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Fiscal Decentralisation and Reforms Implementation: A Comparative Analysis of Two Indian Cities

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Abstract

Urban Local Governments (ULGs) are an important and integral part of the federal system of government in India. For a long time, they were under the control of State governments and were not functioning autonomously with regard to fiscal and administrative decision making. The 74th Constitutional Amendment Act (CAA) was enacted to give more autonomy to the ULGs with regard to fiscal and institutional management that would pave the way for decentralisation. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) attempted to take forward the implementation of 74th CAA by suggesting the implementation of several reform measures as mandatory for accessing funding support under its mission. In this context, the paper is an attempt to analyse the fiscal decentralisation and reforms implementation with reference to two Indian cities – Hyderabad and Pune. The study traces the efforts made to promote fiscal decentralisation in India and impediments they face while achieving them, especially at the state government level. Later, it analyses the grant funds patterns and trends and reviews the progress of the select study cities with reference to decentralisation reforms implementation. The results imply the need for furthering decentralisation through fiscal support to the ULGs as well as reform implementation commitment from the upper-tier governments.

Keywords

Urban Local Governments, Decentralisation, CAA, Fiscal Status, Reforms.

Introduction

Urban Local Governments (ULGs) along with their rural counterparts constitute the third and important tier in a federal system of Government of India. This third tier

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of government provides most of the civic infrastructure services to the citizens. The provision of such civic infrastructure services in urban areas is essential for the long-term sustenance of cities and for the continuity of their role as transforming spaces in the wake of the rising levels of urbanisation. The ULGs need to have adequate fiscal resources for providing adequate infrastructure services (Bahl & Linn, 1995). For a long time, since after independence, ULGs were not given importance in the federal system of India; the fiscal as well as political space was dominated by Central and state governments. Much of the emphasis was laid down on the Central – State political and fiscal relations. It was considered then that the ULGs were a part and parcel of the State governments. Although, this position still remains the same, their role as a third tier of government has come to prominence since the 1990s.

The 74th Constitutional Amendment Act (CAA), 1992 was the first attempt in the post-independent India to bring the ULGs to the fore as a legitimate part of the three-tiered government system. The CAA first defined the functional space of ULGs and pitched for providing necessary technical and financial support by upper tier governments for performing those functions. It clearly listed out the 18 ULG functions under Schedule 12 to be transferred to the ULGs. The state governments were required to transfer (or, devolve) those functions, powers and responsibilities to ULGs, as laid down under Articles 243G and 243W of the CAA, 1992. They were also required to be given adequate powers to raise finances in order to perform this role. All these developments were in line with the ‘decentralisation wave’ that caught many nations in 1990s, accordingly, many nations delegated their functions and financial powers to local governments.

Decentralisation has the advantages of taking the government closer to people, thereby, making it easier to elicit the public preference for civic infrastructure services; once the preference is elicited, government can focus on their production (Musgrave, 1959). This will in turn enable the government’s spending to be aligned with public preference and also holding it accountable with regard to their provision¹ (Oates, 1972). Therefore, it is argued that decentralisation leads to improved public service delivery by promoting allocative efficiency, productive efficiency and public accountability (Azfar et al., 2001, World Bank, 2001). Fiscal and political decentralisation has become a major strand of the government policies, including that of India. Fiscal decentralisation assumes more importance in the context of local governments and it stands on four major pillars (Bird, 2000): (i) expenditure assignment (or, functional domain) (ii) revenue assignment (iii) inter-government transfers (iv) access to capital markets. However, the experience of fiscal decentralisation varies from nation to nation; even from state to state within a nation. Several national governments have undertaken reforms to foster fiscal decentralisation; the Government of India (GoI) came out with the 74th CAA, 1992 towards it. The GoI made it mandatory to undertake reform measures towards its implementation to access funding support under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM).

In this context, the current study is aimed at addressing following research questions: (i) What is the progress on fiscal decentralisation with regard to urban local governments in India? (ii) What is the progress on fiscal decentralisation with reference to the urban local governments of select cities with regard to functional and fiscal devolution? (iii) What are the trends and structure of inter-government grant flows in the urban local governments of select cities? (iv) What is the progress on reform implementation towards ushering fiscal and administrative decentralisation in the urban local governments of select cities? The study is focused on the ULGs of two large Indian cities – Hyderabad and Pune, which are two emerging economic centres. It takes a comparative approach by making use of the secondary information obtained in the form of various official reports and research papers as well as secondary data obtained from the study of ULGs (including their budget documents). Interactions were also made with the Chiefs and other key functionaries of the Finance Divisions of the ULGs of the select study cities. As the field work was carried out prior to Covid 2019 to obtain the data from the ULGs of select cities, the data available until then is utilised in the analysis.

The structure of this paper is as follows: Section 1 introduces the federal structure of governance in India and the importance of decentralisation; it also lays down the research questions. In section 2, the progress made on fiscal decentralisation in India is analysed. Section 3 analyses the progress made towards fiscal decentralisation in the ULGs of selected cities in the form of functional and fiscal devolution. Section 4 performs an analysis of grant flow trends and patterns in the selected ULGs during the study period. Section 5 traces the progress of the ULGs of selected cities on the implementation of institutional and governance reforms mandated under JNNURM towards furthering fiscal decentralisation. Section 6 concludes with major study findings and their policy implications.

Fiscal Decentralisation in India

The roots of decentralisation in India were formed in the CAA 1992, which defined the functional space of local governments and suggested forming mechanisms for devolving funds to them. Although the CAA has brought in functional clarity of local governments, the devolution of functions from State Governments (SGs) to local governments did not progress much. Many State governments did not fully devolve functions, funds and functionaries, which would adversely affect their efficacy of carrying out the functions (Gupta & Chakroborty 2019). The State governments were reluctant to cede their power, which they exercised through their own agencies such as public utilities. The scale economies and efficiency arguments associated with such public utilities reinforced the stance of State governments in some services like water supply, sewerage, transport, waste management, etc. (Buchanan, 1965). The State governments did not act upon functional devolution to ULGs until they were forced to do so under the JNNURM programme of Central government. Functional devolution

was a mandatory reform for the State governments under JNNURM for the mission cities to avail funding support, which will be discussed in detail in Section 4.

Further, although the CAA has emphasised upon the devolution of functions to local governments (ULGs), it has not laid down explicit provisions for adequate finances in the form of either suitable compensation or fiscal transfers or financial powers to them. Given the limited taxing powers of ULGs, it resulted in what is known as constitutionally built-in mismatch between functions and finances (Mohanty, 1995). As the State governments did not devolve the powers to raise resources to ULGs, they had to depend upon the State governments in order to perform their role and functions, which led to a dependency on them (Mohanty et al., 2008). Also, the State governments exercise a considerable amount of control on local government finances, as the ULGs take State government approval for raising new taxes/ user charges, revising current tax rates/user charges, resorting to borrowing and even accessing market debt. In essence, the fiscal space of local governments is under the control of State governments.

This situation has led to fiscal and functional dependency of local governments on state governments, which the CAA, 1992 wanted to reduce. In essence, the CAA 1992 was not implemented in spirit but only in letter; it did not result in a fiscal federal system, as envisaged under the CAA, 1992. The CAA 1992 has, however, made an arrangement to address this issue partly by providing for fiscal devolutions to local governments in the form of the grants-in-aid by the Finance Commission (FC) system. Under this arrangement, Central and State Finance Commissions were to be formed by the Central and state governments, which would work out the devolution of grants-in-aid to the State and local governments respectively.

In this context, it is attempted hereunder to critically review the CFC and SFC mechanisms with reference to ULGs through a discussion on how they worked and what the outcomes were.

(i) Central Finance Commissions

In accordance with the provisions in the Indian Constitution, the Central government constitutes Central Finance Commission (CFC) every five years, which determines the divisible pool of resources, i.e., net tax revenue, between Central and state governments. Central government transfers the share of divisible pool of resources to state governments based on the recommendations of the FC, which are based on the formula worked out by them. For a long time, the fiscal devolution of the CFCs confined only to Central and state governments. After the CAA 1992, the ULGs were also added to list and the CFCs need to work out the fiscal devolutions to be made to ULGs as well. Accordingly, the XI, XII, XIII and XIV CFCs have worked out the fiscal devolutions to be made to the ULGs based on their assessment of fiscal needs while following formulaic approach to funds devolution rather than estimating the fiscal needs of the ULGs.

Each CFC has followed its own criteria in determining the quantum of fiscal devolution and its allocation among the ULGs, which was based on the criteria like population, area, income levels, levels of decentralisation, etc. (Mathur, 2001). The CFC mechanism has, therefore, brought in grant support to the ULGs from the Central government, which would be directly transferred to them (rather than routing through the SGs). Moreover, the fund devolution of the CFCs has been increasing considerably to the ULGs from Rs 5000 crores during 2005-10 (XII FC) to Rs 23,108 crores during 2010-15 (XIII FC) to Rs 87, 144 crores during 2015-20 (XIV FC), thereby giving more financial resources to the ULGs (Joshi, 2017). However, the current approach of the CFC is more of 'gap filling' approach, while the ULGs were expected to mobilise the bulk of resources from their own sources of finance (Sreedevi, 2008).

(ii) State Finance Commissions

The SFC mechanism was brought in the CAA 1992 to mirror the CFC in the devolution of the SG financial resources with the ULGs. The SFCs were required to review the financial position of the ULGs and make recommendations as to:

- (a) frame the principles which should govern
 - i. the distribution between the state and local governments of the net proceeds of the taxes, duties, tolls and fees leviable by the state, which may be divided between them under this part i.e., Part IX for panchayats and Part IXA for municipalities, and the allocation between the local bodies at all levels of their respective shares of such proceeds;
 - ii. the determination of the taxes, duties, tolls and fees which may be assigned to or appropriated by the local governments
 - iii. the grants-in-aid to the local governments from Consolidated Fund of the State (Joshi, 2008)
- (b) identify the measures need to improve the financial position of local governments;
- (c) discuss any other matter referred to the SFC by the Governor in the interests of sound finance of the local level governments.

However, the functioning of SFCs was found to be far-short of expectations as they did not provide a good mechanism for devolving the funds to local governments (Joshi, 2008). There were several issues associated with SFCs that led to the purpose for which they were established not getting served (Gupta and Chakroborty, 2019):

- (i) Not all the states constituted SFCs in a time bound manner, i.e., there were delays in the appointment and constitution of SFCs. Many States did not appoint SFCs for every five years, as was done for CFC. In several cases, SFCs were suspended/terminated by state governments. ULG elections also led some States to either keep aside the SFC constitution or to re-constitute SFCs after the elections.

- (ii) In some states, SFCs did not function effectively for the lack of resources required e.g., lack of space, manpower, technical and other resource support. As a result, they failed to submit reports on time. Such untimely reports were not of much help to the SGs in fund devolution. Also, SFC reports were not co-terminus with CFC, which made these reports. Also, at times, the ULG elections coming on the way rendered SFC reports not very useful to some State governments.
- (iii) Some SFCs took inordinate time to complete the study and submit report, which made them redundant. The SGs resorted to allocating fund transfers either based on previous reports or have adopted *ad hoc* approach. Different SFCs have adopted different interpretations of surplus resources, making their comparison technically not correct. Further, even when SFC reports were submitted, the SGs took a lot of time to submit their Action Taken Reports (ATRs) in State legislature.

All the above issues point to a lackadaisical approach of the state governments towards funds devolution to ULGs. The SFC devolutions are important for the functioning of ULGs, as they are untied grants that give flexibility in spending funds. Several state governments followed an *ad hoc* or arbitrary approach towards devolving funds, sometimes setting aside SFC recommendations, making them redundant. Even the devolved funds did not reach ULGs timely due to procedural hurdles, i.e., finance department has to provide for such funds and send it to treasury department which releases funds to ULGs. It is often said that the funding support reaches ULGs towards the end of financial year, leaving little time for the application of grant funds to service delivery improvements (Joshi, 2008). The inherent complexity, delays and unpredictable nature of funds flow associated with SFC mechanism also affects the equitable development of cities (Sahu, 2024).

Although the SFC mechanism lost its credibility, some SFCs took the task seriously and made some practical recommendations. One of them is incentivising the ULGs for good performance through the division of grant funds into (i) basic grants and (ii) performance grants. While setting aside a major proportion of funds under basic grants, which are mostly based on the urban population, some amount of the funds were proposed to be devolved to the ULGs as performance grants, which is based on the performance parameters set out by SFCs. Some of the performance parameters included own fiscal effort i.e., proportion of taxes and user charges in total revenue, tax revenue reforms, timely budget preparation and audit, etc. This would have given incentives to some ULGs to perform and access those grants.

In summary, the SFC mechanism has not been very successful. Unlike its CFC counterpart, which was rather technical, systematic, formulaic and time-bound and whose recommendations have been accepted by all governments, SFC mechanism lost relevance with SFCs failing to deliver on time or delivered poor quality reports. SFCs also lost credibility due to political and bureaucratic interference in their constitution, organisation and functioning. The State governments need to become more serious and committed to devolving funds to ULGs. They need to come up with action plans

to support civic service delivery by ULGs, and also ensure a timely transfer of grants/ fiscal resources to them for achieving it.

Functional and Fiscal Devolution in the ULGs of Study Cities

In this section, a comparative review of the functional devolution in the study cities – Hyderabad and Pune - is performed based on the study/ status reports and interaction with the functionaries of the ULGs of cities. The Greater Hyderabad Municipal Corporation (GHMC) is the ULG concerning Hyderabad city, which is located in Telangana state and Pune Municipal Corporation (PMC) is the ULG concerning Pune city, which is located in Maharashtra state.

Functional Devolution

Functional devolution, as enshrined under the CAA, 1992, has happened in both the study cities – Hyderabad and Pune. Table 1 shows the status of functional devolution in the study ULGs. Both the Telangana (erstwhile Andhra Pradesh) and Maharashtra State governments devolved most of the functions under the CAA 1992 to study ULGs in order to meet the reform requirements under JNNURM (Doreshor, 2015). Yet, some functions were not fully devolved in Hyderabad city. Hyderabad Metro Water Supply and Sewerage Board (HMWSSB), a State public utility, still takes care of water supply within municipal area and outside. As this utility has existed for almost 40 years with a substantial capital and operating investments made on water supply and sewerage infrastructure, it continued to play the role, but now with an arrangement of Memorandum of Understanding (MoU) with GHMC. Likewise, fire services are provided by State government. Whereas, Pune has all functions devolved to PMC. State government plays a supportive role in water supply and road development.

Table 1: Status of Functional Devolution in the Studied ULGs

S. No.	Function to be devolved	Status in	
		Hyderabad	Pune
I	Urban planning including town planning	Yes	Yes
II	Regulation of land use and buildings	Yes	Yes
III	Planning for social and economic development	Yes	Yes
IV	Roads and bridges	Yes	Yes
V	Water supply for domestic, industrial and commercial purposes	Not Fully HMWSSB takes primary responsibility and it has an MoU with GHMC	Yes PMC takes care of water supply in its jurisdiction

S. No.	Function to be devolved	Status in	
		Hyderabad	Pune
VI	Public health, sanitation, conservancy and solid waste management	Yes	Yes
VII	Slum improvement and upgradation	Yes	Yes
VIII	Urban poverty alleviation	Yes	Yes
IX	Fire services	No Services are run by the State Fire Department	Yes
X	Urban forestry	Yes	Yes
XI	Safeguarding the interests of weaker sections of society	Yes	Yes
XII	Provision of urban amenities and facilities	Yes	Yes
XIII	Promotion of cultural, educational and aesthetic aspects	Yes GHMC plays a limited role in education service	Yes
XIV	Burials and burial grounds	Yes	Yes
XV	Cattle pounds and prevention of cruelty to animals	Yes	Yes
XVI	Vital statistics, including birth and death registrations	Yes	Yes
XVII	Public amenities including streetlights, parking, bus stops and public conveniences	Yes	Yes
XVIII	Regulation of slaughter houses	Yes	Yes

Source: Based on Grant Thornton (2011) and Field interactions

Fiscal Devolution

Fiscal devolution is made through the SFCs as discussed earlier in Section 2. As far as the fiscal devolution is concerned, the track record with regard to SFC mechanism in the States of cities studied is somewhat mixed (Gupta and Chakraborty, 2019):

- Telangana (erstwhile Andhra Pradesh) State government constituted three SFCs, which had given their reports, and another SFC was formed after bifurcation in December 2017, which was yet to give its report. The third SFC had recommended fiscal devolution of Rs. 250.19 per capita to local governments (with the distribution between rural and urban local governments based on assignment and grants) and fund devolution constituted 0.36 per cent of the GSDP.
- Maharashtra State government constituted four SFCs, which had given their reports, and the fifth SFC was constituted in January 2018, which was yet to give

its report. The third SFC had recommended an average fiscal devolution of Rs 1088.14 per capita (with the distribution between rural and urban LGs based on the census population) and fund devolution constituted 0.98 per cent of the GSDP.

Therefore, Maharashtra has devolved more amount of funds to ULGs, when compared to the all India average State devolution of Rs 597.62 per capita and 0.82 per cent of GSDP; whereas Telangana (erstwhile Andhra Pradesh) state has devolved less amount on both terms. The lesser fund devolutions by the erstwhile Andhra Pradesh state government can be attributed to the fragile and weak state of the finances of State government (Sreedevi, 2013).

Grant Funds of the Study ULGs: A Review

It is also important to review the role played by grant funds in the ULGs of study cities as well as their components in order to get an understanding what happened to them and how they changed over time. It is attempted hereunder for the Greater Hyderabad Municipal Corporation (GHMC) while making use of the information contained in the detailed budget documents. Similar analysis could not be done with respect to PMC in the absence of data. Tables 2 and 3 show the trend of revenue (non-plan) as well as capital (plan) grants of the GHMC over time along with the corresponding per capita figures, which were based on population projections.

Grant Funds of the GHMC

It can be seen from Table 2 that actual revenue grants fluctuated and declined until 2012-13; they began to stabilise and rise since after the formation of Telangana state in 2014-15. The provisional figures have been rising continuously until the penultimate year, which implies that the budget planners were expecting and hoping a higher amount of grant support from the State government above that of previous years but that was not getting realised i.e., grant support had been less predictable. The same trend also gets reflected in the per capita revenue grants of GHMC for the provisions and actuals. The fluctuation in GHMC revenue grants might also be due to the fragile and weak finances of State government (Sreedevi, 2013).

Table 2: Trend of Revenue Grants of the GHMC

Year	Revenue Grants (Rs Crores)		Revenue Grants Per Capita (Rs/Cap)	
	Provision	Actual	Provision	Actual
2009-10	38.93	54.29	60.07	83.76
2010-11	7.58	19.21	11.26	28.54
2011-12	10.33	11.94	14.77	17.08
2012-13	20.81	9.88	28.65	13.60

Year	Revenue Grants (Rs Crores)		Revenue Grants Per Capita (Rs/Cap)	
	Provision	Actual	Provision	Actual
2013-14	19.00	24.39	25.18	32.32
2014-15	22.25	18.01	28.39	22.98
2015-16	36.00	20.99	44.22	17.09
2016-17	39.75	29.61*	47.00	35.01*
2017-18	29.83		33.96	

Source: GHMC Budgets

* Revised Estimate

It can also be seen from the Table 3 that actual capital grants began to decline since after 2012-13 i.e., at the end of JNNURM; they reached lowest in 2015-16 when all residual JNNURM funding stopped. The provisional figures have fluctuated in a see-saw motion reflecting the lesser predictability of capital grant flows. It is also evident that the budget planners were expecting a relatively high flow of capital grants from Central and State governments, but the actual capital grants (predominantly coming from Central government schemes and grants) have not been coming anywhere close to those numbers.

The interaction with officials gave an understanding that the surge in capital grants in the recent years i.e., 2014-15 and 2016-17 is from grants for urban mass rapid transit projects of the State government (Metro rail and MMTS projects), which have no implications to the civic services of GHMC. Same trend also gets reflected in the per capita capital grants of GHMC for provisions and actuals. However, it is more glaring to see the effect on per capita basis i.e., wide difference between provisions and actuals.

Table 3: Trend of Capital Grants of GHMC

Year	Capital Grants (Rs Crores)		Capital Grants Per Capita (Rs/Cap)	
	Provision	Actual	Provision	Actual
2009-10	956.17	153.47	1475.42	236.81
2010-11	920.00	165.59	1366.65	245.98
2011-12	1192.61	312.84	1705.52	447.39
2012-13	1092.00	355.92	1503.38	494.96
2013-14	977.58	289.34	1275.77	383.48
2014-15	1135.13	780.54	1448.34	995.91
2015-16	1273.00	163.28	1563.66	200.56

Year	Capital Grants (Rs Crores)		Capital Grants Per Capita (Rs/Cap)	
	Provision	Actual	Provision	Actual
2016-17	1253.43	1259.71*	1482.19	1489.61*
2017-18	413.00	-	470.16	

Source: GHMC Budgets

* Revised Estimate

Grants Composition and Trends in the ULG of Hyderabad

Apart from examining the trend of grant funds flow aggregates and their per capita amounts, it is also important to examine the composition of grants and their trends overtime. However, data at the disaggregated level were available for the ULG of Hyderabad city i.e., GHMC only. Tables 4 and 5 depict the revenue and capital grant items of GHMC and their changes over time. Following are the inferences drawn from them—

(a) Revenue Grants

- General grant support (or, untied grants) e.g., per capita grants and census grants, have lost the relevance over time as the State government perceived GHMC as capable of taking care of its needs and does not require State government support (field interaction with Chief of Finance division). Likewise, the grants-in-aid related to the social services e.g., health, education, family welfare, family planning and public health, have been waning and are not finding any presence over time, as the State government has wound up such schemes under which the access to grants was given;
- Likewise, the closure of some old Central government schemes (under which the state government used to get grant funds) e.g., **Swarna Jayanti Shahari Rozgar Yojana** (SJSRY), **National Credit Framework** (NCRF) and **Employee Assistance Programmes** (EAPs), did not offer much help in the civic service delivery.
- Election expenses and grants have been received consistently over the years although the quantum of it has been fluctuating during the period. Also, the State government payments (or, reimbursements) for miscellaneous expenses is also consistently appearing but it is less predictable.
- Mission for Elimination of Poverty in Municipal Areas (MEPMA) grants had been the only consistent source of revenue grants for GHMC, as it was one of the major initiatives of the state government to alleviate urban poverty which involved reforms, infrastructure and capacity building components.

- On the whole, the revenue grant sources were drying up for GHMC and the uncertainty associated with their realisation has also been rising as evident from the gap between the provisions and actuals. This makes it to depend more on its own sources for providing civic infrastructure services.

(b) Capital Grants

- The major sources of capital grants of GHMC are CFC grants and JNNURM funds, both of which come from Central government. However, other Development Schemes like MLA/ MP Local Area Development Schemes (LADS) are losing their relevance in the urban areas of GHMC. Likewise, several one-time initiatives like Conference of Parties (COP), Abattoir modernisation and subsidies for capital projects, etc. do not add much value to capital development on a continuous basis.
- JNNURM is the flagship programme of Central government with the partnership of State and local governments for the development and provision of urban infrastructure services. Given the consistent flow of funds under it, it can be inferred that the GHMC was able to leverage funds support through it for improving infrastructure service delivery.
- Grants for the Urban Community Development (UCD) are important in size but they come from State government. Some amount of funds came from State government for improving urban transport through Mass Rapid Transit Systems (MRTS) projects – MMTS (Rail Project) and HMRL (Metro Project) – in which GHMC only act as an agent to get the works executed and spend the funds on such projects (field interaction with Chief of Finance division).
- Budgetary provisions for the new development schemes like 2BHK houses for poor and grants for storm water drainage improvements are on the account of the emphasis of State government on undertaking them through GHMC. But, the officials of GHMC were of the opinion that the realisation of funds may not happen, given the fragile and weak state of State government finances (Sreedevi, 2013).
- Several new capital grant sources from Central government e.g., Swachh Bharat Mission, Smart Cities Mission, AMRUT, etc began to appear of late, after the takeover of new government, some of which are new ones in place of wound up old programmes. However, the realisation of grant funds may not take place, as Hyderabad city does not feature in AMRUT and Smart Cities list and Swachh Bharat Mission has limited scope.
- On the whole, the Central government schemes play an important role in determining the quantum of capital grants with GHMC but they were reducing on the account of winding up of some of major schemes like JNNURM. As the new Central schemes launched do not feature Hyderabad city, GHMC received less fiscal support from Central government for capital/ development works.

Table 4: Revenue Grant Items of GHMC and their Trends (Rs in Lakhs)

[illegible]

	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16		2016-17	2017-18
Revenue Grants	Provision	Actual	Provi- sion	Actual	Provision	Actual	Provision	Actual	Provi- sion	Actual	Provi- sion	Actual	Provi- sion	Actual	Re- vised	Provi- sion
Family Planning Incentives	42.8		6.3		0		0		0		0		0		0	0
Anti Malaria Reimbursement	5.5		0.8		10	0.47	12		12							
Other Expenses	45.79	61.79	23.33		23.33		700	3.15	700	1585.36	600		2320	94.36	1225	700
Other Govt Reimbursements		47.72		260.03	500	35.31	234.25	207.4	140	16.84	400	204.97	180	1575.25	1364	658
Total	3892.67	5428.5	758.35	1921.07	1033.33	1194.39	2081.25	987.67	1900	2438.74	2225	1801.34	3600	2099.21	3975	2961
																2983

Table 5: Capital Grant Items of GHMC and their Trends (Rs in Lakhs)

	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16		2016-17		2017-18
	Provision	Actual	Provi- sion	Actual	Provision	Actual	Provision	Actual	Provision	Actual	Provision	Actual	Provision	Actual	Provision	Revised	Provi- sion
Plan Grants																	
JNNURM GoI	46025	11029.57	35120	8158.61	20807.7	10737.95	16500	5943.66	14000	76.75	15000	1992.63		25			
Grants for GIS																	
XII/XIII FC	1000			2511.62	18850	5597.49	8900		13581	5	13610	14422.28	6000	2540.94	13000	13000	
MP/MLA LADS	500	82.5			500												
HTRIMS -																	
GoAP									677	4231	680						
BOOT Projects																	
Contributions									1500		1550		1000		1000		
MMTTS Project	21760		21760	2290	21700	1250	3000	1250	15000	2500	15010	1860.31	2100	1041.66	2100		
Hyderabad Metro Rail Project																	
					9954		45000	13702.27	37500	21509.8	61150	41473.86	25000	1007.48	15000		
Urban Community Development																	
	200		0	211.81	50000	0.48	30800	227.68	10000		10000	179.17					

Plan Grants	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015-16		2016-17		2017-18
	Provision	Actual	Provi- sion	Actual	Provision	Actual	Provision	Actual	Provision	Actual	Provision	Actual	Provision	Actual	Provision	Revised	Provi- sion
JNNURM GoT	24132	4234.94	35120	3386.56	7903.7	3744.24	5000	2256.52	5500		5513	599.3		32.17			
Modernisation of Abbattoirs										591.59		4.85		271.87			
COP Project										20		5.5					
METROPOLIS												1016.25					
Telanagana Hariharam											2500	1500	2500	625	2500		
SC Sub Plan												9300	15500		15500	3875	
Tirbal sub-plan												5700	9500		9500		
XIV FC													20700		46743	56600	36300
Assistance for Roads													25000		5000	2146	5000
National Urban Renewal Mission													5000		5000	5000	
Sardar Patel Housing Yojana													5000		5000	5000	
Smart Cities													5000	1783.7	5000	5000	
Swach Bharat 2BHK flats for Poor													5000		5000	5000	
Assistance for SWD																35350	
Subsidies for Capital Projects	2000		0													15000	
Total Plan Grants	95617	15347.01	92000	16558.6	119261.4	31284.16	109200	35592.03	97758	28934.14	113513	78054.15	127300	16327.82	125343	125971	41300

Source: GHMC Year 2019 or 2020 ???

Review of Reforms Implementation in the Study ULGs

While the grant support aids an effective functioning of ULGs, they need to be financially sound/ efficient to make an effective utilisation of resources (Roy, 2021). The ULGs need to be structurally sound and should have the mechanisms for Transparency, Accountability and Participation (TAP) in place for better urban governance (Vaidya, 2009). It is attempted hereunder to review the reforms implementation. As the JNNURM was designed as a major mission of reform-led urban planning and development in post-independence India (Ramachandran, 2011), it is proposed to use its reform framework. The JNNURM comprised three major types of reforms to be undertaken by States/ ULGs in order to access its funds (GoI, 2008): (i) Mandatory reforms at State level (ii) Mandatory reforms at ULG level (ii) Optional Reforms at State/ULG level. There were a total of 23 reforms which were to be completed by all mission cities covered under it (Sharma, 2018).

Hyderabad and Pune were covered under JNNURM mission cities that entered into a Memorandum of Association (MoA) with Central and State governments to implement projects² under JNNURM in a time bound manner while also implementing the reforms. The Smart Cities and AMRUT programmes have replaced the erstwhile JNNURM and UDSSMT programmes. Whereas Pune city is placed under the Smart Cities programme, Hyderabad city is not featured under it. Also, it does not feature in the list of AMRUT cities. Therefore, it is proposed hereunder to review the reform status in the study city ULGs based on the undertakings given by them under the MOA submitted to Central Government. Confirmation was also made through interaction with official functionaries of the study ULGs.

Table 6 shows the implementation status of mandatory reforms by the State governments of study ULGs. It reflects that the States of both study cities stand on par with one reform measure not implemented – Reform of rent control Act. However, with the Draft Model Tenancy Act formulated by Central government, State governments may fall in line with it. However, it is learnt from field interactions that some of the reforms merely confined to paper with little or no implementation at ground level in both study cities. For example, the MPCs have been constituted through government order but they are not functional in both cities. Community participation law has been passed, but Area and Ward Sabhas are not functional with no meetings held by them. Although both cities are now preparing development master plans, they are doing it through external consultants by outsourcing it to them.

Table 7 shows the implementation status of ULG level mandatory reforms in both ULGs. It also reflects that both the ULGs of study cities stand on par with all reforms implemented except for one. The reform of property tax with GIS is under testing and implementation in both the cities. However, both ULGs computerised property tax assessment and developed online collection systems (Nallathiga and Sridhar, 2025). User charge levy was instituted in both cities but the revenue from user charges was

low and inadequate for cost recovery. Internal earmarking of urban services for poor exists only on paper and the actual implementation status of reform is unknown. Community engagement in pro-poor budgeting and service delivery is also absent, particularly in GHMC.

Table 6: State Level Mandatory Reforms Implementation Status

S. No.	Reform description	Implementation Status in	
		Telangana	Maharashtra
1	Implementation of decentralisation measures under CAA 1992 (functional devolution) including association of ULBs and parastatals for better service delivery and constitution of Metropolitan Planning Committee (MPC)	Completed (MoU signed between GHMC and HMWSSB)	Completed
2	Repeal of ULCRA	Completed	Completed
3	Reform of Rent Control Act	Not Completed	Not Completed
4	Rationalisation of Stamp Duty to not more than 5%	Completed	Completed
5	Enactment of Public Disclosure Law (including medium term fiscal framework and quarterly performance reporting)	Completed	Completed
6	Enactment of Community Participation Law (including constitution of Area sabhas)	Completed	Completed
7	Assigning or associating elected ULGs with city planning function	Completed	Completed

Source: Gol (2008), Doreshor (2015)

Table 7: ULG Level Mandatory Reforms Implementation Status

S. No.	Reform description	Implementation Status in	
		GHMC	PMC
1	Adoption of Modern Accrual based Double Entry Accounting System	Completed	Completed
2	Introduction of IT based e-governance system including GIS/ MIS	Completed	Completed
3	Reform of Property Tax with GIS	Partly Completed	Partly Completed
4	Levy of reasonable user charges on services to recover full O&M costs	Completed	Completed
5	Internal earmarking in budgets for basic services to urban poor	Completed	Completed
6	Providing basic services to urban poor – both shelter and civic services as well as other universal services like education, healthcare and social security	Completed (P-budget is prepared as a part of budget)	Completed (Pro-poor services are identified in ward works)

Source: Gol (2008), PMC (2015) and based on the author's own analysis

Table 8 shows the implementation status of optional reforms undertaken by the State/ ULG of study cities. It also reflects that both study cities/ States stand on par with all reforms implemented except for one. Property title certification is the reform tried and tested but not implemented to full scale by the State governments of both ULGs. The implementation status of several reforms is not known as only orders/ circulars are passed for the same without any action plans or status reports. Administrative reforms for reducing staff costs have not been implemented in spirit. GHMC has proposed a staffing pattern revision but it is still not implemented. Likewise, the actual implementation status of some reforms is uneven.

