mata Chogan in Village Naya Gaon

Bhaiyan. Shrines of *Bhaiyan* evolved as the third sacred place and ranked third among a village's local sacredscape. After the consecration of *Pachvir/Khera* and *Chogan Mata*, the shrine of *Bhaiyan* came into existence in these villages, reflecting the villagers' faith in their ancestors. In a newly settled village, the first person who died was assigned the status of the village's *Bhaiyan* or *Bhumiya*.

Ibbetson (1911, Vol. 2, pp. 374-75) writes about *Bhaiyan*:

> In southeastern Punjab, the village deity is Bhumia or Bhaiyan. There, when a new colony or village is founded in south-eastern Punjab, the first thing to be done before houses are actually built is to raise a mound of earth on the spot near the proposed village and plant a jand tree on it. Houses are then built. The first man who dies in the village, whether a Brahman, a Jat, or a Chamar, is either burnt or buried on this mound, and a masonry shrine is built in his name. The fortunate man is deified as the Bhumia, or Earth God, worshipped by Hindus of all classes in the village and regarded as its sole guardian deity. At weddings, the bridegroom, before proceeding to the bride's village, pays a visit to this shrine and makes offerings to it. If an ox is stolen, a house is broken into, pestilence breaks out, crops fail, rainfall is scarce, locusts visit the village, or any other calamity befalls, Bhumia's shrine is the first place to which the Jats resort for divine help. Such faith is placed in this deity that, in the event of a plague, the villagers will not vacate their houses without consulting the *Bhumia*. Thus, in Jind, we find the Phogat tribal *Sidh* and a *Bhumiya* in every village. Nearly every Jat tribe in that State has its Bhumia, but some have a Khera instead, and others again style their Jathera/Khera/Bhumia (Ibbetson, 1911, Vol. 2, pp. 374-375).

Figure 4

Shrine of Bhaiyan in Village Balaur

Figure 4 shows the shrine of *Bhaiyan* in the Village of Balaur. The most important rituals at *Bhaiyan* include the offering of the first milk from domestic animals, compulsory visits during marriage rituals, and the observance of Bheli* and Cheed-Peed ** rituals during the Jyestha (May-June) month (Table 5).

Table 5

Reverence of Bhaiyan *as a Local Sacred Place in the Study Villages*

Village Name (No. of HH)/ Frequency to visit *Bhaiyan*	Isherheri (214 HH)	Shidipur (177 HH)	Balaur (295 HH)	Gangarwa (60 HH)
Daily	01 (0.5)	07 (4)	03 (01)	01 (1.7)
Weekly	02 (0.9)	04 (2.3)	01 (0.3)	0
Fortnight (*Amavasya/Chaudas*or *Poornima*)	26 (12.1)	04 (2.3)	168 (56.9)	07 (11.7)
On festivals such as Holi and Diwali, etc.	213 (99.5)	161 (91)	294 (99.7)	44 (73.3)
On special occasions, such as weddings, births, and other significant events.	213 (99.5)	177 (100)	294 (99.7)	59 (98.3)
On fasting days, such as Mondays, etc.	01 (0.5)	0	02 (0.7)	0
During Jyestha Month for *Bheli** and *Cheed-Peed* **	213 (99.5)	157 (88.7)	258 (87.5)	34 (56.7)
To offer the first milk of cow/buffalo (HH who keep domestic milking animals at present)	157 (73.4)	122 (68.9)	206 (69.8)	23 (38.3)
Do not visit	01 (0.5)	0	01 (0.3)	01 (1.7)

Note: Figures in parentheses indicate the percentage; Village Naya Gaon (Bir Barkatabad) does not have *Bhaiyan*.

**Bheli* denotes the distribution of jaggery in a fixed quantity of 4.25 Kg.

***Cheed-Peed* offers jaggery-sweetened wet flour cooked in mustard oil or ghee.

Source: Primary Survey, 2020-21

***PitrMadhi* or Ancestral Shrines.** Ancestor worship is a universal practice (Sayers, 2013). Each society regards its forefathers. In Hindu society, ancestor worship has two aspects: Shraadhs are practised in the month of Ashwin (September-October), and a Chhatri or Madhi is offered in the name of family ancestors for both daily and occasional rituals. The primary concept behind ancestor worship is to accumulate heavenly merit by allowing the deceased to reconnect with their living descendants.

Ibbetson (1919, Vol-1, p. 199) writes:

> "For another reason, in a village in Gurgaon, the spirit of young men who died childless, discontented, and unwilling to leave their home is also supposed to haunt the family or village. Worship of the dead is performed in two forms: the sainted dead (Pitr) and the malevolent dead (sonless dead)" (Ibbetson, 1919, Vol. 1, p. 199).

To pacify or counter Pitr, a stone or a set of three or five bricks is commonly placed outside the home or in fields called Pitr Madhi. Hindus' faith in their ancestors is as old as the religion itself. Some individual households may not have Madhi, but within a Kunba, one will find some Pitr Madhis (Figure 5). These rank fourth among local sacred places. These are personal matters of a particular household.

Figure 5

Pitr Madhi at Village Isherheri

Table 6

Visiting PitrMadhis, A Local Sacred Place in the Study Villages

Village Name (No. of HH)/ Frequency to visit *PitrMadhi*	Isherheri (214)	Shidipur (177)	Balaur (295)	Naya Gaon (BB) (234)	Gangarwa (60)
Daily	31 (14.5)	09 (5.1)	45 (15.3)	30 (12.8)	01 (1.7)
Weekly	05 (2.3)	04 (2.3)	08 (2.7)	24 (10.3)	0
Monthly (Amavasya)	131 (61.2)	98 (55.4)	182 (61.7)	195 (83.3)	16 (26.7)
On festivals such as Holi and Diwali, etc.	131 (61.2)	98 (55.4)	182 (61.7)	197 (84.2)	16 (26.7)
On special occasions (marriages, birth, offering the first milk of a cow/buffalo, during *Shraddhs*	131 (61.2)	98(55.4)	182 (61.7)	197 (84.2)	16 (26.7)
Do not have *PitrMadhi*	83 (38.8)	79 (44.6)	113 (38.3)	37 (15.8)	44 (73.3)

Note: Figures in parentheses indicate the percentage; BB- Bir Barkatabad,
Source: Primary Survey, 2020-21

Many families perform a daily bathing ritual, light lamps, and offer food to their ancestors, while others visit during special family functions, such as weddings and childbirth (Table 6). On special occasions, the *Pitrs* are fed before the household members eat their meals. On the morning of each month's *Amavasya*, a family member offers fresh food, mainly sweetened rice boiled in milk (*Kheer*), and lights a lamp inside the small shrine.

Sati Devi *Mata* Shrine. Three villages, namely Isherheri, Shidipur, and Balaur, have Sati Mata shrines, each with its own origin story and narrative behind it. These are ranked fifth, as their origin dates back only 250 years to the sacred landscape of these villages. Therefore, visiting these shrines is not compulsory, but associated households are welcome to visit here.

At Isherheri, the sacred place was inherited by one family (now comprising 24 households) when they migrated to the village nearly 170 years ago. A small shrine to Sati Mata is located at Shidipur village, situated near the Bani Wala Johad, a pond adjacent to the village forest. According to villagers, it was made by a Baniya (village grocer) who lived in the village during the pre-independence era. No particular ritual is practised at this shrine on any specific day, but everyone entering the temple complex pays respect to this shrine. At Balaur village, there is a famous shrine dedicated to Sati, a lady who willingly bears the brunt of her husband's wrath. The villagers reported that this incident occurred during the Muslim period. Later, this place became the habitat of the Ahirs of Balaur, and Sati's site became part of their fields. A man from Balaur was working in his field when the soul of 'Sati' asked for a little space for herself. She offered one boon: if someone is irritated by skin problems like rings (daad), visiting this place on the day of Amavasya will alleviate the issue. From approximately 250 years ago to the present, it has been a place of faith for the villagers (Fig. 6 and Table 7).

Figure 6

Small Shrine of Sati Devi at Village Balaur

Table 7

Reverence of Sati Mata Madhi as a Local Sacred Place in the Study Villages

Village Name (No. of HH)/ Frequency to visit *Sati Mata Madhi*	Isherheri (214 HH)	Shidipur (177 HH)	Balaur (295 HH)
Daily	02 (0.9)	22 (12.4)	02 (0.7)
Weekly	01 (0.5)	27 (15.3)	02 (0.7)
Fortnight (Amavasya – No Moon Night)	03 (1.4)	-	269 (91.2)
On festivals such as Holi and Diwali, etc.	02 (0.9)	36 (20.3)	171 (58)
On special occasions, such as weddings, births, and other significant events.	02 (0.9)	28 (15.8)	154 (52.2)
On *Boli-Kabuli* for boons/ skin problems/fasting days.	-	77 (43.5)	33 (11.7)
During the Jyestha Month for 'Bheli'.	-	-	02 (0.7)
To offer the first milk of a cow/buffalo	-	-	02 (0.7)
On Panchami (5th day) of the *Bhadrapada* month	24 (11.2)	-	-
Do not visit	190 (88.8)	05 (2.8)	06 (2)

Note: Figures in parentheses indicate the percentage.
Villages Naya Gaon (Bir Barkatabad) and Gangarwa do not have Sati *Mata Madhis*.
**Bheli* denotes the distribution of jaggery in a fixed quantity of 4.25 Kg.
***Cheed-Peed* offers jaggery-sweetened wet flour cooked in mustard oil or ghee. **
Source: Primary Survey, 2020-21

Saiyad. Ibbetson (1919, Vol. 1, p. 195) wrote about *Saiyad*:

> It is a site associated with a Muslim saint or war hero who lived or died in this location. In Gurgaon, the Saiyad's place is in the Mohammedan village, which is what Bhaiyan is to the Hindus, but Hindu residents in the village revere it, just as Mohammedans do the *Bhaiyan*. Though built in the form of a tomb, it is erected whenever a village is founded. " The spirit of Saiyad, like that of a boot, must not touch the ground" (Ibbetson, 1919, Vol. 1, p. 195).

Saiyad is a place dedicated to a Muslim pir, or Sufi saint or hero. Sufism (Hindu-Muslim confluence which enacted the bhakti sect) also influenced Hindu followers, who had faith in Muslim *Pirs* in a secular way. *Pir* and Saiyad have the same connotations in Urdu and Arabic, respectively, as mentioned during an interview by a Maulvi at the Dujana mosque in Jhajjar district. Due to an extended period of Muslim rule, lasting approximately 700 years, their influence is visible in the form of various Pirs, Saiyads, and mosques across the northern plains. As all the study villages were settled during Muslim rule, such places are apparent in the surroundings of these villages (Figure 7).

In the study villages, *Saiyads* are regarded as Muslim identities; therefore, they are not ranked among the local Hindu deities. These are seen as intruders in the Hindu sacred landscape, revered by some Hindus for different reasons. *Shrine of Saiyad at Village Isherheri,*

Shidipur, Balaur, Naya Gaon (BB) and Gangarwa, respectively

Figure 7

Shrine of Saiyad at Village Shidipur

The most important day to visit *Saiyad* is Thursday. Therefore, many people from these villages visit the shrine on Thursday, but this visit may not be weekly. Preferably, Thursday is chosen by a significant number of households in the study villages to pay respect to the shrine (Table 8).

Table 8

Reverence of Saiyad, a Local Sacred Place in the Study Villages

Village Name (No. of HH)/ Frequency to visit *Saiyad*	Isherheri (214 HH)	Shidipur (177 HH)	Balaur (295 HH)	Naya Gaon (BB) (234 HH)	Gangarwa (60 HH)
Daily	0	04 (2.3)	04 (1.4)	0	0
Weekly	03 (1.4)	18 (10.2)	37(12.5)	16 (6.8)	0
Monthly (on *Amavasya*)	04 (1.9)	0	12 (4.1)	0	0
On festivals such as Holi and Diwali, etc.	01 (0.5)	117 (66.1)	266(90.2)	76 (32.5)	01 (1.7)
On special occasions, such as weddings, births, and other significant events.	0	154 (87)	263(89.2)	232 (99.1)	06 (10)
On Thursdays (but not weekly)	23 (10.7)	57 (32.2)	102(34.6)	73(31.2)	02 (3.3)
During Jyestha Month for '*Bheli*'*/*Cheed-Peed***	23 (10.7)	43 (24.3)	56 (19)	06 (2.6)	0
To offer the first milk of cow/buffalo (HH who keep domestic milking animals at present)	0	26 (14.7)	113 (38.3)	45 (19.2)	0
Once or twice a year	100 (46.7)	34 (19.2)	13 (4.4)	26 (11.2)	17 (28.3)
Do not visit	94 (43.9)	12 (6.8)	20 (6.8)	02 (0.9)	39 (65)

Note: Figures in parentheses indicate the percentage; BB- Bir Barkatabad
**Bheli* denotes the distribution of jaggery in a fixed quantity of 4.25 Kg.
***Cheed-Peed* offers jaggery-sweetened wet flour cooked in mustard oil or ghee.
Source: Primary Survey, 2020-21

The most critical observation among all the sacred places described so far is the number of non-visitors to the Saiyad (Table 8). Approximately half of the households at Isherheri, the majority of households at Gangarwa, and a few households at Shidipur, Balaur, and Naya Gaon do not visit the village of Saiyad, regardless of the occasion.

Village Temples. Temples are discussed village by village, as each

village has several temples, and each has its own story behind the sacred construction. Building a temple dedicated to any god or goddess is considered a pious or noble act among Hindus. All the selected villages currently have more than one temple (Table 2). However, until the 1970s, none of the villages had a temple within their territory. The only sacred places were Mata, Bhaiyan, Pachvir, etc. In the 1980s, a few well-to-do families built a small personal temple. All villagers visited these. Previously, a Shivling, a rounded stone terrace, was located under trees near the village pond *(Johad)* in each village. Large and beautiful temple complexes in Hindu villages signify the village's prosperity.

Two temples exist at Isherheri; however, the only village temple dedicated to God Shiva was built in the late 1990s and is visited by the entire village. It was constructed by collecting donations from the villagers.

Shidipur has five well-built temples within the village boundary. The first temple that most village people visit on auspicious occasions is that of Baba Navatiya, commonly known as Paal Wala Baba, the Kuldevta of a larger section of the village population. In addition, the village features one Shiva temple, two Hanuman temples, and a Shani Dev temple, which houses an idol of Baba Balaknath.

The Ahir village of Balaur currently has two temples: one is a private temple dedicated to Hanuman Ji, built in 1980, and the other is the Radhe-Krishna and Shiva temple, constructed in 2010.

Figure 8

Shiva Temple at Village Gangarwa

Compared to other study villages, Naya Gaon (BB) is a village with a high concentration of temples. They had overcome the fear of the Nawab's rule in the pre-independence era, which had prevented their ancestors from building even the primary local Hindu sacred places. Presently, five temples dedicated to God Shiva, one each to Dada Boodha (the Kuldevta of the villagers), Shani Dev, and Kali Mata, represent the village's sacred landscape. Second, it also highlights the village's social segregation during religious gatherings. Sainis have their own distinct Shiva temple, known as Prachin Shiva Mandir; Jats possess a different one, while Luhars have constructed theirs.

However, Shiva presides over the entire sacred landscape.

Gangarwa has one temple dedicated to Shiva in the village (Fig. 8), which was constructed with village funds in 2007-08. In 2019, the villagers began construction of a new temple dedicated to Lord Shri Ram,

following the Ayodhya verdict, which is still under construction.

At present, temples are the centres of religious activities in all the study villages, including daily and weekly ritualistic visits for special occasions such as family functions (weddings, births, etc.) and festivals.

Conclusion

A common Hindu householder visits many sacred places in the local environment throughout their life journey, from childhood to death, but this is a highly unsung aspect of Hinduism. Little space is given to this sacred movement and faith in the world of literature.

Larger centres of Hinduism, such as Haridwar and Varanasi, are very much in the spotlight, both internationally and locally; however, the most densely populated areas are still the least represented. Almost all caste villages have reverence for one or more sacred places, such as Pachvir, Bhaiyan, Chogan Mata, and temples, throughout their lives.

Table 9

Frequency of Visits to the Main Temple in Each Village

Village Name	Isherheri	Shidipur	Balaur	Naya Gaon (BB)	Gangarwa
Main temple of the village	Shiva	Paal wala Baba	Radhe Krishan	Shiva	Shiva
No. of Households (HH)	214	177	295	234	60
Daily	21 (9.8)	55 (31.1)	61 (20.7)	40 (17.1)	03 (5)
Weekly	33 (15.4)	34 (19.2%)	57 (19.3)	45 (19.2)	02 (3.3)
Fortnight (Amavasya or Poornima)	10 (4.7)	159 (89.8)	12 (4.1)	06 (2.6)	0 (0)
On festivals such as Shiv Ratri, Janmashtami, Holi, and Diwali.	207 (96.7)	158 (89.3)	295 (100)	234 (100)	60 (100)
On special occasions, such as weddings, births, and other significant events.	213 (99.5)	159 (89.8)	295 (100)	234 (100)	60 (100)
On fasting days, such as Mondays, Thursdays, and Fridays.	127 (59.3)	22 (12.4)	153 (51.9)	191 (81.6)	46 (76.7)
During the Shravan Month, offering water to Shiva	171 (79.9)	31 (17.5)	229 (77.6)	212 (90.6)	55 (91.7)
Do not visit	01 (0.5)	08 (4.5)	0 (0)	0 (0)	0 (0)

Note: Figures in parentheses indicate the percentage; BB- Bir Barkatabad
Source: Primary Survey, 2020-21

At the village level, Hindus have the highest frequency of local visits, ranging from daily ritualistic processes to weekly, monthly, and annual festivities, as well as special occasions. Moreover, this has been a

longstanding tradition in Hindu villages since antiquity. However, its character and intensity are changing rapidly in response to shifting economic, social, and moral paradigms. The grassroots level of Hinduism, which is highly contextual and place-specific, seeks wider coverage and exploration to gain a deeper understanding of the religion practised by the masses in India.

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Regional Disparities in Socio-Economic Development: Case of Jalpaiguri and Alipurduar Districts

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Abstract

The development of socio-economic conditions plays a crucial role in enhancing living standards, as development is a multifaceted process that improves the quality of life, particularly in regions where regional disparities pose significant challenges or barriers to development. Regional inequalities occur when one region becomes more developed than another. Therefore, balanced regional development is an important principle for overall socio-economic development. This paper examines regional inequalities in Jalpaiguri and Alipurduar districts using 35 indicators across demographic, economic, and social sectors. Based on the composite index, backward blocks have been identified within the two districts. Kendall's ranking coefficient method was used to compare and assess the overall development among the blocks of the two districts. The study is also associated with Principal Component Analysis. The study reveals significant regional disparities in terms of development. Therefore, governments, policymakers, and planners should develop diagnostic plans to reduce the gap in development levels.

***Keywords*:** regional disparities, inequality, level of development, socio-economic condition

Introduction

In India, addressing regional disparities is a major concern for policymakers (Gaur, 2010). Achieving balanced regional development is central to India's strategy for ensuring a minimum standard of living (Janardhan, 2016; Sharma, 2016). The country faces uneven socio-economic development across states and districts, which has affected planning processes since independence (Dinesha, 2015). Improving socio-economic conditions

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is critical for enhancing human well-being (Chandra, 2015; Roy & Mondal, 2015).

