

Mapping Spatial Accessibility to Basic Amenities Using IDW and Assessing the Impact of Migration: Evidence from Bhojpur District (Bihar)

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Abstract

Migration remains at the core of human civilisation as the way for satisfying basic amenities needs to live a dignified life. Migration which is basically temporary or permanent change of place of residence doesn't come only with opportunities but its drawbacks also. The cost of migration increases with the number of family members choose to migrate. Thus, some of family members choose to migrate and generate income and they send it back as remittances for left behind family. The ownership of resources and emotional connection at the place of origin also keep the migrant having sense of connection. The remittances sent by the migrant member generate different spectrum of its utilisation based on household needs and what the family choose to lists as priority. The household who choose to remain tied to place of origin and satisfy its basic amenities needs by the income generation locally also have their own priority of amenities. In a welfare state like India access to basic amenities is a shared responsibility of its masses and government. The access to amenities is complemented by both individual and governmental efforts. The presented research paper aims finding out the difference among migrants and non-migrants for access to basic amenities both spatially and statistically. The research work is based on primary household survey using schedule. The sample design for the research work is stratified random sampling and sample size is 400 household. The statistical analysis is mainly done using composite accessibility index and spatial analysis is done by using IDW in Arc GIS software. The findings of the research work statistically at the district level reveals balanced accessibility among migrant and non-migrant household but spatial analysis reveals Zones of differences are in conformity of uniform picture.

Keywords: Migration, Basic amenities, Accessibility, Composite Accessibility Index, IDW

1. Introduction

Human try to satisfy their needs in vicinity. In case the individual needs don't being meet by nearby resources either due to poor affordability or socio-economic structure, he migrates. Migration is in neo-liberal economics conceptualised as household decision to tackle precarity. Migration which in case of Bihar is a livelihood strategy where a migrant leaves his place of

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origin and go somewhere else and live with objective of income generation. The socio-economic cost of migration with whole family is out-weighted by economic opportunities thus the left behind family remains. Individuals sends remittances for the left behind family. The remittances in a household is used in multiple things, however initial phase of remittances goes in improving accessibility of basic amenities such as housing, latrine facilities, drinking water etc. later on remittances is used for enhancing the financial amenities such as insurance, landholding, and cattle to diversify income. Many of the family and people choose to remain immobile due to different conditions and choose to remain tied to their origin place and satisfy their needs.

Basic amenities can be defined as things and infrastructure one needs to live a dignified life. The types of amenities which is considered basic is defined by the development stage and societal needs of the community. The development of amenities is a shared responsibility for an individual and government. Spatial variation of accessibility of amenities is reflected as complex summation of household income, its social status, governmental efforts. The welfare schemes, poverty alleviation schemes, housing schemes, and economic upliftment programmes by the state and central government attempts at providing the minimum basic amenities accessibility to all individuals and household irrespective of their own capacity. Thus, the role of governmental efforts in bridging the gap can't be negated for migrants and non-migrant household. This study attempts at analysing the statistical and spatial derivations of amenities accessibility among migrant and non-migrants' household in Bhojpur district.

2. Literature Review

Kumar (2015) noted the need for inclusive and accommodative basic amenities policy to cater the diverse socio-spatial situation of households in rural India. Mahajan (2016) noted how the basic amenities are indispensable for human life. After analysing the regional inequality of basic amenities among states based on Basic Amenities index, his findings reveal Bihar is at the bottom level in terms of access to basic amenities. Comber & Zeng (2019) stated that IDW method of spatial interpolation gives the finer spatial picture of observations as a continuous spatial surface. Datta (2020) highted the non-transformation of spatial mobility into social mobility thus the vicious circle of precarity remains. Mondal (2021) noted how the peri-urban creates degenerated periphery in terms of access to basic amenities. Samyak & Kumar (2022) based on NFHS-4 (2015-2016) data noted the disparity in household access to amenities based on socio-economic structure. Singh & Mishra (2022) presented the regional inequality in terms of basic amenities in India. They contested the view that urbanization level in the states are in directly relation with level of access to basic amenities. Kalangadan et. al; (2024) analysed the difference relating to basic amenities accessibility among migrant and non-migrant household in Kerala and found better accessibility to migrant households. Kundu et. al., (2024) mentioned the sharp disparity among households in terms of basic amenities in India. Mahalingam, et. al; (2025) found the eastern and north eastern are hotspots of deprivation in terms of access to basic amenities to household.