Table 8: State/ULG Level Optional Reforms Implementation Status

S. No.	Reform description	Implementation Status in	
		Telangana/ GHMC	Maharashtra/ PMC
1	Revision of byelaws and streamlining building/ land development permissions	Completed	Completed
2	Simplification of legal and procedural framework for conversion of agricultural to non-agriculture land	Completed	Completed
3	Introduction of Property Title Certification in ULGs	Not Completed	Not Completed
4	Earmarking 20-25% of developed land in all housing projects for EWS and LIG category	Completed	Completed
5	Introduction of computerised process of registration of land and property	Completed	Completed
6	Revision of building byelaws to make water harvesting and conservation measures mandatory	Completed	Completed
7	Byelaws for reuse of recycled water	Completed	Completed
8	Administrative reforms including the reduction of establishment costs	Completed	Completed
9	Structural reform	Completed	Completed
10	Encouraging PPP	Completed	Completed

Source: GoI (2008), PMC (2015) and based on the author's own analysis

Conclusion

Fiscal decentralisation assumed significance in India after the 74th CAA, 1992, which enshrined the decentralisation principle of rendering autonomy to local governments so that they become the legitimate third tier of the federal government system of India. The CAA, 1992 instituted mechanisms like Finance Commissions (FCs) in order to facilitate funds flow that aids in the autonomous functioning of ULGs. However, the

practice shows that the ULGs are still not autonomous institutions in terms of functions and finances. The comparative study of two emerging large Indian cities – Hyderabad and Pune — was made to understand the current status of fiscal decentralisation and reforms towards furthering it.

The results show that the FC mechanism has not been effective at the State level and the grants support of upper tier government has been fluctuating without any definite pattern, rendering them unpredictable. As a result, the ULGs are not able to deploy grant funds in a meaningful manner. The structure and trends of GHMC grant funds also implies that the reducing grant flow has resulted in a reduced spending of the GHMC on both capital and revenue fronts on certain ULG functions (non-core but development functions), which is a matter of concern. It implies the need for better fiscal support from upper tiers.

Further, although the State governments gave an undertaking to promote decentralisation and improve governance through reforms, the progress on those fronts has been good (with some shortcomings) and at par in both the study cities. However, some reforms have confined to files but not implemented at ground level. The results suggest the need for a better commitment to reforms and more funding support from upper tiers for furthering the autonomy of ULGs. A better design of reforms in decentralisation and governance at the behest of upper tier governments and their complete implementation in letter and spirit by the ULGs will make them autonomously functioning third tier of government. It requires strengthening the SFC mechanism and instituting reform planning and implementation units by the State governments with citizen participation for better reform implementation.

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Endnotes

1. Decentralisation is also referred to the ‘principle of subsidiarity’, which states that the public goods and services can be delivered optimally when the responsibility of providing them is given to the appropriate level of government in a federal system.
2. The projects were identified through City Development Plan (CDP) and Critical Infrastructure Investment Plan (CIIP) prepared by the ULGs of these cities.

Financial Literacy among the Urban Poor in Punjab: Evidence, Gaps, and Policy Imperatives

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Abstract

This paper examines the level of financial literacy and inclusion among the urban poor in Punjab, India, with a specific focus on the Bottom-of-the-Pyramid (BOP) households earning less than ₹20,000 per month. Employing a descriptive research design and a multi-stage sampling strategy across urban areas in ten districts, the study surveyed 500 respondents using a structured questionnaire based on internationally recognised financial literacy parameters. The analysis reveals a critical gap in financial awareness, with over 71 per cent of respondents scoring low on essential financial concepts, including inflation, interest compounding, the time value of money, and diversification. The findings highlight the role of socio-economic determinants—particularly low educational attainment, informal employment, and limited digital access—in perpetuating financial exclusion. The study underscores that inadequate financial literacy not only restricts informed decision-making but also hinders the effective utilisation of formal banking services and government welfare schemes. Drawing on global frameworks and national financial education strategies, the paper proposes targeted, gender-sensitive, and digitally enabled interventions to enhance financial literacy. The study contributes to the literature by offering empirical insights and policy recommendations relevant to both scholars and practitioners in the field of urban financial inclusion.

Keywords

Financial Literacy, Urban Poor, Financial Inclusion, Bottom of the Pyramid (BOP), Policy Intervention.

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Introduction

Financial literacy, defined as the ability to understand and effectively use various financial skills, including personal financial management, budgeting, and investing, is particularly critical for the urban poor, who often operate in precarious economic environments with limited access to formal financial systems. The lack of financial knowledge exacerbates vulnerability to predatory lending, over-indebtedness, and poor financial planning. Globally, the OECD (2020) emphasises that financial literacy is a key component of financial inclusion, enabling individuals to make informed financial decisions and enhance their economic well-being. In the Indian context, the Reserve Bank of India has highlighted that low-income urban households often struggle with understanding basic financial concepts, which impairs their ability to utilise banking services, insurance, or digital financial tools effectively (RBI, 2022). Studies by Cole, Sampson, and Zia (2011) in India found that financial education interventions significantly increased the likelihood of opening a savings account among the poor. Similarly, the Financial Literacy and Inclusion Survey conducted by the National Centre for Financial Education (NCFE) found that only 27 per cent of the Indian population is financially literate, with even lower rates among urban slum dwellers (NCFE, 2019). These findings underscore the urgent need for targeted financial literacy programmes to empower the urban poor, enabling them to better manage financial risks, accumulate assets, and participate meaningfully in the formal economy.

A complex interplay of socio-economic, demographic, and institutional factors shapes financial literacy among the urban poor. Key determinants include educational attainment, employment type, gender, migration status, and access to financial infrastructure. Studies indicate that individuals with low levels of formal education are less likely to comprehend basic financial concepts such as interest rates, inflation, and risk diversification (OECD, 2016). In urban slum settings, irregular income sources and limited exposure to banking institutions further constrain the ability to engage with formal financial systems. In India, the National Centre for Financial Education (NCFE) found a wide disparity in financial literacy across different urban poor groups, with women and informal sector workers demonstrating significantly lower levels of financial understanding (NCFE, 2019). Language barriers, lack of digital literacy, and distrust in formal institutions also contribute to persistent financial exclusion among these communities.

While it is often posited that borrowing and expenditure patterns reflect the level of financial literacy, especially among economically vulnerable groups, such associations are not always reliable or necessary for measuring financial literacy itself. Among the urban poor, both informal borrowing and daily expenditure decisions are predominantly shaped by structural constraints such as irregular income, lack of access to formal financial services, and urgent consumption needs, rather than by financial knowledge or capability (Collins et al., 2009; Banerjee & Duflo, 2011). As such, these behaviours may offer limited insight into an individual's actual financial literacy level,

which encompasses not only behaviours but also financial knowledge, decision-making capacity, and future planning skills (OECD, 2012).

Expenditure and borrowing patterns in low-income urban settings are often necessity-driven rather than choice-driven, with families making daily trade-offs between food, shelter, healthcare, and education (Rutherford, 2000). These choices are often reactive, influenced more by financial shocks or income volatility than by cognitive understanding of budgeting, interest rates, or savings strategies. Thus, correlating such behaviours with financial literacy risks conflates economic vulnerability with cognitive or educational deficits, leading to misleading conclusions about capability (Lusardi & Mitchell, 2014).

Moreover, financial literacy can be reliably assessed through direct measurement tools, such as those developed by the OECD-INFE or the World Bank, which include structured modules on financial knowledge (e.g., inflation, interest), attitudes (e.g., risk preference, saving habits), and self-reported behaviours (Atkinson & Messy, 2012; Xu & Zia, 2012). These instruments are designed to isolate financial understanding from contextual economic pressures, offering a more objective and comparable assessment of literacy across populations.

Furthermore, informal borrowing—such as reliance on moneylenders, neighbours, or rotating savings groups—may in some cases reflect adaptive financial behaviour rather than poor financial judgment (Mullainathan & Shafir, 2013). Individuals may deliberately avoid formal credit due to high transaction costs, lack of documentation, or mistrust, not because they lack financial knowledge. Similarly, specific spending patterns, such as high food expenditure or limited long-term savings, may result from income constraints rather than inadequate planning.

Hence, to understand the financial literacy level among the urban poor, it is more appropriate to apply validated financial literacy assessments that focus on knowledge, skills, and attitudes, rather than relying on borrowing or spending behaviour, which are more reflective of socio-economic context than financial understanding.

The present paper aims to assess the level of financial literacy and financial inclusion among the urban poor, proposing targeted interventions that are expected to make significant contributions to policy design, academic discourse, and programmatic implementation. By generating disaggregated data on financial knowledge, behaviour, and access to formal financial services across diverse urban poor communities, the study provided critical insights into existing gaps and barriers. Such findings are particularly valuable in the Indian context, where the National Centre for Financial Education has highlighted that financial literacy remains low among informal sector workers and slum dwellers, despite broader financial inclusion initiatives like the Pradhan Mantri Jan Dhan Yojana (NCFE, 2019). The study's recommendations could support the development of context-specific financial education strategies, enhance outreach of banking and digital services, and inform the implementation of

the *National Strategy for Financial Education: 2020–2025* (RBI, 2022). Furthermore, drawing on international best practices from the OECD/INFE (2016) framework, the study contributes to global literature by offering evidence from a developing country urban setting. Ultimately, it also strengthens the foundations for inclusive financial systems, empower low-income urban populations, and guide future interventions aimed at achieving equitable economic participation.

Theoretical Foundation for Financial Literacy and Poverty

The relationship between financial literacy and poverty is grounded in several interrelated theoretical frameworks that explain how knowledge of financial principles can influence economic well-being, decision-making, and empowerment. One of the foundational theories is the Human Capital Theory, which posits that investments in education and skills enhance an individual's productivity and earnings potential (Becker, 1964). Financial literacy, as a component of human capital, equips individuals—particularly those at the Bottom of the Pyramid (BOP)—with the necessary knowledge and skills to manage limited resources efficiently, make informed financial decisions, and ultimately improve their socio-economic conditions.

Another relevant framework is Behavioural Economics, which addresses how cognitive biases, limited information, and sub-optimal decision-making often characterise the financial behaviour of low-income individuals (Thaler & Sunstein, 2008). Financial literacy can mitigate such behavioural constraints by promoting a better understanding of risk, savings, and long-term planning. For instance, understanding the concepts of interest compounding and inflation can enable consumers to evaluate loan offers critically and choose appropriate saving instruments, thereby avoiding exploitative financial practices that perpetuate poverty.

In addition, Capability Approach, developed by Amartya Sen (1999), provides a normative framework linking financial literacy to poverty reduction. According to Sen, poverty is not merely a lack of income but a deprivation of capabilities—opportunities to lead the kind of life one values. Financial literacy enhances these capabilities by increasing individuals' access to financial tools and systems, enabling them to plan for contingencies, invest in education or health, and exercise greater control over their economic lives. Thus, improving financial literacy among the poor is not only a means to increase income but a pathway to expand human freedom and agency.

Together, these theoretical perspectives underscore that financial literacy is both a determinant and an enabler in the fight against poverty. It is not simply about transferring knowledge but about building the capacity for economic decision-making, fostering inclusion, and enabling the poor to navigate and benefit from the formal financial system. Policymakers and development practitioners must therefore recognise financial literacy as a foundational element in poverty alleviation strategies and inclusive financial development.

Research Methodology

This paper employed a descriptive research design to examine the level of financial literacy and financial inclusion among Bottom-of-the-Pyramid (BOP) population residing in urban areas of Punjab, India, and to propose measures to enhance their financial capabilities. The descriptive approach is appropriate given the study's objective to describe the existing financial behaviours, knowledge, and access among a defined population segment without manipulating the environment. The research is grounded in the socio-economic context of the BOP segment, characterised by monthly household incomes up to ₹20,000, and focuses on understanding their interaction with formal financial systems and literacy initiatives. The state of Punjab, comprising 23 districts grouped under five administrative divisions—Jalandhar, Ropar, Patiala, Firozpur, and Faridkot—formed the sampling universe for this study.

In line with the study's objectives, a multi-stage sampling strategy was adopted to ensure representativeness across geographic and administrative regions. Two districts were randomly selected from each of the five administrative divisions, resulting in a total of 10 districts for primary data collection. Within each selected district, data collection was confined to urban localities at the district headquarters, where low-income consumers were more likely to be concentrated and accessible. The target population consisted of households having family earning up to ₹20,000 per month, defined as the BOP segment. A sample size of 500 respondents had been planned, with 50 respondents drawn from each selected district. The first respondent in each district was identified through judgmental sampling, ensuring they met the BOP criteria. Subsequent respondents were selected using the snowball sampling technique, wherein each respondent referred the next participant, helping researchers reach a broader yet relevant sample in urban low-income communities.

Data collection was conducted using a structured questionnaire, administered both in electronic and paper-based formats to accommodate varying levels of digital access among respondents. The questionnaire included sections on demographic information, awareness and understanding of financial concepts, financial behaviours (such as savings, borrowing, and use of digital finance), and perceived barriers to financial inclusion. Both closed-ended and Likert-scale items were used to capture a range of measurable variables. The instrument was pre-tested in a pilot phase to ensure clarity, reliability, and contextual appropriateness before full-scale administration.

Following data collection, data preparation involved coding and entering responses into Microsoft Excel in a structured format, which was then exported to SPSS for statistical analysis. A combination of descriptive statistical technique has been applied. Descriptive statistics summarised respondent characteristics and levels of financial literacy and inclusion.

Findings and Implications

Table 1: Demographic profile

Category		Frequency	Per cent	Cumulative per cent
Area	Rural	195	39.0	39.0
	Urban	305	61.0	100.0
Gender	Male	285	57.0	57.0
	Female	215	43.0	100.0
Age	Below 30 years	234	46.8	46.8
	31-40 years	153	30.6	77.4
	41-50 years	88	17.6	95.0
	Above 50 years	25	5.0	100.0
Marital status	Married	350	70.0	70.0
	Unmarried/Single	150	30.0	100.0
Occupation	Labor	277	55.4	55.4
	Private job	208	41.6	97.0
	Farmer	3	.6	97.6
	Business	12	2.4	100.0
Education	Below matriculation	190	38.0	38.0
	10th	136	27.2	65.2
	12th	103	20.6	85.8
	Graduation and above	71	14.2	100.0
Monthly Income	Less than Rs. 10000	64	12.8	12.8
	Rs. 10001-15000	247	49.4	62.2
	Rs. 15001-20000	189	37.8	100.0

Source: Primary data

Demographic Profile of Respondents

The demographic characteristics of the respondents in the study provided essential context for understanding the financial literacy and inclusion patterns among the Bottom-of-the-Pyramid (BOP) population in the urban poor sample state of Punjab. The gender distribution indicated a higher representation of females (61.0 per cent) compared to males (39.0 per cent), reflecting either greater availability or willingness of women within the BOP segment to participate in the study. A significant majority of the respondents (61.0 per cent) were from urban areas, aligning with the study's focus, while 39.0 per cent hailed from peri-urban or rural fringes, suggesting a degree of fluidity in residential categorisation among low-income populations in district headquarters.

In terms of age, the majority of respondents (46.8 per cent) were under 30 years, followed by 30.6 per cent in the 31–40 age group, indicating a predominantly young

and economically active population. Regarding marital status, a substantial proportion (70 per cent) of the respondents were married, while 30 per cent were unmarried or single, which may have implications for household financial decision-making and dependency structures.

Occupational data revealed that more than half (55.4 per cent) of the respondents were engaged in daily wage labour, with another 41.6 per cent employed in the private sector. A minimal percentage reported working as farmers (0.6 per cent) or running small businesses (2.4 per cent), highlighting the dominance of informal and semi-formal employment among BOP consumers.

Income data showed that the vast majority of respondents (87.2 per cent) earned between ₹10,001 and ₹20,000 per month, with 49.4 per cent in the ₹10,001–₹15,000 bracket and 37.8 per cent in the ₹15,001–₹20,000 bracket. Only 12.8 per cent reported earning less than ₹10,000 per month. This distribution confirms the economic classification of the sample and reinforces the relevance of the Balance of Payments (BOP) framework for the study.

Educational attainment among respondents was generally low, with 38.0 per cent having not completed matriculation, and only 14.2 per cent having attained graduation or higher education. These findings suggested that limited formal education and income constraints defined characteristics of the urban poor in Punjab, which were likely to influence their levels of financial literacy and access to formal financial services.

Level of Financial Literacy among the Urban Poor

To assess the financial literacy levels of urban poor in Punjab, respondents were administered five standardised questions, each measuring a core component of financial literacy: number efficacy, interest compounding, inflation, time value of money, and diversification (Aggarwal et al., 2014). These dimensions are widely recognised in financial literacy frameworks, such as those endorsed by the OECD/INFE, for evaluating an individual's ability to make informed financial decisions. Each question had a single correct answer; respondents received a score of '1' for a correct response and '0' for an incorrect one. Based on cumulative scores, respondents were categorised into three groups: those scoring 4 or 5 were classified as having a high level of financial literacy, those with a score of 3 as moderate-high, and those with 2 or fewer correct responses as having a low level of financial literacy.

The highest proportion of correct responses was observed in the domain of number efficacy, where 52.2 per cent of respondents selected the correct answer. This suggests a moderate level of basic numerical competence, which may be attributed to its practical relevance in everyday financial activities such as budgeting and price comparison (See Figure 1).

In contrast, understanding of more abstract financial concepts was significantly lower. Only 41.0 per cent of respondents correctly answered the question related to

interest compounding, indicating limited awareness of how interest accumulates over time—a concept crucial for informed decision-making related to savings, loans, and investment products. The findings were more concerning with respect to inflation and time value of money, with only 28.2 per cent and 35.6 per cent of respondents, respectively, providing correct answers. This lack of understanding suggests that a substantial portion of the urban poor population may not fully grasp the implications of changing price levels or the benefits of early saving and delayed consumption.

The lowest level of comprehension was observed in the area of diversification, where only 25.8 per cent of respondents correctly answered the related question (Figure 1). This indicates a significant gap in awareness regarding risk mitigation strategies in financial planning. Taken together, these findings highlight the fragmented and insufficient financial knowledge among Bottom-of-the-Pyramid (BOP) in urban Punjab. The data underscores the need for targeted, concept-specific financial education programmes that address these knowledge gaps in a contextualised and accessible manner.

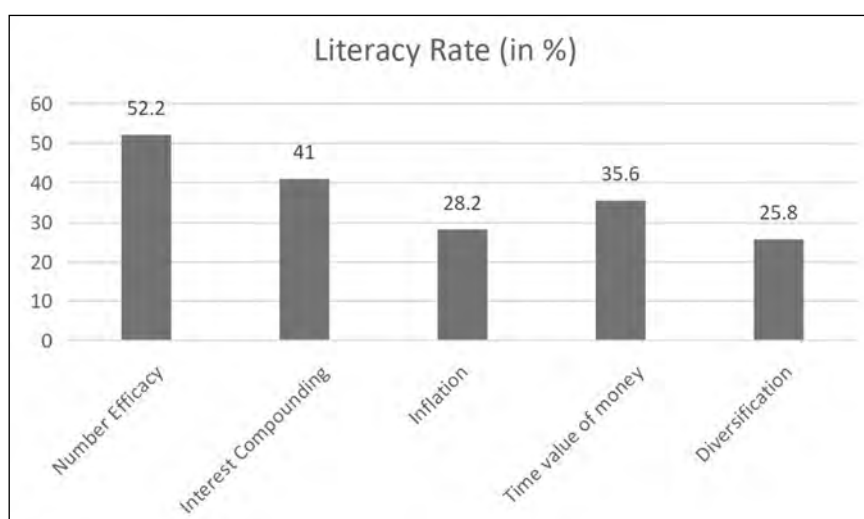


Figure 1: Level of Financial Literacy among Urban Poor on Different Aspects of Finance

Source: Output of Primary Data collected and analysed by the authors

Aggregate Financial Literacy Scores and Implications

While item-wise analysis offers valuable insight into respondents' comprehension of specific financial concepts, a more comprehensive understanding requires assessment of their aggregate financial literacy scores. For this purpose, each correct response across the five financial literacy questions was awarded a score of '1', and incorrect responses were scored as '0'. The total score for each respondent, therefore, ranged from 0 to 5. Based on these aggregate scores, financial literacy levels were categorised into three tiers: low (scores 0–2), moderate (score 3), and high (scores 4–5). This

classification allows for a nuanced understanding of the overall financial knowledge among Bottom-of-the-Pyramid (BOP) population in the urban areas of Punjab.

Table 2: Scores obtained by respondents on financial literacy

Scores	Level of financial literacy	Frequency	Total	Per cent
0	Low level	126	357 (71.4%)	25.2
1		101		20.2
2		130		26.0
3	Moderate level	65	65 (13%)	13.0
4	High level	32	78 (15.6%)	6.4
5		46		9.2
Total		500		100.0

Source: Output of Primary Data collected and analysed by the authors

As shown in Table 2, the findings revealed a predominantly low level of financial literacy among the respondents. Specifically, 71.4 per cent of the total sample (n=500) scored 2 or below, thus falling into the 'low literacy' category. Within this group, 25.2 per cent of respondents scored zero, 20.2 per cent scored one, and 26.0 per cent scored two. A relatively small proportion of respondents (13.0%) demonstrated a moderate level of financial literacy by scoring three. Only 15.6 per cent of respondents were classified as possessing a high level of financial literacy, with 6.4 per cent scoring four and 9.2 per cent achieving full marks. These results highlight a critical gap in foundational financial knowledge among urban BOP populations, which may significantly hinder their ability to make informed financial decisions and engage with formal financial systems.

The implications of such low levels of financial literacy are both immediate and long-term. From a policy standpoint, it raises serious concerns about the effectiveness of financial inclusion schemes and the readiness of BOP consumers to benefit from formal banking, insurance, and digital finance initiatives. Poor financial literacy not only increases the vulnerability of these consumers to financial mismanagement and exploitation but also impedes the broader goals of financial stability, economic empowerment, and inclusive growth. The findings suggest that without timely intervention, the existing disparities in financial knowledge could reinforce cycles of poverty and exclusion.

In this context, it is imperative that government agencies, financial institutions, and civil society organisations undertake targeted financial literacy programmes, particularly for low-income and marginalised communities. These initiatives should focus on delivering practical, context-specific education related to saving, borrowing, budgeting, and risk management. Furthermore, banks should be encouraged to design

inclusive credit products—such as low-interest loans without collateral—to enhance financial participation among BOP consumers. Financial literacy, when supported with accessible financial products and services, can serve as a powerful tool for economic inclusion, strengthening both individual financial resilience and national economic development.

Discussion and Conclusion

The findings of this study underscore the substantial gap in financial literacy among Bottom-of-the-Pyramid (BOP) consumers in urban Punjab. With 71.4 per cent of respondents categorised as having low financial literacy—particularly weak in understanding inflation (28.2%), diversification (25.8%), and time value of money (35.6%)—the results reveal a fragmented grasp of essential financial principles necessary for participating in the formal economy. These deficiencies are strongly correlated with low educational attainment (38% below matriculation), informal employment (55.4 per cent as daily wage labourers), and limited income, with the majority earning less than ₹20,000 per month. As supported by Lusardi and Mitchell (2014), such financial illiteracy compromises individuals' ability to plan for the future, manage debt, or make prudent financial decisions, which in turn exacerbates their economic vulnerability and social exclusion.

Globally, institutions such as the OECD (2020) and national surveys like NCFE (2019) have emphasised that financial literacy is foundational for achieving financial inclusion and economic resilience, particularly among underserved populations. In India, the Reserve Bank of India (2022) has echoed similar concerns, noting that low levels of financial awareness hinder the efficacy of financial inclusion schemes such as Pradhan Mantri Jan Dhan Yojana (PMJDY), Direct Benefit Transfer (DBT), and digital banking. Without timely intervention, financial illiteracy among the urban poor risks undermining policy goals related to inclusive growth and poverty reduction.

Way Forward for Policymakers

- (i) **Implement Community-Based Financial Literacy Campaigns:** The government, in collaboration with financial institutions and local NGOs, must develop and implement grassroots financial education programmes tailored to urban low-income communities. Drawing from international best practices, content should be delivered in regional languages and use culturally relevant analogies (OECD, 2016). Financial Literacy Centres and digital platforms should be expanded and adapted to reach marginalised urban populations.
- (ii) **Integrate Financial Education with Welfare and Livelihood Schemes:** Embedding financial literacy training into existing schemes such as Prime Minister Street Vendor's AtmaNirbhar Nidhi (PM-SVANidhi), Deendayal Antyodaya

Yojana – National Urban Livelihoods Mission, and National Urban Livelihoods Mission (DAY-NULM) can enhance uptake and application of financial knowledge (RBI, 2022). This integrated approach ensures contextual learning and improves the financial behaviour of beneficiaries.

- (iii) **Design Inclusive and Accessible Financial Products:** Policymakers should incentivise banks and NBFCs to offer low-cost, simplified financial products—such as zero-balance accounts, no-collateral microcredit, and goal-based saving instruments—that address the specific needs of the urban poor. As suggested by Cole, Sampson, and Zia (2011), combining product innovation with financial education significantly enhances financial engagement among low-income populations.
- (iv) **Use Digital Infrastructure to Deliver Financial Education:** With increasing mobile penetration, especially among young adults (who made up 46.8% of the sample), digital tools like SMS-based tips, short video tutorials, and interactive learning applications can be deployed to improve financial awareness. The adoption of India's Account Aggregator framework can further help BOP consumers access credit and insurance by building digital financial identities.
- (v) **Ensure Gender-Sensitive Financial Literacy Interventions:** Given the higher participation of women in the study and their traditionally lower access to financial knowledge, targeted programmes focusing on women, including SHGs and BC Sakhi models, should be scaled up to improve their financial agency.
- (vi) **Establish Monitoring and Evaluation Mechanisms:** Continuous monitoring and impact evaluation should be built into financial literacy initiatives using metrics like behaviour change, service usage, and income stability. This aligns with OECD (2020) recommendations to track programme effectiveness and adjust interventions as needed.

By adopting a multi-dimensional approach that combines education, inclusion, accessibility, and technology, policymakers can address the root causes of financial illiteracy among the urban poor. Such efforts will not only support individual empowerment and resilience but also contribute meaningfully to India's broader development objectives of financial inclusion and sustainable urban growth.

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Reconceptualising Urban Green Spaces as Learning Environments

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Abstract

Engagement with nature in educational settings has been acknowledged to improve cognitive abilities and fostering emotional well-being by alleviating stress and anxiety in students. Moreover, green spaces promote social connections, encourage collaboration, improve personal well-being and enhance the cultivation of positive behavioural traits. It encourages pro-social behaviour and reduces feelings of social isolation thereby contributing to personal growth. This paper examines the advantages of incorporating green spaces into urban schools, highlighting their significance as essential learning environments that transcend conventional classroom limits. It also highlights the challenges faced by the schools in urban areas in terms of space constraints and also delineates the effect of these challenges on the students' overall well-being and academic performance. This paper promotes a comprehensive strategy for efficient space management and creative educational planning that emphasises green spaces as vital elements of healthy, inclusive, and sustainable learning environments. Integrating nature into urban schooling can lead to holistic and enriching experience, improved well-being for both teachers and students, and the inculcation of a value system that promotes sustainability.

Keywords

Green areas, Experiential learning, Learning environment, Green spaces.

Introduction

With the rapid pace of urbanisation in the 21st century, overcrowding and ever-growing need for construction of new buildings has led to limited natural spaces like parks, gardens, and open fields especially in the crowded urban areas. It has drastically changed the social, cultural and physical aspects of urban areas around the world. In developing countries, the public schools face challenges related to limited space especially in urban areas such as overcrowded classrooms and insufficient basic facilities. As a result, there

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is restricted exposure for these children to be able to explore, interact and connect with nature unlike their rural counterparts which is important for their mental, emotional, and physical development. Environmental psychology underscores urban green spaces as an important feature for an effective learning setting. Beyond augmenting aesthetic value within school premises, green spaces have cognitive, social, and emotional benefits (Gifford et al., 2011). Interacting with nature helps improve children's attention focus span, memory retrieval processes, creativity, as well as problem-solving skills. In addition, exposure to greenery has calming effects that reduce stress and anxiety which enhance emotional health alongside resilience (Ulrich & Parsons, 1992).

Notably, the green spaces help school children to network with each other by giving them open areas to play, talk, and perform group activities. Open green spaces also offer practical and joyful learning experiences, like gardening or outdoor engagement, which teach children to embrace nature and take responsibility for the environment. Although green spaces offer innumerable benefits to the students, integrating them in urban schools has multiple logistics and policy related bottlenecks. The limited space availability, recurring maintenance costs and strict traditional academic curriculum---all these factors emerge as key challenges for urban schools. The latter often struggle with congested infrastructure, overcrowded classrooms, and a lack of proper teaching resources; green spaces could be a powerful tool to improve learning level and student well-being. It is the need of the hour that enough importance and attention is paid to it by the concerned stakeholders.

This paper explains how green spaces in urban public schools like parks, gardens, or open areas, can be used as valuable, joyful learning environments for the children. It underscores the importance of green spaces as dynamic learning environment and advocates incorporating them in the curricular and pedagogical practices which would help students in acquiring key life skills, improving their focus, creativity, emotional well-being and becoming an active and responsible citizen. The paper also offers recommendations on the formulation of enabling policies and long-term planning so as to make these nature-based learning spaces an integrated part of urban school education. The idea is to redesign the urban public schools to include nature so as to ensure all-round and holistic development of students.

Methodology

For this study, relevant research papers were selected through a systematic and focused literature search. Keywords such as "*urban green spaces*," "*learning environments*," "*nature-based learning*," "*environmental education*," and "*outdoor learning*" were used to identify relevant studies in databases including Google Scholar and JSTOR. The search was limited to papers published between 1989 and 2021 to ensure the inclusion of significant and recent contributions. Titles and abstracts were reviewed to assess relevance to the theme of using urban green spaces as educational settings. Only peer-reviewed, English-language papers that directly discussed the role of nature or

green spaces in learning contexts were included. Full-text articles were then evaluated for quality and depth of analysis, and the reference lists of key studies were examined to identify additional relevant sources.

Theoretical Framework

The rationale and theories that support inclusion of urban green areas into the educational environments consist of multiple holistic reasoning models which explain how natural settings affect human thought processes, behaviours and learning. These frameworks are helpful in understanding the mental, emotional and social benefits that can be derived from green spaces.

Biophilia Hypothesis

The Biophilia Hypothesis introduced by E.O. Wilson proposes that humans have a natural draw to nature and are shaped by its evolutionary factors. It says that connection to the outdoor ecosystem can enhance psychological well-being. Spending time in green spaces can lift one's mood, reduce stress, and improve mental function (Wilson, 1986). From an educational standpoint, this means that incorporating elements of nature will likely make children in school to be more engaged with the content being taught, motivated to perform in academic activities and improve their social-emotional learning.

Restorative Environment Theory

Restorative Environment Theory enhances the Biophilia Hypothesis by elucidating how natural surroundings facilitate the restoration of diminished cognitive resources. This idea posits that metropolitan environments frequently require prolonged directed attention, resulting in cognitive exhaustion. Engagement with restorative surroundings, particularly those abundant in natural stimuli, facilitates the recuperation of attention capacity, alleviates stress, and enhances focus (Kaplan & Kaplan, 1989). Schools that are next to or have green spaces can function as restorative environments, aiding students in sustaining concentration and alleviating psychological tiredness.

Experiential Learning Theory

David Kolb's Experiential Learning Theory in 1984 underscores learning as a cyclical process comprising concrete experience, reflective observation, abstract conceptualisation, and active experimentation (Kolb, 2014). Natural surroundings offer abundant opportunities for experiential learning through hands-on involvement, exploration, and observation. Outdoor classrooms, school gardens, and ecological initiatives promote direct interaction with the environment, enhancing comprehension of scientific principles and cultivating critical thinking (Lieberman & Hoody, 1998). Experiential learning is particularly impactful in environmental education, as students cultivate a feeling of responsibility via active engagement.