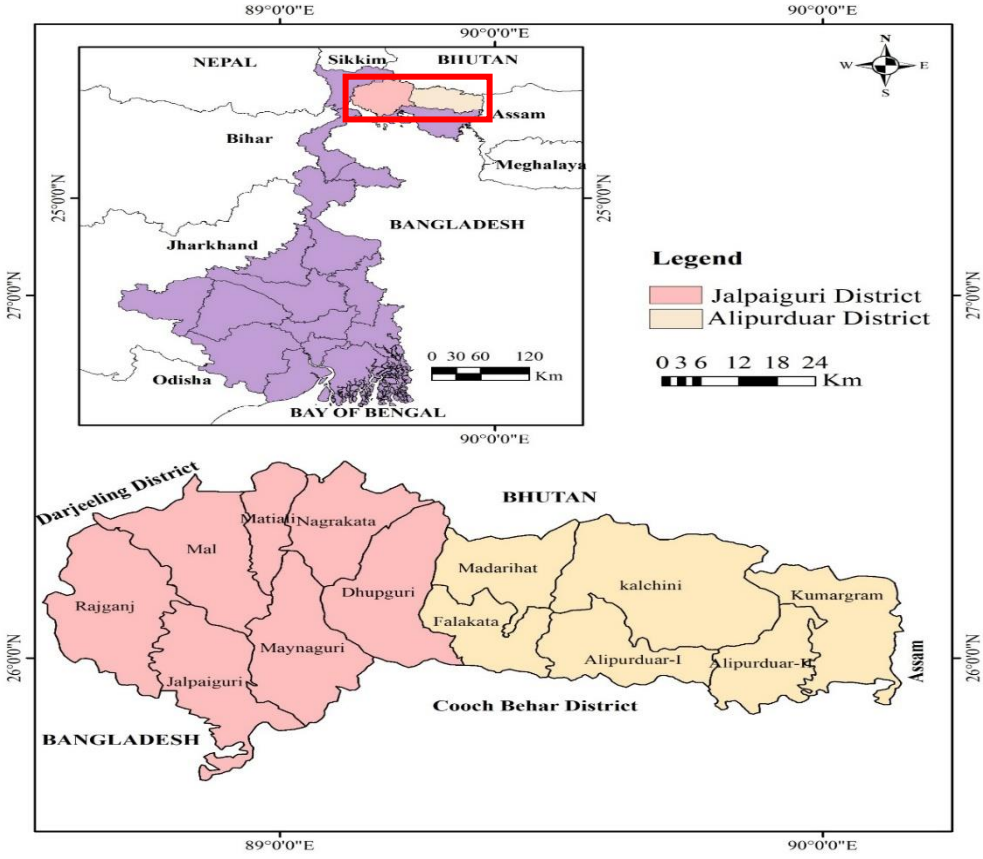
Development is a multidimensional process that reshapes the economic and social systems (Sultana & Aktar, 2016), focusing on economic growth, education, healthcare access, and the distribution of resources (Khan, 2007). Various programmes have been initiated to reduce regional disparities in development (Narain et al., 2000).

Regional inequalities, characterised by the coexistence of developed and underdeveloped areas, hinder socio-economic progress in India, particularly at the inter-regional level (Ahmad et al., 2019; Bose et al., 2020).

This study aims to analyse development levels in the Jalpaiguri and Alipurduar districts of West Bengal.

Figure 1

Location Map



Study Area

Jalpaiguri district, located in the northern part of the state, shares international borders with Bhutan to the north and Bangladesh to the south. It borders Darjeeling to the

west, Kalimpong to the north, Cooch Behar to the southeast, and Alipurduar to the southwest. Covering an area of 3,386.18 square kilometres, it has a population of 2,381,596 (as of the 2011 Census). The district comprises two subdivisions—Jalpaiguri and Mal—along with seven community development blocks, three municipalities, and eighty Gram panchayats. The economy is primarily driven by tea, timber, and tourism, with a significant presence of Scheduled Castes and Scheduled Tribes.

Alipurduar district, established on June 25, 2014, is known for its tea plantations, diverse flora, and tiger population. It covers 2,788 square kilometres and has a population of about 1,501,983 (2011 Census). Bordered by Bhutan to the north and Cooch Behar to the south, it shares an eastern boundary with Assam. The district includes nine census towns and 66 Gram panchayats, organised into six community development blocks: Kumargram, Falakata, Madarihat, Kalchini, Alipurduar I, and Alipurduar II.

Materials and Methodology

The present study is based on secondary data from various sources, particularly the District Census Report 2011 and the District Statistical Handbook, Jalpaiguri 2014. As development is a multidimensional process, its effects cannot be adequately assessed by a single indicator (Narain et al., 2002). In this research, several statistical techniques have been employed to examine the level of development and regional disparities among blocks based on selected indicators. The composite score method, Kendall's rank score method, and Principal Component Analysis (PCA) have been utilised. Regional disparities arise from differences in social, economic, and demographic factors.

Given the current socio-economic conditions of the two districts, 35 indicators have been chosen and organised into three groups: demographic, economic, and social.

These indicators are:

Demographic Indicators

Density of population (V1), decadal growth of population (V2), sex ratio (V3), child sex ratio (V4), % of SC population (V5), % of ST population (V6), % of literacy rate (V7), % of male literacy rate (V8), % of female literacy rate (V9), % of gap in literacy (V10).

Economic Indicators

Percentage of total workers (V11), % of female workers (V12), % of male workers (V13), % of main workers (V14), % of marginal workers (V15), % of cultivators (V16), % of agricultural labour (V17), % household and industrial labour (V18), % of others worker (V19), number of commercial banks (V20), number of Gramin bank (V21), % of cultivated area to total area (V22), % of irrigated area to cultivated area (V23), number of cooperative society (V24).

Social Indicators

The number of primary schools

(V25), middle schools (V26), high schools (V27), higher secondary schools (V28), colleges (V29), libraries (V30), hospitals (V31), health centres (V32), doctors (V33), hospital beds (V34), and post offices and sub-post offices (V35).

Z Score and Composite Score

By utilising these data and selected variables, an effort has been made to investigate the spatial pattern of development in the Alipurduar and Jalpaiguri districts. The Z-score method has been employed to analyse the level of development at the block level. The Z score is algebraically expressed as

$$Zi = \frac{Xi - \bar{X}}{SD}$$

Where Zi represents the standard score of the ith observation and Xi denotes the actual value of the ith observation. $\bar{X}$ stands for the mean of the values of the X variable, while SD represents the standard deviation of the X variable.

Additionally, the results of the Z-scores obtained for various indicators were aggregated by composite standard score (CSS). The formula for the composite score is

$$CSS = \frac{\sum Zij}{N}$$

Where CSS represents the Composite Standard Score, Zij denotes the Z-score of an indicator j in block I, and N signifies the number of indicators. (Sharma, 2014).

To categorise the block variables, an effort has been made to compute the mean and standard deviation. The standard deviation is divided by two, and half of it is added to the calculated mean value to form the high category. In contrast, half of the standard deviation is subtracted from the mean to create the low category. Subsequently, pairwise correlation coefficients have been calculated using SPSS software.

Kendall's Rank Score Method

Kendall's ranking coefficient method was employed to analyse spatial disparities among the blocks. Initially, selected variables of demographic, economic, and social indicators were ranked according to their total numbers; the variable with the highest number was assigned a rank of 1, followed by 2, 3, and so on. Subsequently, the total and average rankings were computed. Based on the total rank of the three sectors, the total rank and combined average rank were calculated. The highest average score signifies a less developed region, whereas a lower average score indicates a highly developed region.

Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is a dimensionality reduction technique that employs mathematical principles to transform a large number of potentially correlated variables into a smaller set of variables. In the present study, PCA has been utilised with the varimax rotation method in SPSS software to identify relatively underdeveloped and developed blocks within Alipurduar and Jalpaiguri districts.

Results and Discussion

Level of Development in Jalpaiguri District

Composite development indices were calculated individually for two districts, concentrating on demographic, economic, social, and overall socio-economic aspects. Subsequently, the blocks were categorised into three groups based on these calculated values.

Demographic Condition

Ten variables were chosen to assess the demographic situation in the Jalpaiguri district. Figure 2 (A) illustrates the inter-block variations in demographic conditions. The composite score for demographic conditions indicates that only two blocks, Jalpaiguri and Dhupguri, are classified as highly developed, with a composite value exceeding 0.096. Blocks with index values ranging from -0.096 to 0.096 are regarded as medium-developed, comprising the Matiali, Maynaguri, Rajganj, and Mal blocks. Only the Nagrakata block is categorised as the least developed region in the district, concerning demographic conditions.

Economic Condition

Disparities in economic sectors are a significant concern for policymakers and economists. For sustainable growth, advancements must be inclusive, avoiding the exclusion of certain regions or groups.

To analyse economic conditions, 14 key indicators were evaluated using SPSS software to calculate combined Z-scores across various blocks. The Jalpaiguri and Dhupguri blocks exhibited favourable conditions with index values exceeding 0.179, while the Rajganj, Maynaguri, and Matiali blocks displayed moderate conditions. Poor economic conditions were observed in the Mal and Nagrakata blocks, with index values falling below -0.179 (see Figure 2(B).

Social Condition

Social and economic inequalities are increasing despite numerous governmental efforts aimed at developing underdeveloped regions throughout the country. Social conditions play a significant role in the overall development of the region. Social services, such as healthcare, education, and postal services, along with other amenities, enhance people's quality of life. The current study has assessed social conditions using 11 indices. Figure 2(C) depicts the standard score and combined score for the social condition of the Jalpaiguri district. The composite score indicates favourable social conditions in the Maynaguri, Jalpaiguri, and Dhupguri blocks. Conversely, Nagrakata and Matiali have faced poor social conditions, with index values below -0.354. Moderate social conditions are evident in the Rajganj and Mal blocks, with composite score ranges from 0.354 to -0.354.

Overall Development: Jalpaiguri District

The Jalpaiguri district shows varied demographic, economic, and social conditions across its blocks. Some blocks exhibit high social development, while others

demonstrate significant economic progress. To evaluate overall development, three main parameters are considered.

The highly developed areas of Jalpaiguri and Dhupguri excel in demographic, social, and economic indicators shows in Figure 2(D).

In contrast, moderately developed regions, such as Maynaguri, Rajganj, and Mal blocks, exhibit scores ranging from -0.186 to 0.186. Table 1 outlines the Composite Score values for each block, reflecting their overall development and specific components.

Correlation Among the Different Sectors: Jalpaiguri District

Pairwise correlations have been calculated to analyse the relationship among the different sectors, i.e., demographic, economic, social, and overall development.

Figure 2

(A) Level of Demographic Condition, (B) Level of Economic Condition, (C) Level of Social Condition, (D) Level of Overall Development of Jalpaiguri District

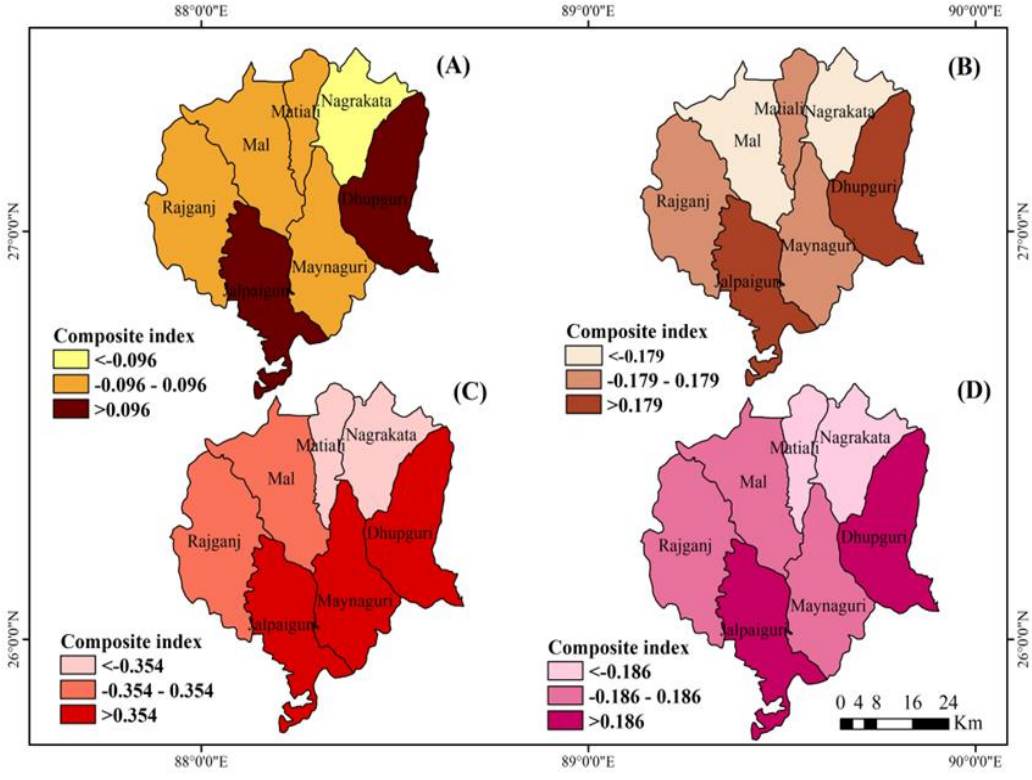


Table 1

Block-wise Composite Score Values in Jalpaiguri District

Block	Demographic Condition	Economic Condition	Social Condition	Overall Development
Nagrakata	-0.393	-0.492	-0.871	-0.583
Matiali	0.082	-0.013	-1.048	-0.311
Mal	-0.073	-0.239	0.004	-0.155
Rajganj	0.011	0.011	0.059	0.026
Maynaguri	0.077	-0.120	0.660	0.182
Dhupguri	0.098	0.211	0.554	0.287
Jalpaiguri	0.197	0.642	0.642	0.515

Source: Census 2011 and District Statistical Handbook, Jalpaiguri 2014

Table 2

Jalpaiguri District: Correlation Matrix

Category	Demography	Economic	Social	Overall development
Demography	1			
Economic	.843*	1		
Social	0.598	0.585	1	
Overall development	.832*	.866	.907**	1

**Correlation is significant at the 0.05 level*
***Correlation is significant at the 0.01 level*

From the correlation matrix, it has been observed that demographic and economic sectors are positively correlated with each other at a significant level of 0.05 (Table 2). However, while demographic, economic, and social conditions are positively correlated, this correlation is not statistically significant. On the other hand, demographic and social development exhibit a very significant correlation with overall development at the 0.05 and 0.01 probability levels. The level of economic development is also positively associated with overall development (r = 0.866).

Level of Development in Alipurduar District

Demographic Condition

Demographic composition is closely linked to regional development. Figure 3 (A) illustrates that Alipurduar-I is the only highly developed block, with a composite score exceeding 0.066, attributed to favourable indicators such as high population density and literacy rates.

Alipurduar-II and Falakata are moderately developed, with composite scores ranging from -0.066 to 0.066. Both areas feature high population densities and moderate literacy rates for both genders.

Madarihat, Kalchini, and Kumargram are the most underdeveloped blocks in the district according to demographic conditions.

Economic Condition

Economic disparity is linked to

equality, opportunity, and outcomes, thus reducing economic development gaps—a significant challenge in regional policy. Figure 3(B) illustrates that blocks with composite scores above 0.110, such as Alipurduar-I and Alipurduar-II, exhibit strong economic conditions. These areas benefit from a high percentage of agricultural labourers and cultivators, primarily due to employment in the tea garden sector and other industries, as well as a considerable cultivated area relative to the total area and a notable presence of cooperative societies.

In contrast, blocks such as Madarihat, Kalchini, and Kumargram exhibit poor economic conditions, with scores below -0.109. Blocks scoring between -0.109 and 0.110, such as Falakata, are deemed moderately developed. The presence of specific indicators is vital in determining the economic status of these regions.

Social Condition

Drewnowski (1972) describes socio-economic indicators as measurable phenomena that reveal how effectively human needs are being met. In this study, we utilised 11 key indicators to assess social conditions at the block level in the Alipurduar district. The analysis indicates that Alipurduar-II, Madarihat, and Falakata are highly developed regions. In contrast, Kumargram and Alipurduar-I are the least developed areas, exhibiting concerning composite scores of -0.183 (Figure 3C). The index values range from -0.183 to 0.183, placing Kalchini in the moderately developed category, highlighting the need for targeted intervention.

Overall Development: Alipurduar District

Using the composite score method, we assessed the overall development of the district. Alipurduar-II and Falakata, with scores exceeding 0.057, are recognised as highly developed (Figure 3 D). As the district headquarters, Alipurduar-II demonstrates strong performance across various dimensions. In contrast, Alipurduar-I, Madarihat, and Kalchini exhibit moderate levels of development, while Kumargram lags behind, reflecting substantial developmental challenges with an index value of -0.057. This disparity highlights the urgent need for investments and policies to foster development in underdeveloped areas.

Table 3 illustrates significant variations in the demographic, social, and economic conditions across the blocks of Alipurduar District. Alipurduar-I has favourable demographic and economic conditions but suffers from poor social conditions, leading to a moderate overall development index. Kumargram is the most disadvantaged block, while Madarihat and Kalchini exhibit poor demographic and economic conditions but better social conditions, resulting in moderate overall development. Falakata displays moderate demographics and economic statistics but excels in social development, achieving a high

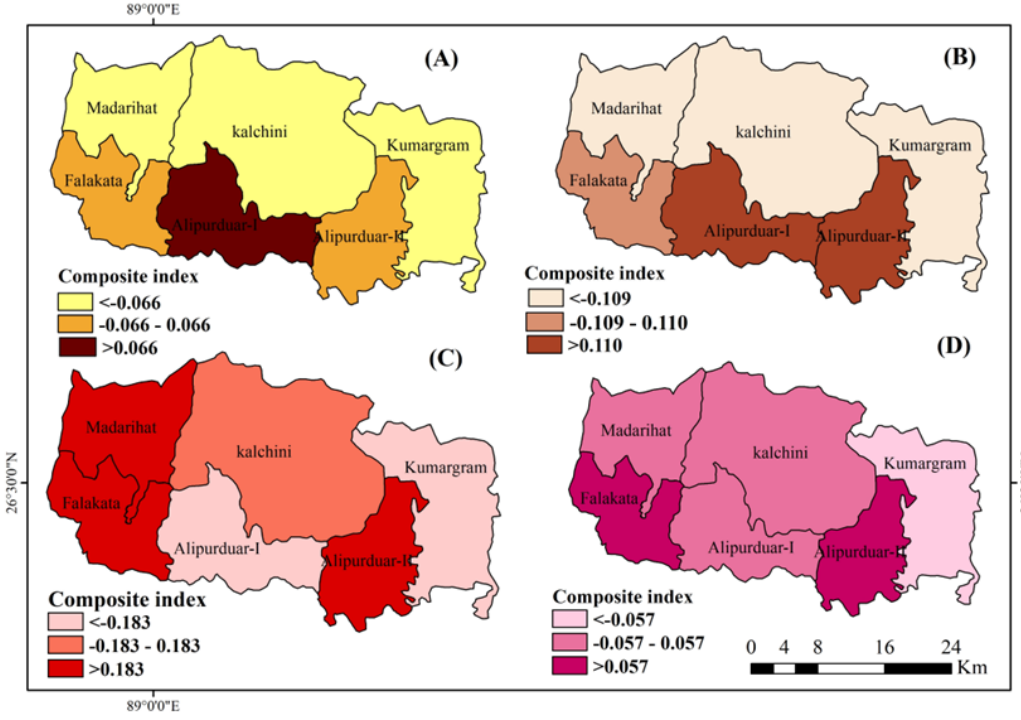
overall development level. Alipurduar-II has a moderate demographic profile characterised by good economic and social conditions, making it a highly developed region.

Correlation among the Different Sectors of Development in Alipurduar District

The correlation between the demographic and economic sectors is significant at the 0.01 probability level (Table 4). However, the correlations between the economic and social sectors, as well as between the social and demographic sectors, are negative. This indicates that economic and demographic growth in the Alipurduar district has not fully utilised social services, such as education and healthcare, which are unevenly distributed. Overall, demographic, economic, and social conditions are positively linked to development.

Figure 3

(A) Level of Demographic Condition, (B) Level of Economic Condition, (C) Level of Social Condition, (D) Level of Overall Development of Alipurduar District



Source: Prepared by authors based on Census 2011 and District statistical handbook, Jalpaiguri 2014.

Table 3
Block-wise Composite Score Values in Alipurduar District

Block	Demographic Condition	Economic Condition	Social Condition	Overall Development
Alipurduar-II	0.045	0.115	0.281	0.147
Falakata	0.050	0.029	0.241	0.102
Alipurduar-I	0.217	0.364	-0.645	0.005
Madarihat	-0.078	-0.230	0.278	-0.027
Kalchini	-0.085	-0.113	0.044	-0.056
Kumargram	-0.149	-0.164	-0.199	-0.171

Source: Census 2011 and District Statistical Handbook, Jalpaiguri 2014

Table 4
Correlation Matrix

Category	Demography	Economic	Social	Overall Development
Demographic	1			
Economic	.953**	1		
Social	-0.459	-0.578	1	
Overall development	0.599	0.499	0.415	1

**. *Correlation is significant at the 0.01 level*

Disparities among the Blocks of Jalpaiguri and Alipurduar Districts

Identifying backward blocks is crucial for addressing disparities and developing effective plans. In this study, blocks are classified as high, medium, or low based on the average rank score of 35 indicators. A spatial disparities index indicates that a low score represents favourable conditions, while a high score signifies poor socio-economic circumstances.

Demographic Condition

The highly developed region comprises Jalpaiguri, Alipurduar-I, Dhupguri, and Maynaguri, known for their high population density, favourable sex ratios, and impressive literacy rates. The moderate category includes Rajganj, Matiali, Madarihat, Falakata, and Alipurduar-II, with scores ranging from 6.59 to 7.41. The less developed region encompasses Mal, Kalchini, Kumargram, and Nagrakata, distinguished by unfavourable sex ratios and low female literacy rates (Fig. 4A).