3. Objectives

1. To examine the differences in accessibility to amenities based on migration status of household.

2. To find out the spatial distribution of amenities accessibility using spatial interpolation.

4. Research questions

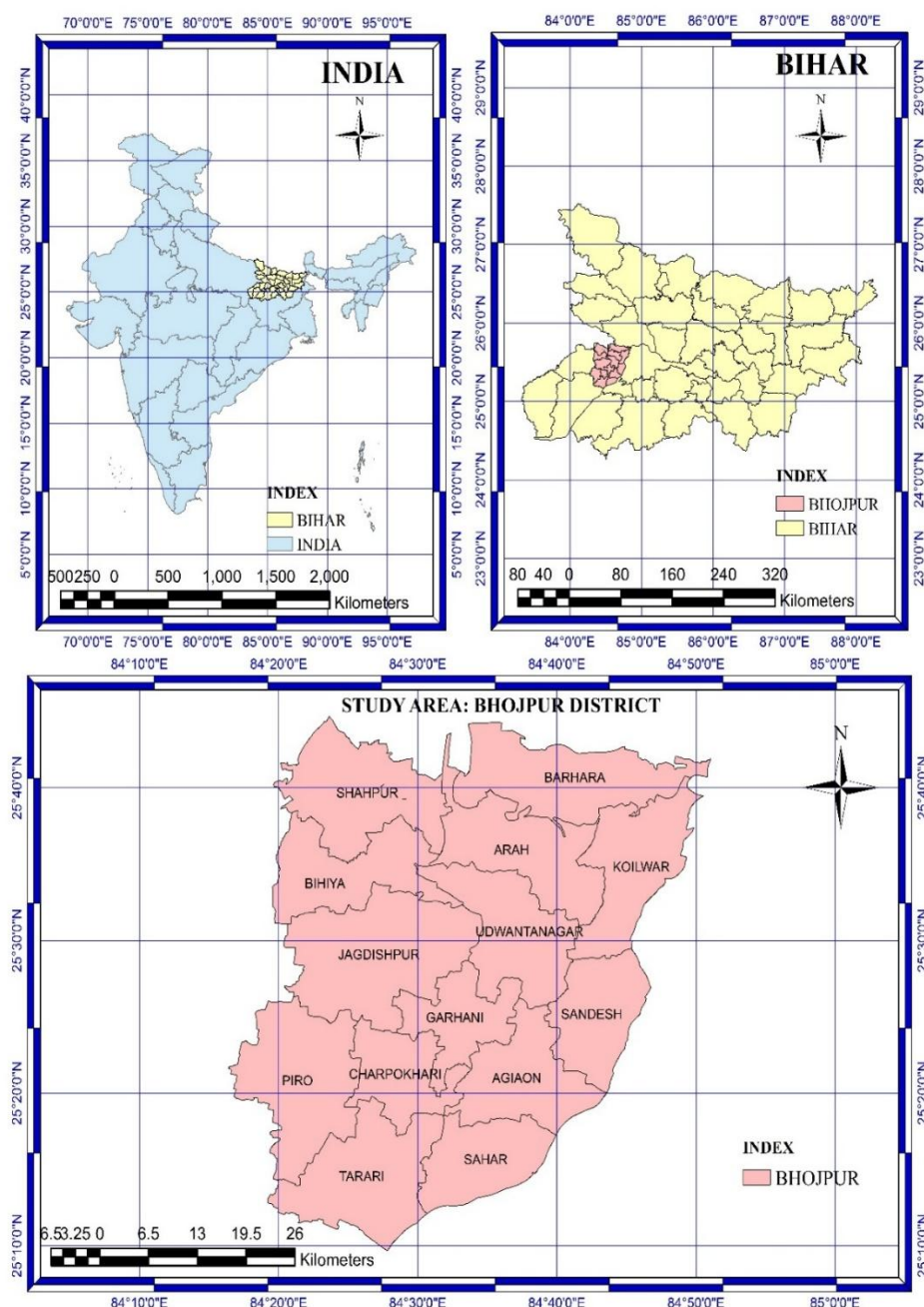
1. How does inequality of accessibility to amenities relate to household migration status?
2. Does accessibility to amenities exhibit measurable spatial heterogeneity?