Attention Restoration Theory (ART)

Attention Restoration Theory, a sub-theory of the Restorative Environment Theory (Kaplan, 1995), posits that natural environments naturally captivate involuntary attention, hence facilitating the replenishment of directed attention necessary in educational contexts. This procedure yields enhanced cognitive performance and superior academic results (Tanner, 2009). These theories collectively establish urban green areas as vital educational instruments that foster cognitive development, emotional regulation, active and experiential learning. Their incorporation into urban classrooms aligns with biological and psychological human requirements while also endorsing pedagogical methods that emphasise holistic, student-centred learning.

Cognitive Benefits of Urban Green Spaces

Access to urban green spaces in educational settings has been consistently associated with several cognitive advantages that improve students' academic performance and overall learning experience. Natural environments offer restorative stimuli that replenish cognitive resources, especially attention and working memory, essential for efficient learning. A notable cognitive advantage is the enhancement of attention and concentration. Attention Restoration Theory posits that natural environments naturally engage involuntary attention, facilitating the recovery of focused attention necessary for classroom activities after exhaustion (Kaplan, 1995). Research indicates that kids with access to green views or outdoor learning experiences exhibit enhanced concentration and less attention deficit symptoms. Children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) had diminished symptoms following exposure to green outdoor environments (Taylor & Kuo, 2009).

Moreover, engagement with green places greatly affects memory and learning. Students who walked in natural environments exhibited superior performance on memory tasks compared to those who strolled in urban areas devoid of vegetation. This indicates that exposure to the outdoors enhances working memory capacity, an essential element for academic achievement. Outdoor learning environments, such as school gardens and green classrooms, enable students to utilise multiple senses and promote experiential learning, hence improving retention and comprehension (Lieberman & Hoody, 1998). Furthermore, natural surroundings enhance creativity and problem-solving abilities by offering varied and adaptable spaces that promote imaginative play and exploration. Research indicates that youngsters engaging in play within natural environments demonstrate elevated creative thinking abilities relative to those in artificial settings (Wells, 2000). Therefore, urban green areas function as cognitive enhancers by augmenting attention, memory, creativity, and learning outcomes, therefore facilitating comprehensive educational development.

Emotional and Psychological Impacts

The green areas in urban educational environments substantially enhance students' socio-emotional and psychological well-being, acting as a natural stress buster of scholastic pressures. Amid escalating noise pollution, and urban overcrowding, natural areas offer restorative surroundings that enhance mental health.

The principal psychological advantage of green spaces is the alleviation of stress. Exposure to natural habitats has been demonstrated to reduce cortisol levels and physiological indicators of stress (Ulrich, 1993). This effect is especially significant for youngsters, who frequently encounter stress from scholastic pressures and social difficulties. Green spaces promote relaxation and emotional recuperation by providing a tranquil environment, alleviating anxiety and agitation (Ulrich & Parsons, 1992). Such surroundings facilitate restorative experiences, allowing students to psychologically rejuvenate, which is essential for maintaining attention and motivation in educational settings (Kaplan & Kaplan, 1989). Furthermore, green environments improve mood and emotional regulation. Studies demonstrate that proximity to green spaces correlates with elevated levels of good emotions, including happiness, tranquillity, and life satisfaction (Bratman et al., 2012). This results in enhanced classroom conduct and increased participation in educational activities. Children with mental health issues like depression or anxiety derive therapeutic advantages from the time spent in nature, which aids in fostering emotional stability and resilience (Ulrich & Parsons, 1992 ; Ulrich, 1993). Social interaction and psychological health are also positively impacted by green spaces. Social interaction, collaboration, sense of belongingness and recreation are generally associated with the natural settings (Chawla, 2015). Nature promotes coping mechanisms and emotional resilience, enabling students to manage stress better. Thus, urban green spaces can enhance students' emotional well-being by improving mood, reducing stress, and building resilience, overcoming challenges, and supporting holistic personal growth.

Social and Behavioural Outcomes

The social behaviour of students is greatly enhanced by the incorporation of green spaces into schools within urban settings. These environments provide opportunities for unstructured play that leads to social interaction as well as teamwork which fosters important social abilities in addition to encouraging pro-social behaviour. In today's modernised and digitised world where children are spending less time outdoors, green areas have become critical for social development alongside serving as community hubs for cohesion. Providing such places greatly supports an increase in social contact and therefore enhances green space's primary benefit of improving social cohesion.

Parks, gardens and the outdoors are places where children engage in group play, negotiation, and conflict resolution, all of which contribute towards developing social competence (Pellegrini & Smith, 1998). These relationships cultivate empathy

and collaboration which improve behaviour in the classroom while also reducing bullying (Dyment & Bell, 2008). Other studies show that green space accessibility enhances addressing behavioural problems and students' social integration within the school (Kuo et al., 1998). Furthermore, natural settings are linked to a greater sense of community belongingness, closeness to peers and pro-social behaviours such as cooperation, sharing and helping others (Chawla, 2015). This nurtures a child's sense of responsibility as well as encourages the children to take care of their surroundings by volunteering for environmental initiatives.

Natural surroundings enhance self-control. Interaction with nature has been shown to reduce both impulsivity and hyperactivity (Kuo and Taylor, 2009), especially among children diagnosed with Attention-deficit/hyperactivity disorder (ADHD). The calming effects of natural environment helps children to cope with the many challenges emotionally and behaviourally which improves the overall school climate and academic participation. Access to green spaces within city boundaries also reduces students' anti-social and aggressive behaviour by providing safe, interesting places where positive social interactions can occur (Wells & Evans, 2003). Moreover, areas with vegetation tend to have lower rates of crime and violence which suggests that schools located in greener urbanised regions may aid in the construction of safer learning environments. Thus, green spaces around educational facilities help to develop critical social skills while promoting pro-social self-regulation as well as safer, inclusive environments throughout the city. These findings strongly justify the inclusion of green spaces in urban design for schools.

Educational Opportunities and Experiential Learning

Urban green spaces create unique opportunities for experiential learning, which is a specific educational technique that engages learners actively with the environment to enhance understanding and retention. Incorporating natural elements into lessons in urban schools dominated by conventional teaching can transform learning by fostering curiosity, critical thinking, and responsible citizenship regarding nature. Kolb (2014) argued in his theory of experiential learning that this form of education derives from real-life events systematically going through: observation and reflection, abstraction of ideas, conceptualisation, formulating new ideas or strategies based on previously defined notions, and then employing active experimentation. Arboretums and other urban green spaces offer authentic experiences which engage children actively, prompting them to investigate questions more deeply beyond textbooks tailored narratives. School gardens and outdoor classrooms are living laboratories allowing learners to study plants in biology as well as ecology and environmental science making once distant topics closer and relevant (Lieberman & Hoody, 1998).

Spatial and outdoor learning comes with proven benefits for academic performance, especially within Science, Technology, Engineering, and Mathematics (STEM)

subjects. A thorough review by the State Education and Environment Roundtable found that students exposed to environmental education had better standardised test scores as well as greater levels of interest and participation (SEER, 2000). Activities like gardening, wildlife observation, or water quality testing foster cognitive connections through active experience and facilitate multisensory learning, which maximally supports diverse learning styles (Berg, 2018). In addition to problem-solving skills, green spaces also foster cooperation, communication, and creativity within a single working space. Collaborative activities such as school garden design or ecological restoration require team-based, communication-sustainable landscape designing and analysing local environmental problems which invoke creative thinking blended with civic responsibility, aimed at ethical stewardship (Chawla, 2015). The development of these competencies allows learners to thrive in today's intricate world. Learning through direct exposure to nature enables the acquisition of knowledge on an active basis while simultaneously heightening care for the environment. By connecting directly with the environment, children develop an emotional connection with it as well as encourage pro-environmental actions and habits of living sustainably (Krasny & Tidball, 2012).

This sense of duty is essential in urban environments where environmental issues like pollution and biodiversity decline are significant. Therefore, urban green spaces increase educational prospects by offering dynamic, experiential learning environments that improve academic performance, develop vital life skills, and promote environmental stewardship, rendering them indispensable assets in urban education.

Challenges and Considerations

The incorporation of urban green spaces into educational settings has various advantages, although it also poses some obstacles and considerations, especially in densely populated and resource-limited metropolitan areas. These obstacles can be classified into spatial, economic, administrative, and socio-cultural dimensions. A significant difficulty is constrained space. Urban educational institutions, particularly in cities such as Delhi, Mumbai, or Bengaluru, frequently function in confined environments with limited open space. Designating areas for vegetation or outdoor educational settings is challenging when fundamental infrastructure like classrooms, sanitation facilities, and playgrounds is insufficient (Wong & Yuen, 2012). The limited availability of land in urban areas, together with elevated real estate prices, frequently deter planners from emphasising green infrastructure in educational facility development.

Financial limitations impede the development and upkeep of green places. Implementing school gardens, outdoor classrooms, or green roofs necessitates upfront capital and continuous upkeep. Government-operated schools, often constrained by economic limits, may not prioritise these programmes as critical in comparison

to other pressing needs such as teacher training or textbook distribution (Dyment & Bell, 2008). Alongside infrastructure and budgetary challenges, administrative and policy deficiencies also hinder advancement. Urban planning and educational policy frequently operate in isolation, exhibiting minimal collaboration between municipal entities and educational authorities. Most Indian cities lack institutional rules or mandates that require or incentivise the integration of green spaces into school facilities. Furthermore, school administrators may be uninformed or untrained in the efficient pedagogical use of green spaces (Maynard, 2007). The existing cultural norms and socio-cultural attitudes may also pose challenges. In rigid systems that give priority to exam results and standardised tests, everything considered “beyond the syllabus” is often ignored (Rickinson et al., 2004). These spaces are hardly used due to safety concerns, unpredictable weather, and fears of vandalism or poor upkeep. In addition to these challenges, even the most beautifully designed gardens in cities struggle with the pollution and water scarcity issues and barely survive without constant care (Gill et al., 2007).

Nevertheless, if we wish to see urban school’s green spaces flourish, we must rethink our planning, construction methodologies along with fiscal allocation. It necessitates collaborative efforts towards integration of nature as a fundamental pillar shaping children’s learning experiences across different sectors and departments. Ultimately, this goes beyond mere vegetation or recreational areas; it strives to allow every single child access to engage with the world outside the confines of four walls which is essential for their development.

Policy Implications and Recommendations

Cities are changing fast and so are the spaces where children learn. Schools are now surrounded by traffic, noise, and concrete, often with little to no greenery. But growing research tells us that green spaces are not just “nice” to have, they are a crucial aspect of the system. Parks, gardens, and natural learning areas support children’s physical health, emotional well-being, creativity, and their sense of connection to the world. It helps in promoting better health for the children, help them to think more clearly, and feel more at peace. This is the need of the hour that we treat them as an essential infrastructure and integral part of the school settings.

Integration into Educational Planning

Urban school planning must progress beyond classroom-focused designs to integrate natural elements as instructional resources. The National Education Policy (NEP) 2020, which prioritises experiential and holistic learning, provides an opportunity to officially require the integration of green infrastructure—such as gardens, green rooftops, shaded courtyards, and biodiversity patches—in all newly built urban schools (Ministry of Education, 2020). It promotes hands-on learning in education, advocating

for field visits and community projects in urban green spaces. The National Curriculum Framework (NCF) 2005 also incorporates environmental studies into school curricula, justifying the integration of local green spaces into classroom learning and activities. Furthermore, building codes promulgated by entities like the Public Works Department (PWD) ought to be amended to provide green infrastructure criteria for school facilities. Accreditation standards and quality evaluations by educational boards should evaluate not only academic achievement but also the environmental attributes of learning settings.

Establishing and maintaining green spaces in urban schools necessitates active collaboration among many governmental agencies—urban local bodies, municipal corporations, school education departments, and environmental planning authorities. Currently, numerous entities function in isolation, resulting in disjointed initiatives and ineffective results. National initiatives such as the Smart Cities Mission and AMRUT (Atal Mission for Rejuvenation and Urban Transformation) prioritise the augmentation of green cover and the enhancement of urban infrastructure. These platforms can be enhanced to incorporate the greening of educational institutions, especially public schools in disadvantaged communities (Ministry of Housing and Urban Affairs [MoHUA], 2021). Local task forces or interdepartmental groups may be formed to facilitate policy implementation, do needs assessments, and offer technical assistance.

Incentives and Funding Mechanisms

Financial constraints continue to be a significant obstacle to the extensive implementation of green infrastructure in educational institutions. Governments ought to implement specific financial incentives, including subsidies, matching grants, and tax credits for green infrastructure. The adequate funding could facilitate not only physical infrastructure but also educator training, curriculum enhancement, and continuous upkeep. Moreover, the significance of Public-Private Partnerships (PPPs) and Corporate Social Responsibility (CSR) programmes is paramount. Numerous business enterprises connected with the UN Sustainable Development Goals (SDGs) endeavour to promote environmental and educational initiatives. Corporate Social Responsibility payments may be allocated to school greening initiatives, especially in economically disadvantaged metropolitan regions (Chelleri et al., 2015). State education departments should furnish explicit cooperation structures and project templates for schools to engage potential sponsors.

Teacher Training and Curriculum Reform

Merely possessing green spaces on school campuses is insufficient; they must be included in the educational framework. Educators frequently lack the requisite training to utilise outdoor areas as educational settings. Consequently, teacher education programmes must incorporate modules on nature-based, inquiry-driven, and experiential pedagogical practices. Curricula in disciplines such as physics, geography,

environmental studies, and even art and literature ought to incorporate outdoor learning elements. National and state curriculum agencies, such as National Council of Educational Research and Training (NCERT) and Social Communication, Emotional Regulation, and Transactional Support. (SCERTS), ought to produce standardised lesson plans and outdoor activity guides that promote the integration of school gardens and natural elements into daily instruction (UNESCO, 2017). In-service training seminars, facilitated by environmental NGOs or local horticulture departments, can enhance teachers' practical skills and concepts to connect natural surroundings with classroom curricula.

Community Participation and Stewardship

Green spaces exhibit greater sustainability when local people possess a sense of ownership over them. Involving students, parents, educators, and local residents in the planning, creation, and upkeep of green infrastructure ensures these spaces are effectively utilised and maintained over time. Examples comprise student-led eco clubs, parent-teacher horticultural committees, and community gardens. Schools may allocate portions of their green spaces for dual purposes—educational usage during school hours and recreational use for the community during nights and weekends. When green spaces are shared and cared for by the community, they tend to be more sustainable. Involving students, parents, teachers, and even local residents can make a big difference. Whether it's an eco-club, a parent-run garden committee, or simply a space like a community park, shared responsibility strengthened the sense of ownership and pride. Activities like tree-planting drives, garden festivals, and biodiversity mapping can also nurture a sense of ecological citizenship and create intergenerational learning. When children and their communities grow something together, it becomes more than a patch of green; it becomes a symbol of care, learning, and connection. This not only fortifies community-school connections but also elevates the school's prominence as a civic cornerstone.

Conclusion

Urban green areas possess the capacity to significantly improve the education and personal well-being of students in our ever-growing cities. Green spaces improve cognitive functions, foster pro-social behaviour, and facilitate experiential learning. Notwithstanding these advantages, the extensive implementation of green spaces in urban educational institutions is constrained by structural obstacles, including spatial limitations, insufficient funding, absence of institutional backing, and minimal prioritisation in policy frameworks.

There is a need for a close collaboration amongst the various stakeholders viz. urban planners, educational officials, school administrators, and community stakeholders. Policies need to be re-looked at so as to consider green spaces as an essential educational resource rather than a luxury. By synchronising educational frameworks

with sustainable urban design, cities may cultivate learning environments that are inclusive and resilient. Such approaches are especially crucial in the Indian setting, where cities are growing at a rapid pace and there is a huge problem of proper urban planning and facilities and services in urban areas are not up to the right standards.

By reinventing urban schools as green, inclusive environments, we advance not only educational outcomes but also the development of environmentally aware and socially responsible citizens. The incorporation of urban green spaces into education is not solely an aesthetic or environmental initiative; it is a calculated investment in the future of learning and urban sustainability. By creating learning settings integrated with nature, India can foster intellectual development and promote ecological awareness, thereby enhancing the resilience and equity of urban areas.

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Bridging Policy, Practice, and People: A Governance Perspective on Bengaluru's Waste Management

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Abstract

The research paper explores the complex dynamics of waste management in Bengaluru, emphasising the roles and challenges faced by various stakeholders. The study scrutinises the collaborative efforts of activists, resident welfare associations, non-governmental organisations, and government bodies in advancing sustainable waste management practices. The research comprehensively analyses stakeholders' interactions and their impact on policy and practice by employing a mixed-method approach and utilising both primary and secondary data. The primary objective is to offer actionable insights to develop effective waste management strategies. Furthermore, the research aims to stimulate community-driven initiatives to address the specific challenges Bengaluru faces in achieving sustainable waste management. This exploration contributes to the broader discourse on effective urban waste management strategies, underscoring the critical importance of stakeholders' involvement in promoting sustainable practices within urban settings.

Keywords

Urbanisation, Municipal waste management, Stakeholders' engagement, Decentralised waste management, Policies, Bruhat Bengaluru Mahanagara Palike (BBMP).

Introduction

The proportion of the population living in urban areas in India is 31.2 per cent, and the annual population growth rate in urban areas is 3.35 per cent as per 2011 census data. This population proportion in urban areas is increasing due to the disparity in income, job opportunities, and infrastructure between rural and urban areas (Kumar, Loungani,

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& Balasubramanian, 2021). This situation leads to a high population density in Indian cities and other developing countries (Joshi & Ahmed, 2016; Sridhar, 2023). This rapid urbanisation has promoted economic and social development while simultaneously creating many challenges to the city environment. For instance, the rising urbanisation leads to municipal waste-related issues, the number of landfills, reduced open spaces and water bodies, and causes ecological destruction in the city. Dutta and Jinsart (2020) discussed the status of waste generation and management in Indian megacities, indicating that urbanisation has strongly affected the increase in per capita municipal solid waste (MSW) generation (Table 1) (Dutta & Jinsart, 2020).

Table 1: Waste Generation in Six Indian Cities and their Population

Cities	MSW generation (in tonnes per day)					Population (in lakhs)				
	1971	1999	2004	2010	2015	1971	1999	2004	2010	2015
Mumbai	2039	5355	5320	6500	11000	8.24	11.57	12.12	12.40	13.43
Delhi	766	4000	5922	6800	8700	3.65	9.59	10.23	10.92	11.95
Chennai	508	3124	3036	4500	5000	1.59	4.24	4.43	4.62	4.96
Hyderabad	593	1556	2187	4200	4000	1.80	3.52	4.59	6.49	6.73
Kolkata	1574	3692	2653	3670	4000	3.15	4.54	4.55	4.50	4.75
Bangalore	529	2000	1669	3700	3700	1.65	4.27	5.54	8.03	8.39

Source: Dutta & Jinsart, 2020

If proper waste management is not in place, it can cause many health-related issues and increase the rate of environmental degradation (Vij, 2012). Municipal Solid Waste Management (MSWM) is essential for sustainable development in urban areas, including the collection, transportation, and proper waste treatment (Kumar, et al., 2009). Many Indian cities face waste management-related issues as the allotted budget for MSWM is mainly used for the collection and transportation of waste, and a meagre amount is used for treatment (Zhu, Asnani, Zurbrugg, Anapolsky, & Mani, 2008). This leads to an increase in urban waste, creating more black spots and landfills that contribute to health issues and environmental degradation.

The role of stakeholders' engagement is crucial to achieving a cleaner city and better participatory governance in waste management. Kerala is one of the few states that took adequate measures to address the issues related to waste by launching the 'Clean Kerala Mission' and '*Malinya Mukta Keralam*' campaigns, where the individual, self-help groups, citizen groups, NGOs and government institutions came together by spreading the waste management strategy of reduce, reuse, recycle and recover to achieve the goal of 'Clean Kerala.' Additionally, the Kerala Tourism Department

launched many campaigns, such as ‘Zero Waste Kerala’ and ‘Plastic Free Kerala,’ with the help of various stakeholders, to minimise waste generation and improve the state’s environmental quality.

Similarly, in Bengaluru, multiple stakeholders are engaged in various environmental activities to regulate waste management practices in the city. Their functional areas include participation, demonstration projects, monitoring, research, advocacy, environmental management, public discussion, cooperation, and network-building among other groups and governmental agencies towards sustainable waste management in the city. However, in recent times, their activities have broadened due to rapid urbanisation, migration from rural areas, and the concentration of economic activities in cities, adding various new challenges to waste management issues. Their activities now include public interest lobbying, participatory pressure groups, urban waste management-related politics, ecological modernisation, promoting environmental education, and capacity-building programmes towards a greener and cleaner city environment. The study analysed citizen-led efforts and stakeholders’ involvement in managing the MSW in the city, using primary and secondary data from various sources.

Study Area

As one of India’s and Asia’s fastest-growing cities with a population over one million, Bengaluru stands with other major metropolises like Mumbai, Seoul, and Tokyo.

Information technology and biotechnology (IT/BT) cluster, favourable climate, high quality of life, cosmopolitan culture, and accumulation of multinational corporations (MNCs) drive the city’s growth. The city is often called the ‘IT hub of Asia’ and the ‘Silicon Valley of India.’ Bengaluru contributes significantly to the national Gross Domestic Product (GDP) (Siddiqui, 2025). However, the city’s rapid urbanisation and industrial growth in the last few decades have led to problems like traffic congestion, inadequate water supply, MSWM issues, sanitation issues, public space encroachments, and environmental degradation (B.PAC, 2023). Hence, unplanned city development has increased conflict between citizens and local governing bodies (Paliath, 2024).

The study analysed satellite images from two different years, 1995 and 2021, using GIS software to understand the urban expansion of Bengaluru city (Figure 1). The five different classes have been created to understand the changes in land use and land cover in these two years, where green, blue, yellow, red, and brown colours indicate vegetation, water bodies, other, settlements, and barren land. Pasture lands and industrial areas have been considered in others (yellow colour). The analysis reveals that only settlement increased by 197.48 per cent, while vegetation, water bodies, others, and barren land declined by 65.62, 26.17, 19.87, and 53.86 per cent, respectively, in 2021 compared to 1995 (Table 2).

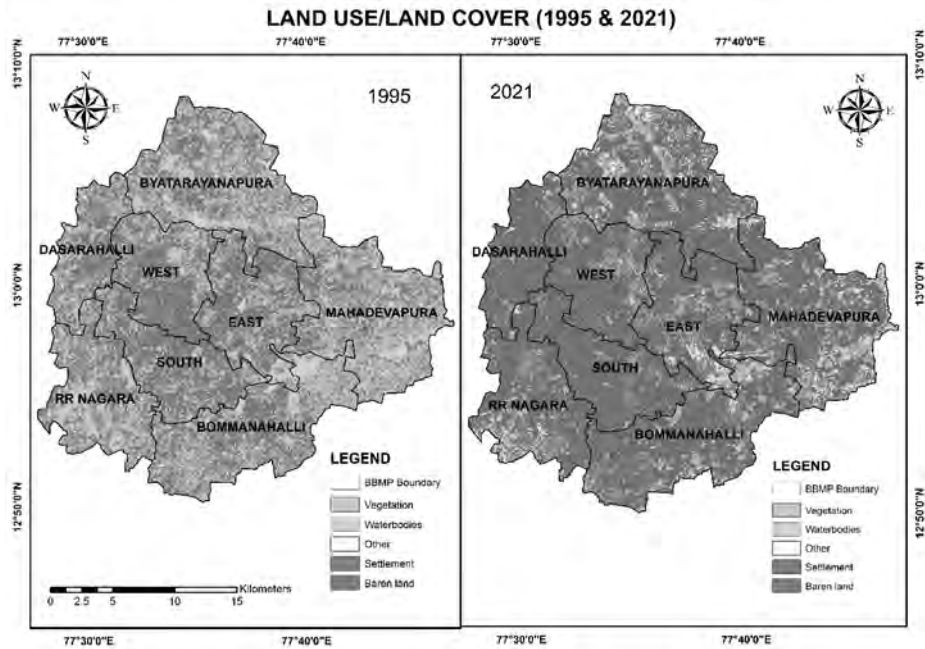


Figure 1: Land Use and Land Cover Map of Bengaluru City in the years 1995 and 2021

Source: Map prepared by the Author

Table 2: Land Use and Land Cover Changes of Bengaluru City in 1995 & 2021

Class Name	Area (Number of Image pixels)		Change (in percentage)	Remarks
	1995	2021		
Vegetation	162605	55900.8	65.62	Decrease
Water Bodies	126733	93560.4	26.17	Decrease
Others	53385.3	42776.8	19.87	Decrease
Settlement	134465	400011	197.48	Increase
Barren Land	213598	98545.7	53.86	Decrease

Source: Calculated by the author based on Figure 1

The concentration of the private sector and MNCs in the city helped to increase the city's GDP. During the period between 1993-2004, India's GDP growth rate per quarter was at 7.93 per cent, while at the same time, Bengaluru had marked a massive 20.76 per cent per quarter growth rate in GDP (Husain, 2019). This expansion is mainly attributable to the several MNCs, businesses, and software firms that have established their headquarters in the city, attracting many job seekers from across the nation and even the globe. As a result, it led to rapid urbanisation and large-scale migration into the city. This phenomenon of unplanned urbanisation has thus aggravated some of the significant environmental issues in the city.

The city faces land encroachment, industrial effluents causing water pollution, urban waste accumulation, floods during heavy rains, pollution of streams like Vrishabhavati and other lakes, and groundwater depletion and pollution. To improve the city environment, it has been observed that since Bengaluru is characterised by high civic activism led by various stakeholders, some of their initiatives have even efficiently influenced policy change, thus improving the city's urban governance. Nearly 200 groups, mainly non-governmental organisations (NGOs), civic groups, resident welfare associations (RWAs), and voluntary groups, are working on environmental concerns, and some of them have also been discussed in this present paper.

Data and Methodology

The study's research design used a mixed-method approach, and used primary and secondary data. The primary data was collected by conducting interviews and discussions with active citizen groups and organisations involved in the city's MSWM. The study focused only on those organisations whose objectives, functions, and approaches are linked with MSWM. The snowball technique was employed to identify citizen groups and NGOs, and to review the most active organisations, resulting in the identification of 46 such groups.

The Scenario of Municipal Waste Management in Bengaluru

According to the Karnataka Economic Survey 2021-22, the city generates 6,100 metric tonnes (MT) of municipal waste daily.¹ The Bruhat Bengaluru Mahanagara Palike (BBMP) is responsible for collecting, transporting, processing, and disposing of municipal waste from different originators. However, out of the total waste, only 30 per cent is collected directly by BBMP. Moreover, a contractor collects and transports 70 per cent of municipal waste. Several *pourakarmikas* (waste workers), drivers, and supervisors are engaged with BBMP to collect and manage municipal waste properly. BBMP has created several waste processing plants in different parts of the city to manage this vast amount of municipal solid waste. The role of these waste processing plants is to segregate the mixed waste and generate economic value from waste. After segregation, only the third category (non-recyclable) of waste can go to landfills.

For proper utilisation of municipal waste and to generate economic value from it, the city government has put several policies forward regarding energy creation from waste. For example, in March 2018, the BBMP signed a partnership agreement with a French company called 3Wayste (a waste management company) to set up a waste-to-energy plant (Reddy, 2019). Earlier, BBMP had set up a few waste processing plants to generate energy from waste. However, the power output (MW/Hour) was significantly less due to a lack of infrastructure and maintenance (*Urban News*, 2025).

As mentioned, waste management is outsourced to contractors who handle 70 per cent of the total municipal waste. Therefore, several management and waste processing issues must be monitored effectively. Some of the key points of the city's MSWM are highlighted in Table 3.

Table 3: Waste Management Status in the City of Bengaluru

S. No.	Waste Management Plan	Present Status
1	Waste segregation at the source	The segregation rate has not crossed 50 per cent; it is between 45 to 50 per cent.
2	Separate collection of sanitary waste	Not yet gained speed.
3	Door-to-door waste collection	The percentage of door-to-door waste collection is 87.46 as per BBMP data, 2019.
4	Installation of storage bins in the congested area	Installed in many places, but ideal places and distances need to be updated.
5	Dry waste collection centre (DWCC)	The city has 119 dry waste collection centres where people may drop off their dry waste.
6	Bulk Waste Generator	The city has 3219 bulk waste generators; out of the total, 20 per cent have the infrastructure for managing their waste.
7	Transportation of waste	The department has 5000 auto tippers and 600 compactors to collect and transport the waste.
8	Dedicated plant for construction and demolition waste	Tender prepared, and BBMP seeks private agency's participation.
9	Animal waste management	Technology finalised to create protein powder and tender is being considered.
10	Clean-up marshals	400 marshals are there in the city to identify, clean up the black spots, and monitor to maintain the cleanliness.
11	ShuchiMitras	Yet to be filled the total number of blocks in the BBMP
12	Use Refused Derived Fuel (RDF) and Compressed Natural Gas (CNG) from the waste processing plant.	Mavallipura waste processing was already considered in December 2020; other plants are yet to be included.
13	Waste to energy plant	BBMP tied with 3Wayste (a French company) to create energy from the waste processing plant and Chikkanagamangala waste processing plant already considered. However, other plants are yet to be included in this program.
14	Tender for Biomining of landfills	BBMP has decided to consider Mandur landfill for Biomining in September 2022, and other sites are yet to be included.

Source: Compiled by author based on fieldwork and other sources.

Without proper disposal, municipal waste pollutes all the vital elements of the living environment, like air, land, and water. Several BBMP's rules cover municipal waste management in the city. However, these policies are not carried out for various reasons, such as a significant amount of mixed waste, poor technology and innovation, lack of citizen awareness and improper implementation on the ground. In the BBMP waste management system, bio-methanation and waste-to-energy have been given significant importance (Table 4). However, according to the Open Government Data (OGD) Platform Smart Cities data on SWM, Bengaluru indicates that those plants with a waste processing capacity of less than five tonnes have been implemented².

Table 4: Capacity and Technology in Waste Processing Plants

S. No.	Plant Location	Capacity (T/PD)	Process Technology
1	Chikkanagamangala, Madiwala, Kannenahalli, Doddaballapur	500	Aerobic
2	Subbarayanapalya, Seegehalli, Banashankari 6th stage (Lingaderanahalli); Dasarahalli	200	Aerobic
3	MSGP (operated by a private agency)	500	Aerobic
4	KCDC, HSR Layout	70	Aerobic
5	Devanara Palya, Freedom Park Campus, Domlur, Jayanagar, Koramangala, KCDC Kudlu, Gunduthopu,	5	Bio-methanation
6	Koramangla 5th block, ward no-168,	4	Waste to Energy
7	Near ACP office Jayanagar, ward no-139 KR Market, Yellahanka, ward no 112 under Domlur flyover	5	Waste to Energy
8	The small waste processing plant at the ward level	1-2	Separation

Source: Compiled by the author based on data from the Open Government Data (OGD) Platform Smart Cities data, and discussions with BBMP officials

A large-capacity plant uses the aerobic method to process municipal waste. In this method, the microorganisms break down organic waste components and decompose. Bio-methanation and waste-to-energy methods are used in plants that produce less than five tonnes daily. It is not implemented in large-capacity plants due to a lack of infrastructure and technology. The separation method occurs below two tonnes daily at the ward-level waste processing plant.

BBMP has various waste management policies, but they are not implemented effectively. One study was based on a primary survey by the Centre for Sustainable Development (CSD) in 2012 to calculate the Environmental Report Card of Bengaluru. They found that 64 per cent of the respondents were unsatisfied with the door-to-door waste collection (Table 5).³

Table 5: Satisfaction Level of the Residents Regarding Waste Collection from Door-to-Door

Satisfaction Level	Zone					Total
	East	West	South	BMP area	Added area	
Highly satisfied	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Satisfied	3.5%	48.4%	50.0%	28.5%	6.4%	15.7%
Neutral	40.4%	19.4%	27.8%	30.6%	13.6%	20.8%
Dissatisfied	43.9%	29.0%	16.7%	33.1%	60.0%	48.7%
Highly dissatisfied	12.3%	3.2%	5.6%	7.8%	20.0%	14.9%

Source: Environment Report Card of Bangalore, CSD, 2012.

Another study by the Bengaluru Political Action Committee examined citizen awareness and participation, the BBMP election, satisfaction levels of civic amenities, and governance based on citizen perception, indicating a poor ranking of services. They collected data from 8405 responses from February to June 2022 and found that 57 per cent of the respondents were unhappy with overall governance services. Despite the city government's efforts to manage municipal waste, several initiatives organised by citizen groups, RWAs, and organisations have struggled to be streamlined, as discussed in the following section.