Economic Condition

Highly developed blocks (Jalpaiguri, Dhupguri, Alipurduar-I, and Alipurduar-II) have a significant percentage of workers and plentiful banking resources. In contrast, Kalchini, Mal, and Nagrakata suffer from poor economic conditions due to limited employment opportunities and restricted access to financial services. Six blocks—Falakata, Rajganj, Matiali, Maynaguri, Kumargram, and Madarihat—display moderate economic conditions (Fig. 4 B).

Social Condition

Blocks such as Jalpaiguri, Maynaguri, and Dhupguri provide sufficient public services, while the moderately developed blocks include Madarihat,

Alipurduar-II, Falakata, Rajganj, Kalchini, Mal, and Kumargram, which score between 5.78 and 7.92. Alipurduar-I, Nagrakata, and Matiali offer the fewest educational and healthcare facilities (Fig. 4C).

Disparities in Overall Socio-Economic Development

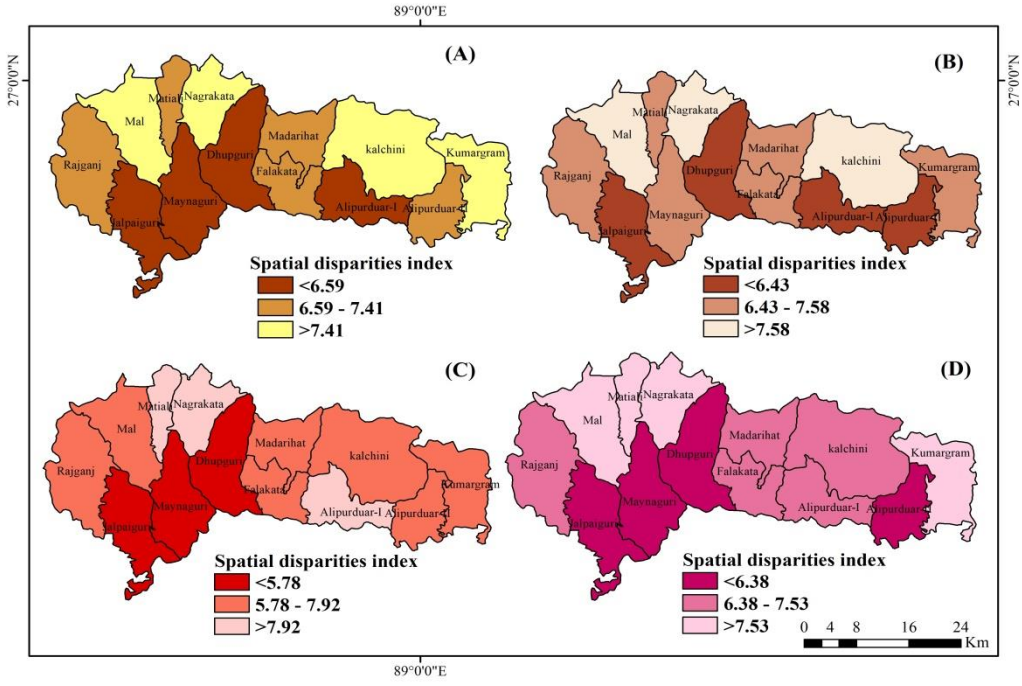
The highly developed region comprises Jalpaiguri, Dhupguri, Maynaguri, and Alipurduar-II. Moderately developed blocks include Falakata, Rajganj, Madarihat, Alipurduar-I, and Kalchini, with scores ranging from 6.38 to 7.53. Less developed blocks—Nagrakata, Matiali, Mal, and Kumargram—face challenges such as low literacy rates, unfavourable sex ratios, and inadequate services (Fig. 4D).

Principal Component Analysis

In the current study, PCA has been utilised to understand the inter-block regional disparities in the Jalpaiguri and Alipurduar Districts. It has helped to extract maximum variance and reduce a large number of variables into a smaller set. 35 demographic, economic, and social variables were grouped into seven components, which together explain over 91% of the total variance. Table 7 displays the rotated component matrix.

Figure 4

(A) Disparities in Demographic Condition, (B) Disparities in Economic Condition, (C) Disparities in Social Condition, (D) Disparities in Overall Socio-Economic Condition of Jalpaiguri and Alipurduar Districts



Source: Prepared by authors based on Census 2011, District statistical handbook, Jalpaiguri 2014

Table 5
Overall Disparities in Socio-Economic Development: Jalpaiguri and Alipurduar Districts

Blocks	Demographic Indicator	Economic Indicator	Social Indicator	Grand Total Rank	Average rank
Nagrakata	83	126	114.5	323.5	9.24
Matiali	68	102.5	119	289.5	8.27
Kumargram	78	106	82	266	7.60
Mal	77	115.5	73.5	266	7.60
Kalchini	78	106.5	71	255.5	7.30
Madarihat	74	106	72.5	252.5	7.21
Alipurduar-I	60.5	84.5	101.5	246.5	7.04
Rajganj	72.5	95.5	70.5	238.5	6.81
Falakata	69	90.5	65.5	225	6.43
Alipurduar-II	69	89.5	64	222.5	6.36
Maynaguri	62.5	105.5	43	211	6.03
Dhupguri	65	84	52	201	5.74
Jalpaiguri	53.5	63	51	167.5	4.79

Source: Calculated by the authors based on Census 2011 and District statistical handbook data

Table 6
Overall Development Scenario of Socio-Economic Condition: Jalpaiguri and Alipurduar Districts

Sectors	Level of development	No. of blocks	Name of the blocks
Demographic	High = < 6.59	4	Jalpaiguri, Alipurduar-I, Dhupguri and Maynaguri
	Moderate = 6.59 to 7.41	5	Rajganj, Matiali, Madarihat, Falakata and Alipurduar-II
	Low = >7.41	4	Mal, Kalchini, Kumargram and Nagrakata
Economic	High = < 6.43	4	Jalpaiguri, Dhupguri Alipurduar-I and Alipurduar-II
	Moderate = 6.43 to 7.58	6	Maynaguri, Madarihat, Falakata, Matiali, Rajganj and Kumargram
	Low = > 7.58	3	Kalchini, Mal and Nagrakata
Social	High = < 5.78	3	Jalpaiguri, Maynaguri and Dhupguri
	Moderate = 5.78 to 7.92	7	Madarihat, Alipurduar-II, Falakata, Rajganj, Kalchini, Mal and Kumargram
	Low = > 7.92	3	Alipurduar-I, Nagrakata and Matiali
Overall development	High = < 6.38	4	Jalpaiguri, Maynaguri, Dhupguri and Alipurduar-II
	Moderate = 6.38 to 7.53	5	Falakata, Rajganj, Madarihat, Alipurduar-I and Kalchini
	Low = > 7.53	4	Nagrakata, Matiali, Mal and Kumargram

Source: Compiled by the authors

Table 7
Rotated Component Matrix

	Component						
	1	2	3	4	5	6	7
V19. Others worker	-0.96						
V17. Agricultural labour	0.95						
V16. % of cultivators	0.92						
V9. Female literacy	0.83						
V10. Gap in literacy	-0.82						
V4. Child sex ratio	-0.82						
V7. % of literacy rate	0.81						
V22. % of cultivable area of total area	0.77						
V5. % of SC population	0.77	0.56					
V8. Male literacy	0.75						
V35. Number of post offices	0.69						
V6. % of ST population	-0.69						
V13. % of male workers	0.67				0.64		
V30. Number of libraries	0.61						
V25. Number of Primary schools	0.61						
V32. Number of health centres		0.81					
V21. Number of Gramin Bank		0.80					
V20. Number of commercial banks		0.78					
V24. Number of cooperative societies		0.76					
V27. Number of high schools		0.76					
V28. Number of higher secondary schools		0.67					
V15. % of marginal worker			0.89				
V11. % of total workers			0.82				
V12. % of female workers	-0.589		0.71				
V2. Decadal growth of population			-0.66				
V33. Number of doctors				0.89			
V34. Number of beds in the hospital				0.76			
V23. % of irrigated area to cultivated area				-0.69			
V14. % of main worker					0.86		
V3. Sex ratio					-0.60		
V1. Density of population					0.55		
V31. Number of hospitals						0.82	
V29. Number of colleges						0.66	
V18. % of household and industrial labour						0.58	
V26. Number of middle school							0.93
Extraction Method: Principal Component Analysis. *Rotation Method: Varimax with Kaiser Normalisation.*							
a. Rotation converged in 16 iterations.							

Source: Calculated by the authors based on Census 2011 and the District Statistical Handbook

Table 8

Total Variance Explained by the Components using Principal Component Analysis (PCA)

Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
16.122	46.063	46.063	11.272	32.207	32.207
4.949	14.139	60.202	5.855	16.730	48.936
3.286	9.389	69.591	3.410	9.744	58.680
3.105	8.871	78.462	3.309	9.454	68.135
1.993	5.694	84.156	3.280	9.370	77.505
1.460	4.172	88.329	2.868	8.194	85.699
1.189	3.398	91.727	2.110	6.028	91.727

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalisation

Source: Calculated by the authors based on Census 2011 and the District Statistical Handbook

Component 1 is associated with 16 variables, the majority of which are positively correlated, with the exception of five: (V4) child sex ratio, (V6) ST population, (V10) literacy gap, (V12) female workers, and (V19) other workers, indicating a need for further development. It explains 32% of the variance, making it the most significant component.

Component 2 comprises seven variables that are positively correlated with one another. Component 3 consists of four variables, with V2 (% of decadal growth rate) exhibiting a negative correlation. Component 4 is characterised by a strong positive loading for the number of doctors and hospital beds, whereas the % of irrigated area demonstrates a negative loading.

Component 5 contains four variables, with (V3) sex ratio showing a negative correlation. Component 6 displays positive correlations across three variables, while

Component 7 consists of a single variable: (V26) number of middle schools, which exhibits a high positive loading value.

Overall, the following variables require attention for development: (V2) percentage of decadal growth rate, (V3) sex ratio, (V4) child sex ratio, (V6) Scheduled Tribe population, (V10) literacy gap, (V12) female workforce, (V19) other workforce, (V23) percentage of irrigated area, and (V26) number of middle schools in Jalpaiguri and Alipurduar districts.

Conclusion

Development is an ongoing process designed to enhance the quality of life for individuals and communities. It necessitates a comprehensive approach to human resource development within a region. Tackling regional inequalities presents a considerable challenge in achieving development goals.

The present study indicates that Jalpaiguri and Dhupguri are the more developed blocks, while the Nagrakata block is the least developed in the Jalpaiguri district. In terms of overall development in the Alipurduar district, the Alipurduar-II and Falakata blocks are more developed than the others. Conversely, the Kumargram block is a poorly developed area. The level of development in the other blocks is moderate. Both the backwards and moderate blocks are making strides towards further development. The discussion highlights significant regional disparities in development levels. Backward blocks, in particular, require enhancements across various dimensions of socio-economic sectors to elevate their development status. Therefore, the government should take proactive measures or formulate diagnostic plans to achieve balanced regional development across all sectors at the grassroots level.

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Spatial Disparity and Change Detection of Children and Reproductive Age Women's Nutritional Status among Tribes in West Bengal, India: A Comparative Study on NFHS-4 & 5

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Abstract

Undernutrition is more prevalent among Scheduled Tribe children under 5 years of age and women of reproductive age compared to other demographics. The present study aims to demonstrate the spatial disparity in nutritional status among tribal children (U5A) and women (URA) by analysing anthropometric indices, including children's and women's anaemia and underweight BMI status. The research utilises Z-score statistics to standardise the raw data from the National Family Health Survey (NFHS) of India in accordance with World Health Organisation (WHO) standards. According to the latest NFHS-5, the findings reveal that the high prevalence of undernutrition among tribal children is primarily concentrated in nine districts of West Bengal. Additionally, the results indicate that twelve districts exhibit a significant prevalence of undernutrition among tribal women. Special educational assistance, empowerment opportunities, and improved access to better healthcare facilities are crucial in addressing these issues. A strong local governance framework and active stakeholder involvement must also be established to combat undernutrition effectively. The study identified districts of West Bengal with high rates of undernutrition among children and women, thereby informing the implementation of various nutritional programs and policies.

Keywords: nutritional disparity, children, women, Scheduled Tribe, West Bengal, India

Introduction

Undernutrition is a significant public health issue, particularly concerning tribal populations. Despite India's considerable economic growth in recent years and its capacity to produce enough food for its population, the country still faces

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higher rates of undernutrition among certain population groups (Chand & Singh, 2023). According to the Global Nutrition Report 2019, 194.4 million people, or 14.5% of the population, were undernourished in India. Furthermore, 20.8% of children were reported as underweight, and an analysis of the National Family Health Survey (NFHS) data indicated that 51.4% of women are anaemic (Sahota, 2022). In the 2023 Global Hunger Index (GHI), India ranks 111th out of 125 nations, with a GHI score of 28.7, indicating a severe hunger crisis (Global Hunger Index, 2023). Undernutrition negatively impacts the health and development of children under five years of age (U5A) and women under reproductive age (URA), 15-49 years. It is primarily caused by deficiencies in macronutrients and micronutrients, which impair cognitive development and hinder physical growth (Gernand et al., 2016).

Undernutrition, which includes insufficient nutritional intake, can be categorised into three types: wasted (low weight-for-height), stunting (low height-for-age), and underweight (low weight-for-age), as well as micronutrient-related undernutrition, which is a deficiency of essential vitamins and minerals (WHO, 2024). Undernutrition is especially prevalent in regions and population subgroups with significant disparities (De Onis & Branca, 2016). Tribal communities, compared to other groups, are often isolated and face social and economic disadvantages. Their unique geographic habitats and dietary habits further distinguish them from other populations (Barman & Chowdhury, 2024).

Tribal communities exhibit characteristics such as geographic isolation, primitive farming methods, social taboos, harmful health-seeking behaviours, poverty, and inconsistent food supplies, all of which contribute to various health issues and malnutrition (National Institute of Nutrition, 2009). The prevalence of undernutrition, wasting, and underweight among children indicates poor nutritional status, which leads to stunted development. Factors associated with wasting and being underweight include regional conditions, birth size (i.e., small versus normal), and delivery location (i.e., institutional versus non-institutional) (Akombi et al., 2017).

Notwithstanding steady economic growth and a reduction in monetary poverty over the last two decades, the incidence of undernutrition in India remains high (Khan & Mohanty, 2018). Child undernutrition is particularly prevalent among low-income families (Singh et al., 2020). Studies by Bentley and Griffiths (2003) and Barman (2024) show that rural women experience a higher prevalence of anaemia than their urban counterparts, especially in poorer communities. Women with a lower body mass index (BMI; less than 18.5 kg/m^2) face a greater risk of anaemia compared to those with normal or elevated BMI. Moreover, this malnutrition among tribal women presents a significant health concern in India, indicating severe

nutritional stress within these communities.

From a public health perspective, it is crucial to implement appropriate nutritional programmes for this ethnic group swiftly. The Government of India must take active measures to reduce undernutrition among the tribal population (Bisai & Bose, 2009). To promote good health, government officials and health experts must identify the underlying causes and intervene effectively through various promotional and therapeutic strategies (Rohisha et al., 2019). The NFHS report for children under five found that the proportion of stunted (32.5% to 33.8%) and underweight (31.6% to 32.2%) children increased slightly from NFHS-4 to NFHS-5. While the rates of wasting (20.3%) have remained unchanged over both the NFHS rounds. Nonetheless, the persistently high levels of undernutrition in West Bengal remain a serious concern (MoHFW & IIPS, 2020).

To the best of our knowledge, there are currently no studies focusing on the nutritional status of Scheduled Tribe (ST) children and women within West Bengal's primitive tribal population, specifically regarding inter-district nutritional assessments based on the NFHS-4 and NFHS-5. For this, the present study aims to investigate inter-district inequalities in the nutritional conditions of ST children (U5A), focusing on stunting, wasting, and underweight, as well as the nutritional status of ST women (URA) based on anaemia levels and body mass index (BMI) across districts in West Bengal.

Additionally, this research aims to highlight the differences in undernutrition status between the two rounds of the NFHS in districts that faced high levels of undernutrition. The findings of this study can inform the formulation of nutritional intervention policies and programs that focus on key nutritional interventions to address the challenges faced by the tribal population, particularly among young children and women of reproductive age.

Materials and Methods

Database

The study utilised data on children's anthropometric indices, women's anaemia status, and height and weight for BMI assessment from the NFHS databases. The analysis was based on two rounds of the NFHS: NFHS-4 (2015-16) and NFHS-5 (2019-21). The NFHS datasets are available on the Demographic Health Survey (DHS) site, though access to the dataset requires a prior request.

All NFHS surveys were conducted under the administration of the Ministry of Health and Family Welfare (MoHFW) of the Government of India. The MoHFW appointed the International Institute for Population Sciences (IIPS), Mumbai, as the nodal agency to carry out the survey. While various health, socio-economic, and demographic

datasets are available on the website, our study focused specifically on data related to children and women with completed interview records (IIPS & ICF, 2022).

The survey included children who lived in the sampled households on a regular basis. Anthropometric measurements, including height and weight, were collected for children under five years of age and women aged 15 to 49 years. Additionally, haemoglobin levels were recorded to assess the anaemia levels of the women. This information is included in the DHS datasets, which also gather caste information for each household (IIPS & ICF, 2022). For this study, we specifically selected datasets for ST children and women, as illustrated in Figure 1.

Anthropometry of Children

This study examines the anthropometric indices of stunted (ST) children, specifically focusing on the conditions of stunting, wasting, and underweight in children under 5 years of age (U5A). The analysis utilises the NFHS dataset to calculate three key indicators: Z-scores of height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ). The NFHS authorises surveyors to collect data on children's height and length, as well as their weight measurements (WHO, 2006).

Statistical evaluations were performed on this data using Z-scores to assess the nutritional status of children under five in tribal communities in West Bengal. Z-scores were used because this standardises the raw values, making comparisons across the population more effective. Furthermore, each anthropometric index is classified as either mild or severe, indicating different levels of undernutrition.

Women's Body Mass Index

The Body Mass Index (BMI) is a measurement that is expressed as the weight in kilograms divided by the height in meters squared. It is widely used across various nations, groups, races, and ethnicities to classify individuals as underweight, normal weight, overweight, and obese. There is a clear relationship between height and weight; BMI accounts for this by adjusting weight according to the square of height (Roth et al., 2005).

In this analysis, we defined a BMI of less than 18.5 as underweight. BMI is calculated by dividing a person's weight in kilograms by the square of their height in meters. To determine the percentage of women in each BMI category, we divided the number of women in each category by the total number of women and then multiplied by 100. Women with a BMI between 18.5 and 24.9 are considered to have a normal body mass, while those with a BMI above 25.0 are classified as overweight or obese (*Guide to DHS statistics*, n.d.).

Women's Anaemia Status

Anaemia occurs when the amount or concentration of haemoglobin in red blood cells is lower than normal. Where haemoglobin is essential for transporting oxygen, therefore, when there are too few or defective red

blood cells, or insufficient haemoglobin, the blood's ability to deliver oxygen to the body's tissues is compromised (WHO, 2019). Anaemia is defined based on haemoglobin levels: for non-pregnant women, a haemoglobin level below 12.0 g/dL indicates anaemia, while for pregnant women, the threshold is below 11.0 g/dL (*Guide to DHS statistics*, n.d.). We have analysed the anaemia status of women of reproductive age using a specific variable, and our findings indicate that a significant number of them appear to be anaemic.

Statistical and Geospatial Techniques

MS Excel and StataSE version 14 (CropLP) were used for statistical analyses. The sequential analytical methods used to assess the nutritional status of children and women are illustrated in Figure 2. All datasets were weighted according to DHS standards to adjust for changes in probability, ensuring that the sample remained representative of the overall population distribution in the country. And the missing data were excluded from the datasets for the analysis of the reported variables. Additionally, ArcGIS version 10.8 was utilised for thematic mapping and spatial analysis of the prevalence of undernutrition among children (U5A) and women (URA) across the districts of West Bengal, comparing data from the current and previous rounds of the NFHS survey.