5. Methodology

This section of the research paper gives the comprehensive methodological design of the research work.

5.1 Study Area

Figure: 1 Study Area Map of Bhojpur district (Bihar)



The study area for the research work is Bhojpur district of Bihar which is illustrated in Figure: 1.0. The locational extent of the district is between 25°10' and 25°40' North latitude and 83°45' and 84°45' East longitude. The district is endemic to migration since antiquity. The study area is characterised by uniform alluvial fertile plain of middle Gangetic region. The district resource base is mostly agrarian deprived of any mineral or industrial resource base. The shrinking agricultural landholding and there by profit, regional and social inequality, low level of regional development, poor amenities development have propelled the streams of out-migration in the district. According to Census of India, 2011 the district have total population of 2,728,407 comprised of 1,430,380 males and 1,298,027 females. The number of households in the district is 4,16,090.

5.2 Sampling technique

The research work uses stratified random sampling design in which blocks of the district are taken as a strata and sample are drawn from the village of highest household and urban centres. The sample size is proportionally distributed among blocks. The unit of sample is taken as household.

5.3 Sample size

The sample size for the research work is calculated using Slovin's formula i.e.,

$$n = N / (1 + Ne^2)$$

where,

n = Number of samples calculated

N = Universe Population

e = Margin of error (0.05)

The calculated sample size using above discussed formula is 399.9~400 households.

5.4 Data collection

The research work is mainly based on primary data. The data has been collected by administering schedule at household level. Migrant and non-migrant household have been categorised based on the criteria: if any member of the household has migrated for economic reason or not. If any of the household member is migrated for economic reason the household is migrant household and vice-versa.

5.5 Data analysis

The research paper uses both spatial and statistical component for analysis which has been described as follows.

5.5.1 Spatial analysis

The spatial dimension of the research work has been done using Arc GIS 10.2 especially tool IDW (Inverse Distance Weighting) interpolation.

5.5.2 Statistical analysis

Statistical analysis for the research work is done using both descriptive and inferential statistics.

The research work has taken only those amenities i.e., house type, dwelling type, number of dwellings, electricity facility, latrine facility, banking facilities landholding, means of transport and others for which ordinal scores can be assigned. Accessibility scores for each amenities among migrants and non-migrant household are assigned and lastly composite accessibility index is calculated and their differential impact between migrant and non-migrant is analysed.

$$\text{CAI (Composite accessibility index)} = \frac{\sum (M_i - NM_i)}{n}$$

Where,

M_i = Migrant amenity score

NM_i = Non-migrant amenity score

n = Number of amenities

$$\text{Impact} = \bar{x}_m - \bar{x}_{nm}$$

Where,

$\bar{x}_m$ = Mean accessibility score of migrants

$\bar{x}_{nm}$ = Mean accessibility score of non-migrants

5.6 Discussions and Findings

5.6.1 Statistical analysis of migration accessibility index

For the statistical analysis of impact of migration on household the differential value has been categorised as those blocks which have value greater than 0.10 have high migrant advantage, between 0.05 to 0.10 have moderate migrant advantage, -0.05 to 0.05 have balanced accessibility and less than -0.05 have non-migrant advantage.

Based on Table:1.0, 7.14% of the blocks in the district i.e., Ara have non-migrant advantage with impact score of -0.09 while mean amenities accessibility score for migrants and non-migrants household is 1.86 and 1.95 respectively. 57.14% of the blocks in the district such as Agioan, Shahpur, Koilwar, Sandesh, Behea, Sahar, Piro and Jagdishpur with impact score of -0.02, -0.02, -0.01, -0.01, -0.01, 0.00, 0.01, and 0.03 have balanced accessibility for amenities among migrant and non-migrant household. Agiaon block of the district have mean accessibility score for migrant and non-migrant household as 1.70 and 1.72. Shahpur block of the district have for migrant and non-migrant household mean accessibility score of 1.84 and 1.85 respectively. Koilwar block of the district have mean accessibility score of 1.83 and 1.84 for migrant and non-migrant household. Sandesh block of the district have mean accessibility score for migrant and non-migrant household as 1.91 and 1.92 respectively. Behea block of the district have mean accessibility score of 1.83 and 1.84 respectively for migrant and non-migrant household. Sahar block of the district have same mean accessibility score of value 1.67 for both migrant and non-migrant household. Piro block of the district have mean accessibility score for migrant and non-migrant household as 1.87 and 1.86 respectively. Jagdishpur block of the district have mean accessibility score for migrant and non-migrant household as 1.91 and 1.89 respectively. 28.57% of blocks in the district lies in the category of blocks where migrant household have moderately better accessibility over non-migrant household, The blocks of