Government Institutions on Municipal Waste Management in Bengaluru

The Solid Waste Management Department under BBMP is responsible for delivering proper waste management facilities to the citizens of Bengaluru. The department has collected all types of waste from different sources, transporting and disposing of it. The department follows various strategies and methods to create resources from waste. Also, the department is intensely focused on segregating waste at the source and follows a decentralised waste management system. To properly manage waste and reduce environmental problems, the department provides services such as,

- Door-to-door collection of municipal waste from households and small commercial establishments
- Street Sweeping
- Encouraging and supporting in-situ waste management techniques
- Linking of bulk generators with certified vendors
- Processing of waste to generate maximum value
- Management of sanitary landfill
- Enforcing segregation
- Enabling market linkages for processing outputs
- Ensuring a clean city

The department has taken several initiatives, such as the establishment of dry waste collection centres (DWCCs), Bio-methanation, the organic waste converter (OWC), coconut and sugarcane waste processing units, and a zone-wise waste processing yard to manage the waste as well as create resources from waste. In addition, to create awareness and strengthen waste management practices, the department has adopted many programmes, like '*Kasa Vilavaari Sevdararu*,'⁴ '*Shuchi Mitra*,'⁵ '*Kartavya Dry Waste Collection Centre*,'⁶ and Clean Bengaluru.

In 2015-16, the city generated 3486.55 metric tonnes of municipal waste per day, and in 2021-22, it increased to 6100 metric tonnes per day, as per Karnataka Economic Survey data, 2021-22 (Figure 2). This total amount of waste includes wet waste, dry waste, domestic hazardous waste, sanitary waste, and mixed waste. As waste generation increases over the years, the annual expenditure for municipal waste management also increases. For example, in 2015-16, the total spending was Rs 5048.34 million, which increased to Rs 16220.00 million in 2021-22. The total expenditure includes treatment, disposal, conservancy, equipment purchase, and maintenance costs (Figure 2).

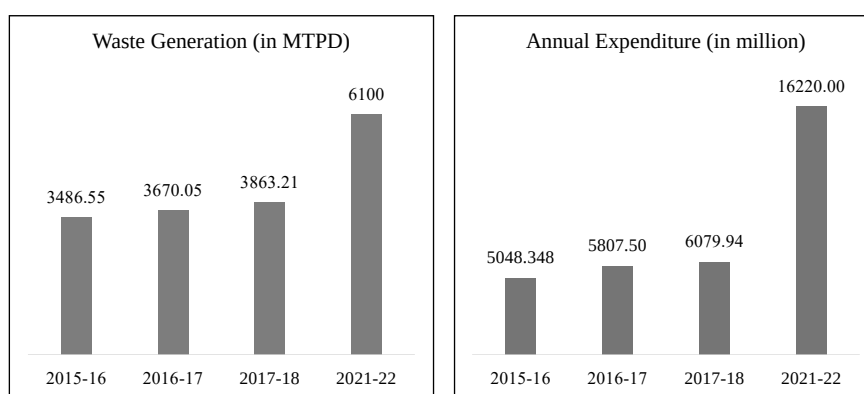


Figure 2: Waste Generation and Annual Expenditure on MSWM

Source: BBMP's SWM data, 2019 and Karnataka Economic Survey 2022-22

Citizen Groups and Organisations in Managing Municipal Waste in Bengaluru

In the city, various community-based organisations and NGOs have engaged with BBMP to improve the disposal of MSWM and community composting and recycling activities. In the proper management of the city's MSW, various initiatives have been taken by civic groups as well as local governments, ranging from awareness creation, segregation at source, collection and transport, and disposal of waste. Some prominent organisations and their group activities are discussed in detail in the following section.

Citizens' Voluntary Initiative for the City of Bengaluru (CIVIC Bengaluru)

CIVIC was started in 1991 to work on Solid Waste Management (SWM) in the city of Bengaluru, and in 1994 it was registered as a Trust. After that, the organisation

has been working on the 74th Constitutional Amendment to bring transparency and accountability to the local government. Later, from 1999 to 2000, the Trust did a project in Jayanagar, started door-to-door garbage collection, and tried to build awareness among the residents about the segregation of waste at its source. That project had a fixed time frame, and after completing it, they submitted the report to the BBMP's officials. Later, CIVIC provided an integrated plan to BBMP for SWM, criticising the issued contracts and tenders and advocating activities. In this regard, CIVIC is working on issues related to Ward Committees (WCs). The group argues that the WCs should be strengthened and they should be made responsible for all local affairs, including SWM. During the discussion, a trustee from CIVIC mentioned that:

“The formation of WCs is present in the solid waste management rule, but the local government is not ready to constitute it because Members of the Legislative Assembly (MLAs) and Councillors do not want to give the power to the people.”

The respondents opined that if the WC constituted every ward, people would participate and intervene in the governance system. The group has done detailed advocacy-related work on the 74th constitutional amendment and solid waste management rules and submitted them to the government. The government accepted many suggestions to strengthen WC's function and transparency and promised that an 'Area Sabha' would be formed for every ward to better community engagement and solve the problems locally.

CIVIC did a state-level consultation and suggested that there should be a sub-committee at the ward level to look after garbage, roads, and sewerage drains. It helps to create a platform where a maximum number of people can participate in local affairs and create better awareness. In 2017, CIVIC filed a complaint in the High Court of Karnataka as the government took no initiative to form the WC. In 2017, the court ordered the government to set up the constitution of WCs and identify a place locally to set up the wet-waste processing unit. Furthermore, the court said that by December 2017, all the WCs should be formed. Further, they should meet and prepare an action plan for processing garbage locally and give the report to the court. In August 2019, BBMP finalised bye-laws for the SWM and said that WCs would be responsible for garbage management and creating awareness at the local level.

Saahas

Saahas is an NGO working in the field of waste management. They believe that if waste is managed at source, it becomes a resource. It was established in 2001, and it has been helping build communities across rural and urban India that manage the waste at source by reducing, reusing, and recycling and achieving a significant amount of resource recovery. The founder of this organisation is a former journalist who promotes waste management practices in alignment with the Progressive Municipal Solid Waste (Management and Handling) Rules 2000. It is headquartered in Bengaluru, and its other

operational areas are Gurugram, Surat, Chennai, Hubballi, and Bellari. Their principle primarily focuses on segregation at source and decentralised waste management. In addition, the organisation caters to creative ideas for resource creation and advocacy for a sustainable ecosystem of solid waste management, including stakeholders from the public and private sectors. Some of the activities and programmes led by this organisation are discussed in the following section.

Kasa Rasa (Community Waste Processing Centres)

Kasa Rasa is a Public Private Partnership (PPP) that built community waste processing facilities. *Saahas* is a pioneer in establishing these centres, where the government provides the land, corporations fund the infrastructure, and a non-profit group establishes the centre. The *Kasa Rasa* facilities have a decentralised waste management approach, in which garbage is managed locally, and resources are extracted from it. Additionally, this strategy creates employment opportunities in the field of waste management. The *Kasa Rasa* centres have been established in Bengaluru, Ejipura, Koramangala, and Doddanekundi with assistance from *Saahas*. The *Kasa Rasa* centres employ 4-5 people and manage 2-3 metric tonnes of garbage daily. The community's waste segregation is carried out here. The dry waste is then divided into several recycling categories and delivered to the proper recycling locations, while the wet garbage is composted in tanks. Finally, the rejected dry waste is delivered to cement companies for further processing. Additionally, it provided the citizens with a facility to dump their dry garbage and e-waste at these locations.

Beyond the Broom (Green Waste Management)

The programme aims to look beyond street sweeping and take a more comprehensive approach to garbage management. Residents are made aware of proper waste management procedures and ways by adopting which the people and communities can help reduce the amount of garbage disposed off in landfills as part of the programme.

Parivartana Hejje (Steps of Change)

The organisation intensively supported the decentralised approach to waste management. Dry waste collection centres (DWCCs) have been established in this scheme, where the dry waste gathered from the neighbourhood is sorted. The centre is operated by an entrepreneur who sells dry garbage with a high market value and sends the non-recyclable waste of lower quality to the closest cement factory.

AlagKaro, Har Din Teen Bin (Source segregation by using three bins every day)

The *AlagKaro, Har Din Teen Bin* programme aims to improve municipal solid waste management. The project's goals are to establish and maintain source segregation and build the capacity of waste collectors to ensure high recycling rates. It is a joint effort of the government, the corporate sector, and civil society representatives. The Swachh Bharat Mission is actively pushing source segregation, and this initiative's goals are

aligned with it. The programme's coverage includes business enterprises and schools as well. Throughout the programme, open forums and workshops with participation from all parties are organised to raise awareness and encourage direct engagement with the citizens.

bE-Responsible (E-Waste Awareness and Collection)

India is the fifth-largest producer of e-waste, which has emerged as the waste stream with the fastest growth over the past few years. Bengaluru is the IT hub and the country's third-largest e-waste producer. If not treated appropriately, the waste could harm human health and the environment. The 'bE-Responsible' initiative seeks to raise awareness of the risks associated with e-waste among individuals, families, schools, and other organisations and make it easier to collect non-bulk e-waste. *Sahaas* has set up public drop boxes in various locations under this programme, enabling individuals to drop off their e-waste conveniently. Additionally, across the city, they operate many recycling units and dry waste collection centres where people can put both dry waste and e-waste.

Discussion

Urban waste management is a significant problem in the city, primarily due to mixed waste generation and inadequate infrastructure. One of the BBMP officials said that in the city, no ward has reached 70 per cent segregation of waste at source, which is why a significant amount of waste is going to landfills compared to processing plants (Ramani, 2020). As a result, the number of illegal dumpsites is growing in the city, and more than sixty illegal dumpsites have been identified (Kumar N., 2021). While the government closes these dumpsites, another emerges elsewhere, creating many problems for the residents. To enhance the strength of waste management practices in the city, BBMP decided in July 2017 to reduce the dependence on private contractors and is willing to take control of collecting and managing the city's waste (Dutta S., 2017). However, the contract system in the waste management system has not been very effective and has also created significant issues in the payment of *pourakarmikas* and municipal workers. This issue is now resolved with the online payment to the beneficiary's account number.

Additionally, this initiative will encourage the residents to participate in waste management practices in the city, which will gear up waste segregation at the source and reduce the amount of mixed waste generation. In addition, the city government is promoting decentralised waste management practices where the ward committee can handle, segregate and manage their surrounding waste. Singh did one study in 2015, arguing that the door to the collection, waste segregation, and decentralisation of waste management has played a significant role in the sustainable waste management system (Singh, 2015). Also, the ward committee helps to enhance the efficiency and effectiveness of the actual waste management in the city (Shah & Ghosh, 2015).

The citizen groups and BBMP have organised various campaigns and training programmes to manage the MSW and improve the city environment. These programmes include '*Not in My Backyard*,' '*My Waste My Responsibility*,' and '*Kasa Muktha Bengaluru*.' For example, in the last few years, various civic groups have organised several campaigns and public discussions with the help of the BBMP to ban plastic. In this campaign and training programme, different people, such as traders, street vendors, and restaurant owners, have participated and shared their knowledge of waste management practices. Additionally, eco-clubs have been set up in schools and colleges so that students can encourage better waste management.

Environmental Support Group, an NGO, has done much work on environmental rights, social justice, and improving the health and social dignity of *Pourakarmikas*. For example, in the mid-2000s, a group from Mavallipura asked the Environmental Support Group (ESG) to help protest against a landfill that had polluted the surrounding soil, water, air, and agricultural fields. ESG was surveyed for groundwater analysis and found that toxin leachate from landfills had reduced the groundwater quality.⁷ As a result, the surrounding residents filed Public Interest Litigation (PIL) with the help of ESG for environmental rights concerning waste management. Also, the group organised various training programmes for rag pickers and pourakarmikas and discussed the segregation and recycling of waste.

Solid Waste Management Round Table (SWMRT) is one of the pioneer civic groups that educates teachers, staff, and students about trashonomics and the best strategy for waste management. More than 200 groups in the city actively engage with municipal waste management and on social media to discuss the current issues, transparency, and accountability in BBMP's waste management system (Kalra & Manasi, 2020).

Waste segregation is one of the most critical tasks in municipal waste management, and '2bin1bag' by SWMRT is one of the most successful initiative programmes. In this programme, organic and rejected waste are collected in green and red bins, while recyclable waste is collected in a bag. Due to unplanned urban expansion, waste management is the central issue in the city. Due to this, various groups and individuals protested and filed PIL to improve waste management practices. Also, the city generates a majority of mixed waste, and the segregation of waste is a significant concern in waste management (Kalra & Manasi, 2020).

To better waste management, in 2015, the Karnataka High Court passed an order for citizens to adopt the idea of a '2bin1 bag' to segregate the waste at the source.⁸ As per the SWMRT report, more than two lakh households adopted this initiative, and many civic groups have taken a positive initiative to implement it in the city. Another NGO, Hasiridala, plays a vital role in managing the waste from bulk generators such as apartment complexes, hotels, marriage halls, and hospitals. In addition, to secure and improve social status, the group works with BBMP to provide identity cards and improve the health condition of waste workers and rag pickers. They say more than 10,000 waste workers have received their occupational identity cards in Karnataka.

The processing of MSW is another primary job in the urban waste management system. The BBMP has eight waste processing units and some bio-methenisation units. Many civic groups favour decentralising the waste processing system at the ward level and organic waste composting at the household level to manage MSW properly. Regarding the *'Zero Waste Initiative'*, green weddings, roof gardening, and home composting are gaining attention in citizens' perceptions.

'Compost Santhe' is a decentralised waste processing initiative encouraging citizens to manage household garbage. Moreover, the compost from organic garbage helps with roof gardening and biogas generation. The BBMP has planned to install *Compost Santhe* units in all 198 wards (now 243 wards), and from these units, the farmer can collect compost for their agricultural production. In the city, many municipal councillors and MLAs have come forward to implement this in their locality. Furthermore, this initiative has drawn attention to social media and newspapers, where people started a campaign called *"Our Waste, Our Responsibility"* to promote the *Compost Santhe* initiative.

Another group called Daily Dump is well known for home composting and producing eco-friendly products. They organised various training programmes on how to create wealth from waste, job creation in the field of waste management, and research on waste composting. They provide facilities like leaf composting, flower composting in the temple during religious festivals, and home organic composting units. They play a significant role in creating awareness about vermicompost, waste segregation according to its nature, and how to reduce the burden on the city's waste management system.

Communities play a significant role in the segregation and composting of waste, leading to several places being demarcated as zero-waste zones in Bengaluru. LIC Colony in Jayanagar and Sadashivnagar manage their waste by using community composting with the help of Daily Dump and, in the process, have minimised their waste and have found an alternative for creating resources from waste (Navaya, 2011). The Green Diamond Project, headed by Shalini Khanna Charles and with the help of some active volunteers, also collects segregated waste from offices and apartments and has earned twelve thousand rupees by managing and collecting three tons of dry waste. They often incentivise people by offering free bins, organising carnivals, and planning to install a biogas plant to process organic waste. In November 2008, the Brigade Millennium Mayflower Resident Association launched the 'Blue Drum Campaign' in J.P. Nagar, the 7th phase, to collect dry waste such as paper, cardboard, glass, and other waste. They also organised door-to-door campaigns and educated the residents and maids about waste segregation, recycling waste, and distributing segregation guidelines.

Similarly, the residents of Sadashivnagar launched a programme called *'Sada Zero'* for a zero-waste initiative surrounding their locality with the help of BBMP contract waste workers. They segregated the dry waste from the wet waste and categorised it

into plastic, e-waste, and paper. They formed a volunteer group that helped monitor and check the segregation status of houses, collected dry waste, categorised waste according to its quality, and sold it to local vendors. They share the margin with the BBMP contract workers, which has a positive impact on their livelihood, wages, and maintaining the cleanliness of that area (Reporter, 2021). A gated community of around 340 plots called Ferns Paradise started to manage its waste in 2009 by collecting door-to-door collection and segregating waste with the support of Saahas and Daily Dump. The community segregated the waste into dry, wet, sanitary, and rejected. They collect dry and sanitary waste twice a week through door-to-door collection. Wet waste directly goes for home composting used for gardening, and reject waste is picked up daily along with sanitary waste.

In the same way, the residents of J.P Nagar have taken the initiative to segregate the waste with the help of a group run by women from ward number 177, called WOW (Women of Wisdom), Waste Wise Trust (an NGO) and *pourakarmikas* and converted BBMP's ward office area into a segregation centre. They segregate waste according to quality and earn money by selling dry waste to the local paper mill and e-waste to Samarthanam (an NGO). Moreover, to manage organic waste, many individual and community groups started organic terrace gardening, composting organic waste, and using it to grow vegetables. For example, the Resident of J. P Nagar-Jayanagar organised an event named '*Oota from your Thota*' (food from your garden) in August 2021 to discuss organic terrace gardening and wet waste composting. Experts such as Dr Vishwanath and Vinita (organic terrace gardening specialist), Daily Dump, and students from BM English School and 600 people participated and shared their knowledge (Meera, 2018).

Lastly, human behaviour and people's mindset play a vital role in the waste management system in every city. For example, during the course of a discussion, one respondent from Saahas, an NGO, mentioned that in cities, most citizens think they are paying their taxes to the government and that it is their responsibility to manage the waste. On the other hand, a lack of knowledge about the management of waste, the growing population, and people's consumption habits increase waste management problems in the city. Additionally, the composting method needs adequate space to meet its goal. However, it is becoming a cesspool of disease by attracting mosquitoes, rats, and dogs, thereby straying from its goals. Finally, in urban areas, most people do not have sufficient space to manage their waste, which is also detrimental to waste management.

It was found that cultural beliefs significantly impact the city's waste management process. For example, a respondent from CIVIC mentioned that people believe that if they keep garbage in their houses, then *Rahu* (the North Node) and *Ketu* (the South Node) (shadow planets considered inauspicious) will come at night. This belief is another reason why they throw their garbage wherever they find space, which has increased the number of black spots in the city.

Conclusion

In summary, this study highlights the crucial role of stakeholders in shaping waste management practices in Bengaluru. With the city facing various challenges, such as mixed waste generation and inadequate infrastructure, the study stresses the need for collaborative efforts from government bodies, citizen groups, NGOs, and communities to establish sustainable solutions. The BBMP's initiatives to take greater control over waste management underline the importance of active stakeholder engagement. The success of behavioural change campaigns like '2bin1bag' demonstrates the positive impact of stakeholders in promoting waste segregation at the source. Community-driven models, such as those in Farns Paradise and LIC Colony, showcase the power of collective efforts. However, cultural beliefs that influence disposal habits pose a challenge. The research highlights the significance of stakeholders' continual collaboration, education, and awareness-building to address these issues and promote collective responsibility for sustainable waste management in Bengaluru. Ultimately, the findings underscore the critical role of stakeholders in bridging gaps and charting a course towards a cleaner, more sustainable urban future.

Declaration

The Author has no point of conflict of interest.

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- 3 *Bengaluru Citizen Perception Survey*. (2022). Bengaluru: Bangalore Political Action Committee.
- 4 KasaVilavaari Sevdararu is a programme launched by BBMP in 2013 to manage waste from bulk generators. This programme promotes in-situ waste management, connects the bulk generator with BBMP empanelled vendors, forms rules and norms for bulk waste management, and facilitates licensing to the service provider.
- 5 Shuchi Mitra is a citizen participation programme where civic-minded citizens take part voluntarily to clean their locality and monitor the status of civic service delivery. Additionally, it engages with technology support, training.
- 6 These centres are a unique initiative in Bengaluru and it is for the first time such a concept has been established in a metro area. The name *Kartavya* signifies duty, reminding the public of their responsibility towards recycling the waste they generate.
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Understanding Vulnerable Road User Plight through Crash Data: Insights from Amritsar City

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Abstract

Amritsar is one of the most celebrated religious cities in the world where millions of devotees and tourists not only come to pay their respects but also to explore the culture that was infused by the Gurus some 550 years ago. It becomes important to know and assess the condition of Vulnerable Road Users (VRUs) within the City itself and upgrade the infrastructure as per the scientific and data-driven evaluation. This paper analyses 2018–2022 road accident data from Amritsar City to assess the vulnerability of two-wheelers, pedestrians, and cyclists (VRUs). VRUs accounted for a critical 80 per cent of total victims, dominated by two-wheeler riders (49%) and pedestrians (24%). While the 2020 pandemic reduced crashes, the post-pandemic phase saw a 130 per cent surge in serious injuries caused by two-wheelers by 2022. The pedestrian risk is exacerbated by hit-and-run incidents, which comprise 74 per cent of crashes and 72 per cent of fatalities in this category. These results underscore a systemic governance and infrastructure failure, necessitating urgent modal prioritisation, physical segregation, and targeted enforcement to mitigate catastrophic risk (Census of India, 2011).

Keywords

Road Safety, Pedestrian Safety, Vulnerable Road Users, Blackspots, Road Crashes.

Introduction and Contextualisation of Amritsar's Urban Mobility

Geographic and Socio-Economic Profile of Amritsar

Amritsar stands as a pivotal cultural and economic nucleus within Punjab, strategically located on the fertile Upper Bari Doab plain. Founded in the late 16th Century, the city, which derived its name from the surrounding 'Amrit Sarovar' (Pool of Nectar), serves as the spiritual home of Sikhism. As of the 2011 Census of India, the Municipal

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Corporation housed approximately 1.18 million people, positioning it as Punjab's second-largest urban centre. Its diversified economy, which relies heavily on tourism, trade, textiles, and services, coupled with its placement along the Grand Trunk Road (NH-3) and proximity to the India–Pakistan border, solidifies its role as a regional growth hub.

Urban Structure and Transport

Infrastructure Challenges

The city's settlement pattern is defined by a dichotomy between its medieval urban core and planned modern extensions. The original walled city, characterised by narrow streets and high-density mixed-use areas, contrasts sharply with British-era interventions like Mall Road and post-independence developments such as Ranjit Avenue. This urban duality results in significant traffic conflict zones. The road network operates on a radial-concentric pattern, expanding outward from the congested old city. Key radial arteries connect to national highways (NH-3, NH-54, NH-354) (Amritsar City Development Plan, 2011).

The structural configuration of the road network significantly contributes to crash exposure for vulnerable groups. Congestion is managed in the core by slowing speeds, but peripheral and arterial roads facilitate higher vehicular speeds.

Frequently transition between these low-speed and high-speed environments, maximising their risk exposure at points where traffic dynamics abruptly change or where mandated segregation measures cease to exist. Persistent issues such as narrow carriageways, encroachments, and unregulated traffic flows in the old city are explicitly cited as factors contributing to congestion and elevated accident risk. Furthermore, the land use structure, with roughly 44 per cent residential and 10 per cent commercial development, implies that critical mixed-use areas often function as high-volume thoroughfares, lacking essential traffic calming infrastructure to protect local residents and non-motorised users (World Health Organisation, 2018).

Macro Analysis of Road Accident Trends (2018–2022)

Temporal Fluctuations and COVID-19 Impact

The five-year analysis of road accident data reveals significant temporal fluctuations influenced by mobility patterns and the decisive impact of the COVID-19 pandemic.

In the pre-pandemic period (2018–2019), Amritsar experienced a substantial deterioration in road safety performance. Total reported accidents increased by approximately 9.8 per cent, rising from 123 cases in 2018 to 135 in 2019. Fatalities tracked this surge, climbing sharply from 72 to 90 over the same period. The fatality ratio peaked at about 67 per cent of total accident cases in 2019, reflecting heightened crash severity primarily driven by increased vehicular movement, prevailing mixed traffic conditions, and inadequate enforcement of safety regulations (Punjab Traffic Police, 2022).

The year 2020 marked a temporary reversal of this trend. Due to the nationwide lockdown and severe mobility restrictions, the city recorded a significant decline in accident frequency, dropping 27 per cent (from 135 to 99) compared to 2019. Fatalities also decreased by 29 per cent, falling from 90 to 64. This decline directly demonstrates the causal relationship between reduced traffic exposure and improved safety statistics (Figures 1 and 2).

The downward trend proved unsustainable as mobility normalised in the post-pandemic phase (2021–2022). Accidents rose again in 2022 to 114, an approximate 16 per cent increase compared to 2021. Despite this, fatalities rose only modestly to 66, resulting in a fatality ratio of roughly 58 per cent in 2022—a noticeable reduction compared to the 2019 peak.

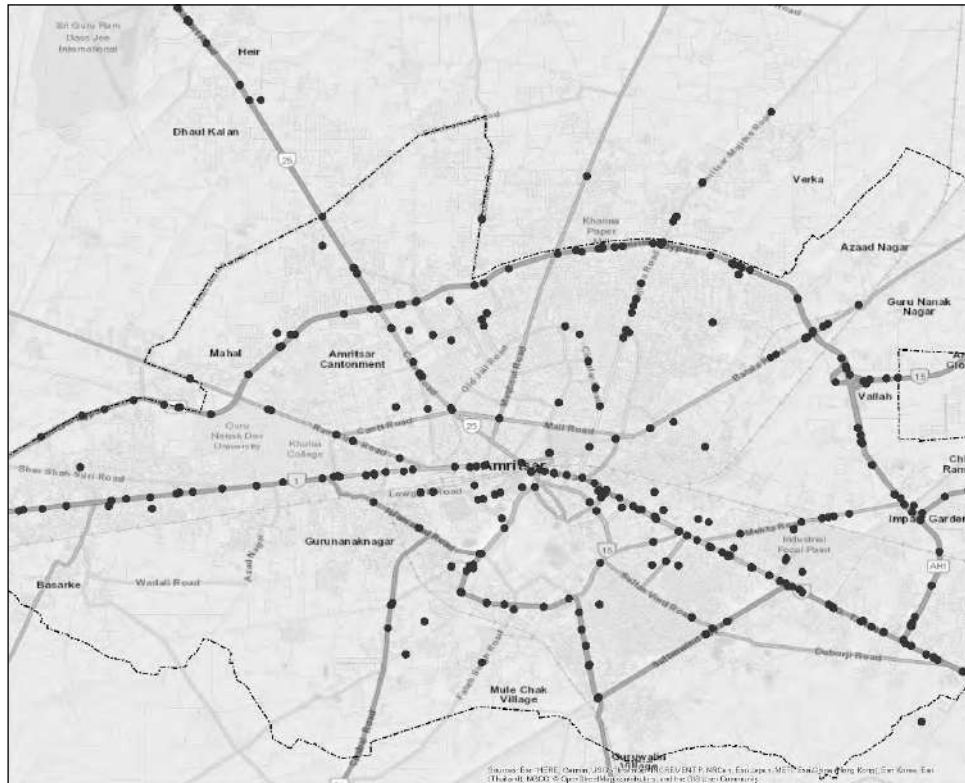


Figure 3: GIS Map Showing Fatal Road Crashes in Amritsar (2018–2022)

Source: Created by the author using QGIS/ArcGIS. Raw crash coordinates were decoded from e-FIR records provided by local police authorities.

However, analysis of the VRU-specific data (detailed in subsequent sections) indicates that this marginal improvement in the overall fatality ratio may be misleading. While fewer people died immediately at the crash scene, the concurrent data reveals a sharp increase in serious non-fatal injuries, particularly among two-wheeler riders. This suggests that post-crash medical response might be improving outcomes (reducing mortality), but the high rate of severe trauma persists because the fundamental risks—speeding and mixed traffic dynamics—remain unmitigated. The challenge has shifted from fatality reduction to comprehensive crash prevention. The Map in Figure 3 highlights the fatalities among the Vulnerable Road Users (VRUs).

The overall trend data is summarised in Table 1.

Table 1: Overall Accident Trends and Severity Profile in Amritsar (2018–2022)

Year	Total Accidents	Total Fatalities	Fatality Ratio (%)	Comparison to Pre-COVID Peak (2019)
2018	123	72	58.5%	Base Year
2019	135	90	66.7%	(Highest Peak)
2020	99	64	64.6%	27% Reduction in Accidents
2021	98	64	65.3%	Stable Low
2022	114	66	57.9%	16% Rise from 2021

Source: Traffic safety and enforcement statistics: Annual Report 2022. Government of Punjab.

Dominance of Vulnerable Road Users (VRUs)

The most striking finding of the five-year analysis is the overwhelming dominance of Vulnerable Road Users (VRUs) in the casualty profile. VRUs—defined as two-wheeler riders, pedestrians, and cyclists—collectively account for approximately 80 per cent of total victims in Amritsar’s road traffic crashes.

The victim distribution highlights systemic deficiencies in urban design:

- **Two-Wheelers:** Account for 49 per cent of all victims, representing the largest single category, consistent with their status as the majority of registered private vehicles in Amritsar.
- **Pedestrians:** Form the second-largest group at 24 per cent.
- **Cyclists:** Account for 7 per cent of victims.

This 80 per cent VRU victimisation rate fundamentally indicates a systemic failure in urban planning and traffic management that prioritises vehicular throughput over human safety. The transport system is structurally biased towards motorised four-wheelers, despite VRUs representing the majority of travel modes and the bulk of crash risk exposure (Government of India, Ministry of Road Transport and Highways, 2022). In a city where two-wheelers are the most common private vehicles, the absence of dedicated lanes and robust enforcement of speed and helmet regulations means the predominant mode of transport is concurrently the most unprotected and hazardous.

The victim profile in Amritsar states that, among all the road users, the top 3 vulnerable road users are two-wheelers, pedestrians and cyclists as can be seen from the pie chart (See the pie chart in Figure 4).

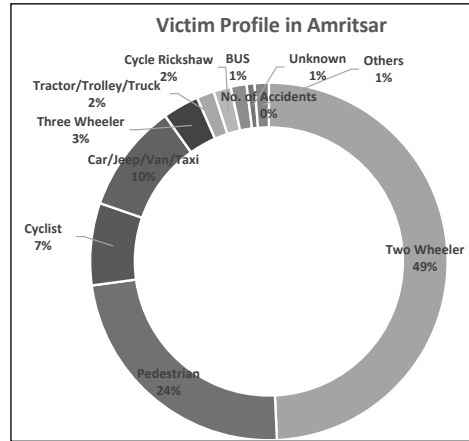


Figure 4: Victim Profile in Amritsar

Source: Pie chart created by the author using data decoded from e-FIR crash records provided by Amritsar Traffic Police.

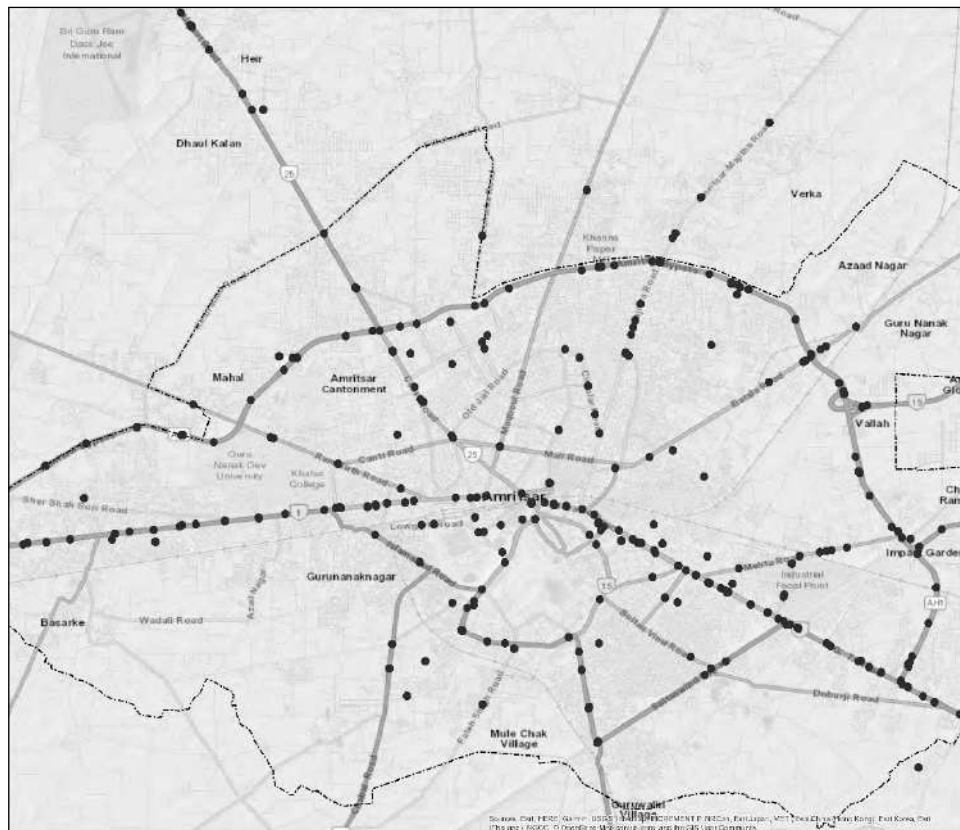


Figure 5: GIS Map Showing Fatalities among Vulnerable Road Users in Amritsar (2018-2022)

Source: Created by the author using QGIS/ArcGIS. Raw crash coordinates were decoded from e-FIR records provided by local police authorities.