Figure 1

Sample Size at Different Levels of the NFHS Dataset for West Bengal, India

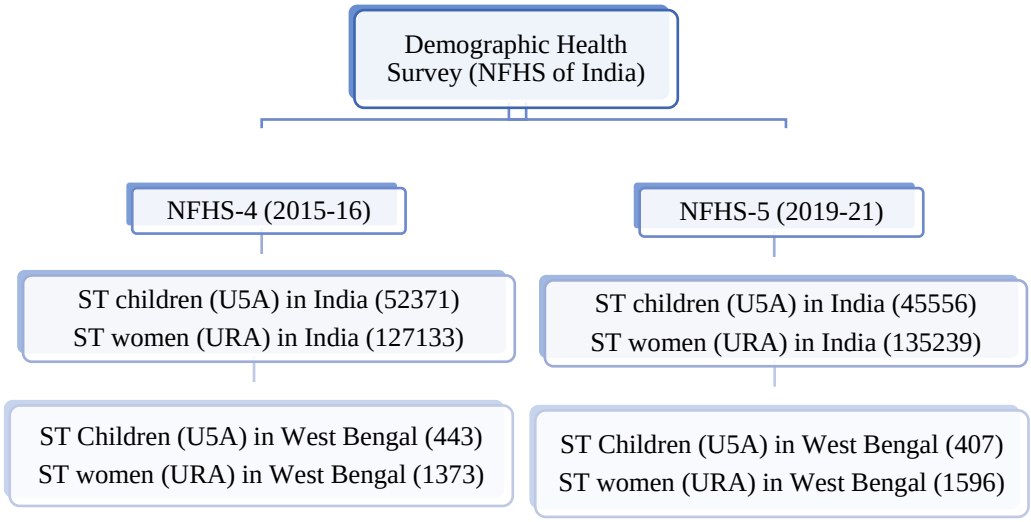
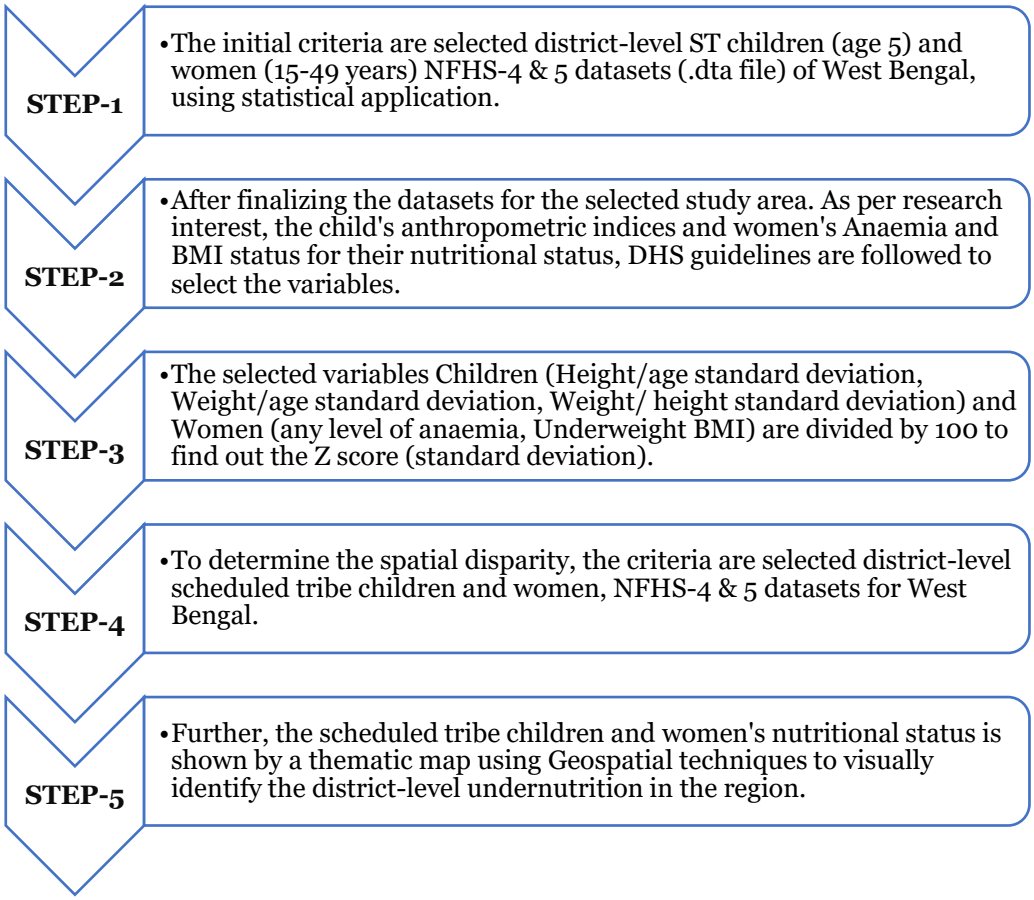


Figure 2



Sequential Steps of Analytical Methods for Children (u5 age) and Women (15-49 years) Nutrition

Results

Disparity of Chronic Undernutrition Status of ST Children in the Districts of West Bengal

According to the NFHS datasets, the incidence of stunting, or chronic undernutrition, among ST children has been classified into two groups: moderate and severe stunting. A concerning trend of severe stunting has been observed in six districts: Haora, Birbhum, Jalpaiguri, Dakshin Dinajpur, Bankura, and Uttar Dinajpur. Similarly, moderate stunting is also on the rise in eight districts: Haora, Birbhum, Jalpaiguri, Dakshin Dinajpur, Uttar Dinajpur, Purulia, Paschim Medinipur, and Barddhaman within West Bengal (see Table 1).

Table 1: *Disparity of Stunted Children (ST) in West Bengal, India*

Districts	Prevalence of stunted children (%)			
	NFHS- 4		NFHS- 5	
	Moderate	Severe	Moderate	Severe
Haora	0.0	0.0	53.8	46.2
Birbhum	29.1	0.0	22.7	31.1
Jalpaiguri	18.6	23.1	20.2	27.6
Dakshin Dinajpur	17.2	8.6	20.7	24.4
Bankura	14.4	12.9	11.2	21.5
Uttar Dinajpur	37.4	24.7	27.7	20.3
North 24 Parganas	30.5	0.0	19.2	19.2
Darjeeling	25.6	12.5	19.4	17.9
Puruliya	26.3	20.5	28.6	17.6
Hugli	35.2	0.0	11.4	16.8
Maldah	34.6	15.8	14.2	14.5
Paschim Medinipur	26.5	6.0	26.3	10.2
Barddhaman	27.6	13.4	31.3	7.7
Kochbihar	25.4	23.4	0.0	0.0
Kolkata	36.2	0.0	0.0	0.0
Murshidabad	0.0	0.0	8.5	0.0
Nadia	20.1	0.0	0.0	0.0
Purba Medinipur	50.0	0.0	0.0	0.0
South 24 Parganas	0.0	15.3	0.0	0.0

Source: DHS datasets of NFHS-4 & 5

Overall, four districts in West Bengal- Haora, Birbhum, Jalpaiguri, and Dakshin Dinajpur show a significantly higher (over 20%) number of undernourished children in both severe and moderate stunting. Currently, 31.07% of ST children under the age of five are stunted or severely undernourished. However, the prevalence of stunting among ST children under five has changed since 2015-16. The NFHS data from 2019-21 indicates that the rate of stunted ST children in West Bengal has slightly decreased from the previous two rounds, dropping from 33.21% to 31.07%, although this figure remains alarming.

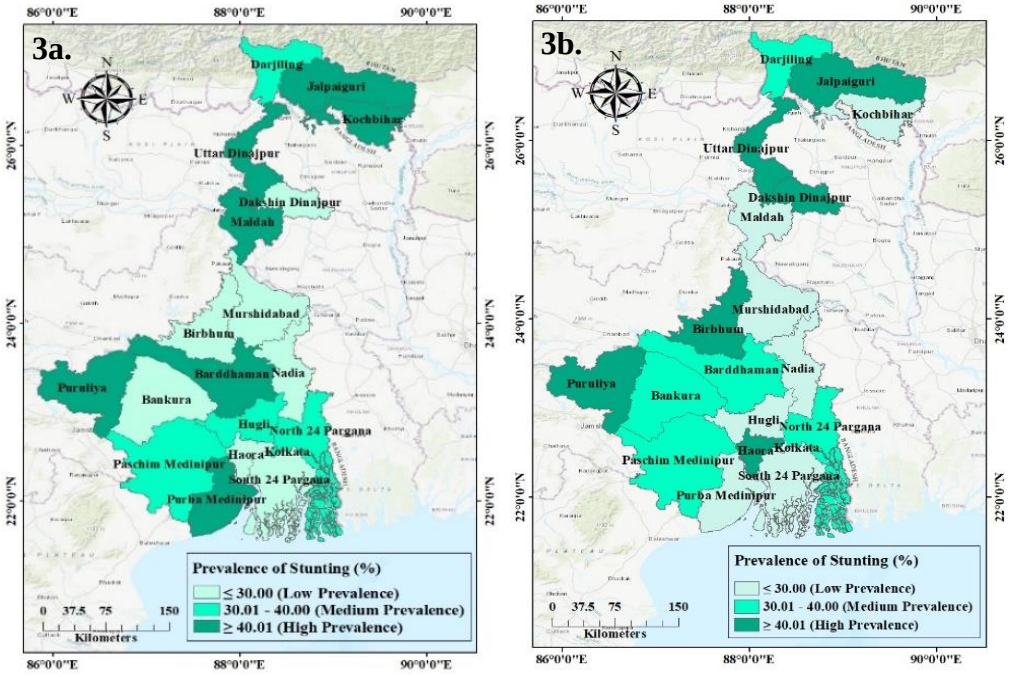
The prevalence of stunted children varies significantly across districts, ranging from 15.3% in South 24 Parganas to 62.1% in Uttar Dinajpur (see Figure 3a). In the fifth round of the NFHS, the proportion of stunted children ranges from 8.5% in Murshidabad to 53.8% in Birbhum (see Figure 3b). As per NFHS-5, West Bengal has five districts with a high prevalence of stunted ST children: Birbhum, Dakshin Dinajpur, Jalpaiguri, Purulia, Uttar Dinajpur and Haora above 40%. Whereas, seven districts report lower rates of stunting: Hugli, Maldah, Murshidabad, Nadia, South 24 Parganas, Purba Medinipur, and Kochbihar. The remaining districts fall into a moderate prevalence category, with stunted children making up between 30% to 40%.

The high rates of childhood stunting are primarily due to

inadequate nutritional intake during critical growth periods, including conception and birth, as well as various other contributing factors (Bloem et al., 2013)

Figure 3

Spatial Disparity of ST Stunted Children of West Bengal, India (3a. NFHS-4, 3b. NFHS-5)



Disparity of Acute Undernutrition Status of ST Children in the Districts of West Bengal

The data presented in Table 2 reveal concerning trends related to wasted ST children, which can be classified as moderate and severe wasting. Three districts are experiencing increasing rates of severe wasting in NFHS-5 from the previous round: Paschim Medinipur, Darjeeling, and Hugli. Additionally, nine districts in West Bengal have reported rising trends in moderate wasting: Darjeeling, Dakshin Dinajpur, Puruliya, Birbhum, Barddhaman, Haora, Kochbihar, Murshidabad, and North 24 Parganas.

It is noteworthy that six districts in West Bengal have reduced the percentage of wasted children. However, Darjeeling is the only district experiencing a significant increase in the number of chronically undernourished ST children in both moderate and severe wasting. Currently, 19% of ST children under five years old in West Bengal are classified as wasted. Since the 2015-16 period, there has been a significant change in the prevalence of wasting among ST children under five. Data from the state's NFHS, conducted

between 2019 and 2021, indicate that the percentage of wasted children in this age group plummeted dramatically from 33% to 19% over two successive rounds.

Despite this overall reduction, certain districts still display unacceptably high rates of ST child wasting (see Figure 4a), with percentages ranging from 9.3% in Darjeeling to 48.6% in Kochbihar. Only nine districts accounted for less than 25% of wasted ST children. The rest of the districts fall under the moderate (5 districts) and high prevalence (5 districts) categories, with prevalence rates ranging from 25% to 35% and above 35% of wasted children. The latest data further highlight this issue (see Figure 4b), indicating that the incidence of wasting among children varies from 7.3% in Jalpaiguri to 47% in Paschim Medinipur. There are two high and three moderate prevalence districts in West Bengal where stunted children were found, i.e., Birbhum, Haora, Kochbihar, Paschim Medinipur, and Puruliya.

Research indicates that the high incidence of wasting among these children, characterised by both acute and chronic undernutrition, is closely linked to their low socioeconomic and demographic circumstances (Sen & Mondal, 2012).

Figure 4
Spatial Disparity of ST Wasted Children of West Bengal, India (4a. NFHS-4, 4b. NFHS-5)

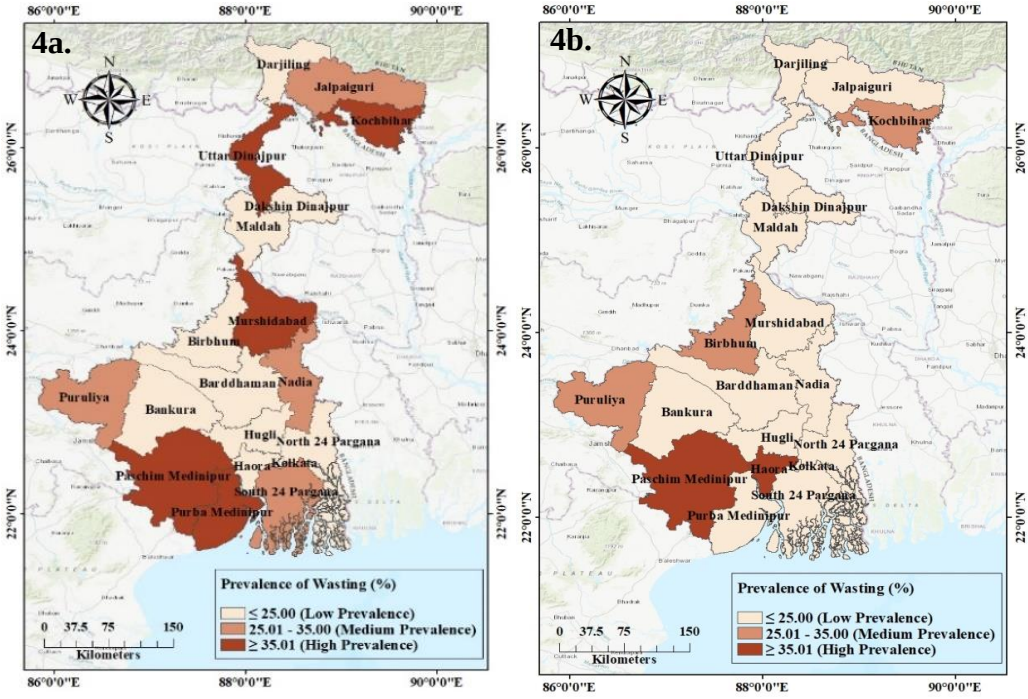


Table 2

Disparity of Wasted Children (ST) in West Bengal, India

Districts	Prevalence of wasted children (%)			
	NFHS- 4		NFHS- 5	
	Moderate	Severe	Moderate	Severe
Paschim Medinipur	26.4	12.5	20.9	26.2
Darjeeling	6.3	3.0	10.4	14.1
Hugli	25.0	0.0	10.7	11.0
Dakshin Dinajpur	10.7	8.0	16.9	7.7
Bankura	19.2	0.0	14.8	7.2
Puruliya	20.1	9.9	26.0	6.9
Birbhum	10.2	9.4	24.2	6.7
Barddhaman	6.1	16.8	19.0	4.7
Haora	0.0	0.0	46.2	0.0
Jalpaiguri	16.9	12.9	7.3	0.0
Kochbihar	25.2	23.4	33.3	0.0
Kolkata	0.0	18.0	0.0	0.0
Maldah	13.7	2.7	0.0	0.0
Murshidabad	0.0	100.0	7.8	0.0
Nadia	19.9	9.6	0.0	0.0
North 24 Parganas	9.4	15.3	19.9	0.0
Purba Medinipur	100.0	0.0	0.0	0.0
South 24 Parganas	30.2	0.0	0.0	0.0
Uttar Dinajpur	37.7	0.0	18.7	0.0

Source: DHS datasets of NFHS-4 & 5

Disparity of Underweight Status of ST Children in the Districts of West Bengal

The analysis of underweight ST children reveals concerning trends (Table 3) across nine districts of West Bengal. For severe underweight, higher prevalence rates were noted in NFHS-5 for the districts of Birbhum, Howrah, Puruliya, Paschim Medinipur, and South 24 Parganas. Regarding moderate underweight, increasing trends have been observed in six districts: Birbhum, Puruliya, Dakshin Dinajpur, Hugli, Barddhaman, and North 24 Parganas.

Despite an overall reduction in the percentage of underweight ST children across 11 districts from the fifth to the fourth round of evaluation, Birbhum, Dakshin Dinajpur, Howrah, Hooghly, and South 24 Parganas show a concerning growth trend (higher than 10%) in the prevalence of underweight ST children. Currently, 37.08% of ST children under the age of five in West Bengal are underweight and undernourished, indicating a shift in proportions from 2015-16 to 2019-21.

According to state-level data from the NFHS conducted between 2019 and 21, the percentage of ST children under 59 months of age classified as underweight decreased from 42.56% to 37.08% compared to the previous round. However, this rate remains above normal levels. Regionally (see Figure 5a), the prevalence of underweight ST children varies significantly, with more than 50% prevalence found in five districts. The latest round reports four districts with a higher proportion of underweight ST children (see Figure 5b).

Table 3

Disparity of Underweight Children (ST) in West Bengal, India

Districts	Prevalence of underweight children (%)			
	NFHS- 4		NFHS- 5	
	Moderate	Severe	Moderate	Severe
South 24 Parganas	14.9	15.3	0.0	100.0
Haora	0.0	0.0	0.0	46.2
Paschim Medinipur	35.4	11.9	28.6	26.0
Birbhum	29.1	0.0	29.9	25.1
Puruliya	36.1	22.3	39.2	22.3
Darjeeling	19.4	9.3	17.2	18.2

Dakshin Dinajpur	11.4	5.4	27.8	15.4
Hugli	13.4	11.6	37.3	11.8
Bankura	34.9	0.0	21.6	11.4
Uttar Dinajpur	50.1	12.4	28.5	9.2
Jalpaiguri	23.9	19.4	21.7	8.4
Murshidabad	100.0	0.0	15.5	7.8
Barddhaman	32.5	8.2	37.4	3.1
Kochbihar	50.6	23.4	33.3	0.0
Kolkata	0.0	18.0	0.0	0.0
Maldah	34.2	10.8	16.1	0.0
Nadia	20.1	9.6	0.0	0.0
North 24 Parganas	9.7	15.3	19.9	0.0
Purba Medinipur	100.0	0.0	25.5	0.0

Source: DHS datasets of NFHS-4 & 5

Specifically, in NFHS-5, four districts—Birbhum, Paschim Medinipur, Puruliya, and South 24 Parganas—have a prevalence rate of over 50% for underweight Scheduled Tribe (ST) children. In contrast, ten districts show a lower frequency of underweight children, while the other districts fall within the moderate prevalence category, where 40% to 50% of ST children are underweight.

Research indicates that undernutrition in tribal children persists due to remote-based living conditions, poverty, cultural taboos, insufficient nutritional information, poor health values, inadequate services, and weak infrastructure (Gangadharan & Kumar, 2014).

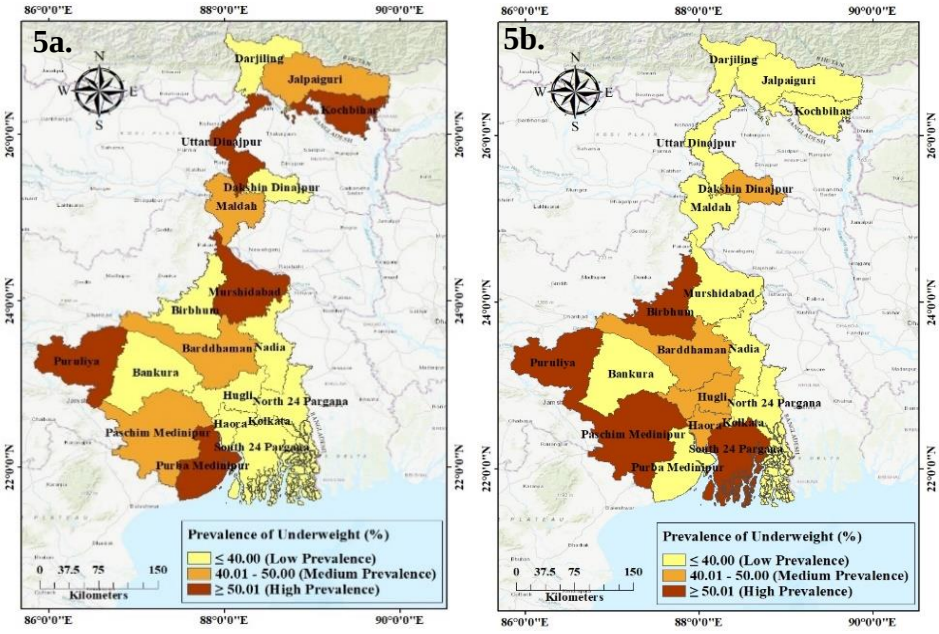
Anaemia Status of the Scheduled Tribal Women in the Districts of West Bengal

According to the NFHS datasets, a concerning trend of anaemia among scheduled tribal women has been observed in 14 districts of West Bengal. The prevalence rates of districts increased from NFHS-4 to NFHS-5 are as follows: Bankura, Birbhum, Dakshin Dinajpur, Darjeeling, Howrah, Hooghly, Jalpaiguri, Koch Bihar, Malda, Nadia, North 24 Parganas, Paschim Medinipur, Purba Medinipur, and South 24 Parganas.