moderate migrant advantage are Tarari, Udwantnagar, Barahara, and Charpokhari with impact score of 0.05, 0.05, 0.07, and 0.09 respectively. Tarari block of the district have mean accessibility score of 1.81 and 1.76 respectively for migrant and non-migrant household. Udwantanagar block of the district have mean accessibility score of 1.79 and 1.74 for migrant and non-migrant household. Barahara block of the district have mean accessibility score for migrant and non-migrant household as 1.81 and 1.75 respectively. Charpokhari block of the district have mean accessibility score for migrant and non-migrant household as 1.81 and 1.71 respectively. In 7.14% of blocks in the district i.e., Garhani have high migrant advantage with impact differential score of 0.18. The mean accessibility score for migrant and non-migrant household are 1.85 and 1.67 respectively.

At the district level, statistically balanced accessibility emerges between migrant and non-migrant household with impact score of 0.04. The district have mean accessibility score for migrant and non-migrant household as 1.84 and 1.80 respectively.

Table: 1.0

Composite Accessibility Index for Amenities among Migrant and Non-Migrant Households

Category	Block	$\bar{X}_m$	$\bar{X}_{nm}$	$\frac{\sum(M_i - NM_i)}{n}$	% of Blocks
Non-Migrant Advantage	Ara	1.86	1.95	-0.09	7.14
	Agiaon	1.70	1.72	-0.02	
	Shahpur	1.84	1.85	-0.02	
	Koilwar	1.83	1.84	-0.01	
	Sandesh	1.91	1.92	-0.01	
Balanced Accessibility	Behea	1.83	1.84	-0.01	57.14
	Sahar	1.67	1.67	0.00	
	Piro	1.87	1.86	0.01	
	Jagdishpur	1.91	1.89	0.03	
Moderate Migrant Advantage	Tarari	1.81	1.76	0.05	28.57
	Udwantnagar	1.79	1.74	0.05	
	Barahara	1.81	1.75	0.07	
	Charpokhari	1.81	1.71	0.09	
High Migrant Advantage	Garhani	1.85	1.67	0.18	7.14
Balanced Accessibility	Bhojpur	1.84	1.80	0.04	100.00