Two-Wheeler Rider Risk and Resurgent Severity

Prevalence, Exposure, and Crash Severity

Two-wheeler users are unequivocally the most vulnerable group in Amritsar, accounting for 49 per cent of all road crash victims. This high representation reflects their ubiquitous presence in the city's mixed-traffic environment. Across the five-year study period, two-wheeler crash outcomes were severely high, with fatalities consistently constituting 30–40 per cent of the total two-wheeler victims (Figure 6).

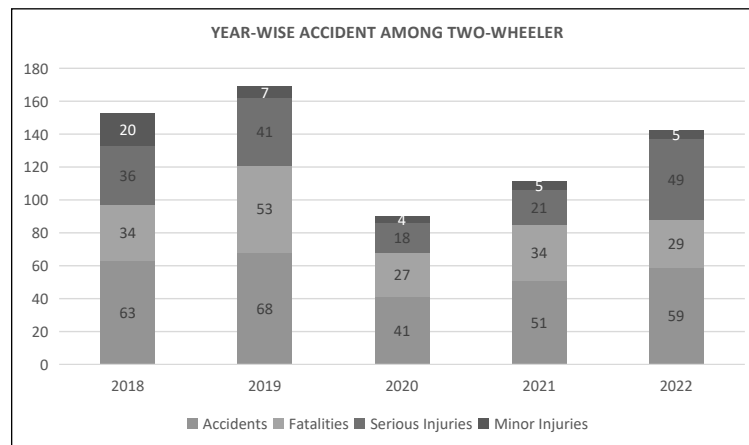


Figure 6: Year-wise number of accidents among two-wheelers

Source: Stacked Column chart created by the author using data decoded from e-FIR crash records provided by Amritsar Traffic Police.

The vulnerability of this group was profoundly highlighted by the post-pandemic data. In 2022, while the overall number of two-wheeler accidents (59) remained slightly below the 2019 peak (68), serious injury cases rose sharply by over 130 per cent compared to the 2020 lockdown year. This rapid increase in severe non-fatal trauma suggests that as mobility normalised (people's movement and travel patterns returned to typical, pre-pandemic levels after the lockdown period), the high-speed dynamics facilitated by clearer roads resulted in more forceful impacts. The risk of sustaining a major, life-altering injury returned to, or even surpassed, pre-pandemic levels, underscoring the necessity of targeted interventions focusing on crash prevention rather than solely relying on post-crash medical improvements to suppress fatality rates.

Crash Mechanics and Conflict Vehicle Analysis

Analysis of crash mechanics reveals clear conflict patterns for two-wheeler riders. Cars, jeeps, vans, and taxis are the predominant impacting vehicles, involved in 38 per cent of all recorded two-wheeler crashes. This demonstrates the frequent and dangerous interaction between the city's highest-volume vehicle classes in environments lacking physical segregation (Kumar et al., 2021) (Figure 7).

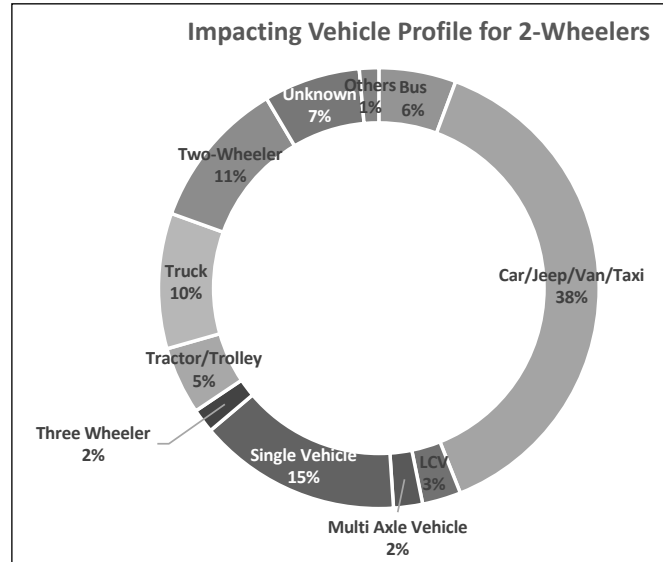


Figure 7: Impacting Vehicle Profile for two-wheelers

Source: Pie chart created by the author using data decoded from e-FIR crash records provided by Amritsar Traffic Police.

A significant secondary concern is the high proportion of single-vehicle accidents, which form the second-largest category at 15 per cent. Such incidents are self-fall cases that suggest a causal link between aggressive riding behaviour (speeding, loss of balance) and inadequate road infrastructure (surface defects, sudden changes in road geometry, lack of maintenance). When internal failures like self-falls account for such a high portion of incidents, it mandates a dual safety approach: rigorous enforcement of speed and lane discipline alongside a focused review of primary riding routes for road surface integrity.

Furthermore, heavy vehicles contribute substantially to crash severity. Trucks (10%) and tractors/trolleys (5%) collectively contribute 15 per cent of impacting incidents. Collisions involving these larger, heavier vehicles are disproportionately lethal or severely injurious due to the massive difference in mass and resulting kinetic energy transfer, especially concerning on arterial roads where speed limits are higher.

Pedestrian Safety Crisis and Hit-and-Run Systemic Failure

Extreme Vulnerability and Infrastructure Deficits

Pedestrians constitute the second-largest victim category, accounting for 24 per cent of all casualties. This persistent, high casualty rate is direct proof of serious deficiencies in urban infrastructure, including the absence of safe, dedicated crossings, adequate footpaths, and appropriate signalised intersections (Mehta et al., 2022).

The severity of pedestrian crashes is exceptionally high. In 2018, the fatality rate for pedestrian crashes reached nearly 78 per cent of total cases (25 fatalities out of 32 incidents). Even during the 2020 pandemic lockdown, when exposure was lower, fatalities increased (22 deaths from 28 incidents). This suggests that the reduced traffic volume allowed motorised vehicles to achieve higher speeds on urban roads, dramatically intensifying crash severity upon impact.

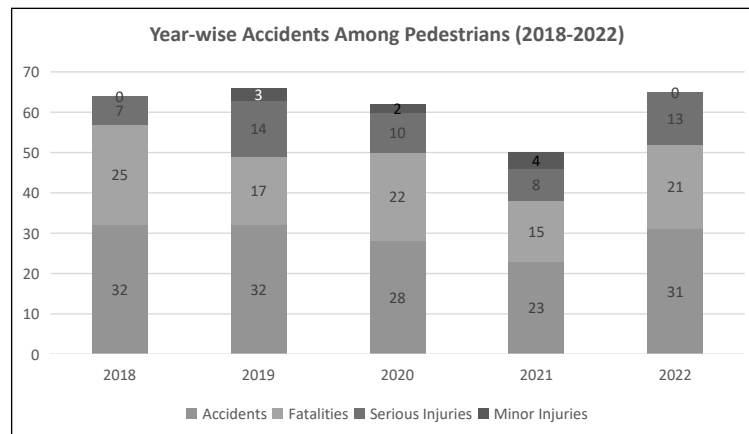


Figure 8: Year-wise Accidents among Pedestrians (2018-2022)

Source: Stacked Column chart created by the author using data decoded from e-FIR crash records

The Crisis of Hit-and-Run Incidents

The analysis of hit-and-run incidents identifies a catastrophic systemic failure in public safety and governance. Out of a total of 146 pedestrian-related accidents recorded during the study period, 74 per cent (108 incidents) were classified as hit-and-run cases.

This high proportion of unidentified crashes contributes disproportionately to mortality. Hit-and-run incidents accounted for 72 per cent of total pedestrian fatalities (72 deaths), compared to 28 fatalities from the 38 incidents involving identified offenders. See Table 2

Table 2: Pedestrian Hit-and-Run Incident Analysis (2018–2022 Consolidated)

Incident Type	Total Crashes	Total Fatalities	Fatality Share (in total Peds Fatalities)	Implication for Policy
Hit and run	108 (74% of crashes)	72	72%	Urgent need for CCTV and EMS optimisation
Identified Offender (Bus, LMVs, Tractor/Trolleys, Two-Wheelers)	38 (26% of crashes)	28	28%	Standard collision response

The overwhelming fatality contribution from hit-and-run cases exposes critical deficiencies across three areas: first, a lack of deterrence and surveillance (e.g., CCTV coverage) that enables drivers to flee with impunity; second, ineffective enforcement and traceability; and third, a critical failure in the post-crash response system. The elevated fatality ratio directly correlates with victims remaining unattended, resulting in catastrophic delays in receiving medical assistance during the crucial “Golden Hour,” thereby severely increasing mortality rates.

Conflict Vehicle Patterns

In collisions involving pedestrians, cars, jeeps, vans, and taxis constitute the highest share of impacting vehicles at 34 per cent. This reflects the high-frequency intersection of pedestrians and private motorised traffic in urbanised areas. Further contributing to severe outcomes are heavy vehicles. Trucks, tractors, and trolleys (12%), along with buses (12%), collectively cause nearly one-fourth of pedestrian collisions. Due to their greater mass and inertia, these larger vehicles necessitate specialised intervention measures, especially concerning speed management and segregation in mixed commercial and residential zones.

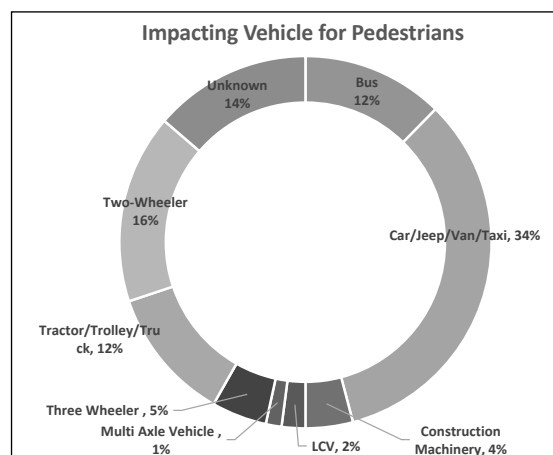


Figure 9: Impacting Vehicle Profile for Pedestrians

Source: Pie chart created by the author using data decoded from e-FIR crash records provided by Amritsar Traffic Police.

Cyclist Vulnerability and Extreme Severity

Disproportionate Risk and Fatality Rates

Cyclists form the smallest major VRU category, accounting for 7 per cent of total victims, but they face a disproportionately high risk of fatality. This group demonstrates the most extreme crash severity profile in the city.

In 2018, cycling accidents recorded 9 fatalities out of 11 incidents, meaning over 80 per cent of cycling crashes resulted in fatalities. This extreme risk exposure in mixed-

traffic conditions remained generally consistent throughout the study period, even during the 2020 lockdown. For a city aiming to encourage non-motorised transport, such a catastrophic fatality rate reveals a structural failing (A deep Systemic flaw in the city's transport system that fails to provide safe conditions for cyclists, resulting in consistently high fatality rates) in protecting the most physically vulnerable road users.

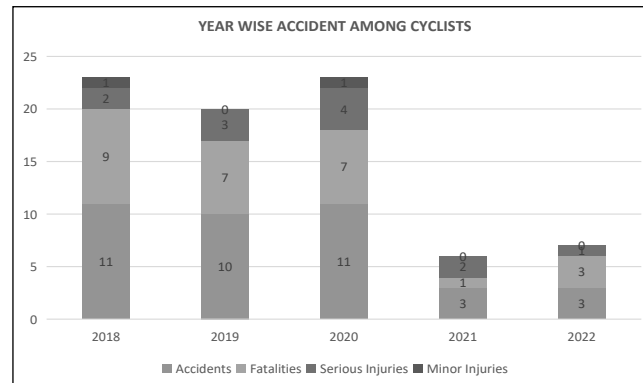


Figure 10: Year-wise Accident among Cyclists

Source: Stacked Column chart created by the author using data decoded from e-FIR crash records provided by Amritsar Traffic Police.

Primary Conflict and Infrastructure Requirements

The crash profile of cyclists is a clear indictment of the structural lack of segregated infrastructure. Cars, jeeps, vans, and taxis are the highest impacting vehicle category, accounting for a stark 50 per cent of collisions with cyclists. This high proportion verifies that cyclists are routinely forced to share high-speed arterial space with motorised traffic (Figure 11).

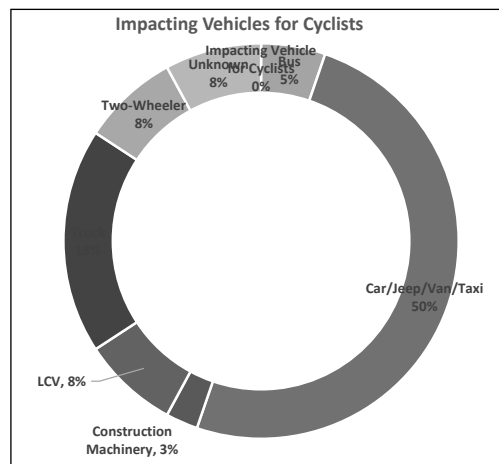


Figure 11: Impacting Vehicle Profile for Cyclists

Source: Pie chart created by the author using data decoded from e-FIR crash records provided by Amritsar Traffic Police.

Furthermore, trucks are the second most significant vehicles at 18 per cent. The collision pattern (50% with 4-wheelers, 18% with trucks) is direct evidence that the physical mixing of vehicles with vast speed and mass differentials is the primary mechanism of fatal injury for cyclists. Unlike two-wheelers, which possess greater speed and maneuverability, cyclists are slow and highly marginalised.

When crashes occur with high-speed motorised traffic, the outcome is rarely survivable. The key contributing factors are identified as the absence of dedicated cycle tracks, unsafe road shoulders, and poor visibility, particularly at night. The data strongly dictates that the solution must be absolute physical separation on all high-volume routes.

Policy Implications and Data-Driven Recommendations (Vision Zero Framework)

The analysis confirms that Amritsar's road safety challenge is fundamentally one of infrastructure equity (fair and balanced distribution of safe, accessible, and protective road infrastructure for all types of road users, especially for those who are most vulnerable.) and enforcement priority, with VRUs representing 80 per cent of total victims. To mitigate this systemic risk, the following policy interventions are essential, categorised under the framework of Engineering, Enforcement, and Emergency Response.

Engineering and Infrastructure Interventions

- **Mandate Dedicated VRU Corridors:** To address the 49 per cent two-wheeler victimisation and the catastrophic 50 per cent cyclist conflict rate with 4-wheelers, there must be a shift towards providing physically segregated lanes for two-wheelers and dedicated, curbed cycle tracks. This is critical along major arterial roads, bypasses (NH-3, NH-54), and the existing BRTS corridor, ensuring these vulnerable modes are not competing directly with high-speed or heavy traffic.
- **Establish Pedestrian Safe Zones & Junction Design:** To tackle the 24 per cent pedestrian casualty burden and mitigate crash severity, there is an urgent need for ubiquitous provision of functional footpaths, grade-separated crossings (where warranted), better junction design following all IRC codes and properly timed, signalised intersections in mixed-use and commercial areas.
- **Implement Traffic Calming:** The 15 per cent rate of two-wheeler single-vehicle crashes, combined with high pedestrian risk in core areas, demands the immediate installation of traffic calming measures such as raised crossings, speed tables, and rumble strips, particularly at entry points to residential zones and through the historic core.

Enforcement and Regulatory Reforms

- **Targeted Speed Control:** Aggressive and consistent enforcement of speed limits is paramount, especially on post-pandemic arterial roads, to mitigate the documented

surge in two-wheeler serious injuries (130% rise in 2022) and reduce the high severity of pedestrian crashes.

- **Addressing the Hit-and-Run Crisis:** Given that 74 per cent of pedestrian crashes are hit-and-run, investment in robust, high-resolution surveillance infrastructure (CCTV) is mandatory to improve traceability, ensure driver accountability, and provide a greater deterrent effect. This investment must be focused on identified high-risk pedestrian corridors.
- **Mandatory Safety Compliance:** Robust and mandatory enforcement of high-quality helmet use for all two-wheeler riders must be implemented to directly counter the 30–40 per cent fatality rate within this category.

Emergency Response and Data Quality

- **Optimising Golden Hour Response:** Protocols for Emergency Medical Services (EMS) response must be optimised, particularly focusing on reducing response times to unattended crash scenes. This is directly relevant to reducing the 72% fatality contribution associated with hit-and-run incidents, where delays in trauma care exponentially increase mortality.
- **Standardising Accident Reporting:** Data collection processes must be improved to minimise the ‘Unknown’ category classifications (e.g., 14% for pedestrian impact vehicles) to ensure that future policy interventions are driven by highly specific and traceable accident casualty data.

Road Safety Audit at various stages

- **Feasibility Stage:** Road Safety Audits (RSAs) at the feasibility stage ensure that safety is embedded at the earliest point in project planning. As recommended in IRC SP:88, this stage evaluates alignment options, junction layouts, land-use interactions, and mobility patterns to eliminate inherently unsafe concepts before design finalisation (Indian Roads Congress, 2010). Early audits help prevent long-term risks and reduce the need for costly safety-related revisions later.
- **Design Stage:** During the design stage, RSAs critically assess engineering drawings, geometric elements, and VRU provisions to ensure the proposed layout translates into safe operational conditions. IRC SP:88 emphasises reviewing sight distances, lane widths, cross-sections, intersections, signage, and pedestrian and cyclist facilities to identify and rectify potential hazards before construction begins (Indian Roads Congress, 2010).
- **Construction Stage:** Construction-stage RSAs focus on verifying that safety features are implemented correctly and that temporary traffic management is functioning safely. As per IRC SP:88, this includes reviewing work-zone controls, signage placement, pedestrian diversions, and installation quality of permanent

safety elements to prevent construction-related risks and future operational hazards (Indian Roads Congress, 2010).

- **Operation Stage:** Operational RSAs evaluate real-world traffic behaviour, crash trends, and conflict points once the roadway opens. IRC SP:88 recommends this stage to identify residual safety issues, such as high-speed conflicts or inadequate VRU facilities, enabling targeted corrective actions to maintain safe road performance throughout its lifecycle (Indian Roads Congress, 2010).

Conclusion

The analysis of road accident data from 2018 to 2022 unequivocally establishes that Amritsar's urban transport system poses a profound and systemic threat to its most frequent users. The statistics that Vulnerable Road Users (two-wheelers, pedestrians, and cyclists) account for 80 per cent of all road crash victims is not merely a high figure; it represents a critical failure of urban planning to prioritise human safety over vehicular movement.

The post-pandemic data is particularly alarming, highlighting a sustained resurgence of risk, exemplified by the 130 per cent surge in two-wheeler serious injuries in 2022. Most critically, the finding that hit-and-run incidents constitute 74 per cent of pedestrian crashes and 72 per cent of pedestrian fatalities reveals a crisis of governance and public safety that necessitates immediate, targeted investment in surveillance and emergency medical response (Transport Department, Punjab, 2023).

Effective mitigation of this crisis requires a comprehensive shift in municipal focus, moving decisively away from existing policies towards adopting a framework that centres on modal prioritisation and physical separation. Only through the rigorous implementation of dedicated infrastructure and robust, data-driven enforcement can Amritsar transform its transport environment and ensure the safety of its mobility majority.

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Gender, Soil Health, and Energy Economics: A Comprehensive Analysis of Rural- Urban Dynamics and Sustainable Development

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Abstract

The current study examines the intersection of gender, soil health, and energy economics, highlighting the crucial role women play in the conservation and production of soils, particularly within rural settings. This work addresses issues related to soil management practices and traditional gender roles, and examines how the challenges caused by urbanisation affect the soil resources of the countryside. Through a mixed-methods approach based on case studies, interviews, and data analysis, the paper identifies key strategies to foster both equitable and sustainable solutions in the rural and urban contexts. Evidence shows that empowering women through their land rights, education access, and participation in policy formulation significantly enhances soil health management and energy sustainability. This study provides a sharp critique of policies, researchers, and practitioners who intend to come up with more inclusive and effective solutions for the problems of soil health and energy economics.

Keywords

Gender Equality, Soil Health, Energy Economics, Sustainable Development, Rural-Urban Dynamics, Bioenergy, Soil Conservation, Gender-Sensitive Policies.

Introduction

Soil health is an important constituent of sustainable development. It acts as a foundation for food security, environmental stability, and renewable energy systems. However, degradation of soil resources has been increasingly noticed as a result of urbanisation, industrial expansion, and unsustainable agricultural practices around the

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world. This is very alarming in developing countries because the rural communities are the most dependent on healthy soils to support their livelihoods. The challenge is further complicated by the increasing rural-urban divide, which not only exacerbates resource depletion but also brings to the fore socio-economic disparities between these regions (FAO, 2021). Such issues require a multi-dimensional approach that takes into account ecological, economic, and social factors. A less-talked-about dimension in the soil health debate is gender. Women, especially in rural settings, are highly involved in agriculture and soil management; hence, they play important roles in soil fertility, natural resource conservation, and sustainable practices. In many instances, however, women face systematic obstacles such as lack of rights to land ownership, insufficient access to technology, and lack of involvement in decision-making (Agarwal, 1997).

Urbanisation is another significant factor in soil degradation, which also has a significant impact on rural areas. With the growth of urban centres, rural lands are being converted for industrial, infrastructural, and residential purposes without much consideration for ecological sustainability. The fertile soils are depleted with this change in land use, which affects agricultural productivity and rural livelihoods. It is also an imposition by the city on the countryside: its increasing demands create disequilibrium and exacerbate gendered effects for women and poor rural people. Soil degradation in rural areas translates to the search by women for new sources of livelihood or food production. These end up exacerbating gender inequities, as shown by UN Women (2020). The connection between soil health and energy economics raises additional complexity. Healthy soils are basic to the production of bio-energy, carbon sequestration, and sustainable agriculture.

This inequitable distribution of natural resources benefits the urban population while denying rural communities their rights, thereby widening the socio-economic gap.

Rural women, in particular, are often left to cope with the consequences of soil depletion and resource scarcity, while urban areas benefit disproportionately from these resources. Such disparities highlight the need for equitable policies that address the rural-urban divide and recognise the gendered dimensions of soil and resource management. However, energy economics provides a critical lens for understanding the broader implications of these dynamics. Soil health directly impacts the feasibility of bioenergy production, which is an integral part of sustainable energy systems. Poor soils limit the prospects of bioenergy crops such as switchgrass and sugarcane to flourish, thus limiting renewable energy opportunities. Moreover, soil fertility loss increases the reliance on chemical fertilisers, and other inputs which carry high energy costs and have environmental implications. Women, being the main users and managers of soil in many rural areas, are in a unique position to drive the adoption of sustainable practices that enhance soil health and support energy transitions. Their role in energy economics is often overlooked, however, both in research and in policy-making. These results

might inform policies that are both gender-sensitive and ecologically sustainable; for instance, recognising the work of women in soil management could mean taking action to give more access to resources, training, and decision-making opportunities. Similarly, soil and energy policies could be directed to address the rural-urban divide to ensure that rural communities, particularly women, are not disproportionately burdened with the consequences of urbanisation and resource depletion. The insights are critical for achieving broader goals related to sustainable development, which include food security, energy sustainability, and gender equity.

The intersection of gender, soil health, rural-urban dynamics, and energy economics is a critical area for study with profound implications. Through the exploration of related issues of soil degradation, gender disparities, and rural-urban imbalances, the present paper aims to contribute towards an equitable and sustainable future. The following sections provide further coverage on these issues by looking into existing literature, research methodologies, and significant findings to analyse this relevant issue comprehensively.

Literature Review

The role of women in agriculture, especially in developing economies, is well documented. Bina Agarwal's seminal work *"A Field of One's Own"* (1997) brings out women's major contribution to sustainable soil and land management, despite limited access to resources and land ownership. Women are the principal actors in crop rotation, organic farming, and composting tasks, all of which are critical for maintaining soil fertility. The Food and Agriculture Organisation (FAO, 2021) states that women account for more than 40 per cent of the agricultural labour force worldwide, but they are also subjected to systemic barriers, including unequal access to land, technology, and credit. Such barriers limit their ability to effectively implement soil conservation practices. Quisumbing et al., (1995) also found that enhancing women's access to agricultural resources could raise yields by 20–30 per cent, indicating that women have the potential to improve soil health. However, much of the extant literature focuses on contributions by women in rural areas and ignores their role in urban contexts. Moreover, gender-insensitive policies on soil conservation are also a critical gap in addressing the issue of soil degradation.

In Rattan Lal's work, specifically the study on soil degradation and its impact on sustainable development, the impacts of urbanisation on soil health have been well articulated (Lal, 2020). Urban sprawl usually ends up converting fertile agricultural land into urban infrastructure, causing soil erosion, compaction, and contamination. Soil loss, especially topsoil, is an essential by-product of urban expansion due to its contribution to the soil's fertility for agricultural production. Urbanisation breaks the balance between the rural and urban areas because it leaves the rural areas to absorb the environmental costs of urban growth. Further, a study by Ramankutty et al. (2008) shows the effects of urban expansion on smallholding farmers, mainly women, using

subsistence farming. Women take the responsibilities of finding another source of livelihood and substitution for reduced soil productivity that their men folk may present, yet their voices barely appear in urban planning frameworks and policies.

Soils are crucial for the production of bioenergy, which has increasingly been perceived as an alternative to fossil fuels. Lal argues that soil degradation undermines the potential of bioenergy crops such as sugarcane, maize, and switchgrass, thereby lowering the yields and increasing the production costs. In addition, degraded soils require more chemical inputs, including fertilisers, which are energy-intensive and contribute to greenhouse gas emissions. They argue that sustained soil management practices enhance productivity of bioenergy production and could simultaneously support carbon sequestration efforts. The economic implications, however, of soil degradation on energy systems are almost never analysed from a gender perspective. In general, women, especially those living in rural areas, form the core of bioenergy systems and are responsible for handling most bioenergy crops and other forms of biomass.

However, the relationship between gender and soil health is closely tied to women's roles in agriculture and natural resource management. Women, particularly in rural communities, are deeply involved in sustainable practices such as crop rotation, composting, and organic farming, which directly contribute to maintaining soil fertility. However, systemic barriers such as limited access to land ownership, credit, and agricultural training hinder their capacity to manage soil resources effectively. Scholars argue that addressing these gender disparities could significantly enhance soil conservation efforts. Agarwal (1997) highlights that providing women with equal access to land and decision-making opportunities can increase agricultural productivity by 20–30 per cent, reflecting their pivotal role in resource management. Despite this, women's contributions often remain invisible in policy frameworks, further marginalising them in discussions on soil health and sustainability (FAO, 2021).

Urbanisation further complicates the soil health issue, because the conversion of fertile agricultural land into infrastructure creates soil degradation, compaction, and erosion. Lal has discussed this issue in great details about how the process of urban expansion disrupts natural ecosystems and undermines the productive capacity of rural soils. The women are mostly affected in many rural households because they are the ones responsible for subsistence farming. Their workload goes up as they try to reduce the impacts of soil degradation while also being locked out of the urban development policies (UN Women, 2020). However, soil health plays a vital role in energy economics. Thus, healthy soils become very important in the cultivation of energy crops such as sugarcane, switchgrass, and maize, which are key inputs of the bioenergy systems. Soil degradation degrades crop yields, as it increases the use of energy-intensive chemical fertilisers.

The rural-urban divide also amplifies the challenges experienced in balancing soil health with gender equity. Urbanisation has led to the exploitation of rural lands to

feed the growing city demands for food, energy, and infrastructure. This dynamic not only exhausts rural soil resources but also exacerbates socio-economic differences between the urban and rural population. A study by Ramankutty et al., (2008) shows how small-holder farmers, particularly women, suffer disproportionately at the hands of urbanisation-induced soil degradation. The women are given the added burden of finding alternative livelihoods or changing their ways to meet reduced soil productivity, but their voices rarely enter policy discussions over land use and urban development (FAO, 2021). Even though extensive literature is being developed on soil health, energy economics, and the process of urbanisation, crucial gaps exist at the crossing of these disciplines. Very few studies incorporate a gender-sensitive lens to view how gender dynamics impel soil management practices across both rural and urban settings. Additionally, research often treats rural and urban areas as distinct entities, neglecting the ways in which urban demand shapes rural soil use and livelihoods. The exclusion of women from soil and energy policy-making further compounds these challenges, as their knowledge and contributions are critical for sustainable resource management.

Bina Agarwal in her study, 'A Field of One's Own (1997)' has argued that access to land is critical to women's empowerment in contributing to sustainable agriculture. Her research concludes that restrictions on women's access to land ownership result from patriarchal inheritance rules and socio-cultural norms, thereby thwarting their attempt to implement long-term soil conservation measures. Agarwal emphasises how the empowerment of women with access to land rights and farm resources can significantly increase soil fertility and agricultural productivity, and benefit not only women but also the entire rural communities. Agarwal also comments on the gendered division of labour in agriculture. She states that women often participate in crop diversification, composting, and agroforestry, which are essential for soil health.

Vandana Shiva in her book, *Staying Alive: Women, Ecology, and Development* (1988), Shiva critiques industrialised agriculture, which she claims focuses on profit rather than ecological balance and marginalises women's traditional knowledge systems. Shiva argues that women as primary caregivers of the land and soil have special knowledge about soil fertility and biodiversity conservation, which becomes a very important aspect of sustainable farming. Shiva's "earth democracy" is a concept that fights patriarchal and capitalist structures, which exploit women and natural resources. She argues for a return to indigenous farming methods, such as organic farming and seed preservation, which inherently prioritise soil health. Her ecofeminist perspective links the degradation of soil with the oppression of women, arguing that sustainable development is only possible when both are liberated from exploitative systems.

Given the world of geo-environmental concerns, Diana Liverman, has many significant contributions to understanding women's roles in managing environmental resources under changing socio-economic and climatic conditions. The research done by her indicates how gender inequality shapes vulnerabilities and adaptive capacities

associated with women's responses to environmental challenges, including soil degradation. Montanari & Bergh (2019) in their work, 'Why women's traditional knowledge matters in the production processes of natural product development: The case of the Green Morocco Plan', present an extensive perspective using a case study that traditional knowledge is not only significant for various realms from climate change to better resource management, but can be vital and needs to be factored through women's lens for enhancement of natural product development too.

Esther Boserup's pioneering work, 'Women's Role in Economic Development' (1970) laid the foundation for understanding the gendered dimensions of agriculture and resource management. Boserup argued that women's contributions to agriculture, including soil management, are often undervalued in economic analyses and development policies. Her findings showed that modernisation and industrialisation in agriculture often displace women from their traditional roles, which in turn affect the adoption of sustainable practices like intercropping and natural fertilisation, necessary for soil fertility maintenance. Boserup's work has been crucial in bringing out the importance of integrating women into agricultural modernisation efforts while conserving their traditional knowledge systems. Her work continues to influence contemporary debates on gender and sustainable development, especially in the context of soil conservation and rural livelihoods.

Methods

Rural women provided information regarding their role in soil management, their knowledge of sustainable practices, and the challenges they face due to urbanisation and gender inequities. The impact of urban expansion on rural soil health, energy production, and existing policies was evaluated by interviewing the urban planners and policymakers. Soil health reports provided critical data on fertility, degradation, and land use patterns that help establish the ecological impact of urban expansion. Energy production data, especially concerning bioenergy crops, had also been analysed to link soil health with economic outputs (Tilman et al., 2002). FAO (2021) conducts gender-disaggregated demographic studies that outline the structural inequalities between women and men in accessing land, credit, and other agricultural resources. Secondary sources related to government reports, international organisations' publications, and peer-reviewed journals will constitute the quantitative backbone of the analysis. Regional and on-the-ground variations will also be captured through case studies.