The districts with the most significant decrease in anaemia rates are Barddhaman, Kolkata, Murshidabad, Purulia, and Uttar Dinajpur, with the largest decrease (over 8%) observed between the NFHS-4 and NFHS-5 surveys. However, five districts in West Bengal demonstrated a reduction in the proportion of anaemic women from the fifth to the fourth round of NFHS. The districts that experienced the largest increases in anaemia prevalence (higher than 10%) include Bankura, Howrah, Koch Bihar, Malda, Nadia, North 24 Parganas, Paschim Medinipur, and South 24 Parganas. Consequently, anaemia affects approximately 81.87% of women aged 15-49 in West Bengal. The incidence of anaemia among women aged 15 to 49 in West Bengal has shifted since the 2015-16 survey. According to the 2019-21 NFHS report, the percentage of ST women (URA) categorised as underweight dramatically increased from 73.73% to 81.87% between the last two NFHS cycles.

Figure 5

Spatial Disparity of ST Underweight Children of West Bengal, India (5a. NFHS-4, 5b. NFHS-5)



The prevalence of anaemia among ST women in the reproductive age group varies across districts, ranging from 45.8% in Koch Bihar to nearly all in Murshidabad and Kolkata in NFHS-4. According to NFHS-4, seven districts in West Bengal were found to have a percentage of anaemic ST women exceeding 80% (Table 4 & Figure 6a): Barddhaman, Dakshin Dinajpur, Hugli, Kolkata, Murshidabad, Purulia, and Uttar Dinajpur. Conversely, seven districts report comparatively lower prevalence rates: Bankura, Darjeeling, Howrah, Koch Bihar, Malda, Nadia, and North 24 Parganas. The remaining districts fall into the moderate prevalence category, with 70% to 80% of ST women being anaemic.

As per NFHS-5, twelve districts in West Bengal reported (Table 4 & Figure 6b) that the percentage of anaemic ST women exceeds 80%, placing them in the high-prevalence category (Table 4 & Figure 6b): Koch Bihar, South 24 Parganas, Haora, Dakshin Dinajpur, Malda, Paschim Medinipur, Murshidabad, Bankura, Hugli, Jalpaiguri, Purulia, and Birbhum.

Table 4
Disparity of Women (ST) Anaemia Status in West Bengal, India

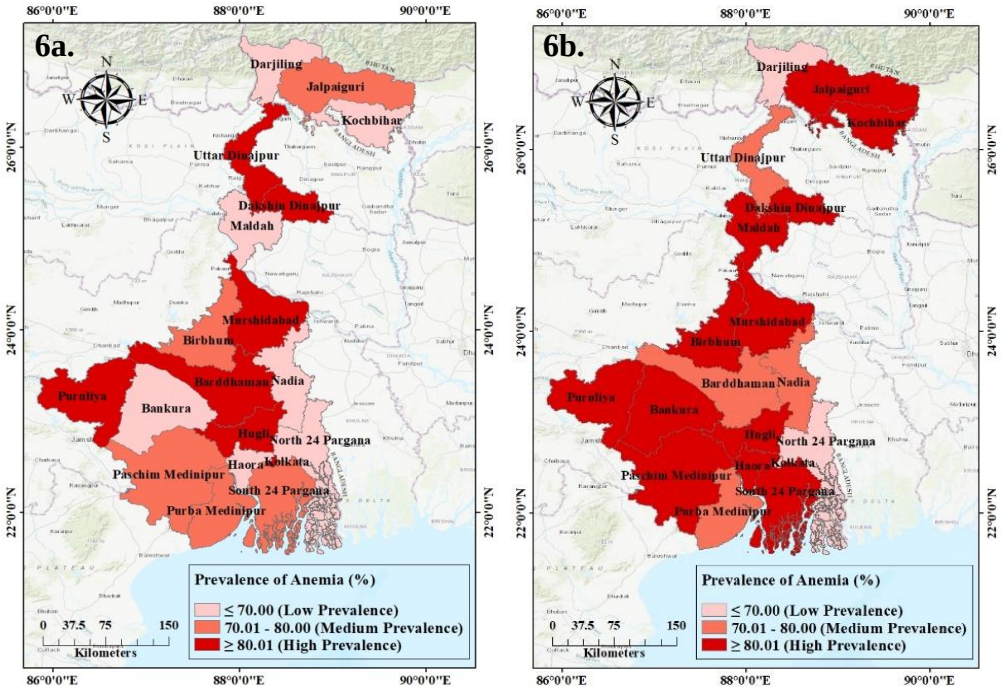
Districts	Prevalence of anaemia (%)	
	NFHS- 4	NFHS- 5
Kochbihar	45.8	100
South 24 Parganas	75.6	100
Haora	49.6	91.5
Dakshin Dinajpur	81.5	91.1
Maldah	65.0	90.6
Paschim Medinipur	76.4	89.2
Murshidabad	100	89.0
Bankura	68.1	86.2
Hugli	82.9	84.1
Jalpaiguri	77.4	82.2
Puruliya	91.0	82.0
Birbhum	74.5	81.7
Barddhaman	87.2	79.2
Uttar Dinajpur	87.3	78.7
Nadia	59.8	75.2
Purba Medinipur	70.7	74.7
North 24 Parganas	55.0	65.8
Darjeeling	52.8	61.7
Kolkata	100	52.4

Source: DHS datasets of NFHS-4 & 5

Conversely, three districts report comparatively lower prevalence rates (<70%), classifying them as lower-prevalence districts: Kolkata, Darjeeling, and North 24 Parganas. The remaining three districts fall into the moderate-prevalence category (70% to 80%): Barddhaman, Uttar Dinajpur, Nadia and Purba Medinipur. These statistics indicate a worsening anaemia scenario in many districts compared to NFHS-4, with a marked rise in high-prevalence zones.

Most anaemic tribal women are impoverished and illiterate, highlighting the high anaemia rates in this group. Heavy workloads with little rest and poor diets lacking fruits, vitamin C, and pulses further contribute to their anaemia (Unisa et al., 2010; De et al., 2011).

Figure 6
Spatial Disparity of ST Anaemic Women of West Bengal, India (6a. NFHS-4, 6b. NFHS-5)



BMI status of the scheduled tribal women in the districts of West Bengal

According to recent NFHS records, there is a rising trend of underweight Body Mass Index (BMI) conditions from the previous round among scheduled tribal women in six districts of West Bengal: Haora, Hugli, Kolkata, Maldah, Purba Medinipur, and South 24 Parganas (see Table 5). Whereas, ten districts showing the most significant improvement in reducing underweight conditions are Barddhaman, Birbhum, Darjeeling, Jalpaiguri, Kochbihar, Murshidabad, North 24 Parganas, Paschim Medinipur, Puruliya, and Uttar Dinajpur, all of which have experienced a decrease of more than 5% between the NFHS-4 and 5 survey cycles. However, 13 districts in West Bengal reported a decline in the prevalence of underweight children from the fourth round of NFHS to the fifth round.

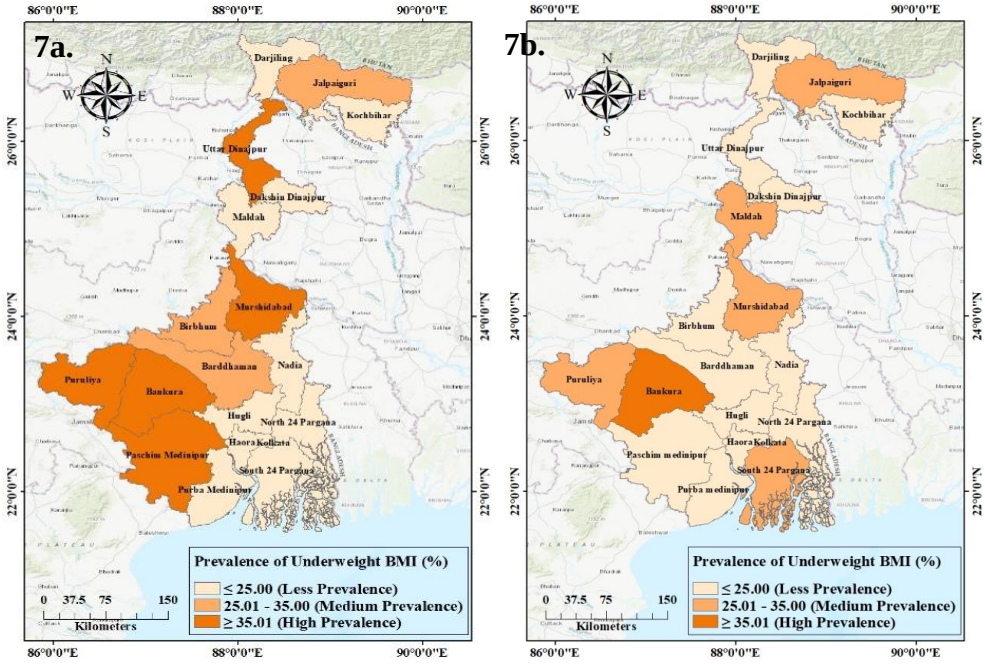
Haora and Kolkata are the two districts where there has been a significant increase (over 10%) in underweight BMI among women. Additionally, anaemia affects 21.19% of women in West Bengal aged 15–49. The prevalence of underweight BMI among women in this age group changed between the 2015-16 and 2019-21 surveys. The statewide NFHS reported a decrease in the percentage of women with an underweight BMI, from 29.30% to 21.19% over the last two NFHS rounds.

In specific districts, the frequency of underweight BMI among women aged 15 to 49 in West Bengal ranges from 10.8% in Hugli to 49.5% in Puruliya, as per NFHS-4 (see Figure 7a). Five districts exhibit a high prevalence of underweight BMI among women, exceeding 35%: Bankura, Murshidabad, Paschim Medinipur, Puruliya, and Uttar Dinajpur. Conversely, eight districts report a lower prevalence of underweight women with a BMI: Dakshin Dinajpur, Darjeeling, Kochbihar, Malda, Nadia, and North 24 Parganas. The remaining districts in West Bengal fall into the moderate prevalence category, with underweight BMI rates among women ranging from 25% to 35%.

Across the districts, as per NFHS-5, the proportion of underweight BMI among scheduled tribe women varies from 10.2% in Haora to 35.3% in Bankura (see Table 5 & Figure 7a). Additionally, Bankura is the only district where the proportion of women with underweight BMI exceeds 35%. Only five districts have a moderate prevalence of underweight BMI ST women: Jalpaiguri, Malda, Murshidabad, Puruliya, and South 24 Parganas. The rest fall into the lower prevalence category, with a proportion of underweight BMI women ranging from less than 25%.

Figure 7

Spatial Disparity of ST Underweight BMI Women of West Bengal, India (7a. NFHS-4, 7b. NFHS-5)



Several factors contribute to poor nutritional status and low BMI among vulnerable groups, including persistent poverty, unhygienic and crowded living conditions, lack of sanitation and clean water, and limited awareness of healthy practices. These interrelated socio-environmental issues create a cycle of deprivation that hinders dietary intake, nutrient absorption, and overall health (De & Kundu, 2016).

Table 5

Disparity of Underweight BMI Women (ST) in West Bengal, India

Districts	Prevalence of underweight BMI (%)	
	NFHS- 4	NFHS- 5
Bankura	48.5	35.3
Puruliya	49.5	34.7
South 24 Parganas	24.7	33.1
Murshidabad	100.0	30.8
Jalpaiguri	34.4	27.6
Maldah	22.5	25.7
Birbhum	30.0	23.7
Barddhaman	29.7	21.9
Purba Medinipur	13.9	21.8
Dakshin Dinajpur	24.5	21.2
Uttar Dinajpur	44.2	20.9
Kolkata	0.0	16.8
Kochbihar	24.3	15.3
Darjiling	24.3	14.8
Hugli	10.8	13.2
Nadia	14.3	12.5
North 24 Parganas	22.6	12.0
Paschim Medinipur	38.6	11.2
Haora	0.0	10.2

Source: DHS datasets of NFHS- 4 & 5

Discussion

This research examines the nutritional status of ST children (U5A) and women (URA) utilising anthropometric indicators and anaemia for women, across the districts of West Bengal. It highlights the disparities in nutritional conditions among ST children (U5A) and quantifies the differences. The study identified 13 districts, Bankura, Birbhum, Dakshin Dinajpur, Howrah, Jalpaiguri, Paschim Medinipur, Purulia, South 24 Parganas, Murshidabad, North 24 Parganas, Bardhaman, Darjeeling, and Hooghly, as high-priority areas. In these districts, at least one development indicator, such as stunting, wasting, or underweight, has either increased moderately or remained unchanged from 2015-16 to 2019-21.

Furthermore, nine districts have been identified where the prevalence of specific issues is particularly high: stunting is most prevalent in Birbhum, Dakshin Dinajpur, Jalpaiguri, Purulia, Uttar Dinajpur, and Howrah; wasting is notably high in Birbhum, Howrah, and Paschim Medinipur; and underweight status is highest in Birbhum, Purulia, Paschim Medinipur, and South 24 Parganas.

The disparities in nutritional status among children in these districts are attributed to uneven development across geographic regions, a lack of awareness about proper nutrition, and inadequate hygiene and sanitation compared to other social groups (Khadse & Chaurasia, 2020). Therefore, it is crucial to focus efforts on these nine high-prevalence districts to address undernutrition among ST children.

Despite India's various child development programmes, progress in nutritional development has been slow. Previous research indicates that child undernutrition has increased in recent years (Chatterjee, 2007).

The study also provides an overview of women's nutritional status in West Bengal, focusing on anaemia and body mass index (BMI) across various districts. Through thematic representations, it highlights significant variations in the nutritional status of ST women (URA).

Twelve districts have been identified as hotspots for anaemia among women: Jalpaiguri, Kochbihar, Dakshin Dinajpur, Maldah, Murshidabad, Birbhum, Purulia, Bankura, Paschim Medinipur, Hugli, Howrah, and South 24 Parganas. These districts exhibit the highest prevalence of anaemia, highlighting a need for targeted interventions to address women's undernutrition in these high-risk areas.

Moreover, Bankura has been identified as a hotspot for women with a low BMI, showing the highest rates of underweight women in the region. Targeted efforts are essential in this district to reduce the prevalence of underweight status among women.

It is essential to closely observe social groups to understand and address these nutritional and health inequities. The ST population, in particular, faces significant marginalisation and represents one of

the most socioeconomically disadvantaged groups regarding health outcomes (Sharma, 2020).

Nutritional issues among tribal children remain a significant concern in India, particularly in West Bengal. A noticeable socioeconomic disparity exists in children's health at the district level. Research indicates that the burden of undernourished children is higher in the least developed districts of India (Liou et al., 2020). According to the Comprehensive National Nutrition Survey (2016-2018), approximately 4.7 million children under the age of five suffer from chronic undernutrition, which adversely affects their growth, development, education, and overall academic performance.

Several factors contribute to this issue, including inadequate food intake, illness, family food insecurity, poverty, and a range of other challenges, such as insufficient infrastructure, geographical isolation, limited access to public services, and cultural differences. These factors often hinder the effectiveness of health and nutrition interventions (ALEKH, 2020).

The prevalence of the Composite Index for Anthropometric Failure among tribal children closely relates to these challenges. Tribal children under five who receive irregular supplemental nutrition and come from households with low food security are more likely to experience various anthropometric inadequacies (Mukhopadhyay & Biswas, 2010).

To address childhood undernutrition, complementary nutrition and health promotion initiatives could be developed based on new anthropometric indices (Das & Bose, 2011).

Mostly, the primitive tribal women had a low socioeconomic status and belonged to the lowest and middle classes; they also consumed a significantly lower number of macronutrients, which contributed to their malnourished status (Dash & Adhikari, 2017). Furthermore, the nutritional status of tribal women of reproductive age is alarmingly poor, with disparities observed among different subtribes (Mohandas et al., 2019).

A significant barrier to the sustainable development of tribal communities is a lack of awareness about policies and programs specifically designed for them. This situation can only be improved by increasing literacy rates within these communities. Many tribal individuals drop out of school at a young age and lack knowledge about the policies and programs available, as well as their rights. Therefore, government policies should not only focus on tribal development but also promote long-term growth among tribal populations (Minz, 2020).

Recommendations

Government programs aimed at combating undernutrition often face challenges such as a lack of coordination, insufficient staffing, inadequate funding, and disorganised efforts (V, & Pal, 2022). This discussion examines district-wise undernutrition rates for ST children (U5A) and women (URA) in West Bengal. It provides recommendations

for enhancing nutritional and health conditions based on data from the NFHS. The analysis focuses on nine districts with high rates of undernutrition: Birbhum, Dakshin Dinajpur, Howrah, Jalpaiguri, Koch Bihar, Paschim Medinipur, Puruliya, South 24 Parganas, and Uttar Dinajpur. Moreover, 12 districts (Jalpaiguri, Koch Bihar, Dakshin Dinajpur, Malda, Murshidabad, Birbhum, Puruliya, Bankura, Paschim Medinipur, Hooghly, Howrah, and South 24 Parganas) report a high prevalence of undernutrition among ST women. Based on the study, several recommendations are proposed:

1. Establish a clear administrative role and institutional framework, along with a revised policy structure tailored to the needs of the tribal region.

2. Focus on creating effective policies for undernourished tribal sub-plans.

3. Ensure effective implementation of the Public Distribution System, the Integrated Child Development Scheme, and Accredited Social Health Activists services with ongoing monitoring and awareness led by local authorities.

4. Collaborate with non-governmental organisations to support the tribal population in improving their nutritional status.

5. Address the key determinants of nutrition, which include education, socioeconomic status, and awareness of healthy lifestyles, through various interventions, policies, and programs.

6. Provide special educational assistance to raise awareness among tribal populations, ultimately promoting better nutritional and health outcomes for both children and women.

Limitations

This study used spatial and descriptive methods to examine undernutrition in West Bengal. It did not statistically assess the determinants and instead relied on existing evidence. NFHS data are cross-sectional and not specifically tribal, which limits causal inference and representativeness.

Conclusion

The anthropometric indices of children under five years of age (U5A) and the body mass index and anaemia status of reproductive-aged women (URA) are vital indicators of nutritional status. This study reveals that in numerous districts of West Bengal, Scheduled Tribe (ST) children under five years are more nutritionally vulnerable than the average population. The prevalence of undernutrition among these ST children is higher than both the state and national averages in several districts. Conversely, many districts in West Bengal also exhibit elevated rates of anaemia and an underweight body mass index among ST women compared to state and national averages.

The rising issue of undernutrition in various tribal areas and districts of West Bengal poses a significant concern for the health and well-being of ST children under the age of five and reproductive-aged women. It is vital to implement targeted

educational initiatives, empower communities through public-private partnerships, and enhance the affordability and accessibility of healthcare facilities in the undernourished tribal regions.

The findings of this study aim to highlight these issues and assist in reducing the nutritional disparities faced by ST children and women in various districts of West Bengal through a range of initiatives and policy decisions.

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Higher Education Institutions in Haryana: Growth and Spatial Patterns of Distribution

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Abstract

In developing countries, the demand for higher education is rapidly increasing, with more students progressing through the education system than ever before. This paper examines the growth and spatial distribution of higher education institutions in Haryana since their establishment, using secondary data. The study looks at the rise in total colleges, including both government and private institutions, and calculates the coefficient of variability to analyse their spatial distribution. There have been significant variations in the growth and distribution of colleges, particularly as the number of districts in the state has increased. The decade from 2000 to 2010 saw the highest growth in colleges and universities, driven largely by the private sector's involvement in higher education. Districts in the National Capital Region (NCR) close to Delhi have notably experienced a surge in higher education institutions.

***Keywords*:** growth, spatial distribution, higher education institutions, Haryana

Introduction

Higher education is essential for achieving sustainable growth and development in any country (Pujar, 2014). According to the National Policy on Education (NPE) of 1986, "Higher education provides people with an opportunity to reflect on the critical social, economic, cultural, moral, and spiritual issues facing humanity. It contributes to national development by disseminating specialised knowledge and skills. Therefore, it is a vital factor for survival. As the pinnacle of the educational pyramid, it also plays a key role in producing teachers for the education system."

Since India gained independence in 1947, the higher education sector has experienced significant growth. This expansion began rapidly but was

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initially based on a limited foundation. Until around 1980, higher education primarily focused on courses in languages and the humanities, reflecting the lingering influence of British education. Engineering education is largely provided by the Indian Institutes of Technology (IITs) and Regional Engineering Colleges, now known as National Institutes of Technology. Management education is offered by the Indian Institutes of Management (IIMs). The establishment of these high-quality institutions, particularly the Indian Institutes of Technology (IITs), is widely regarded as a milestone in Indian higher education (Agarwal, 2007b).