Source: Primary field survey (2025) and calculated by the research scholar

5.6.2 Spatial analysis of migrant accessibility index

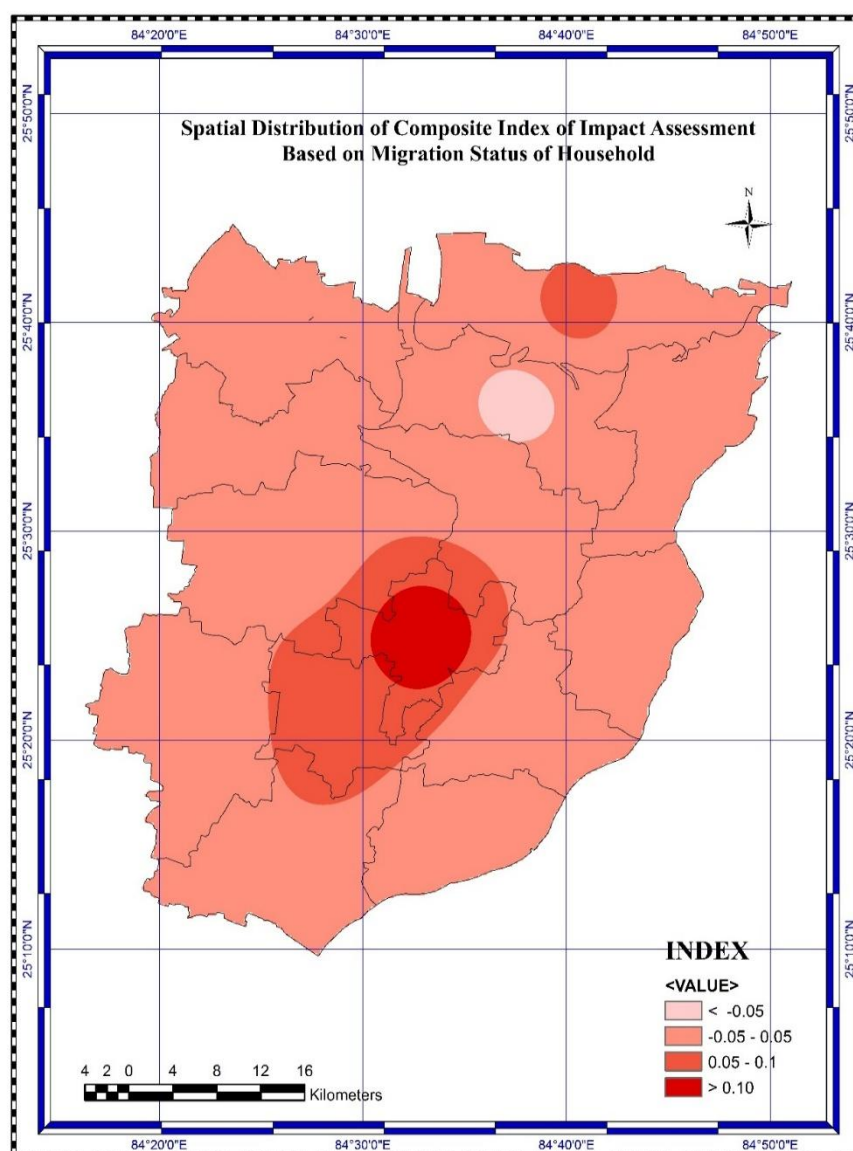
Spatial analysis of the composite migrant accessibility index using IDW reveals that the impact of migrant and accessibility of amenities among household doesn't coincide with administrative boundary rather form transitional zones. Based on the analysis of Figure: 2.0, the following interpretation has been given.

The boundary of zone in high migrant advantage transcends beyond core block Garhani, and subsided by Jagdishpur, Charpokhari, and Udwanthnagar. The zone of moderate advantages are Barahara, Garhani, Charpokhari, Jagdishpur, Piro, Tarari, Udwanthnagar, and Agiaon block. The zone of non-migrant advantage are Ara and a miniscule part of Udwanthnagar. The zone of balanced accessibility are Shahpur, Behea, Jagdishpur, Piro, Tarari, Sahar, Sandesh, Agiaon, Koilwar, Barahara, Udwanthnagar, Ara, with miniscule portion of Charpokhari except for Garhani.

5.6.3 Findings

The statistical analysis of the data reveals no significant differences between migrant and non-migrant household for accessibility of basic amenities. However, spatial analysis using IDW interpolation reveals zonation in terms of unequal accessibility of amenities in the district. The zonation of blocks in the district shows the blocks which have high in-migrant flow especially Ara have non-migrant household at advantageous position in terms of accessibility to amenities which can be often tied to the block being having district headquarter and administrative functions. The block only has Tier-I city is Ara administered by Ara municipal corporation area and have migrants with low ownership of housing and limited amenities served by municipality beyond its recorded residents. It is notable that the blocks in the zone of migrant household in advantageous position than non-migrants shows a unique feature of being locked completely in the district boundary and doesn't get benefit of inter-district opportunities in the state. The zone of moderate advantage are basically the proximate regions to boundary locked blocks, however they are miniscule in areal extent. The zone of balanced accessibility is the zone where most of the blocks lies, it is due to regional uniformity in socio-economic space, more or less same geographical features and uniform administrative setup. The findings of the research work is suggestive of analysing migration variables especially differences in terms of accessibility to amenities should be done both statistically and spatially, mere statistical analysis doesn't shows the effect of core regions to proximate regions. Spatial analysis for accessibility can be used both as relating temporal and spatial phenomenon and generate a composite picture.

Figure: 2.0 Spatial distribution of composite index of impact assessment based on migration status of household



6. Conclusion

The above discussed paper on differential impact of migration on accessibility of amenities among migrant and non-migrant household shows a uniform picture statistically at the district level however IDW interpolation reveals zones of inequality which needs governmental efforts in shaping uniform access. The governmental positive affirmation schemes such as skill training, employment, etc., for immobile population should be implemented and the individual household capacity building should be done.

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