Rural Case Study: Bundelkhand Region, India

The Bundelkhand region, covering Uttar Pradesh and Madhya Pradesh, has suffered from considerable soil degradation because of deforestation, water scarcity, and overgrazing. *Johads*, (*Johads* in Rajasthan are traditional, community-built earthen check dams and reservoirs that capture and store rainwater, preventing runoff and recharging groundwater in arid regions) developed by women in this area, have

restored soil fertility through the revival of agricultural productivity in some areas. However, they are not scalable because they lack institutional support (Singh, Jain, & Sharma, 2018).

Urban Case Study: Delhi's Peri-Urban Areas

Urban expansion in Delhi has resulted in the invasion of peri-urban agricultural zones, which have caused soil compaction and erosion. According to Ramankutty et al., (2008), the fertile agricultural lands are lost due to urban development. Such losses are more serious to smallholder farmers, particularly women, who rely on those lands for subsistence farming. Sharma, & Kumar, (2021).

International Case Study: Sub-Saharan Africa

Studies in Sub-Saharan Africa have shown that women farmers significantly contribute to maintaining soil fertility. For instance, in the case of agroforestry and intercropping in Malawi, women cooperatives have promoted the use of N-fixing trees like *Faidherbia albida*, which has led to improved soil health and higher crop yields. Still, lack of land ownership and agricultural inputs remain the most significant constraints to scaling this practice (UN Women, 2020).

Energy Production Case Study: Sugarcane Industry in Brazil

Healthy soils are important to the sugarcane industry, a leading source of bioethanol production in Brazil. A study by Lal has pointed out how soil degradation affects the yield and quality of energy crops, impacting the bioenergy economy. The women working in the sugarcane fields of Brazil are at the forefront of mulching and organic fertilisation but remain under-recognised in national energy policies.

These case studies illustrate the various ways in which gender, soil health, and rural-urban dynamics intersect across different contexts. While soil health and energy economics can be measured through numerical indicators like soil fertility indices and bioenergy outputs, gender dynamics and rural-urban linkages require qualitative insights to capture their socio-cultural complexities. This methodology is aimed at presenting actionable insights for policy formulation and sustainable development by weaving in the perspectives from diverse stakeholders and analysing their interconnections.

The analysis of gender, soil health, and energy economics revolves around key themes that intersect with both rural and urban contexts. A central theme is the gendered impact on soil health, where traditional gender roles significantly influence how soil is managed and conserved. In many rural settings, women are the primary custodians of soil health through their roles in crop cultivation, composting, and agroforestry. However, despite their critical role in maintaining soil fertility, women are often excluded from decision-making processes that affect land use and soil conservation strategies. Research by Bina Agarwal (1997) shows that the exclusion of women from land ownership and resource access restricts their ability to adopt sustainable practices

that could benefit soil health in the long term. Whereas the patriarchal rules controlling land rights tend to diminish women's authority even when they manage soil health and are involved in activities like organic farming or water harvesting (Shiva, 1988). This gendered division of labour not only limits the effective management of soil resources but also perpetuates inequalities, making women vulnerable to the impacts of soil degradation and climate change. Another important theme is urbanisation vs. rural resilience, which questions how the expansion of urban areas leads to soil degradation in the countryside. Urban sprawl has direct consequences for agricultural land, including soil compaction, loss of biodiversity, and disruption of local water cycles. As cities expand, rural areas are increasingly pressed to maintain food production while their soil resources are compromised. Studies by Ramankutty et al. (2008) on Delhi's peri-urban areas emphasise that urbanisation not only affects land but also significantly alters local soil quality, making it harder for rural communities to maintain productive and sustainable farming systems. Moreover, urban encroachment often leads to the depletion of essential ecosystem services, such as groundwater recharge and soil fertility, which are critical for maintaining rural resilience. These women, in their livelihoods, are involved with small-scale farming and hence have their roles in food production severely undermined by the loss of fertile land (Agarwal, 1997).

The theme of soil health and energy economics relates the linkage between soil degradation and bioenergy. Soil degradation due to the impact of human activity such as deforestation, overgrazing, and poor agricultural practice has direct economic impacts. Sugarcane, maize, and wheat are some of the most common bioenergy crops produced in many countries for the purpose of contributing to the energy sector. However, as soil fertility declines, the productivity of these crops also decreases, affecting bioenergy production and rural economies. A study by Tilman et al., (2006) demonstrates how degraded soils lead to reduced bioenergy yields, thus affecting local economies and national energy strategies. The loss of soil health increases the burden of rural women, as these are the individuals most likely to be in charge of the land. Thus, apart from deteriorating food security, a reduction in the chances of female participation in energy-related economic activities continues to solidify gender disparities (Shiva, 1988).

Lastly, policy and gender equality arise as an important theme while appraising policies that have successfully been undertaken with regard to soil conservation and energy transitions in conjunction with gender equity. Most policies related to conservation of soil and promote sustainable agriculture practices, do not consider the gendered dimensions of land use and resource management. According to Agarwal (2003), "policies typically overlook the fact that women are central producers in agriculture and custodians of land but they are rarely consulted in policy making." This exclusion leads to policies that overlook the role of women and provide them with neither the resources nor any kind of support to effectively manage soil. In the context of energy transitions, policies that seek to promote bioenergy without considering gender dynamics often neglect women's knowledge and participation in sustainable

practices. Gender-sensitive policies are important not only to advance women's rights but also to ensure more effective conservation of soil and energy solutions. Ensuring gender equality in the policy-making process can have the potential to lead to more inclusive and sustainable results for both soil health and energy production. Against this backdrop, understanding the impacts on soil management that take on gendered dimensions would go a long way into comprehending the challenges to urbanisation, the economics of soil degradation on bioenergy, and the role of policies for inclusiveness.

Discussion and Results

The integration of gender equality into sustainable soil and energy policies is essential to address the intersecting challenges of soil health, energy production, and rural-urban dynamics. Policies towards soil conservation and energy transitions do not take into account the gendered nature of land use and resource management. As discussed above, women, especially in rural areas, play an important role in soil management and bioenergy production. However, they have often been left out of processes in policy making, resulting in less adoption of suitable and long-lasting practices. Agarwal (2003) opines that the gender-sensitive policies should be supportive by incorporating women into agricultural activities and caring for environmental issues for sustainable soil and energy policies.

Balancing rural-urban resource demands through equitable strategies is another important step towards sustainable soil and energy solutions. As the pace of urbanisation encroaches on rural lands, management strategies for resources have to take both rural and urban demands into consideration. Urban areas require huge parcels of agricultural land to expand their space, thus causing soil degradation and decreased agricultural productivity in the surrounding rural regions. Simultaneously, rural areas rely heavily on healthy soils for food production and energy resources, such as bioenergy crops. This creates a conflict between urban development and the need to preserve agricultural systems. One way of achieving this balance is through fair land use policies that ensure sustainable agricultural practices in relation to the increasing demand for infrastructure in urban areas. An alternative method could be to integrate the city planning approach with rural conservation, thus ensuring that vital agricultural lands are not taken over by urban sprawl.

Finally, by focusing on the role of women as key agents in energy sustainability and soil health, it emphasises the recognition of women's contributions in both sectors. Women are often at the forefront of soil conservation practices in rural communities, using traditional knowledge to enhance soil fertility, prevent erosion, and improve water retention. However, policymakers and researchers often fail to recognise their role in managing soil health. Studies of women's knowledge concerning sustainable land use in developing countries suggest it is a valuable resource for addressing soil degradation. Women are also significantly involved in small-scale bio-energy production, from cultivating bio-energy crops and managing organic wastes to

producing biogas. However, their participation in the formal energy economy is often overlooked. By acknowledging women as key agents of change in both soil health and energy production, policymakers can create more inclusive, efficient, and sustainable solutions to the challenges posed by soil degradation and energy demands. This will help in the innovation, productivity, and long-term environmental sustainability of soil conservation and energy strategies through the recognition and incorporation of women's expertise.

The global discourse on soil health typically neglects the enormous inputs women make in rural communities. Women, especially in farming households, are the key players who plant, harvest, and conserve soil resources. Traditional gender roles in agricultural settings often bar women from direct land ownership and control over their farmlands and gardens, thus limiting them in using sustainable agriculture techniques. In many societies, the laws and customs of land ownership are male-centric; therefore, women suffer from having fewer property rights. Legal systems play a significant role in redressing these gender disparities. International frameworks, such as the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), emphasised the need for equal access to land for women, and several countries have taken steps towards gender-sensitive land reforms. For instance, in Rwanda, legal reforms granted women rights to own land and allowed them to fully participate in soil management practices Agarwal, B. (1997). Legal recognition of women's land rights leads to higher empowerment, allowing women to establish sustainable soil health. National Policy on Agriculture in India also recognises the need for gender equity in agricultural development, but the implementation is still not consistent, and their contribution to soil health remains under-valued (World Bank, 2007).

Urbanisation and its effects on soil health is another critical area where gender and legal perspectives intersect. With urbanisation, rural land is becoming commodified, leading to soil degradation through unsustainable farming practices, deforestation, and overexploitation of land. Urbanisation does not only exert pressure on rural soils but also increases gender inequalities. Urban migration often places a disproportionate burden on rural women, who are left to manage increasingly degraded soils with limited resources and legal support (Shiva, 1988).

The legal dimensions of soil health also intersect with energy economics, particularly in the context of bioenergy. In many rural areas, bioenergy is a source of energy derived from agricultural residues and other organic materials. However, bioenergy production is often linked to unsustainable farming practices that degrade soil health, leading to a cycle of environmental degradation and energy insecurity. The legal frameworks governing bioenergy production and distribution must consider the role of women in both agriculture and energy production. In many regions, women play a central role in collecting biomass for cooking and energy use but are excluded from the decision-making processes related to energy policy. The National Bioenergy Policy of India, for instance, is directed at enhancing the role of renewable energy,

which is inclusive of bioenergy; it often overlooks the gendered aspects of energy production and consumption (Chan & Foster, 2013). This would mean a legal approach that considers gender perspectives for ensuring that women are at the benefiting end of sustainable energy solutions such as clean cookstoves and biofuels as well as through more sustainable agriculture that supports soil health.

Although the issue demands legislative reforms, implementation mechanism measures would also be essential. The legislation of women-responsive policies should be accompanied by transparency within a legal system in such a way that these would facilitate tracking the change among them concerning access to land and soil and also on matters relating to energy. Legal provisions for land tenure, access to credit, and participation in decision-making processes are essential for empowering women in rural communities and ensuring that they can play a central role in sustainable soil and energy management. In this context, legal advocacy and the strengthening of civil society are vital for challenging discriminatory practices and ensuring that legal reforms translate into real change on the ground (Benería, 2003).

Furthermore, the issue of gender, soil health, and legal perspectives is complex and multifaceted and calls for integrated solutions. Legal frameworks that promote gender equality in land ownership and soil management are crucial for achieving sustainable soil health and energy production. With the challenges of urbanisation, climate change, and resource depletion facing the world, legal systems need to prioritise gender-sensitive approaches to address these issues. By recognising the contributions of women in soil conservation and energy production and ensuring that they have access to the resources and rights necessary to sustain these practices, societies can move towards more equitable and sustainable development.

Conclusion

Therefore, there is an utmost need for soil conservation policies to adopt gender-sensitive strategies because these contribute to fostering the adoption of sustainable agricultural practices. The women, who are located in rural spaces, have a central place in the sustenance of soil health; however, their contributions are underrated in policy-making. So policies that promote these programmes of soil conservation need to ensure that women are not left behind in their equal shares of land, resources, and education on sustainable farming methods. Another serious challenge is to balance the rising demand for energy and soil resources of urban and rural areas, which would need policies that are balanced and forward-thinking. Rapid urbanisation in most parts of the world and especially in developing countries creates significant pressure on rural agricultural lands. Given the continued growth of cities, policies must focus on the long-term sustainable management of both the urban and the rural to meet the demands of those in the cities as well as the rural dwellers while not compromising the integrity of the environment. Since women are usually the bearers of the impacts of urban expansion on agriculture, they must be included in policy decisions regarding land use in order to achieve more balanced and equitable outcomes.

Another important factor towards sustainable soil and energy systems is the need to offer incentives for sustainable practices such as organic farming and bioenergy production. Organic farming, especially avoiding harmful chemical fertilisers and pesticides, makes a massive contribution to developing soil and reducing soil degradation. To conclude, this research paper for the inclusion of the intersectionality between gender, soil health, and energy economics in sustainable development efforts. The soil conservation and bioenergy productions in rural areas depend greatly on women. Further, maintaining soil health in the face of rural-urban balance through integrated land use planning and promotion of organic farming and bioenergy would be crucial for advancing energy sustainability.

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Accessibility Characteristics of Healthcare Facilities of Different Hierarchies in Baghpat District, Uttar Pradesh, India

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Abstract

Accessibility in healthcare comprises five key dimensions addressing both spatial and non-spatial factors: availability, physical accessibility, affordability, adequacy, and acceptability. The study conducted by the authors, identified factors associated with healthcare access through a global literature review and analysis in the Indian scenario. India offers universal free healthcare; assuming financial barriers are the main hurdle, however, a significant gap persists in the consistent use of public healthcare services. This paper aims to identify the accessibility factors affecting healthcare utilisation in India. A comprehensive review of existing research to outline commonly cited healthcare factors, followed by a socio-spatial analysis of user travel at healthcare facilities, has been done by the authors for their study. The present paper aims to understand what impedes equitable access and suggest ways to strengthen healthcare delivery systems beyond addressing affordability alone. Results identify the importance of healthcare infrastructure and transport availability in improving health outcomes.

Keywords

Accessibility, Healthcare Utilisation, Healthcare Equity, Rural Regions.

Introduction

Accessibility refers to the simplicity or difficulty of reaching various opportunities, such as schools, healthcare facilities, workplaces, and shopping centres. (Lechowski &

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Jasion, 2021). It is a function of opportunities to be reached by putting effort in terms of time, distance, or cost. Geographic location and socio-economic characteristics of the individual as well as the performance of the transportation system play an important role in enabling spatial accessibility (Leminen et al., 2018). Demographic and social parameters, including age, sex, education, and income, contribute to non-spatial accessibility. Accessibility to public facilities, transportation systems, and information & communication technologies is an essential right as per the United Nations (Guida et al., 2022). Adequate accessibility to healthcare services is a symbol of an advanced society. Health equity is considered a fundamental right globally, and efforts to make it accessible to the public have been ongoing for many decades. Countries are working towards achieving Universal Health Coverage (UHC) regardless of people's socio-economic status (Huisman et al., 2022). Access to healthcare services has been a multifaceted challenge, especially for underprivileged people (Khanna et al., 2018). Challenges such as cultural behaviour, social exclusion, economic crises, and poor supply of health services are major characteristics of issues associated with its utilisation and poor outcomes.

Health inequalities persist across geographic spaces due to limited access to health facilities and poor public funding. Studies in low and middle income countries (LMIC) have shown that financial requirements for attaining primary health care have deterred its utilisation (Robert & Ridde, 2013). The study identifies key mechanisms and approaches to improve access to healthcare facilities for better health outcomes.

Healthcare Delivery in India

Over the past few years, health outcomes for the Indian population have improved significantly. India achieved all the Millennium Development Goals related to health. However, the country is still lagging in terms of Health Infrastructure due to its large population (Mustafa & Shekhar, 2021). The delivery of services through the public health sector in India follows a 3-tier structure: primary, secondary, and tertiary care. This covers both urban and rural areas. Further, in rural regions, healthcare facilities are very limited, indicating significant disparities between rural and urban areas. People in the rural areas have to suffer due to a shortage of healthcare facilities including the lack of hospital beds, a low doctor-to-population ratio, and rising healthcare costs.

In developing nations like India, public transport is insufficiently accessible in rural areas, significantly impacting citizens' mobility (Kanuganti et al., 2015). They must rely primarily on personal and paratransit services in the absence of accessible infrastructure. Many cities in India have high geographic and demographic growth. However, the public administration is not able to meet the healthcare needs of the population, resulting in poor health outcomes (Sharma & Patil, 2021). The dispensing of modern medicine is still through unqualified and traditional healers in some regions (Kane et al., 2022). Lack of confidence in the public healthcare system, financial

constraints on utilising private health services, and stigma are some of the common challenges associated with India's social demographics.

The National Rural Health Mission (NRHM) was launched in 2005 to provide affordable, accessible, and high-quality healthcare to rural populations in India. The aim was to decentralise operations and strengthen healthcare infrastructure. The National Health Mission is the umbrella body encompassing programmes at both rural and urban levels. The National Urban Health Mission (NUHM) is the urban counterpart that provides access to healthcare services for the urban population, especially the vulnerable population, and was launched in 2013. The Indian Public Health Standards (IPHS) issued mandatory guidelines for ensuring the delivery of essential services through public healthcare facilities. These guidelines were developed in 2007, updated in 2012, and further updated in 2022, as can be seen in Table 1. The Ministry of Health and Family Welfare (Home | Ministry of Health and Family Welfare | GOI, n.d.) is the implementing agency of the current IPHS 2022 guidelines.

Table 1: Essential Guidelines for Ensuring Healthcare Delivery as issued by Indian Public Health Standards (IPHS)

S. No.	Facility Type	Radial Distance
1.	Primary Healthcare Facility (PHC)	6.28 Km
2.	Secondary Healthcare Facility (CHC)	13.39 Km
3.	District Hospital (DH)	—

Source: IPHS 2022 Guidelines | National Health Systems Resource Centre, n.d.

In 2019, India, along with 193 countries, reaffirmed its strong political commitment to universal health coverage (UHC) (Dubey, 2023). This paper aims to highlight the barriers faced by the people residing in the rural district of Baghpat, Uttar Pradesh, at different hierarchies of healthcare facilities.

Literature Review

Healthcare access refers to the opportunity to obtain and utilise appropriate healthcare services. The healthcare system is a complex interplay of supply and demand factors. Access to healthcare varies among the nations and is influenced by the region's socio-economic structure and healthcare infrastructure. Thorough literature exists on barriers to healthcare accessibility, spanning sociological, ethical, epidemiological, economic, and political contexts. A seminal model, presented by Penchansky & Thomas (1981), organises healthcare access into five distinct dimensions. It includes availability, geographic accessibility, affordability, adequacy, and acceptability, comprising both spatial and non-spatial perspectives. These factors are further expanded, acting as the sub-determinants of healthcare from the global literature.

Geographic Accessibility

The physical distance or travel time to the potential user.

Availability

Constitutes the physical existence of health resources with sufficient capacity to produce services. It refers to whether a service is present or absent, as well as its quantity (Costa et al., 2020).

Adequacy

It refers to the extent to which available health services are sufficient in quantity, quality, and structure to effectively meet the needs and expectations of individuals with specific health issues, thereby increasing the likelihood of desired health outcomes.

Acceptability

Relates to cultural and social factors determining the possibility for people to accept the aspects of the service.

Affordability

Reflects the economic capacity of people to spend resources and time to use appropriate services.

The list of acting barriers is identified from low and middle income countries (LMIC) in Table 2. Among the identified accessibility factors, barriers applicable to Indian healthcare delivery are highlighted in relation to the facility hierarchy through factor analysis.

Table 2: Identified Parameters of Healthcare Accessibility Acting as barriers to Healthcare Utilisation from the Literature on 5 A's of Accessibility (Penchansky & Thomas, 1981).

S. No.	Accessibility Barriers	5 A's Model	Authors
1.	Access to Laboratory (Pathology, Radiology)	Availability	(Condino-Neto et al., 2011); (Ong et al., 2017)
2.	Lack of a Specialised Doctor		(Oliphant et al., 2022); (Shaw & Sahoo, 2020a); (De Mesa et al., 2023)
3.	Specialised Diagnostic Test		(Hemadeh et al., 2020)
4.	Non-Availability of Medicine		(Amihanda & Odhus, 2023)
5.	Health Infrastructure		(Lapão et al., 2017) (Herrero-Arias & Diaz, 2021)
6.	High Waiting Time		(Cavalcanti et al., 2022)

S. No.	Accessibility Barriers	5 A's Model	Authors
7.	Absenteeism of Doctor	Adequacy	(Busza et al., 2014)
8.	Inhuman Care / Quality of Care		(Oliveira et al., 2019); (Assis & Jesus, 2012)
9.	Out of Hours Care (OOHC)		(Vargas et al., 2016); (Nóbrega et al., 2017)
10.	Policy Interventions		(Duong et al., 2018)
11.	Special Programs		(Pinazo et al., 2022)
12.	Information and Communication	Acceptability	(Oliveira et al., 2019); (Lapão et al., 2017)
13.	Individual Behaviour		(Klarman et al., 2021)
14.	Social Support		(H. Logie et al., 2018)
15.	Cultural Beliefs		(Rodrigues et al., 2021)
16.	Distance to Facilities	Physical Accessibility	(Whitaker et al., 2022); (Kapwata & Manda, 2018)
17.	Transport Availability		(Ochieng & Odhiambo, 2019)
18.	Economic Background	Affordability	(Kane et al., 2022)
19.	Access to Insurance		(Huisman et al., 2022)

Source: Author

Parameters acting as Barriers to Healthcare Accessibility

High Waiting Time

Effectively managing waiting times is essential for regulating access to public health services. To improve equity in healthcare services, it is crucial to manage the waiting time for patients. In Brazil, secondary-level centres for dental care constitute a vital factor in general health. It is highlighted that the waiting time for access to specialised care is identified as a dissatisfaction factor (Cavalcanti et al., 2022). Waiting time can be the result of many factors; however, the absenteeism of doctors is one of the crucial reasons.

Lack of Specialised Doctors

Nicholas (Oliphant et al., 2022) highlighted the shortage of Human Resources for Health (HRH) in rural, remote, and underserved areas of Sierra Leone. Similarly, in Gujarat, research has identified inaccessibility to healthcare services due to a shortage

of physicians in rural and tribal regions (Shaw & Sahoo, 2020b). In Mexico, a lack of investment in human resources in public healthcare facilities leads to endless and undesirable inequalities. The Philippines also suffers from a maldistribution of the healthcare workforce, resulting in high disparities. In rural and remote areas of the region, health facilities are mostly understaffed and lack supervision (De Mesa et al., 2023)

Access to the Laboratory

The readiness of health care services decreases with the unavailability of medical equipment in Laboratories. Hemadeh et al., highlighted the challenges related to access to advanced medical equipment in healthcare Laboratories (Hemadeh et al., 2020).

Access to Insurance

In sub-Saharan Africa, a limited percentage of people are covered by health insurance schemes, 11-15 per cent in Kenya, Nigeria 3 per cent in Uganda 6 per cent, and 9 per cent in Tanzania (Huisman et al., 2022) Similarly, in Mexico, people working in the formal sector have access to social security institutions, and only 50 per cent of the population has formal employment (Choperena-Aguilar et al., 2021). In India, people are reluctant to use specialised services due to the high cost of treatment. Affordability is a concern for people seeking care, and thus, the cost of treatment is greater than the opportunity cost of people living a healthy life.

Information & Communication

The availability of electronic data records is critical in analysing the effectiveness of healthcare delivered. Also, it contributes significantly in terms of referral management, the lack of which presents a challenge in providing healthcare (Oliveira et al., 2019). Technological support is considered a complementary axis of the healthcare system for the performance of facilities (Lapão et al., 2017). The introduction of electronic records has removed duplication in registration and provided better access for the population of Portugal.

Non-Availability of Medicines

The government of Kenya aims to provide robust, essential-level healthcare to its citizens, starting from the rural regions. Medical supply adequacy is an important criterion to ensure facility utilisation. Kisumu County region is highlighted by Amihanda and Odhus with other regions in the country facing a shortage of Medical supplies (Amihanda & Odhus, 2023).

Individual Behaviour

The healthcare-seeking behaviour of an individual is dependent on recognition and response towards an illness. Location, age, level of education, and finances are some

factors that help enable decision-making in taking a treatment (Klarman et al., 2021). The decision is also influenced by the type of care available; in the Haiti region, the area is largely served by non-conventional treatment. The region is highly rural and lacks conventional infrastructure provided by the Government.

Cultural Beliefs

The cultural beliefs of a region influence informal health subsystems. From the framework of medical anthropology, socio-cultural context determines the search for healthcare (Rodrigues et al., 2021). In the Brazilian Amazon region, informal healthcare delivery overlaps with professional systems based on individual needs. The influence of family, friends, and society as a whole has a broader role in seeking care. The system of health healing is performed through Shamans, healers, prayers, and the use of medical herbs.

Distance to Facilities

Variations in the geographic condition of the population and the need for healthcare provided a foundation for allocating facilities within physical access to the population group. The reasonable distance a person is willing to travel varies according to their age, social status, and economic status. Distance to Healthcare facilities becomes fundamental to the success of programs, strategies, and health outcomes (Choperena-Aguilar et al., 2021). Distance travelled to the facilities is a useful way to reduce prehospital time (Whitaker et al., 2022).

Availability of Transport

The public transport system provides access to the city centre and runs on pre-established routes for financial safety. Thus, regions with low density, skewed towards the outskirts, remain unconnected (Rastogi & Krishna Rao, 2003). In the Kenyan government, intervention on maternal health is a significant step. The focus is to increase healthcare utilisation by abolishing the user fee at government centres. However, it is highlighted by Ochieng and Odhiambo that half of the maternal deliveries take place outside the facilities due to the unavailability of transport to these healthcare centres (Ochieng & Odhiambo, 2019). Also, the appointments taken by the users were either postponed or cancelled due to a lack of transport.

Quality of Care

The management of care provided by the system is a critical factor emphasised by Assis & Jesus (2012). The evaluation of the Family Health Strategy in Brazil reflects upon the regional and state inequalities due to the varying competencies of health professionals. This highlights the importance of quality of care in healthcare delivery. At the regional level, workers with less experience are enrolled as compared to the state level, where importance is given to health professionals with high experience

and skills. In Brazil, it was highlighted that due to a lack of quality of care, the 30 day mortality rate of patients is higher for patients from public treatment compared to private. One of the likely causes is the timely and proactive treatment at private facilities (Oliveira et al., 2019).

Special Programmes

In Southeast Asia, Vietnam was the first country to establish a National Program on Non-Communicable Disease Prevention and Control (NCD) (Duong et al., 2018) Globally, the disease burden has shifted to NCDs. Death from NCDs increased from 42 per cent to 63 per cent from 1986 to 2008.

Methodology

The study employs a mixed-methods approach, incorporating a literature review on accessibility, qualitative interviews with individuals who use public healthcare facilities in India, followed by spatial analysis. This study focuses on public healthcare facilities; private healthcare facilities are not considered in this research.

Key parameters to healthcare facility accessibility are identified from the global literature on LMIC countries, and these factors are mapped against the prevailing conditions in the Indian District. Interviews were conducted with patients to explore the determinants of healthcare services using an open-ended questionnaire. The respondents selected the acting barrier most relatable to accessibility in the hierarchy of healthcare centres they used. First, descriptive statistics were used to present the research's demographic and socio-spatial data. Further, factor analysis was performed to identify the key barriers at different hierarchies of healthcare facilities.

The target population was approached in the waiting area of the healthcare centres, and informed consent was obtained if the patient was receptive. Participants in the study were interviewed at different facilities.

Case Study Region

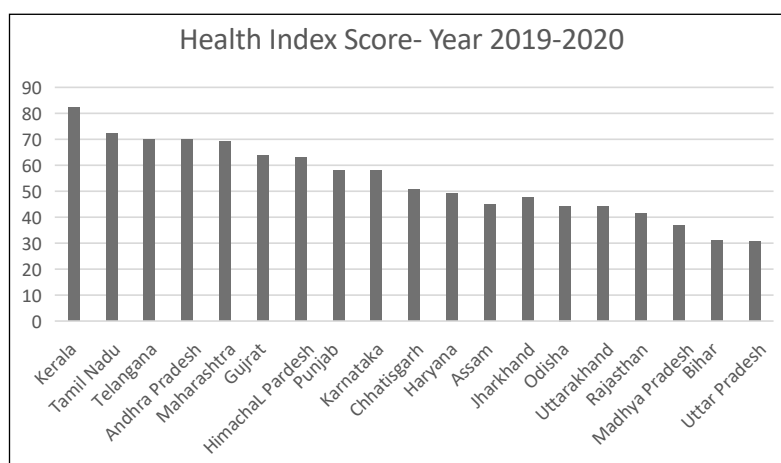
In 2017, NITI Aayog, the Ministry of Health and Family Welfare (MoHFW), and the World Bank initiated an annual health index to assess the overall health performance of states and Union Territories (UTs). The main aim of the index is to track the progress on health outcomes and health system performance. The index is a composite weightage of 24 important indicators identified by the government. In the year 2019-2020, Kerala and Tamil Nadu occupied the first and second ranks, whereas Uttar Pradesh was the least performing state (Table 3). The performance score of Kerala was 82.2, and Uttar Pradesh stood at 30.57 (*NITI AAYOG, India*, n.d.) Figure 1. The results below are presented for the large state category.

Table 3: Large State Health Index Score 2019-2020.

Large State	Year 2019-2020 Score
Kerala	82.2
Tamil Nadu	72.42
Telangana	69.96
Andhra Pradesh	69.95
Maharashtra	69.14
Gujarat	63.59
Himachal Pradesh	63.17
Punjab	58.08
Karnataka	57.93
Chhattisgarh	50.7
Haryana	49.26
Assam	44.74
Jharkhand	47.55
Odisha	44.31
Uttarakhand	44.21
Rajasthan	41.33
Madhya Pradesh	36.72
Bihar	31
Uttar Pradesh	30.57

Source: Author

The Health Index is a weighted composite of 24 indicators that cover key aspects of health performance. These indicators are selected based on importance and availability of reliable data from the Health Management Information System (HMIS) Platform. The performance data is obtained from the health care centres of both urban and rural regions of a state.

**Figure 1:** Health Index Score-Year 2019-2020**Source:** Author

Uttar Pradesh has the lowest score on the Health Index 2019-2020, signifying regional disparities in health outcomes. The state has 75 districts, with the most populous being among the other states. The state accounts for 16.5 per cent of the Indian population and three per cent of the total world population, as per the 2011 census. Thus, it is critical and equally crucial to cater to the healthcare needs of its population.

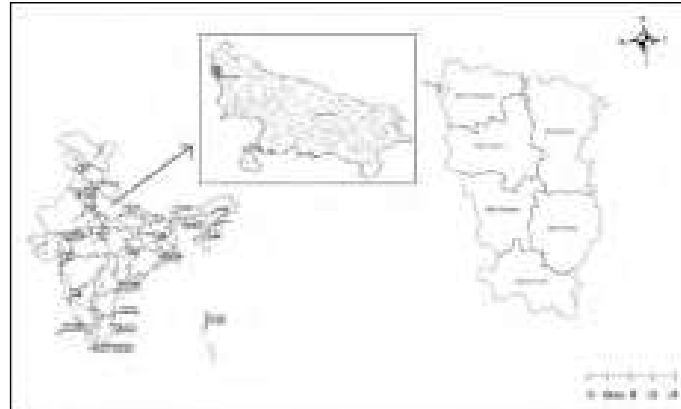


Figure 2: Uttar Pradesh State, with Baghpat District

Baghpat district is a newly formed district in Uttar Pradesh, India. Out of the total population, 78.9 per cent of the population lives in rural areas, whereas 21.1 per cent of the population resides in the urban region of the district, as shown in Figure 2. It has 6 blocks: Chhaprauli, Baraut, Binauli, Baghpat, Pilana, and Khekra under three Tehsil regions.

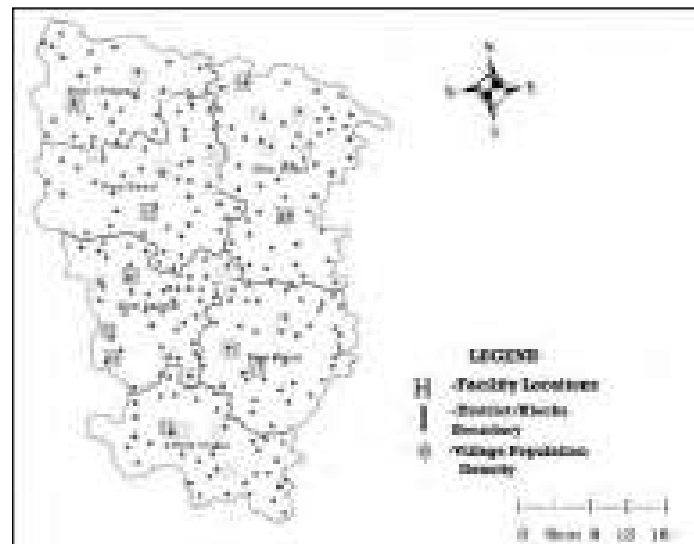


Figure 3: Baghpat District with 30 healthcare facilities

Source: Author

There are 30 facilities in the district, as illustrated in Table 4 and Figure 3. At the Primary level (PHC)- 20 facilities, the Secondary Level (CHC) – 9 facilities, and at the Tertiary level (District Hospital)- 1 facility are scattered throughout the district. 300 people were approached for the interview, 59 refused, and the rest completed the interviews. A total of 241 people responded.