To be recognised as a welfare state during the 1960s and 1970s, the Indian government funded higher education by establishing universities and colleges while also managing the financial operations of private institutions. However, during the 1980s, a surge in demand for quality higher education that met the needs of businesses and industries placed a strain on government resources. As financial constraints limited the government's ability to establish new universities and colleges, only a few were created, and even fewer were government-sponsored. This situation indicated a withdrawal of the government from its broader responsibilities in higher education (Tilak, 2005).

While budgetary constraints limited the expansion of government-funded institutions, those that already existed faced financial difficulties and had to introduce self-financing courses to meet the growing demand from students. State universities and colleges began offering self-funded courses, leading to an increase in the number of private institutions over time. Despite initial reluctance, the state eventually had no choice but to allow for the growth of private institutions (Kapur & Mehta, 2004).

Trends post-1980 indicate that the number of public institutions—both government-funded and aided—expanded slightly, while the number of private institutions surged dramatically. Although significant growth in government-aided universities and colleges is unlikely in the future, the number of private, unaided higher education institutions is expected to rise (Agarwal, 2006).

Growth of Higher Education in Haryana

Since its inception in 1966, the higher education sector in Haryana has experienced remarkable growth in both quality and quantity. The 2019-2020 academic year continued this upward trend, characterised by a significant increase in the number of colleges, lecturers, and, notably, female student enrolment across various institutions.

The period from 1975 to 1985 is regarded as one of the most critical phases in the development of the educational system. During this period, the rapid expansion of institutions and student enrollment led to budgetary difficulties and resource shortages.

Around 1999-2000, the Haryana government initiated efforts to restructure the higher education sector. This included merging certain college programmes based on student and staff availability, as well as expanding education in rural areas by establishing additional colleges. The transformation of Haryana's higher education landscape was guided by the "Education Policy - 2000," which aimed to enhance educational quality, encourage private initiatives, promote computer education in colleges, and make higher education more job-oriented, particularly in rural areas.

There was a growing demand for access to education, coupled with a declining government budget and shifting political ideologies. This situation compelled successive Haryana governments to seek alternative funding strategies for the higher education system. Initially, the government encouraged local philanthropists to invest in education. This local involvement resulted in the establishment of various institutions, many of which were later integrated into the government system, contributing 85 to 90 per cent of recurring grants. By 2004, private institutions had overtaken public colleges in both rural and urban areas.

In 1966, Haryana had only 54 colleges and one university. By 2019-20, the number had risen to 1,075 colleges and 53 universities across 22 districts. The state ranked 12th in the country, accounting for 2.56% of India's total colleges and held eighth place with 5.08 per cent of the country's universities in 2019-20.

The growth of higher education in Haryana accelerated after 1991, following the implementation of the New Economic Policy. This policy had a profound impact on the development of higher education, not only in the state but also nationwide. By permitting the private sector to invest in higher education, the policy revolutionised educational opportunities in Haryana. Between 1966 and 1980, the number of colleges increased dramatically by 170 per cent, which then slowed to only 17 per cent from 81 to 1990.

Table 1
Haryana: Growth of Colleges and Universities, 1966-67 to 2019-20

Year	Colleges	Universities
	Number	
1966-67	54	1
1970-71	86	1
1980-81	146	3
1990-91	171	3
2000-01	228	4
2010-11	777	23
2019-20	1075	53

Sources: Statistical Abstract of Haryana, 2012-13; All India Survey on Higher Education (AISHE) Report, 2020.

Regarding universities, Haryana had only one university until 1970 Table 1). This number increased to three during the decade from 1971 to 1980, reflecting a remarkable growth rate of 200%. However, the decade of 1981-1990 saw no growth in the number of universities. The introduction of the New Economic Policy in 1991 created an environment that facilitated the rapid expansion of the private sector in higher education.

Objectives and Methodology

The primary objectives of this paper are to investigate two main areas: i) the trends in the growth of colleges, both government and private, and ii) the trends in the growth of universities, also categorised as government and private. The study examines the growth of higher education institutions (colleges and universities) at the district level from 1966 to 2019. Additionally, it discusses the district-wise number of colleges and their respective shares, along with the calculation of their coefficient of variability. Furthermore, the paper provides a detailed exploration of the growth of (i) government and privately managed colleges and (ii) various types of universities based on their management structure.

The analysis of higher education growth in the state of Haryana relies on secondary data gathered from several sources, including the Statistical Abstract of Haryana from various years, the annual reports from the Department of Higher Education, the All-India Survey on Higher Education (AISHE), census publications, relevant websites, and various books. The data collection spans from 1966 onward, with the analysis conducted at the district level. For data tabulation and representation, relevant tables, figures, and maps have been created.

Results and Discussion

Colleges in Haryana

According to the All-India Survey on Higher Education (AISHE) report, "colleges" are defined as institutions that are not authorised to award degrees in their name and are therefore affiliated with or recognised by universities.

An assessment of the data revealed that significant growth in the number of colleges occurred in Haryana since the state's formation in 1966. The number of colleges continued to rise, especially after 1991, with a substantial increase observed during the decade from 2000 to 2010. In fact, the total number of colleges grew more than threefold, increasing from 228 in 2000-01 to 777 in 2010-11.

Trends in Growth and Spatial Patterns of Distribution of Colleges

In 1966, there were 54 colleges in the state, but their distribution was uneven across the districts. Karnal had the highest number of colleges, followed by Rohtak, Ambala, and Hisar. By the 1970-71 academic year, the Coefficient of Variation (CV) index value was 0.62, indicating considerable inter-district variations in college distribution.

During this period, Rohtak became the district with the highest number of colleges, followed by Hisar, Karnal, and Ambala. Notably, 66.28% of all colleges were concentrated in just three districts: Rohtak, Hisar, and Karnal.

Data from 1980-81 confirmed that Rohtak continued to have the largest number of colleges, followed again by Ambala and Hisar. However, inter-district variations in the distribution

of colleges narrowed considerably after the 1990-91 academic year. This improvement can be attributed to the policy of Liberalisation, Privatisation, and Globalisation (LPG). From 1970-71 to 2010-11, Rohtak consistently ranked as the top district in terms of the share of colleges, due to various socio-demographic factors, political support, and the positive attitude of the people of Rohtak toward education, which reflects their overall development.

In 2019-20, Rohtak slipped to second place behind Sonipat. Although the total number of colleges continued to increase since 1966, the percentage share of colleges in each district decreased, as the number of districts had risen following the state's formation.

In 2019, noticeable inter-district variations were evident in the distribution of colleges offering higher education, with numbers ranging from a low of 14 colleges in Nuh to 90 colleges in Sonipat. The five districts with the highest number of colleges—Sonipat, Rohtak, Mahendragarh, Hisar, and Gurugram—accounted for 395 colleges, or 36.74% of the state's total. In contrast, the five lowest-ranking districts—Kaithal, Fatehabad, Charkhi Dadri, Panchkula, and Nuh—collectively had only 115 colleges, or 10.74% of the total.

The CV index values from 1966 to 2020 demonstrate trends in college distribution. The lowest value, 0.43, occurred in 1980-81, indicating reduced inter-district variation in that year. The maximum value of the CV index, 0.62, was recorded in 1970-71, reflecting significant disparities in college distribution at that time. The CV index increased from 0.54 in 1966-67 to 0.62 in 1970-71, despite the number of districts remaining constant. This increase was due to significant growth in the total number of colleges across nearly all districts, except for Jind and Mahendragarh, which did not experience the same level of expansion.

Government and Private (Aided and Un-aided) Colleges. Three categories of colleges are discernible (Table 4): government, private aided and private unaided. At the time of the state's formation in 1966, the colleges were either government or private-aided, in a 30:70 proportion. Although the number of colleges in each category has increased, the proportion of government colleges has declined over the years, except during the 1990s, a trend also reflected in the year 2000. The state had only seven districts. While Karnal and Rohtak had a substantial number of government colleges, Ambala and Hisar had private-aided colleges. Ambala did not have a government college, while the remaining four districts had one each.

However, by 2010-11, this figure had declined significantly to 11.97%. This notable drop was attributed to the liberalisation policy that allowed the private sector to enter the realm of higher education.

Although the absolute number of government colleges continued to rise, their percentage share declined due to the consistent increase in the

share of private colleges, both aided and un-aided.

In the late 1990s, private un-aided colleges emerged, and by 2000-01, their share constituted 17.11%. Previously, private aided colleges held a larger share, but by 2010-11, their percentage had decreased to 13.51%. Conversely, the share of private un-aided colleges surged from 17.11% in 2000-01 to 74.52% in 2010-11. Many of these private aided colleges were established by philanthropists, social reformers, and charitable trusts aiming to promote higher education, particularly for women.

In 2019-20, four districts—Rohtak, Sonipat, Yamunanagar, and Ambala—accounted for 37.69% of the state's total private aided colleges. Fatehabad and Panchkula had the lowest share, with only one private aided college in each district. In private un-aided colleges, Sonipat had the highest number, while Nuh had the lowest. Almost 50% of these colleges were concentrated in seven districts: Sonipat, Mahendragarh, Gurugram, Rohtak, Jhajjar, Hisar, and Yamunanagar (Map 1).

Map 1

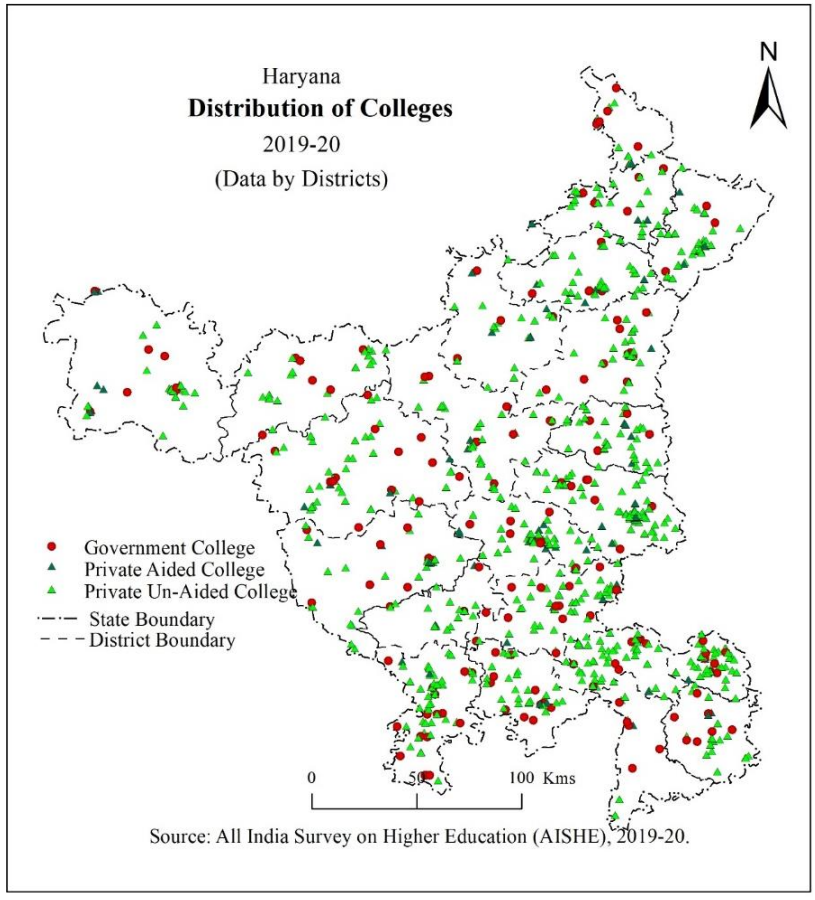


Table 3

Haryana: Trends in Growth and Spatial Patterns of Distribution of Number of Colleges,1966-67 to 2019-20

Districts	1966-67	1970-71	1980-81	1990-91	2000-01	2010-11	2019-20
Hisar	10 (18.52)	18 (20.93)	16 (10.96)	19 (11.11)	16 (7.02)	45 (5.79)	68 (6.33)
Gurugram	7 (12.96)	11 (12.79)	8 (5.48)	10 (5.85)	14 (6.14)	55 (7.08)	67 (6.23)
Jind	2 (3.70)	2 (2.33)	11 (7.53)	10 (5.85)	11 (4.82)	55 (7.08)	43 (4.00)
Mahendragarh	2 (3.70)	3 (3.49)	10 (6.85)	5 (2.92)	8 (3.51)	58 (7.46)	83 (7.72)
Ambala	10 (18.52)	13 (15.12)	19 (13.01)	16 (9.36)	16 (7.02)	32 (4.12)	42 (3.91)
Karnal	12 (22.23)	17 (19.76)	12 (8.23)	8 (4.68)	10 (4.39)	32 (4.12)	46 (4.28)
Rohtak	11 (20.37)	22 (25.58)	23 (15.75)	26 (15.20)	23 (10.09)	70 (9.01)	87 (8.09)
Bhiwani*	-	-	12 (8.23)	13 (7.60)	18 (7.89)	49 (6.31)	48 (4.47)
Faridabad*	-	-	8 (5.48)	10 (5.85)	20 (8.77)	50 (6.44)	53 (4.93)
Kurukshetra*	-	-	14 (9.58)	12 (7.02)	9 (3.95)	37 (4.76)	44 (4.09)
Sonipat*	-	-	9 (6.16)	11 (6.43)	17 (7.46)	55 (7.08)	90 (8.37)
Sirsa*	-	-	4 (2.74)	6 (3.51)	9 (3.95)	28 (3.60)	45 (4.19)
Panipat**	-	-	-	5 (2.92)	7 (3.07)	33 (4.25)	41 (3.81)
Rewari**	-	-	-	7 (4.09)	10 (4.39)	31 (3.99)	47 (4.37)
Kaithal**	-	-	-	7 (4.09)	11 (4.82)	28 (3.60)	30 (2.79)
Yamunanagar**	-	-	-	6 (3.51)	12 (5.26)	37 (4.76)	59 (5.49)
Panchkula***	-	-	-	-	4 (1.75)	11 (1.42)	22 (2.05)
Jhajjar***	-	-	-	-	8 (3.51)	43 (5.53)	66 (6.14)
Fatehabad***	-	-	-	-	5 (2.19)	20 (2.57)	26 (2.42)
(Nuh) Mewat****	-	-	-	-	-	6 (0.77)	14 (1.30)
Palwal****	-	-	-	-	-	2 (0.26)	31 (2.88)
Charkhi Dadri*****	-	-	-	-	-	-	23 (2.14)
Total	54	86	146	171	228	777	1075
Mean	7.71	12.29	12.17	10.69	12.00	37.00	48.86
C.V. Index	0.54	0.62	0.43	0.53	0.43	0.48	0.43

Source: Statistical Abstract of Haryana of different years. Note: *Formed after 1971 Census

** Formed after 1981 Census *** Formed after 1991 Census **** Formed after 2001 Census

*****Formed after 2011 Census

Table 4

Haryana: Trends in Growth and Spatial Pattern of Government and Private Colleges, 1966-67 to 2019-20 (to be continued)

Districts	1966-67			1970-71			1980-81		
	Govt.	Private Aided	Total	Govt.	Private Aided	Total	Govt.	Private Aided	Total
Hisar	1	9	10	1	17	18	3	13	16
Gurugram	1	6	7	1	10	11	4	4	8
Jind	1	1	2	1	1	2	2	9	11
Mahendragarh	1	1	2	1	2	3	3	7	10
Ambala	0	10	10	1	12	13	1	18	19
Karnal	7	5	12	4	13	17	2	10	12
Rohtak	5	6	11	7	15	22	7	16	23
Bhiwani	-	-	-	-	-	-	3	9	12

Faridabad	-	-	-	-	-	-	2	6	8
Kurukshetra	-	-	-	-	-	-	0	14	14
Sonipat	-	-	-	-	-	-	0	9	9
Sirsa	-	-	-	-	-	-	1	3	4
Panipat	-	-	-	-	-	-	-	-	-
Rewari	-	-	-	-	-	-	-	-	-
Kaithal	-	-	-	-	-	-	-	-	-
Yamunanagar	-	-	-	-	-	-	-	-	-
Panchkula	-	-	-	-	-	-	-	-	-
Jhajjar	-	-	-	-	-	-	-	-	-
Fatehabad	-	-	-	-	-	-	-	-	-
Nuh (Mewat)	-	-	-	-	-	-	-	-	-
Palwal	-	-	-	-	-	-	-	-	-
Charkhi Dadri	-	-	-	-	-	-	-	-	-
Total	16 (29.63)	38 (70.37)	54 (100)	16 (18.60)	70 (81.40)	86 (100)	28 (19.18)	118 (80.82)	146 (100)

Districts	1990-91			2000-01				2010-11			
	Govt.	Private Aided	Total	Govt.	Private Aided	Private Un-Aided	Total	Govt.	Private Aided	Private Un-Aided	Total
Hisar	6	13	19	5	11	0	16	10	5	30	45
Gurugram	6	4	10	6	4	4	14	5	3	47	55
Jind	3	7	10	3	7	1	11	5	3	47	55
Mahendragarh	3	2	5	8	0	0	8	8	0	58	58
Ambala	3	13	16	2	11	3	16	3	10	19	32
Karnal	1	7	8	4	5	1	10	5	5	22	32
Rohtak	10	16	26	5	14	4	23	7	10	53	70
Bhiwani	3	10	13	5	11	2	18	7	9	33	49
Faridabad	3	7	10	5	7	8	20	4	7	39	50
Kurukshetra	0	12	12	2	6	1	9	3	6	28	37
Sonipat	0	11	11	2	12	3	17	5	9	41	55
Sirsa	2	4	6	2	4	3	9	4	4	20	28
Panipat	1	4	5	1	5	1	7	3	5	25	33
Rewari	1	6	7	3	6	1	10	5	6	20	31
Kaithal	7	0	7	0	8	3	11	1	7	20	28
Yamunanagar	0	6	6	0	9	3	12	1	8	28	37
Panchkula	-	-	-	3	1	0	4	4	1	6	11
Jhajjar	-	-	-	5	2	1	8	6	6	31	43
Fatehabad	-	-	-	4	1	0	5	4	1	15	20
Nuh	-	-	-	-	-	-	-	2	0	4	6
Palwal	-	-	-	-	-	-	-	0	0	2	2
Charkhi Dadri	-	-	-	-	-	-	-	-	-	-	-
Total	49 (28.65)	122 (71.35)	171 (100)	65 (28.51)	124 (54.38)	39 (17.11)	228 (100)	93 (11.97)	105 (13.51)	579 (74.52)	777 (100)

Districts	2019-20			
	Govt.	Private Aided	Private Un-Aided	Total
Hisar	16	6	46	68
Gurugram	8	2	57	67
Jind	10	3	30	43
Mahendragarh	16	7	60	83
Ambala	5	9	28	42
Karnal	10	5	31	46
Rohtak	15	19	53	87
Bhiwani	10	6	32	48
Faridabad	8	6	39	53
Kurukshetra	7	7	30	44
Sonipat	9	11	70	90
Sirsa	8	6	31	45
Panipat	4	5	32	41
Rewari	11	6	30	47
Kaithal	4	7	19	30
Yamunanagar	3	10	46	59
Panchkula	6	1	15	22
Jhajjar	14	4	48	66
Fatehabad	6	1	19	26
Nuh (Mewat)	6	2	6	14
Palwal	5	2	24	31
Charkhi Dadri	3	5	15	23
Total	**184 (17.12)**	**130 (12.09)**	**761 (70.79)**	**1075 (100)**

Source: Statistical Abstract of Haryana (1968, 1972, 1982, 1992, 2002, 2012 and 2021)

Universities in Haryana

The All-India Survey on Higher Education (AISHE) defines universities and university-level institutions as those empowered to award degrees under an Act of Parliament or State Legislature. An assessment of the data has revealed that Haryana, which began with a very small base, now occupies the eighth position in the country owing to its large number of universities.

Trends in Growth and Spatial Patterns of Distribution of Universities

Kurukshetra University, inaugurated in 1956, was the first state public university in Haryana, established a decade prior to the state's creation. Following its inception, Haryana's university education system entered a period of dormancy lasting 15 years, during which no new universities were founded. It was not until 1970, when Chaudhary Charan Singh (CCS) Haryana Agricultural University was established, that the system experienced a revival. Maharshi Dayanand University (MDU) was founded in 1976. In subsequent years, the following universities were established: Guru Jambheshwar University of Science and Technology (GJUST) in Hisar in 1995, Chaudhary Devi Lal University in Sirsa in 2003, Deenbandhu Chhotu Ram University of Science and Technology in Murthal in 2006, Bhagat Phool Singh Women University in Khanpur Kalan, Sonipat in 2006, Pt. B.D. Sharma University of Health Sciences in Rohtak in 2008,

YMCA University of Science and Technology (now J. C. Bose University of Science and Technology) in Faridabad in 2010, Lala Lajpat Rai University of Veterinary and Animal Sciences in Hisar in 2011, Indira Gandhi University in Meerpur, Rewari in 2013, Ch. Ranbir Singh University in Jind in 2014, and the State University of Performing & Visual Arts in Rohtak in 2014.