Table 4: Block-wise facilities and population in Baghpat District.

S. No.	Tehsil	Blocks	Population			PHC	CHC	D.H
			Rural (Block)	Urban (Tehsil)	Total			
1	Baraut	Chhaprauli	1,41,562	1,50,992	7,13,106	10	4	0
2		Baraut	2,19,215					
3		Binnauli	2,01,337					
4	Baghpat	Baghpat	1,67,091	75,357	4,04,950	7	4	1
5		Pilana	1,62,502					
6	Khekra	Khekra	1,36,316	48,676	1,84,992	3	1	0
7	Total		10,28,023	2,75,025	13,03,048	20	9	1

Source: Author

Out of 10 PHCs and 4 CHCs in Baraut Tehsil, 3 CHCs and 1 PHC are in the urban area, and the remaining 1 CHC and 9 PHCs are in rural blocks. Similarly, of the 7 PHCs, 4 CHCs, and 1 District Hospital in Baghpat Tehsil, 2 PHCs, 2 CHCs and 1 District Hospital are in urban areas, and the remaining healthcare facilities are in rural areas. Out of 3 PHCs and 1 CHC in Khekra Tehsil, 1 CHC and 1 PHC are in the urban area, and 2 PHCs are in rural areas.

Data Analysis

The characteristics of the respondents to the survey are as follows: 41 per cent are male and 59 per cent are female. The respondents' demographic profile is presented in Table 5 and Figure 4. Irrespective of the facilities hierarchy, 58 per cent of the population uses the facility for primary care, 34 per cent for secondary care, and only 8 per cent for specialised care.

Table 5: User Demographic Characteristics at Healthcare Facilities.

S. No.	Respondent Age	Percentage Share
1	0-5 years (accompanying caregiver)	7.2%,
2	5-15 years	10.8%
3	15- 30 years	32%
4	30-40 years	26.2%
5	40-60 years	20%
6	above 60 years	3.8%

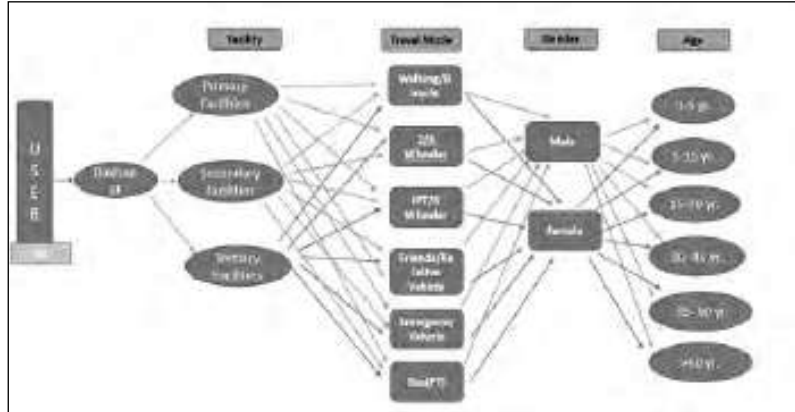


Figure 4: Attributes of Users

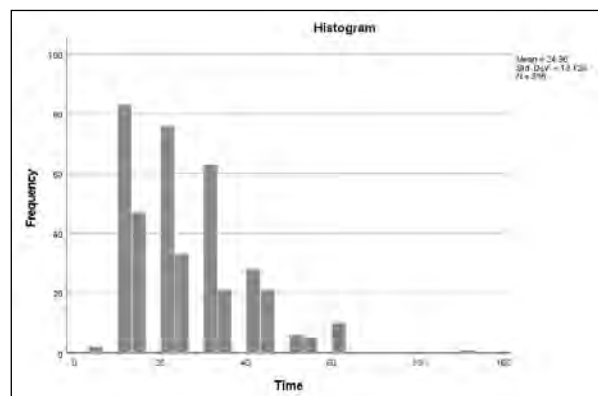
Normality Test of the data

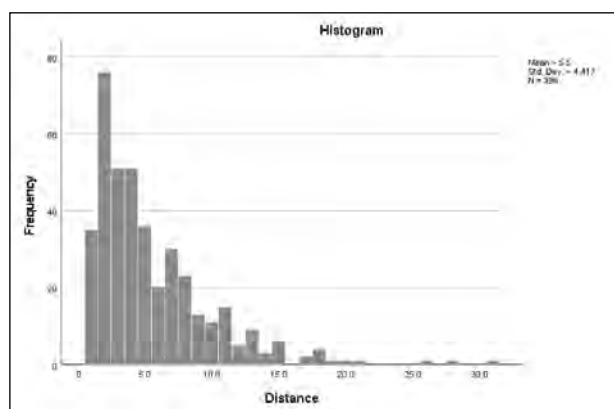
To determine whether a data collection is adequately described by a normal distribution or not, normality tests are used. The Kolmogorov-Smirnov test and Shapiro-Wilk test were run to verify the distribution of the study's performance variables in Table 6. The data set must have a regular distribution if the estimated p-value for the normality test has a significance level greater than 0.05. If the calculated p-value is less than 0.05, the null hypothesis, which claims that the data are distributed normally, is rejected. The test must then accept the alternative hypothesis.

Table 6: Normality Test for Users Survey at Baghpat District

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Time	.173	241	.000	.908	396	.000
Distance	.174	241	.000	.823	396	.000

a. Lilliefors Significance Correction





Source: Author

The null hypothesis of a normal distribution is rejected for both variables, time and distance. The data points are clustered on the left side of the graphs and taper towards the right. The distribution is right-skewed, where lower values are more frequent, while higher travel time and travel distance are less common. The spread is significant, with instances of longer time durations and travel distances.

Travel Characteristics of users Survey (241 respondents)

Table 7 breaks down the typical travel characteristics and transportation methods used by individuals visiting 30 healthcare facility hierarchies in the Baghpat district. The data show that the most common mode of travel at primary facilities is walking and two-wheelers. At the secondary level, I.P.T. and two-wheelers show high user numbers across CHCs. Whereas, at the tertiary level, the convenient modes of travel are Public Transport, followed by I.P.T. and two-wheelers. The district hospital has the highest average travel time of 38.5 minutes and average distance of 12km. Two-wheeler trips remain notably high, suggesting dependence on personalised motor transport.

Table 7: Trip Analysis at PHCs, CHC's and D.H. of Baghpat District

Facility Name	Avg. Travel Time to Facility	Avg. Travel Distance to facility	By P.T. (N.o)	By I.P.T (N.o)	By Two Wheeler (N.o)	Friends Vehicle (N.o)	Ambulance (N.o)	Walking/ Bicycle (N.o)	Sample Size
Baghpat D.H	38.5	12	8	8	5	4	1	2	28
Baghpat CHC	23	6	0	8	7	0	1	4	20
PHC Tatiri	15	3	0	1	2	0	0	3	6
PHC Gwalikhera	10	2	0	0	1	0	0	3	4
PHC Ghanora	10	2.5	0	0	2	0	0	2	4
PHC Pawla	15	2.5	0	0	1	0	0	3	4
PHC Ninada	15	2	0	0	1	0	0	3	4
Surrorpur CHC	17	3	0	0	4	1	0	9	14
Khekra CHC	23.5	4	0	6	5	2	1	4	18
PHC Bada Gaon	15	3	0	0	2	0	0	2	4
PHC Ratol	12	2	0	0	2	0	0	2	4
PHC Kekhokra	13	4	0	0	2	0	0	2	4
Pilana CHC	14	4.5	0	1	6	0	0	5	12
Doula CHC	20	4.5	0	1	6	0	3	1	11
PHC Pura Village	15	2.5	0	0	2	0	0	2	4

Facility Name	Avg. Travel Time to Facility	Avg. Travel Distance to facility	By P.T. (N.o)	By I.P.T (N.o)	By Two Wheeler (N.o)	Friends Vehicle (N.o)	Ambulance (N.o)	Walking/ Bicycle (N.o)	Sample Size
PHC Aminagar Sarai	15	3	0	0	2	0	0	2	4
Baraut CHC	25.5	7	1	6	3	1	5	3	19
PHC Bijrol	15	3	0	0	2	0	0	2	4
PHC Baoli	10	2	0	0	2	0	0	2	4
PHC Kandehra	12	2.5	0	0	2	0	0	2	4
PHC Pusar	15	3	0	0	2	0	0	2	4
CHC Binauli	30	9.5	0	2	0	0	10	1	13
CHC Tikri	23	5	0	4	3	1	0	2	10
PHC Doaha	20	2.5	0	0	1	0	0	3	4
PHC Mulsam	15	2.5	0	0	2	0	0	2	4
PHC Daughat	15	3	0	0	2	0	0	2	4
CHC Chapprauli	22.5	5.5	2	0	4	2	4	2	14
PHC Adarsh Nagar	12	2.5	0	0	2	0	0	2	4
PHC Kirthal	15	3	0	0	2	0	0	2	4
PHC Rambhal	15	2	0	0	1	0	0	3	4

Source: Author

Figure 6 highlights that the maximum distance travelled to the Primary facilities at public healthcare facilities is 3 km, and the travel time is 16 minutes. Whereas at Secondary facilities, the maximum distance travelled is 21 km at CHC Binnauli, and the travel time is up to 60 minutes. At tertiary facilities, the maximum distance travelled is 31 km, and the travel time is up to 60 minutes (Figure 8).

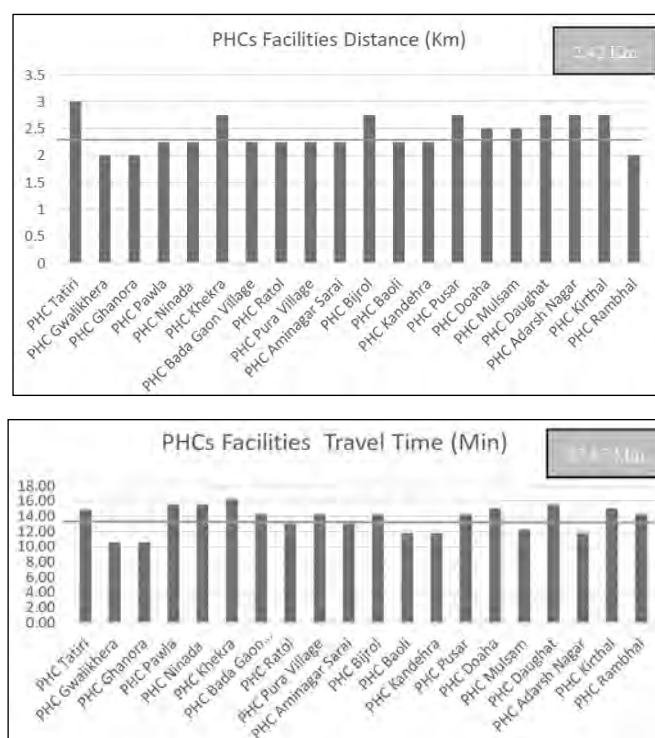


Figure 6: Comparison of Travel Time and Distance at Primary Level Facilities.

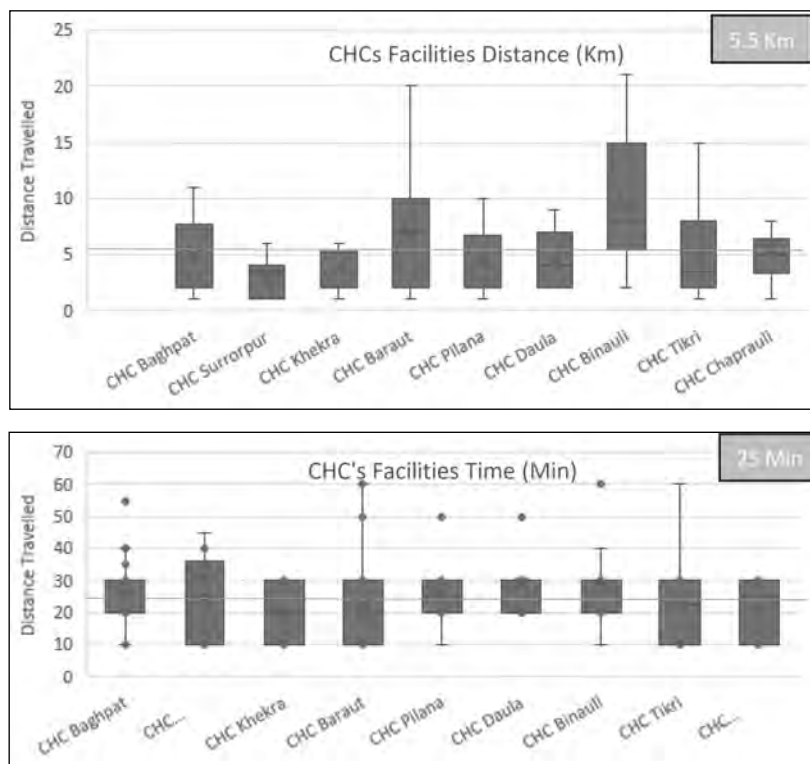
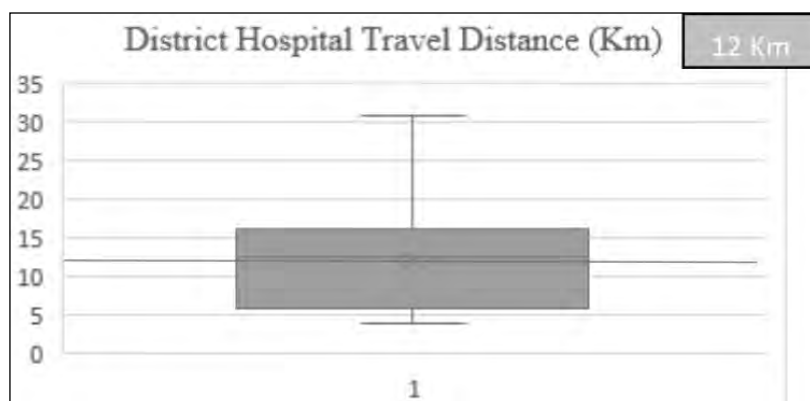


Figure 7: Comparison of Travel Time and Distance at Secondary Level Facilities.

Travel distances vary widely across CHCs; some show very large variation, showcasing uneven distribution of health facilities (Figure 7). This reflects that some CHCs are serving a wider population due to the attractiveness of their services. Some outliers reflect individuals who prefer to travel up to 60 minutes due to a lack of closer specialised services. This also highlights the dependence on public transport due to limited access to private vehicles.



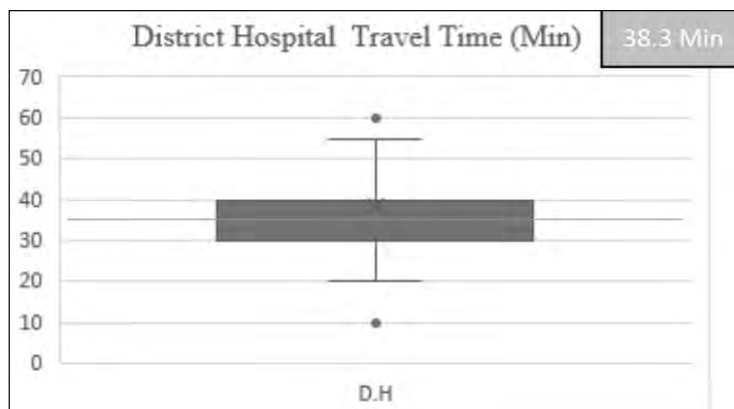


Figure 8: Comparison of Travel Time and Distance at Tertiary Level Facilities, Public.

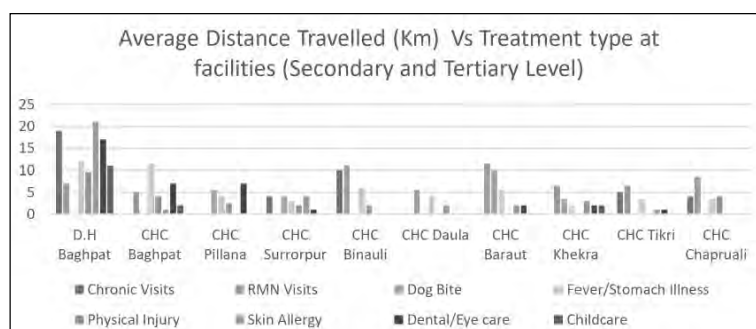


Figure 9: Average Distance Travelled at Secondary and Tertiary Level facilities.

It is observed from Figure 9 that people are willing to travel a higher distance for the same type of treatment at the District hospital level due to its increased attractiveness. The presence of a specialised doctor and advanced diagnostic labs at the district hospital increases users' confidence in travelling a long distance.

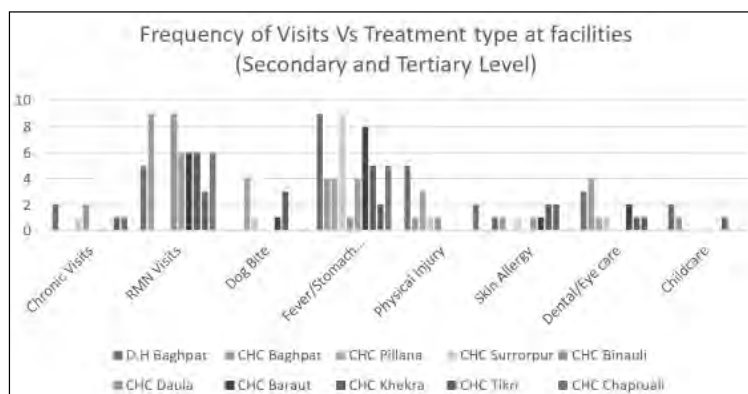


Figure 10: Prevalent Treatment Offered at Secondary and Tertiary Level Facilities.

Figure 10 highlights the current status of the Indian Healthcare system. It reflects that people are visiting the facilities for preventive and curative treatment; however, specialised treatment is very limited at these secondary and tertiary level facilities.

Spatial Analysis

Broad disparities exist in spatial access to healthcare facilities at the PHC level within the district, as shown in Figures 11a and 11 b. Poor population coverage in the Baghpat district is observed from buffer analysis. The district healthcare facilities are insufficient to cater to the needs of the population in the region. Also, from the survey, it is evident that people are unwilling to travel to healthcare facilities due to a lack of services and infrastructure. Figure 12 highlights the importance of road networks and healthcare facility hierarchy in delivering equitable health services. The sparse population in the regions creates inequitable access to healthcare. To reach the nearest PHC facility, people have to travel up to 14 km in some areas. The average distance travelled is 5.3km which is within the IPHS distance threshold.

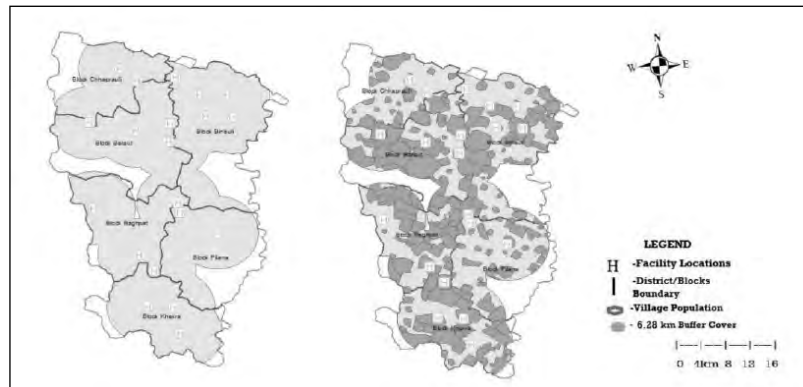


Figure 11a: Radial Distance coverage from PHC – 6.28 Km from the IPHS Guidelines.

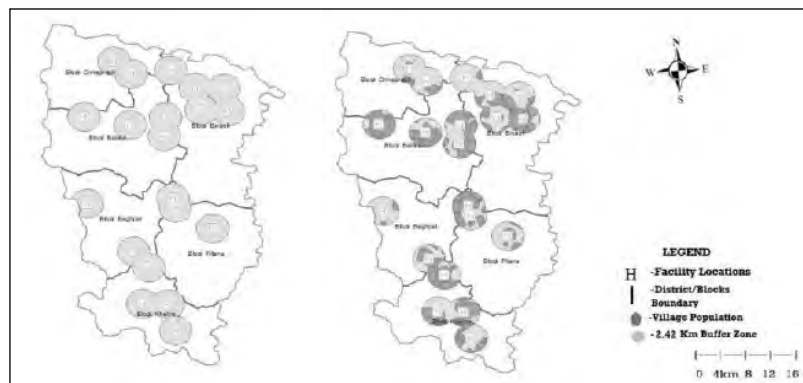


Figure 11b: Radial Distance coverage from PHC – 2.42 Km from the user Survey.

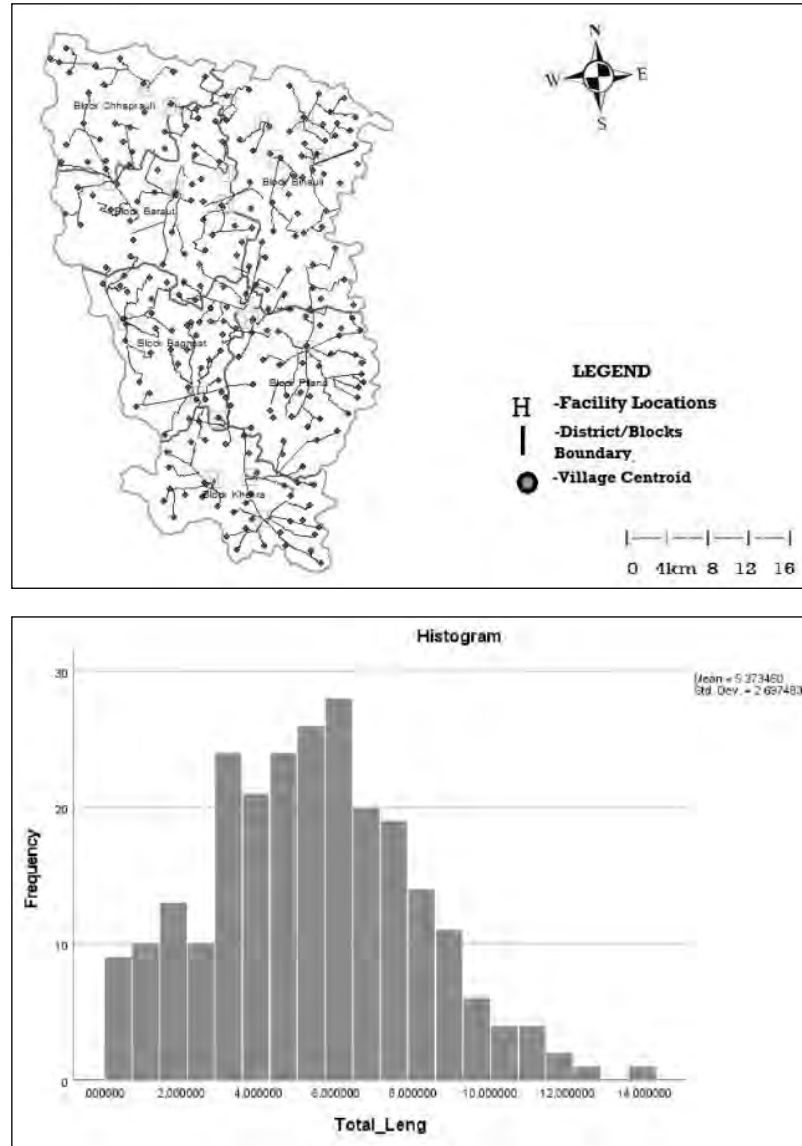


Figure 12: Travel Distance from Village Centroids to Nearest PHC facility.

At the CHC level, the healthcare facilities in the district suffice the population coverage as per IPHS norms. However, a substantial coverage gap exists in spatial access to healthcare facilities within the district, from the users' perspective, as shown in Figures 13a and 13b. People are unwilling to travel to healthcare facilities due to limited services and infrastructure. From Figure 14, it is evident that to reach the nearest CHC facility, people have to travel up to 19 km in some areas. The average distance travelled is 7.5km, which is within the IPHS distance threshold.

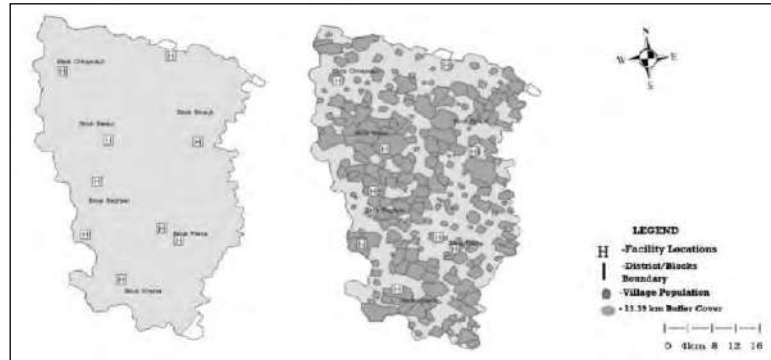


Figure 13a: Radial Distance coverage from CHC – 13.39 Km from the IPHS Guidelines.

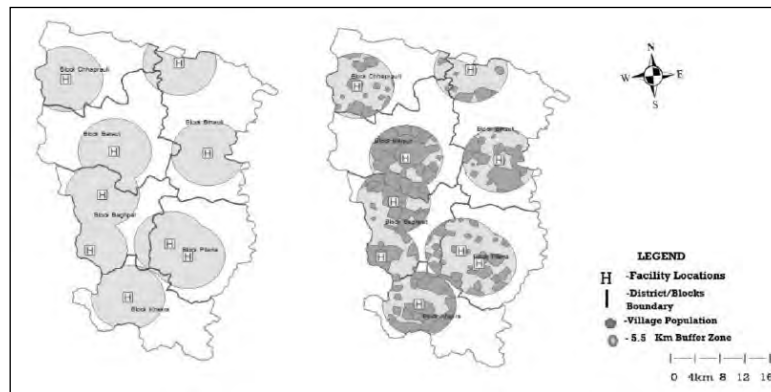
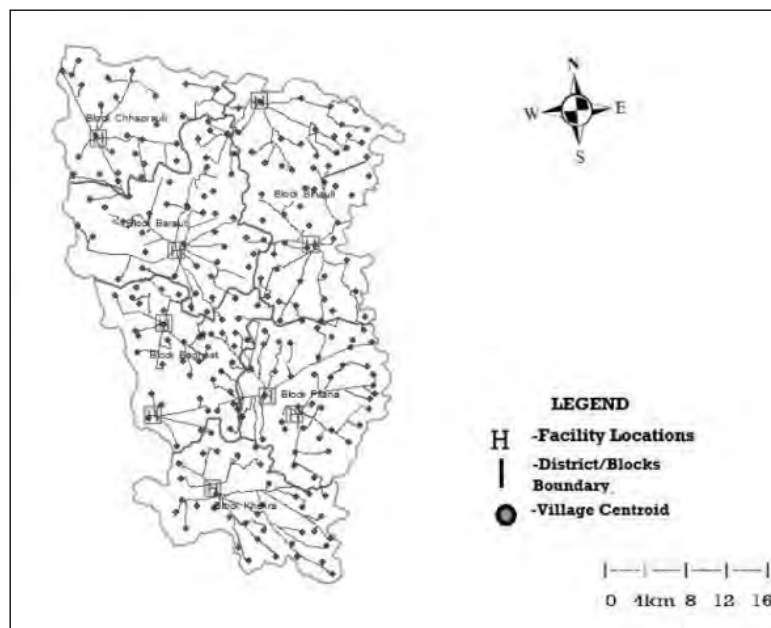


Figure 13b: Radial Distance coverage from CHC – 5.5 Km from the user Survey.



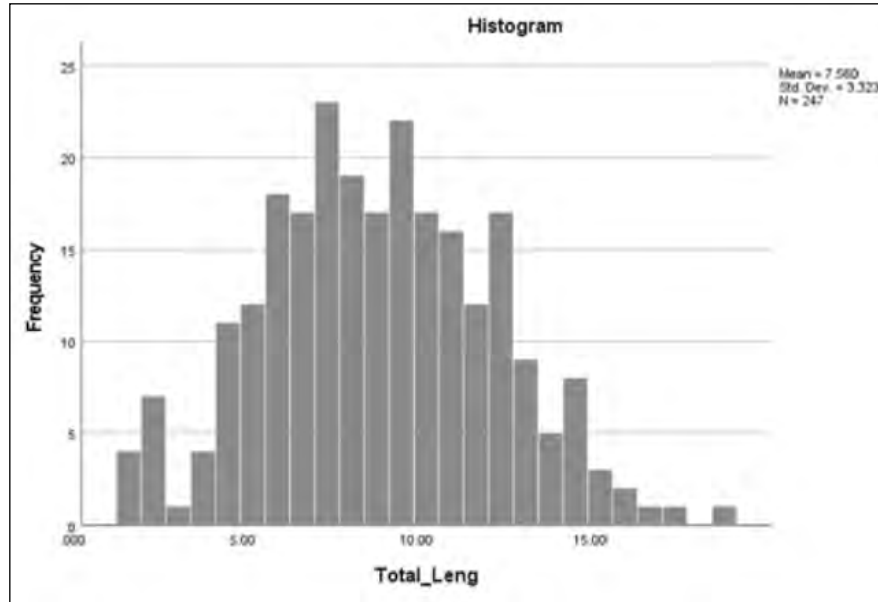
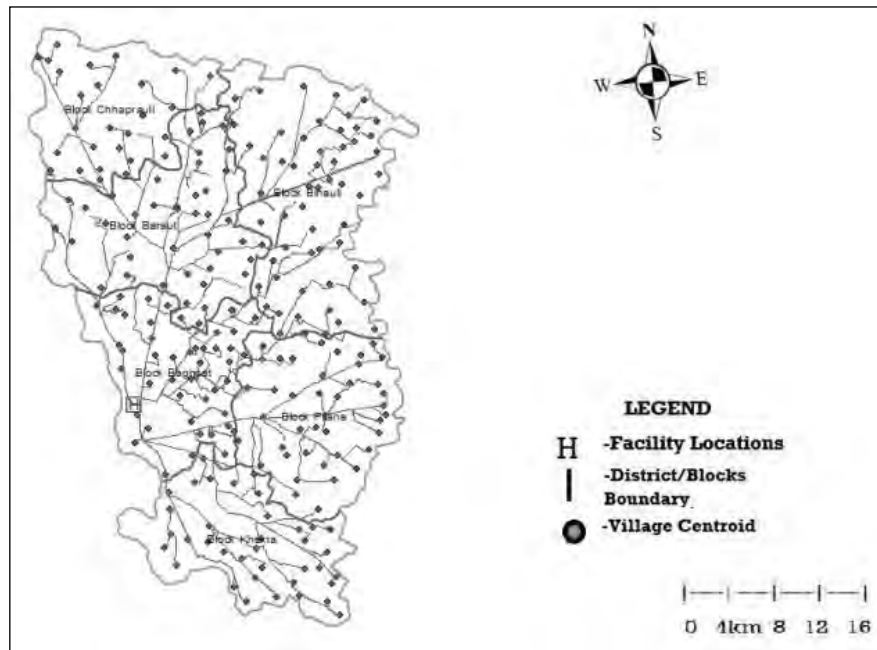


Figure 14: Travel Distance from Village Centroids to Nearest CHC facility.

At the District Hospital (D.H.) level, the Indian Public Health Standards (IPHS) do not define a threshold for population coverage distance. Figure 15 shows that, in some areas, people have to travel up to 41 km to reach the nearest D.H. facility. The average distance travelled is 23km.