As of the 2019-20 academic year, there were 23 state private universities in Haryana, starting with O.P. Jindal Global University, established in Sonipat in 2009. However, the distribution of state private universities across the region was uneven. Of the 22 districts in Haryana, only nine had state private universities. Among the 23 state private universities, 10 were located in Gurugram (including Amity University, Ansal University, BML Munjal University, G.D. Goenka University, IILM University, and K.R. Mangalam University), four in Sonipat, and two each in Faridabad and Jhajjar. Additionally, districts such as Ambala, Hisar, Kaithal, Palwal, and Rohtak each had one state private university.

In 2019-20, there were a total of six deemed universities in the state—three deemed universities (government) and three deemed universities (private). Among the oldest deemed universities in Haryana is the National Dairy Research Institute in Karnal. The National Brain Research Centre, established in 2002 in Gurugram, is another notable deemed university. The private deemed universities include Maharishi Markandeshwar University in Ambala (established in 2007), Lingaya's University in Faridabad (2009), and the Manav Rachna International Institute of Research & Studies in Faridabad (2009).

Haryana has one Central University established in 2009, which is situated in the Mahendragarh district, a rural area.

In summary, the academic year 2000-01 marked a significant transformation in the state's educational landscape, characterised by the establishment of various institutions, including central universities, institutes of national importance, state private universities, and deemed universities (both government and private). Consequently, the share of state public universities fell sharply from 100% in 2000-01 to 45.45% in 2010-11. This notable decline was attributed to the liberalisation policies that allowed private sector involvement in higher education. By the academic year 2019-20, the share of state public universities had further reduced to 33.96%, while the participation of state private universities rose from 27.27% in 2010-11 to 43.40% in 2019-20. In 2019-20, the state comprised a total of 23 state private universities, 18 state public universities, five institutes of national importance, three deemed universities (government), three deemed universities (private), and one central university.

The five Institutes of National Importance are distributed across

four districts of Haryana: two in Kurukshetra, one in Faridabad, one in Rohtak, and one in Sonipat. Of the total 53 universities, one-third (18) are state public universities, which are located in 11 districts. Notably, three districts—Hisar, Rohtak, and Sonipat—each host three state public universities, collectively constituting half of the total (Map 2).

Table 5

Haryana: Trends in Growth of Universities, 1966-67 to 2019-20

Districts	1966-67	1970-71	1980-81	1990-91	2000-01	2010-11	2019-20
Ambala	0	0	0	0	0	2 (9.09)	2 (3.77)
Bhiwani	0	0	0	0	0	0	1 (1.89)
Faridabad	0	0	0	0	0	3 (13.64)	6 (11.32)
Gurugram	0	0	0	0	0	5 (22.73)	12 (22.64)
Hisar	0	0	1 (33.33)	1 (33.33)	2 (50)	3 (13.04)	4 (7.55)
Jhajjar	0	0	0	0	0	0	2 (3.77)
Jind	0	0	0	0	0	0	1 (1.89)
Kaithal	0	0	0	0	0	0	1 (1.89)
Karnal	0	0	0	0	0	0	1 (1.89)
Kurukshetra	1 (100)	1 (100)	1 (33.33)	1 (33.33)	1 (25)	2 (9.09)	4 (7.55)
Mahendragarh	0	0	0	0	0	1 (4.55)	1 (1.89)
Palwal	0	0	0	0	0	0	2 (3.77)
Rewari	0	0	0	0	0	0	1 (1.89)
Rohtak	0	0	1 (33.33)	1 (33.33)	1 (25)	2 (9.09)	5 (9.43)
Sirsa	0	0	0	0	0	1 (4.55)	1 (1.89)
Sonipat	0	0	0	0	0	3 (13.64)	9 (16.98)
Total	1	1	3	3	4	22	53

Sources: Statistical Abstract of Haryana (1968, 1972, 1982, 1992, 2012 and 2021); All India Survey on Higher Education, 2019-20.

Table 6

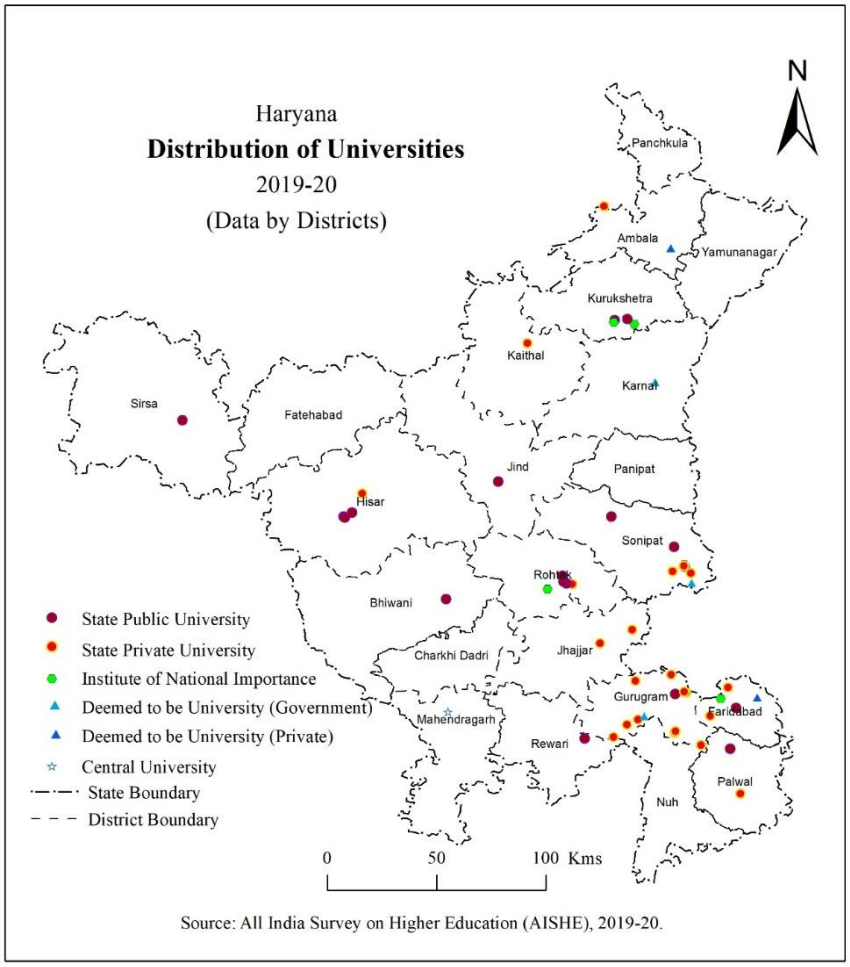
Haryana: *Trends in Growth and Spatial Patterns of Distribution by Type of Universities,*

1966-67 to 2019-20

Types of Universities	1966-67	1970-71	1980-81	1990-91	2000-01	2010-11	2019-20
Central University	0	0	0	0	0	1 (4.55)	1 (1.89)
Institute of National Importance	0	0	0	0	0	1 (4.55)	5 (9.43)
State Public University	1 (100)	1 (100)	3 (100)	3 (100)	4 (100)	10 (45.45)	18 (33.96)
State Private University	0	0	0	0	0	6 (27.27)	23 (43.40)
Deemed to be a University (Government)	0	0	0	0	0	1 (4.55)	3 (5.66)
Deemed to be a University (Private)	0	0	0	0	0	3 (13.64)	3 (5.66)
Total	1	1	3	3	4	22	53

Sources: Statistical Abstract of Haryana (1968, 1972, 1982, 1992, 2012 and 2021); All India Survey on Higher Education (AISHE), Report 2015 and 2020.

Map 2



Conclusion

At the time of its formation in 1966, Haryana had a limited higher education infrastructure, comprising only 54 colleges. However, as public awareness of higher education grew and demand increased, the number of colleges began to rise. Between 1966 and 1980, Haryana experienced impressive growth in the number of colleges. In contrast, the period from 1980 to 1990 witnessed very low growth. Following 1991, increased private investment led to rapid expansion in higher education institutions. While the total number of institutions steadily increased from 1966 to 2019, the most significant growth occurred during the decade from 2000 to 2010, when the number of colleges more than tripled, and the number of universities increased almost sixfold. During this period, the majority of new institutions were established in the private sector.

Until 1990-91, Haryana had both government and private-aided colleges,

with a higher proportion of private-aided institutions. After 1990-91, private unaided colleges began to emerge. Regarding university expansion in the state, it is noteworthy that there was only one university at the time of Haryana's formation, and the number remained low until 2000. During the decade from 2000 to 2010, the number of universities increased by 5.5 times, and in the subsequent decade (2010-2019), it more than doubled. Until 2000, all universities were either government or state public universities. After that, various types of universities emerged, including state private universities, deemed-to-be universities (both government and private), and central universities. By 2019, 16 out of the 22 districts in Haryana had universities, while six districts—Charkhi Dadri, Fatehabad, Nuh, Panchkula, Panipat, and Yamunanagar—lacked them. The absence of universities in these districts may be attributed to their proximity to universities in neighbouring districts. Although there has long been a demand for a university in Nuh, residents have only received assurances from political parties that have never been fulfilled. In 2019, one-third of the total universities in Haryana were state public universities, with notable growth observed in the districts of the National Capital Region (NCR).

Haryana offers several advantages over other states. Firstly, the predominantly flat terrain facilitates the development of efficient transport facilities. Additionally, the state boasts a substantial student population. These favourable conditions have encouraged investment opportunities for establishing colleges in the private sector, resulting in faster growth in Haryana than in many neighbouring states. Factors such as government policies favouring the privatisation of higher education, a robust transport network, and growing recognition of the importance of higher education among the populace have all played crucial roles in the expansion of higher education in the state. However, it is essential to examine the quality of education provided by the numerous higher education institutions.

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Analysis of Nature and Determinants of Occupational Diversification of Rural Workforce in Puruliya District, West Bengal, India

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Abstract

Occupational diversification in Puruliya district, West Bengal, India, has a significant impact on rural livelihoods by involving people in multiple income-generating activities, leading to shifts from agricultural to non-agricultural pursuits. The study examines the nature and factors influencing occupational diversification in the rural workforce, utilising secondary data from the Indian Census. In 2001 and 2011, Jhalda-II and Jaypur experienced the highest diversification, while Barabazar and Manbazar-I experienced the lowest. The study found that irrigation intensity, average landholding size, and small landholding area significantly predicted Rényi entropy in 2001, while literacy rate, cropping intensity, crop diversification index, and small landholding area also significantly predicted it in 2011 ($n = 20$, $p < 0.05$, $p < 0.10$). From 2001 to 2011, occupational diversification in the five Community Development blocks of Puruliya district increased significantly, indicating a persistent diversification of occupations among rural workers, which emphasises the importance of employment for economic and livelihood development.

Keywords: occupation, rural workforce, diversification, entropy, marginal effect

Introduction

A country's occupational structure refers to the division of its population among various occupations and professions. The United Nations Framework Convention on Climate Change defines occupational diversification as a strategy for transforming economies by engaging a large workforce in multiple economic activities (UNFCCC, 2016, p. 7). According to Sinha (2007, p. 51), the "new economic policy" introduced in the 1990s created

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employment opportunities in non-agricultural sectors in India. The diversification of the economy is a crucial factor in generating employment in developing and least-developed countries (Freire, 2017, pp. 1-2).

In this context, Chand et al. (2017, p. 67) noted that the growing trend of job creation in the non-farm sector led to a shift of the workforce away from agriculture in rural areas of India. Occupational diversification within households from agricultural to non-agricultural activities became evident in the post-1980s period in India (Bhue & Vijay, 2018).

According to the Census of India (2001), 31.7% of the population was engaged in cultivation as cultivators, and 26.7% as agricultural labourers. Additionally, 4.7% were involved in household industries, while 37.5% were classified as other workers. However, this scenario changed by 2011. The Census of India (2011) reported that 41.89% of the population was engaged as cultivators and 49.45% as agricultural labourers, with 8.21% in household industries and 27.67% as other workers.

The present study employs generalised entropy measures to analyse the disaggregation and diversity of occupations. It explores the interrelationship between selected dependent and independent variables to understand how individual determinants impact occupational diversification in the study area. The focus of this study is to analyse the nature of occupational diversification in the rural workforce and to identify the primary factors influencing this diversification from 2001 to 2011.

Review of Contemporary Research

The Census defines an individual's occupation as their role in a productive activity (Census of India, 1971). A significant social development impacting local economies, livelihoods, migration, well-being, and social organisation is the structural shift in employment within India's rural-urban continuum (Choithani et al., 2021, p. 105617). The decades following India's economic reforms in the post-1980s saw a transition in household occupations from agricultural to non-agricultural pursuits (Bhue & Vijay, 2018). Research indicates that while there have been changes in occupational diversification, these are not as prominent as the shifts in gross value added across all economic sectors, which have contributed to rising unemployment in India during the post-reform era (Padder & Mathavan, 2022, p. 392).

The role of the labour force in the The agricultural sector has been in decline, particularly among hired labourers. Consequently, many households of agricultural labourers have turned to occupational diversification as a strategy to

enhance their income (Kundu and Das, 2022). To ensure sustainable income for this group in West Bengal, India, addressing poverty through vocational diversity is a crucial first step (Kundu and Das, 2022).

Mehta (2018) reported that in 1993 and 1994, the share of GDP (gross domestic product) attributed to agriculture was 79 per cent; by 2011–2012, it had decreased to 73.2 per cent (p. 23). Moreover, India witnessed an increase in 'rural employment' in non-agricultural sectors, rising from 27 to 42 per cent between 2005 and 2015 (p. 24). Saha and Bahal (2015) identified key socio-economic and household-level drivers of this change, including 'family labour,' 'household income,' 'landholding size,' 'land cultivation,' 'livestock,' 'educational development,' 'social participation,' and 'migration' (p. 7).

Individuals with an education in rural India have a better chance of finding work in non-agricultural sectors (Kaur et al., 2019, p. 214). They are increasingly venturing into non-agricultural fields in search of more 'secure and regular' occupations (p. 214). According to Ray and Majumder (2010, p. 11), 'occupational mobility' was insufficient for Scheduled Tribes (STs) across almost all of India's states in 1993. Mandela and Niyati (2020) cited the growth of non-agricultural activities in rural areas, the advancement of education among non-agricultural households, and the development of industrial and service sectors in urban areas as potential causes of these changes.

Chandrasekhar (1993) explained the diversification of occupations in West Bengal, noting that the increase in 'agricultural productivity' in farming activities and 'work participation in non-agricultural activities' (p. 208), along with the decreasing reliance of villages on nearby 'urban centres' (p. 207), revitalised occupational diversification. Roy et al. (2018) identified primary factors influencing livelihood diversification in the Burdwan and Purulia districts, including the respondents' age, 'dependency ratio,' educational attainment, 'land-man ratio,' and the distance from the nearest town or market (p. 41). The 'livelihood diversification index' indicated an increase in impoverishment in Purulia district and a decrease in the agriculturally advanced Burdwan district between 2017 and 2018 (p. 39).

To accelerate occupational and livelihood diversification in West Bengal, Dutta and Ghosal (2014) proposed extending the 'employment generation program' to rural regions alongside effective 'land reform measures' (p. 145). This study focuses on diversifying the main worker categories, investigating workforce diversification, the economy, and occupations in rural areas. It integrates key determinants to

comprehend how socio-economic issues affect diversification. The study initiates an assessment of the marginal effects of predictors on occupational diversification and compares essential diversity-measuring indices. Conducted regionally, this study contributes to our understanding of the evolving intra- and inter-occupational connections within the Indian societal context.

Objectives of the Study

The study aims

1. To analyse the spatio-temporal variation of occupational diversification and its socio-economic determinants in the Community Development Blocks (C.D. Blocks) of Puruliya District, West Bengal, from 2001 to 2011.

2. To identify the relationship between occupational diversification and its determinants.

3. To predict the marginal effects of the determinants of occupational diversification in the study area.

Materials and Methods

Study Area

Puruliya district is the westernmost district in West Bengal, India, and it is one of the most drought-prone areas in the country (Fig. 1). It is situated between latitudes 22°42′35″ N and 23°42′00″ N, and longitudes 85°49′25″ E and 86°54′37″ E. The district covers an area of 6,259 square kilometres and comprises twenty Community Development Blocks (Census of India, 2011). The northwest, west, and southwest regions of Puruliya are characterised by predominantly undulating terrain, which is part of the Chota Nagpur plateau region (Fig. 2).

According to the 2001 Census of India, the district had 38,400 cultivators and agricultural labourers, as well as 22,614 household industry workers. By 2011, the number of cultivators and agricultural labourers had risen to 38588, while the total number of household industry workers and other workers reached 31624 (Census of India, 2011). The local population primarily relies on the primary sector for their livelihoods, although many workers are migrating to neighbouring border districts and states.

There has been a significant shift in the district's employment structure since the post-land reform period. The proportion of cultivating and non-cultivating households in rural areas decreased from 65.61% in 2002-2003 to 52.39% in 2012-2013, with non-cultivating households constituting 47.61% of the rural demographics (Bhue, 2017, p. 619).

Figure 1

Location Map of the Study Area

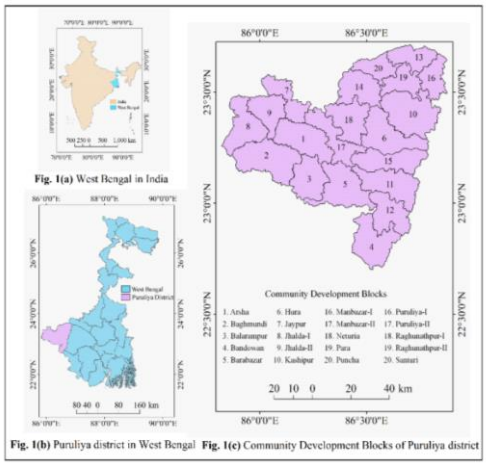
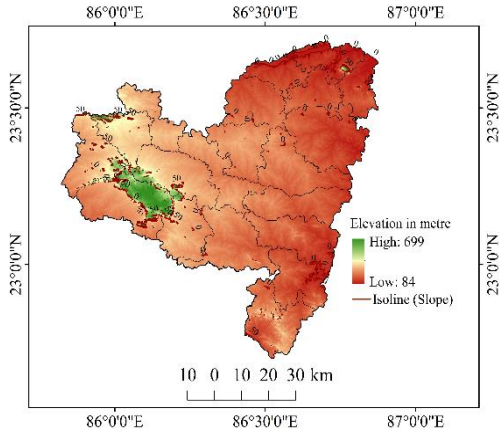


Figure 2

Relief and Slope Condition of Puruliya District



Sources of the Data

The study has been conducted using secondary data. Different categories of work participation rates have been collected from the Census of India (2001 and 2011) to measure occupational diversification. Other relevant data have been collected from the District Statistical Handbook: Puruliya (2000–2001 combined and 2011) and the Agricultural Census of India (2000–2001 and 2010–2011).

Methods and Techniques

Rényi Entropy: Definitions and Notations

In the econometric study, economic diversification has been expressed as a proportion of employment across different sectors using Shannon's entropy (Hackbart & Anderson, 1975, p. 374). Shannon (Shannon & Weaver, 1949) defined the possible results of the distribution's uncertainty as $H\ (p_1,\ p_2,\ldots,\ p_n)$ is

$$\sum_{k=1}^{n} p_k log_2 \frac{1}{p_k} \qquad (1)$$

where probabilities $p_1,\ p_2,\ \ldots,\ p_n$ are the entropy of the distribution p, and $H(p)$ is the quantity (Rényi, 1961, p. 547). Shannon's entropy is 'generalised' to be Rényi entropy (Mayoral, 1998, p. 102) and is expressed as a 'continuous' form of 'Shannon's entropy' (Bromiley et al., 2004, p. 2). In the present study, Rényi entropy (Rényi,1961) has been used to measure the diversification of occupations in the study area. When the determination of Rényi entropy is 'alpha ($\propto$) variable' with the 'logarithmic base' e (Masisi et al., 2008, p. 42), the equation is

$$H^r(X) = \frac{1}{1-r}\log\left(\sum_{i=1}^{M} q_i^r\right),\ r \neq 1,\ r > 0 \qquad (2)$$

where q is the proportion of item i.

$$H_\alpha = \frac{\ln\left(\sum P_i^{\propto}\right)}{1-\propto} \qquad (3)$$

where P is the proportion of item i. In this study, P is the percentage of

workers of the total workers, and $\propto$ is the scale parameter ≥ 0 and $\neq 1$. The widely used scale parameters in the diversity measurement by 'Shannon's Index' are 1, 'Simpson's Index' is 2, and 'Berger Parker's is ∞ (Kindt et al., 2001, p. 1). In the study, the scale parameter is 2 ($\alpha \rightarrow 2$).

Statistical Techniques

The multiple linear regression model has been used to identify the relationship between occupational diversification and its determinants. The formula of the 'multivariate regression' model (Uyanık & Güler, 2013, p. 235) is

$$Y = \beta_0 + \beta_1 X_1 + \ldots + \beta_n X_n + e_t \quad (4)$$

(where Y is the dependent variable (here, Rényi entropy); X_1 is the independent variable; β_1 is the parameter, and e_t is the error). The 'marginal effect' of the population mean has been calculated using the following formula in the regression model's post-estimation analysis adopted by Leeper (2017, p. 9),

Marginal Effect concerning

$$X_1 = \frac{dY}{dX_1} = \beta_1 + \beta_3 X_2 \quad (5)$$

where d is the change; Y is the dependent variable; X is the independent variable; β_1 is the parameter.

Relevant socio-economic indicators have been selected to predict occupational diversification are:

1. Average Household Size (AHS)
2. Percentage of Scheduled Caste to Total Population (SC)
3. Percentage of Scheduled Tribes to Total Population (ST)
4. Literacy Rate (per cent) (LR)
5. Crop Productivity (Overall Yield Index) (OYI, Shafi, 1972)
6. Cropping Intensity (per cent) (CI)
7. Irrigation Intensity (per cent) (II)
8. Crop Diversification Index (CDI, Entropy Index (*EI*) (Hart, 1971)
9. Average Landholding Size (hectare) (ALS)
10. Percentage of Area under Marginal Landholdings (MLS)
11. Percentage of Area under Small Landholdings (SLS)

Results and Discussion

Occupational Categories and Spatio-Temporal Changes in Workforce Distribution

The Census of India (2011) categorises occupations into four main and four marginal worker groups. Between 2001 and 2011, the percentage of the working population in the Puruliya district decreased from 44.55% to 42.65% (Figs. 3 and 4). In 2011, the rates of main and marginal workers in the district were 20.93% and 21.71%, respectively, which were 25.43% and 19.03% in 2001.

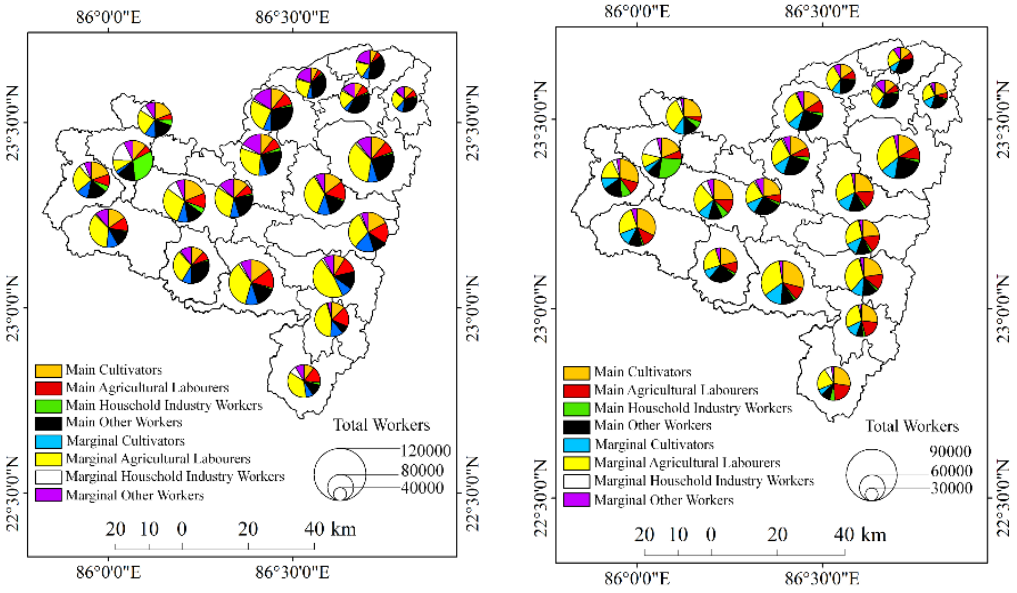
In the C.D. blocks of Manbazar-II and Puncha, the participation rate in agriculture increased, whereas it declined in other blocks. Notably, Neturia and Raghunathpur-II

witnessed the most significant rise in the number of workers engaged in non-agricultural activities compared to Manbazar-II and Puncha.

There was a significant decline in work participation among main cultivators across several blocks, including Baghmundi, Bandowan, Barabazar, Manbazar I, and Manbazar II, between 2001 and 2011. In Barabazar, Jaypur, Puruliya-I, Puruliya-II, Puncha, Raghunathpur-I, and Santuri blocks, the proportion of main agricultural labourers fell below 5%.

Figures 3 and 4

Work Participation of the Different Categories of Workers in 2001 and 2011



In contrast, the percentage of other main workers increased significantly in the Raghunathpur-I, Raghunathpur-II, and Santuri C.D. blocks. The rise in main household industry workers was particularly noteworthy in Jhalda-II and Neturia.

Overall, the report underscores the urgent need for the region to adopt more sustainable and inclusive work practices. While agriculture continues to employ the majority of the working population in the district, all C.D. Blocks in Puruliya have seen an increase in non-agricultural workers, except Manbazar-II and Puncha.

Nature and Spatio-Temporal Changes of Diversification (Rényi Entropy)

The study investigates how the C.D. Blocks in the Puruliya district of India are diversifying their occupations from agriculture to non-agricultural activities (see Figures 5, 6, and 7). The highest level of occupational diversification was observed in Jhalda-II in 2001, with a Rényi entropy score of 2.58. The lowest

scores were reported in Barabazar in 2001 (2.15), in Jaypur in 2011 (2.62), and in Manbazar-I in 2011 (1.87). Among the blocks, Manbazar-II experienced the smallest decrease in Rényi entropy, whereas Jaypur saw the largest increase in entropy.

Furthermore, the study indicates that a significant proportion of both primary cultivators and agricultural labourers, as well as marginal cultivators and agricultural labourers, were concentrated in Manbazar-I and Manbazar-II, demonstrating substantial occupational diversification in both 2001 and 2011. During those same years, Jhalda-I and Jhalda-II experienced a notable shift towards non-agricultural occupations, with a high percentage of primary household industry workers and marginal household industry workers. Numerous rural households in the Raghunathpur-I and II and Neturia blocks of the Puruliya district have diversified their livelihoods from agricultural activities to casual work.

Relationship Between Occupational Diversification and Its Determinants

This study examines the factors influencing occupational diversification in the Puruliya district. The Rényi entropy of occupational diversification is predicted by independent variables, which account for 78.30% ($p < 0.1$) of the variation in entropy in 2001 (Table 1) and 78.70% ($p < 0.1$) in 2011 (Table 2). Model validation is achieved using the Durbin-Watson statistic, which reveals a DW value of 2.749 in 2001 and 1.672 in 2011, indicating almost no autocorrelation at a significant level.

Figures 5 and 6

Occupational Diversification in Puruliya District in 2001 and 2011

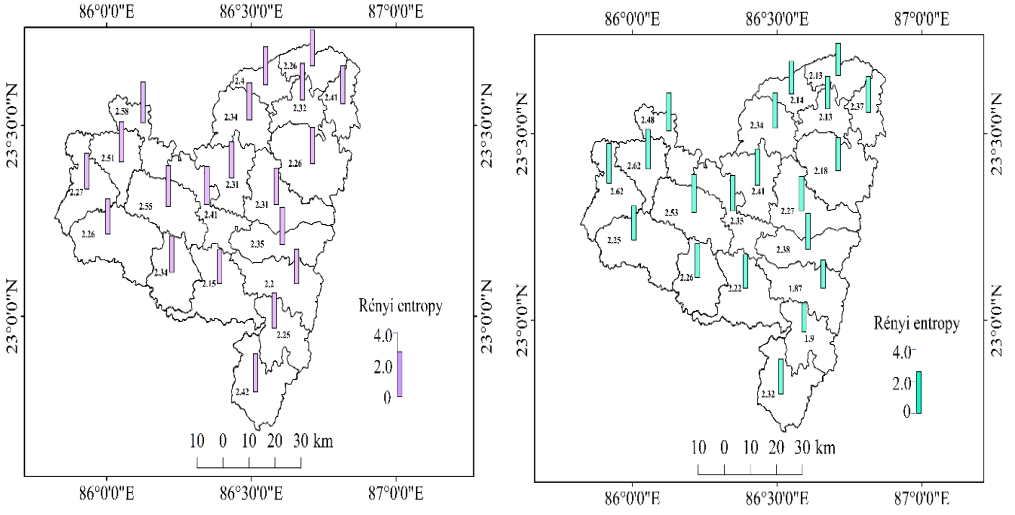


Figure 7

Difference (2001-2011) of Work Participation Rates and Rényi Entropy in the C.D. Blocks of Puruliya District

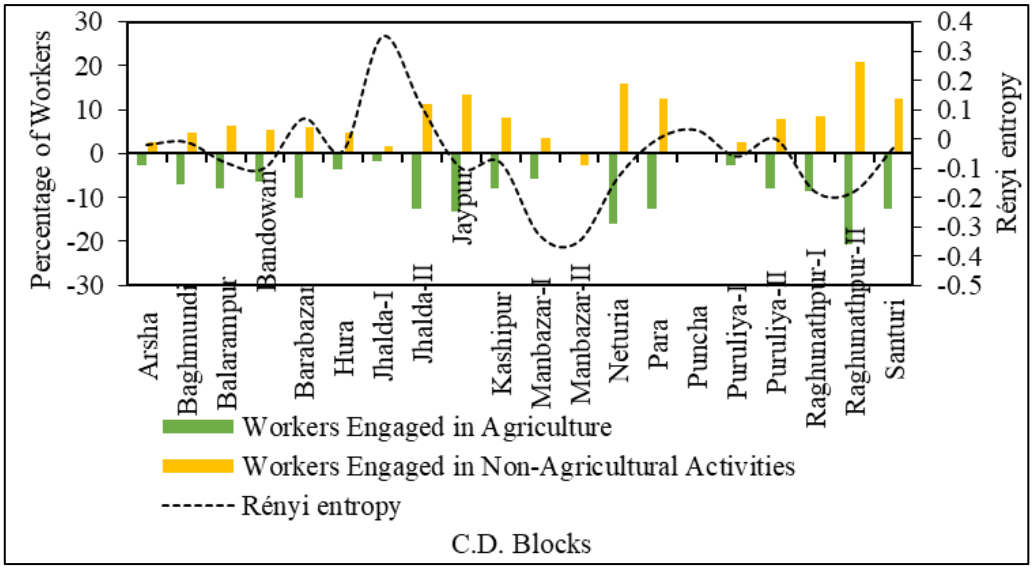


Table 1

Coefficients of Multiple Linear Regression Model, and Marginal Effect Analysis (2001)

Coefficients[a]					
Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig. P>| t |
	B[b]	Std. Error	Beta		
(Constant)	4.761	1.183		4.024	0.004
AHS	0.02	0.079	0.075	0.25	0.809
SC (%)	-0.002	0.004	-0.24	-0.592	0.57
ST (%)	0.001	0.003	0.144	0.363	0.726
LR (%)	-0.004	0.003	-0.349	-1.213	0.26
OYI	0.002	0.002	0.195	0.859	0.415
CI	-0.006	0.006	-0.301	-1.045	0.327
II	0.009	0.005	0.496	1.893	0.095*
CDI	-0.058	0.382	-1.119	-2.073	0.569
ALH (Hectares)	-0.791	0.006	-1.043	-1.735	0.072*
MLS (%)	-0.011	0.004	-0.599	-3.017	0.121
SLS (%)	-0.012	0.098	-0.134	-0.594	0.017**

[a]Dependent Variable: Rényi entropy, R=0.885, R square=0.783, Durbin-Watson statistic (Durbin & Watson, 1971): 2.749, F=2.622 (Sig.= 0.091), RMSE=0.038; [b]Marginal Effect: Delta method (dy/dx); *Significant at 90 percent confidence interval, ** Significant at 95 per cent confidence interval

Source: Authors' calculation

Table 2

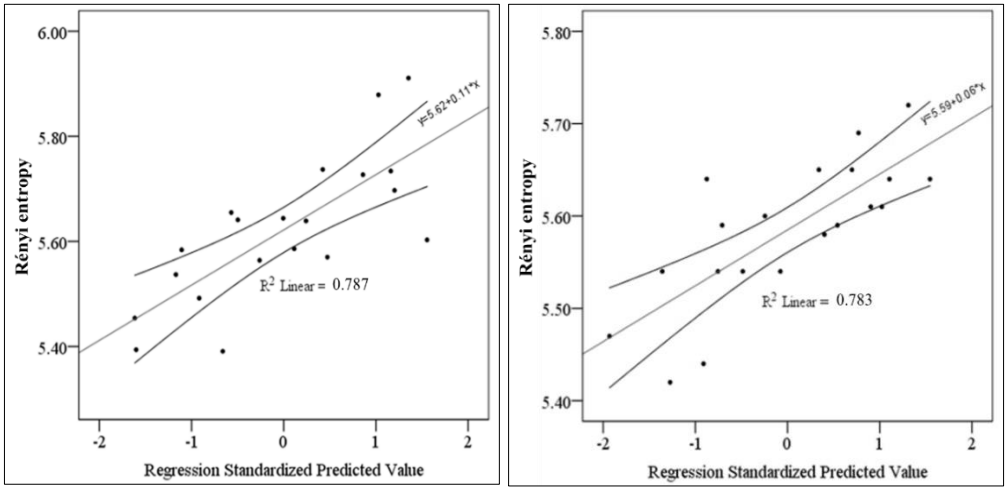
Coefficients of Multiple Linear Regression Model and Marginal Effect Analysis (2011)

Coefficients[a]					
Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig. P>| t |
	B[b]	Std. Error	Beta		
(Constant)	1.506	2.029		0.742	0.479
AHS	0.021	0.259	0.026	0.081	0.937
SC (%)	0.003	0.006	0.127	0.463	0.655
ST (%)	-0.005	0.005	-0.35	-1.174	0.274
LR (%)	-0.026	0.011	-0.588	-2.377	0.045**
OYI	-0.004	0.002	-0.355	-1.82	0.106
CI	0.025	0.008	0.926	3.127	0.014**
II	0.000133	0.003	-0.011	-0.046	0.964
CDI	-0.336	0.286	0.079	0.347	0.056*
ALH (Hectares)	0.099	0.043	-0.688	-1.586	0.738
MLS (%)	-0.069	0.026	0.72	1.926	0.151
SLS (%)	0.05	0.15	-0.737	-2.239	0.090*
[a]Dependent Variable: Rényi entropy, R=0.887, R square=0.787, F=2.688 (Sig.=0.085), Durbin-Watson statistic (Durbin & Watson, 1971): 1.672, RMSE 0.164; [b]Marginal Effect: Delta method (dy/dx); *Significant at 90 percent confidence interval, ** Significant at 95 percent confidence interval					

Source: Authors' calculation

Figures 8 and 9

Relationship Between Rényi Entropy and Standardised Predicted Values in 2001 and 2011



In 2001, the Rényi entropy increased by 2% as the average household size grew; however, it declined by 0.2% with a 1% rise in the Scheduled Caste (SC) population, while it increased by 0.1% with a 1% increase in the Scheduled Tribe (ST) population. A 1% rise in literacy led

to a 0.4% decrease in Rényi entropy. Additionally, the overall yield index and irrigation intensity raised Rényi entropy by 0.2% and 0.9%, whereas cropping intensity and the crop diversification index decreased it by 0.6% and 5.8%, respectively. An increase of one hectare in area under marginal and small landholdings reduced Rényi entropy by 1.1% and 1.2%, respectively,

while an increase of one hectare in the average landholding size resulted in a dramatic decrease of 79.1% in Rényi entropy. Notably, average landholding size was the strongest predictor of occupational diversification in 2001.

In that year, the highest prediction for occupational diversification was observed in Kashipur (1.357), while the lowest was in Arsha (-1.637). By 2011, Rényi entropy increased by 2.1% with a unit increase in average household size. Similarly, Rényi entropy rose by 0.3% with a 1% increase in the SC population but decreased by 0.5% with a 1% increase in the ST population. The literacy rate also reduced Rényi entropy by 2.6% in 2011. The overall yield index had a negative impact, lowering Rényi entropy by 0.4%. Conversely, the crop diversification index significantly reduced Rényi entropy by 36.6%, while cropping intensity and irrigation intensity increased it by 2.5% and 0.0133%, respectively. In 2011, the most influential factor affecting occupational diversification was the crop diversification index.

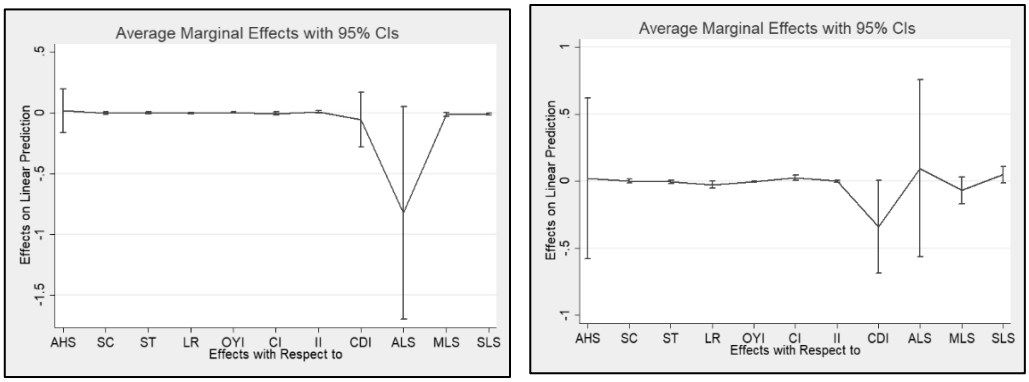
Moreover, in 2011, a 1-hectare increase in average landholding size raised Rényi entropy by 5.9%, while a 1% increase in area under marginal landholdings decreased it by 6.9%. An increase of 1% in area under small landholdings raised it by 5.9%. The highest prediction for occupational diversification in 2011 was in Bandowan (1.406), and the lowest was again in Arsha (-1.740). The regression models were validated using RMSE analysis, yielding RMSE values of 0.038 in 2001 and 0.164 in 2011, which indicates reasonable predictive performance, as both values are below 0.5. Figs. 8 & 9 and Figs. Figs. 10 and 11, respectively, show the relationship between Rényi Entropy and Standardised Predicted Values in 2001 and 2011, as well as Average Marginal Effect Plots in 2001 and 2011.

In the Puruliya district, most Community Development (C.D.) blocks experienced a decline in occupational diversification by 2011, despite a lack of significant improvement in this area, which was linked to increases in average household size in both 2001 and 2011. The percentage of the ST population had a positive effect on the rate of occupational diversification, while the percentage of the SC population had a negative effect. Rising literacy rates in the Puruliya district hindered the diversification of occupations among non-farming workers. While agricultural output positively influenced occupational diversification in 2001, it had a

negative impact in 2011, contradicting higher expectations for that year. Furthermore, cropping intensity had an adverse effect on diversification in 2011, despite higher projections. Meanwhile, the crop diversification index promoted agricultural diversification but hindered the transition from agricultural to non-agricultural activities in both 2001 and 2011. The study underscores the considerable impact of average landholding size on occupational diversification in the Puruliya district. Small landholders often engage in non-agricultural activities, whereas marginal landholders primarily work as agricultural labourers.

Figures 10 and 11

Average Marginal Effect Plots in 2001 and 2011



Conclusion

The study examines twenty Community Development blocks in Puruliya district to investigate the movement of workers between agricultural and non-agricultural sectors. Between 2001 and 2011, a clear trend of occupational diversification emerged among agricultural workers, with a decrease in the number of people working in agricultural operations. A significant shift in occupational diversification has occurred with the transition from agricultural to non-agricultural pursuits. Crop diversification, the amount of land under marginal landholding, literacy rate, irrigation intensity, and average family size all negatively influenced occupational diversification. Cultivators and agricultural workers increased because of agricultural activities such as increasing crop output, irrigation intensity, and average landholding size. However, literacy rates hindered the ability of non-agricultural workers to diversify their livelihoods, as they did not provide them with the necessary assistance to improve their skills. Trends in crop diversification reduced the need for farmers to change their occupations. The district could generate resources and a variety of jobs despite natural

limitations. Resolving these issues may help remove barriers to the rural economy and improve the standard of living for residents of the Puruliya district.

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