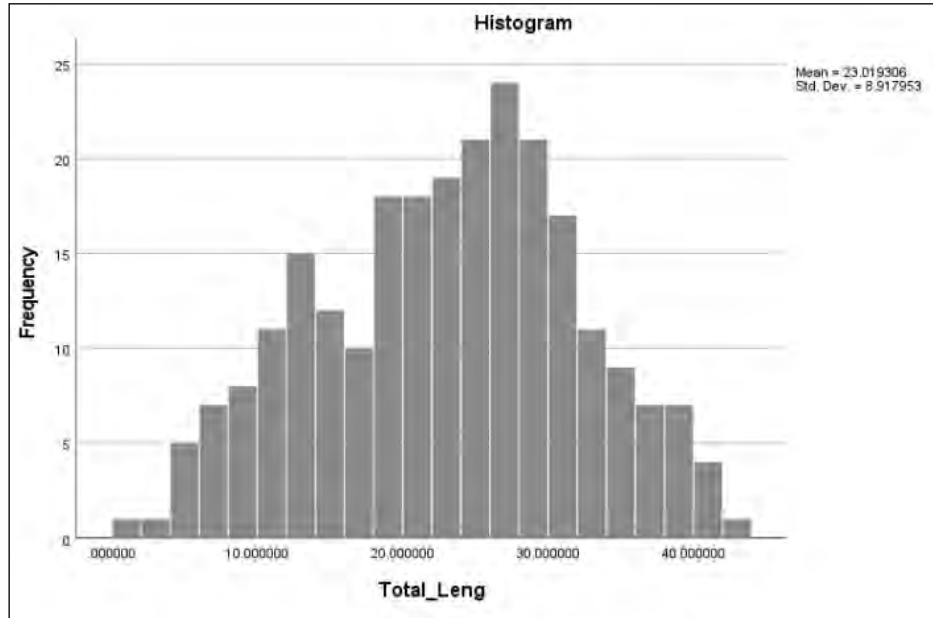


Figure 15: Travel Distance from Village Centroids to Nearest D.H. facility.

Factor Analysis of Spatial and Non-Spatial Parameters

Factor analysis assumes that all variables correlate to some degree. The significant factors are extracted to explain the maximum variability of the group.

Table 6: Rotation Value of PCA Factors

S. No	Factor loadings	F1	F2	F3
1	Access to Laboratory (Pathology, Radiology)	-0.759	0.150	-0.334
2	Lack of Specialised Diagnostic Test	0.651	0.220	-0.338
3	Lack of Specialised Doctor	0.804	-0.201	-0.377
4	Inhuman Care / Quality of Care	0.395	-0.081	0.729
5	Out of Hours Care	0.501	-0.425	0.171
6	Health Infrastructure/ Waiting Time	0.440	0.746	0.153
7	Non-Availability of Medicine	0.146	-0.333	-0.619
8	Absenteeism of the Doctor	-0.798	0.142	-0.011
9	Distance to Facilities	0.692	0.445	0.039
10	Transport Availability	0.840	-0.275	-0.091
11	Information and Communication	0.174	0.771	-0.235

Source: Author

The rotation value of the factor analysis must be above 0.7 to have a significant impact. Table 6 highlights the rotation value of the First 3 PCA Factors.

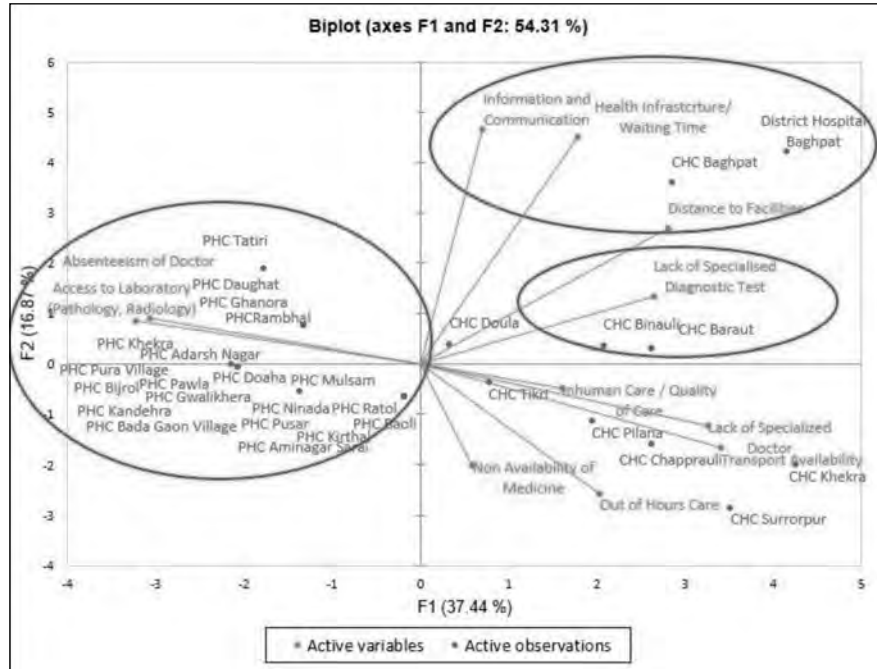


Figure 6a: Biplot Between Principal Component F1 and F.

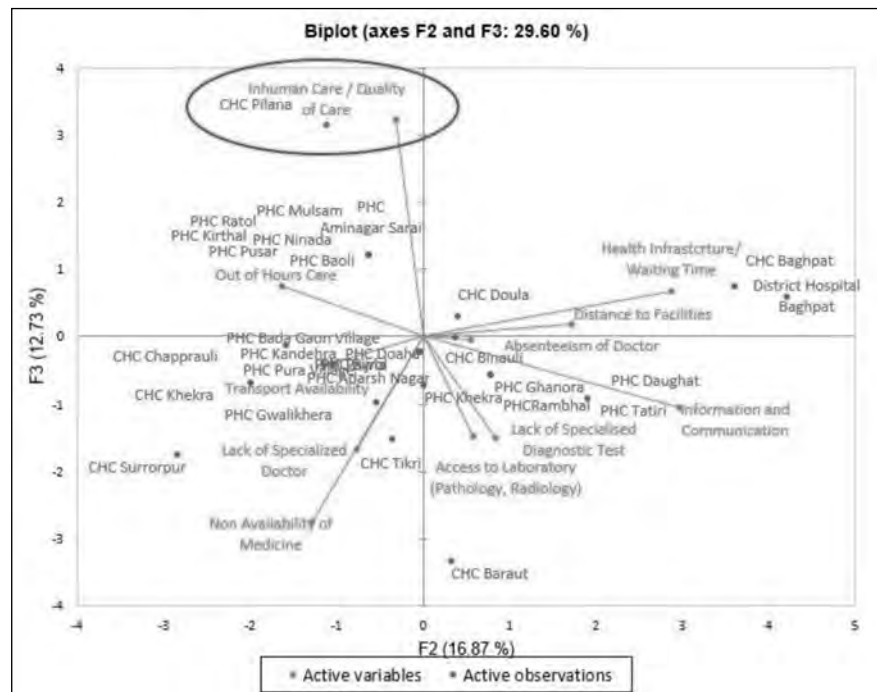


Figure 6b: Biplot Between Principal Components F2 and F3.

The bi-plot shown in Figures 6a and 6b shows the correlation between a Healthcare facility hierarchy and the barriers associated with it. The dots represent the relative positions of healthcare facilities with principal components factors 1 and 2 in Figure 6a, and with principal components factors 2 and 3 in Figure 6b. The Principal Component Analysis cluster technique proved effective in identifying barriers within the healthcare facility hierarchy to inform interventions. The biplot 6a shows that the F1 factor captures the largest variation with 37.44 per cent, and the F2 factor captures secondary variation of 16.87 per cent. F3 captures 12.73 per cent of the new variations. Most of the CHCs are on the positive right side, reflecting challenges of distance travelled, lack of specialised diagnostic tests and high waiting time. A few CHC facilities in the lower half also reinforce the quality issue, such as a shortage of medicine and a lack of specialised doctors. Whereas on the left side, most PHCs are present, highlighting operational and manpower challenges. At the District Hospital, administrative and system-level challenges are prevalent.

At the Primary Healthcare Centres (Tier 1) level, the absenteeism of doctors and limited access to laboratories act as barriers, hindering the efficient delivery of healthcare services. Secondly, the lack of specialised doctors and the availability of transportation are acting as barriers to the utilisation of public healthcare at Community Healthcare Centres (Tier 2) levels. A higher hierarchy of healthcare facilities, such as CHCs, attracts people from distant regions; thus, reflecting the facilities' attractiveness. The role of the availability of healthcare services and infrastructure becomes crucial at the secondary level. At the Tier 3 level, that is, the District Hospital level, high waiting times and information and communication parameters are acting as barriers to the effective utilisation of healthcare services.

Conclusion

This study assessed spatial and non-spatial accessibility to public healthcare facilities across the district by analysing demographic and socio-spatial data. The findings reveal clear and persistent inequities in healthcare access, strongly influenced by both geography and transport availability. It is observed that the number of Primary Healthcare centres in Baghpat district is not spatially accessible to the district population. In terms of non-spatial parameters, the study highlights supply-side gaps, including administrative, infrastructural and system-level challenges

As per the IPHS norms, the radial distance is 6.28 km for the Primary Healthcare Centre and 13.39 km for the Community Health Centre. However, the survey indicates that users' network coverage is much lower due to the healthcare service's lack of attractiveness. At the Primary Healthcare Centres, it is 2.42 km, and at the Secondary Healthcare Centre, it is 5.5 km.

Overall, the results reveal a systemic accessibility gap, where healthcare provision is dependent on private transport, leaving economically weaker and mobility-constrained

populations at a disadvantage. These spatial inequalities highlight the urgent need for strengthened public transport connectivity and strategically located new healthcare facilities. Also, mobile healthcare units can be set up at distant locations where the population is limited, as every individual's health is indispensable.

Improving equitable access, particularly for remote, underserved blocks, should be prioritised to ensure that healthcare delivery aligns with the principles of inclusivity and efficiency.

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Kerala's Urban Transition: Exploring the District-Level Dynamics

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Abstract

Urbanisation involves a transition from dispersed human settlements to concentrated urban centres. This process is finite and represents a cycle through which nations evolve from agrarian to industrial societies. India, as a developing country, is experiencing rapid urbanisation. Kerala is distinct among Indian states due to its unique urbanisation process and the challenges that come with it. Unlike other states, Kerala's urbanisation is not confined to specific cities and towns; instead, the entire state exhibits an urban-rural continuum. This rapid urbanisation in Kerala is driven not by industrialisation, but by significant expansion in the service sector. This paper aims to explore the urbanisation process in Kerala at both the state and district levels, analysing the dynamics involved. It is hypothesised that economic and demographic factors influence the degree of urbanisation in Kerala.

Keywords

Level of urbanisation (LoU), Per capita income, Decadal urban population growth rate (DGR), Population density, Emigrants per hundred households, Decadal change in towns.

Introduction

Urbanisation is perpetually taking place in countries around the world. Being a continuous process, urbanisation represents a social shift from traditional rural societies to modern urban communities. While it accompanies the development process and offers new opportunities and possibilities, it also presents significant and often more complex challenges compared to those in rural areas. In 2007, a significant milestone was reached in global history: the urban population surpassed the rural population. As per the 2011 Census, Delhi, the National Capital, is the most urbanised region in India, with 97.5 per cent of its population residing in urban areas. Chandigarh follows

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closely with 97.25 per cent and Lakshadweep with 78.08 per cent. Among the major states, Goa ranks highest with 62.17 per cent urbanisation, followed by Mizoram at 51.51 per cent, Tamil Nadu at 48.45 per cent, and Kerala at 47.72 per cent. Notably, Kerala had consistently lagged behind the national urbanisation figures until 2001. The urban population in Kerala experienced significant growth from 2001 to 2011, primarily due to the substantial increase in census towns. Kerala's rapid urbanisation, unlike other regions, has been driven by the swift expansion of the service sector rather than industrialisation. The share of different sectors in Net State Value Added by economic activity at constant prices (base year 2011-12) in per cent shows the growth of service sector in Kerala is so remarkable that there has been a magnificent increase in the contribution of service sector from 57.92 per cent in 2011-12 to 61.84 per cent in 2020-21 (Renjini, 2024). This paper aims to analyse the dynamics of urbanisation process in Kerala at both the state and district levels. Using a multiple regression model, the study investigates the direction and magnitude of the relationship between selected explanatory variables and the level of urbanisation (LoU) across different districts. To predict the future urban scenario, including the LoU up to 2051, time series regression has been employed to estimate the time trend for urbanisation in all districts.

Some important research questions based on the objectives of study are as follows- How do economic factors (e.g., per capita income) and demographic factors (e.g., population density, emigration) influence the level of urbanisation across districts in Kerala? What are the projected levels of urbanisation for Kerala and its districts up to 2051, and how will inter-district variations shape urban development in the state? These questions directly address the core themes of study while being specific and researchable.

While many descriptive and analytical studies on urbanisation processes have been done in India, similar to those done in developed Western countries, urbanisation in Kerala has remained relatively under-researched. Historically, Kerala has exhibited a low degree of urbanisation but has maintained a relatively high town density (Sreekumar, 1988; Retnaraj, 1999). A historical analysis shows that the growth of urban population in Kerala is because of the emergence of new towns, while decreases have resulted from the reclassification of existing towns into villages. In Kerala, historical processes have created a spatial form that is neither purely rural nor strictly urban. The evolving pattern over various decades indicates that India is progressively advancing in development. This shift leads to a population movement away from the primary sector towards the service and industrial sectors (Bala, 1986; Krishnakumari, 1991; Mitra, 1992; Sahay and Patra, 2007).

The expansion of urban agglomerations is a key driver of urbanisation in Kerala (Retnaraj, 1999). This led to significant population pressure in urban centres, resulting in urban poverty, with most of Kerala's urban population accumulated in Class I cities. Between 2001 and 2011, Kerala witnessed a significant rise in urbanisation

from 25 per cent to 47 per cent, because of the rise in census towns. This growth in towns is linked to improved transportation facilities, a decline in the male workforce in agriculture and related activities, and a shift towards the service sector (Kuruvilla, 2014). The growth of urban populations has been significantly influenced by the expansion of urban areas and the urbanisation of the outskirts surrounding major cities. Changes in consumption patterns and lifestyles are notable outcomes of urbanisation and modernisation in Kerala (Hari, 2015).

Kerala significantly differs from other states in several respects such as population density, cropping pattern, topographical characteristics, and structural characteristics of the economy, educational and social development, and migratory tendencies of the people. Due to these distinct factors, the pattern and rate of urbanisation in Kerala differ from those in other Indian states. According to 2001 Census, Kerala was considered as least urbanised state due to slow growth of urban population, i.e. 25.97 per cent which was below the national average. Kerala experienced the highest level of urbanisation in its history during 2001–2011, reaching 47.72 per cent, with an 83.82 per cent increase in its urban population. While Kerala was 19th in urbanisation among Indian states in 2001, it moved up to 9th place by 2011. Unlike other states, the urbanisation in Kerala is not confined to specific cities and towns. Except for a few isolated and hilly regions in the Panchayats, the entire state presents an urban-rural continuum. Overall, Kerala society can largely be considered urbanised. Hence, this paper endeavours to investigate the urbanisation process in Kerala at the state and district levels, hypothesising that urbanisation is influenced by economic and demographic factors.

Data Sources and Statistical Tools

In this study, secondary data were primarily used due to their availability and comprehensiveness. Secondary data were collected from a variety of sources such as Decennial Censuses, Directorate of Economics and Statistics (Government of Kerala), Vital Statistics Bulletin and Urban Statistics Handbook. To address various limitations regarding the secondary sources, data were cross-verified across multiple authoritative sources such as Census reports, Kerala Economic Reviews, and Migration Surveys. The study utilised a range of statistical techniques including averages, percentages, multiple regression analysis and time-series regression analysis for data analysis. Additionally, graphs and tables were used for the presentation and analysis of data.

Analysis and Discussions

Urbanisation in Kerala

Kerala has urbanised rapidly due to a fairly high population density, close settlements in the lowlands and coastal plains, and an increasing shift towards service sector employment. By 2011, Kerala had transformed into one of India's most urbanised

states. Kerala's urbanisation trend and pattern show distinct characteristics. Usually, an upward trend in urban population is driven by the over-concentration of residents in existing cities, particularly metropolitan areas. However, in Kerala, the primary factor contributing to population growth in urban areas is the expansion of urban areas and the urbanisation of peripheral areas around existing major urban centres (GoK, 2015). This section, aims to explore the trends of urbanisation in Kerala. Table 1 displays the trends in LoU and other related indicators over time.

In 1901, Kerala's urban population was 4.5 lakhs, increasing to 159.3 lakhs by 2011. The 2011 Census revealed a remarkable increase in urbanisation in Kerala. Urbanisation, as measured by the urban population share, jumped from 25.96 per cent in 2001 to 47.72 per cent in 2011. For India, the corresponding figures were 27.78 per cent in 2001 and 31.16 per cent in 2011. The rise in the number of towns included in the Census surveys and urban outgrowths is the principal reason for this demographic shift in Kerala. Pre-independence, the LoU in Kerala was low, at just 7.11 per cent in 1901, increasing to 13.48 per cent in 1951. From 1961 to 1991, the urban population growth rose from 15.11 per cent to 26.39 per cent. However, the 2001 Census showed a slight reduction in urban population to 25.96 per cent, attributed to a decline in the number of Census towns and variation in the jurisdiction of statutory urban areas. As per the population projections for Indian states 2011-2036, urban population in Kerala was 75.3 per cent as on 2023. Urban population in Kerala, which was earlier close to the national estimates, has consistently stayed above the national estimates after 2001, and the gap between the two has widened particularly over the past two decades.

Table 1: Trend of Urban Population in Kerala

Year	LoU (Per cent)	Urban Population (in lakhs)	Decadal Growth of Urban Population	Number of Towns
1901	7.11	4.5	-	21
1911	7.34	5.3	15.44	27
1921	8.73	6.8	29.78	44
1931	9.64	9.2	34.58	53
1941	10.84	12.0	30.47	62
1951	13.48	18.3	52.72	94
1961	15.11	25.5	39.89	92
1971	16.24	34.7	35.72	88
1981	18.74	47.7	37.64	106

Year	LoU (Per cent)	Urban Population (in lakhs)	Decadal Growth of Urban Population	Number of Towns
1991	26.39	76.8	60.97	197
2001	25.96	82.7	7.6	159
2011	47.72	159.3	92.72	520
2022-23	75.3*	-	23.3*	-

*Projected

Source: Various Census Reports and Population projections for Indian States 2011-2036 by the Technical Group on Population Projections, National Commission on Population Ministry of Health and Family Welfare, Government of India.

Determinants of Urbanisation

Economic variables and demographic variables, associated with overall economic development, affect the LoU to a great extent. These variables are especially relevant to the development context of Kerala. As a result, the urbanisation process in Kerala from 2001 to 2011 has been analysed. Level of urbanisation (LoU) in a district is taken as the dependent variable. It has been expressed as the percentage of urban population relative to the total population of a particular district at a particular time. Urbanisation is an essential part of modern economic development. A number of different indices of economic development are available to explore the connection between urbanisation and economic development.

The per capita income (PCI), decadal growth rate of urban population (DGR), population density (PD), emigrants per hundred households (EMIHH) and decadal change in towns (DCT) are considered as independent variables in this analysis.

(1) PCI

PCI is commonly employed as an indicator of economic development. For this analysis, the PCDDP (in Rs.) at constant prices (2004-05) is taken into account. It is hypothesised that as economic development takes place and as income rises, there is a general shift in demand from food items to non-food items. This rise in demand for non-food items subsequently increases the need for labour in non-agricultural activities. This heightened demand for workers leads to increased urbanisation (Bhasin, 2001). Therefore, a favourable relationship between LoU and PCI is anticipated.

(2) DGR

DGR is influenced by various factors, can enhance the urbanisation level. Therefore, a positive association between urbanisation and the DGR is expected.

(3) PD

PD (Population Density) is defined as the number of people per square kilometer. It is an important index that indicates the concentration of individuals in a particular area. As per the 2011 Census, a population density is an important criterion for an urban area (400 persons). Therefore, it is hypothesised that rising PD leads to a higher level of urbanisation. This leads to the expectation of a positive coefficient for this variable.

(4) EMIHH

Emigration is expressed as the count of emigrants per hundred households. Kerala is known to be the most emigration-intensive state in India. Under these circumstances, emigration is generally expected to positively influence the LoU.

(5) DCT

DCT indicates the difference in the total count of towns over the decade from 2001 to 2011. DCT was selected as a key variable due to its direct influence on urbanisation. The reclassification of villages as towns and the establishment of new census towns significantly alter urban population shares and urban-rural dynamics, as seen in Kerala's rapid urban growth between 2001 and 2011. Kerala's urbanisation is characterised not by the expansion of existing cities but by the proliferation of new towns, making DCT a vital factor in capturing this distinct pattern. In Kerala, the number of census towns increased from 159 in 2001 to 520 in 2011. Accordingly, a positive association between DCT and LoU is expected.

The independent variables considered may not be extensive but it is sufficient to serve the purpose at hand. Using the technique of multiple regression, a cross-sectional analysis was conducted throughout the period 2001-2011. The model employed for this investigation is detailed below:

$$LU_i = \alpha_0 + \beta_1 PCI_i + \beta_2 DGR_i + \beta_3 PD_i + \beta_4 EMIHH_i + \beta_5 DCT_i + \varepsilon_i$$

where ε is the error term, i represent districts, α and β are the parameters, which are to be estimated.

District-level data are used for the empirical investigation. The data are of secondary in nature and were collected from Census of India, Kerala (2001 and 2011) published by Registrar General of India and Economic Review (2012) and Kerala Migration Survey (2011) published by Centre for Development Studies, Kerala. Tables 2 and 3 display the estimated results.

Table 2: Estimated Coefficients of Multiple Regression

Determinants	Estimated Coefficients	t-Statistic	Significance Level	Collinearity Statistics	
				Tolerance	VIF
Constant	-17.893	-2.176	0.061		

Determinants	Estimated Coefficients	t-Statistic	Significance Level	Collinearity Statistics	
				Tolerance	VIF
PCI	0.00001425	2.400	0.043	0.442	2.264
DGR	-0.071	-2.183	0.061	0.560	1.785
PD	0.021	2.246	0.055	0.445	2.249
EMIHH	0.699	2.885	0.020	0.603	1.659
DCT	0.286	2.364	0.046	0.603	1.658

Source: Computed

Dependent Variable: LU

Table 3: Model Summary

R ²	Adjusted R ²	Standard Error of the Estimate	F
0.907	0.849	9.07864	15.587 (0.001)

Source: Computed

The parenthesis indicates the significant level of F-statistic

All coefficients were statistically significant and Kerala's urbanisation levels during the period 2001-2011 were affected by different factors such as PCI, DGR, PD, EMIHH and DCT. These variables operated simultaneously and exerted their effect on urbanisation levels.

From among these variables, PCI had the expected positive sign. Income from the secondary and tertiary sectors has contributed to Kerala's overall economic development and has significantly influenced the level of urbanisation.

The sign of the DGR was unexpectedly turned to be negative. Broadly speaking, the rise in the number of urban residents could directly impact the level of urbanisation. In Kerala, much of the urban population growth between 2001 and 2011 is attributed to the reclassification of rural areas into census towns rather than natural population increase or migration into existing urban areas. Different districts in Kerala exhibited various patterns in the association between LoU and DGR of the urban population. In certain districts like Malappuram, Kollam, and Kasaragod, the DGR was above the state-level, while the LoU was lagging behind it. This occurred because the reclassification component was more influential in Kerala's urban growth than other elements like natural increase and migration. This partly explains the negative sign.

The PD had the positive sign as expected. According to 2011 census, the population density was 859 in Kerala which is higher as compared to national density (382). At the same time, Kerala occupied a third position in population density. The state of Kerala

shows a rural-urban continuum, with increased population density driving higher urbanisation levels.

Emigrants per hundred households (EMIHH) had the expected positive sign in the analysis. This indicated the emigration intensity situation in Kerala.

In 2011, the number of Kerala emigrants (EMIHH) living abroad was estimated at 2.28 million. Remittances from these emigrants to Kerala in the same year were estimated to be around Rs. 49,695 crores. Remittances account for 31 per cent of the state's domestic product. Non-resident Keralites, through their inward remittances, contribute a major share in the level of consumption, saving and investment in the state. The involvement of an emigrant or return migrant has significantly enhanced the living standards of a household. Within Kerala, the intensity of migration varies significantly across the districts. A certain district like Malappuram is excessively emigration intensive in the sense that foreign remittance constitutes more than half of the district income, while districts like Wayanad and Idukki lag far behind in this respect. The massive doses of Gulf money that have followed into the state during the last three and half decades have affected the entire gamut of the Kerala economy. Gulf money has played a crucial factor in the coming up of business establishments, shopping complexes, hospitals, educational institutions, technical institutes, etc. from one end of the state to another. Therefore, emigration leads to the growth of tertiary sector and the urbanisation in Kerala.

Decadal change in towns (DCT) had the positive sign as expected. In Kerala, there are 520 towns for Census 2011 as against 159 in Census 2001. The establishment of 362 new Census towns has increased the total number of towns in the state to 520. This increase explains the favourable association between the decadal change in towns and the LoU in Kerala.

The coefficients of determination ($R^2=0.907$) reflected that about 90.7 per cent of the systematic variations in Kerala's urbanisation was explained by the various determinants incorporated. The model's fitness is also validated by the F-test. It indicates that R^2 is statistically significant at about one per cent probability level. Collinearity statistics assess the relationship among multiple variables. In this regression model, all VIF values for the independent variables are below five, and all tolerance values exceed 0.2. This indicates no strong multicollinearity, suggesting that the predictors are not highly correlated. As a result, the coefficient estimate remains stable and reliable.

The research offers empirical proof of the connection between urbanisation levels and the other factors being analysed. However, it has limited application for two main reasons: First, it relies on cross-sectional analysis from a single decade's data. Second, the determinants used in the model are limited in scope. Other factors could potentially be influencing the rate of urbanisation growth.

Future Urban Scenario in Kerala

Level of urbanisation projections are a prerequisite for any future action in the area of urban development. Urbanisation, as measured by the share of the urban population, had a gradual increase from 7.11 per cent in 1901 to 26.4 per cent in 1991. It had shown a sharp increase from 25.96 per cent in 2001 to 47.72 per cent in 2011. For projecting the future urban scenario (i.e., LoU), a linear time trend was fitted.

Table 4: Estimated Parameters of Time Series Regression

Districts	Period	Level of Urbanisation (LoU)			
		A	β	R ²	F
Thiruvananthapuram	1961-2011	45.405	0.493 (3.158)**	0.714	9.970**
Kollam	1961-2011	34.272	0.632 (3.282)**	0.729	10.769**
Pathanamthitta	1981-2011	11.910	0.134 (0.907)	0.291	0.822
Alappuzha	1961-2011	44.460	0.694 (3.631)**	0.767	13.183**
Kottayam	1961-2011	22.885	0.267 (2.280)***	0.565	5.201***
Idukki	1971-2011	5.140	0.033 (2.022)	0.577	4.089
Ernakulam	1961-2011	63.395	0.823 (7.496)*	0.934	56.189*
Thrissur	1961-2011	51.557	0.959 (3.483)**	0.752	12.133**
Palakkad	1961-2011	19.842	0.212 (2.487)***	0.607	6.187***
Malappuram	1961-2011	28.385	0.584 (2.133)***	0.532	4.552***
Kozhikode	1961-2011	54.864	0.670 (2.974)**	0.689	8.847**
Wayanad	1991-2011	3.950	0.025 (2.887)	0.893	8.333
Kannur	1961-2011	63.579	1.062 (5.645)*	0.888	31.862*
Kasaragod	1981-2011	35.576	1.045 (4.831)**	0.921	23.335**
Kerala	1961-2011	39.282	0.571 (3.740)**	0.778	13.987**

Source: Computed.

Figures in brackets are 't' values

* denotes 1 per cent level of significance

** denotes 5 per cent level of significance

*** denotes 10 per cent level of significance

Values without stars are not significant.

The model employed for forecasting trends in time series data is as follows:

$$LU_t = \alpha_0 + \beta T_t + \varepsilon_t$$

where $t = 1, \dots, N$ as a predictor variable, ε_t is the error term, α and β are the parameters, which are to be estimated.

Based on population census data from 1961 to 2011, two parameters of the time series regression model have been estimated for fourteen districts and for the entire Kerala state. The results are summarised in Table 4. It was amply clear that the linear time series regression model fits the data very well at state and district levels.

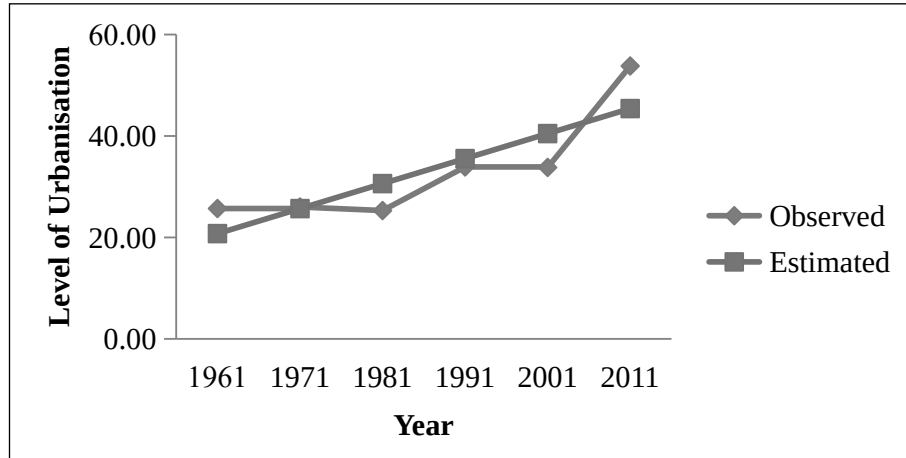


Figure 1: Linear Trend Line for Thiruvananthapuram

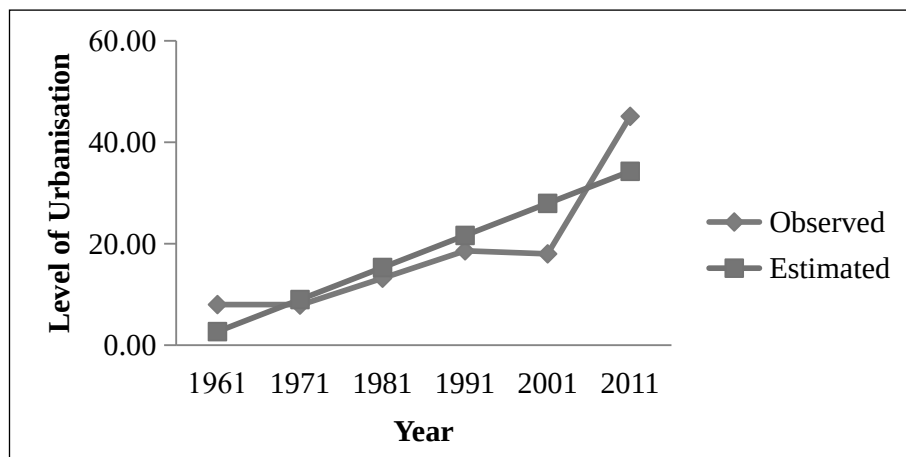


Figure 2: Linear Trend Line for Kollam

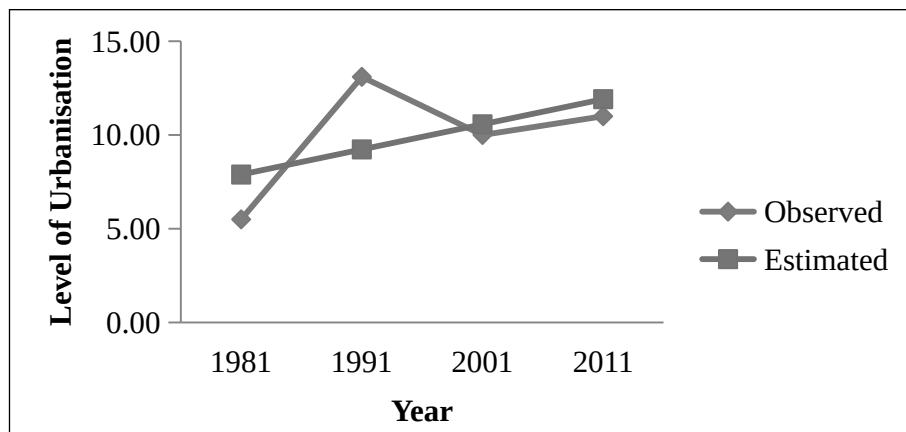


Figure 3: Linear Trend Line for Pathanamthitta

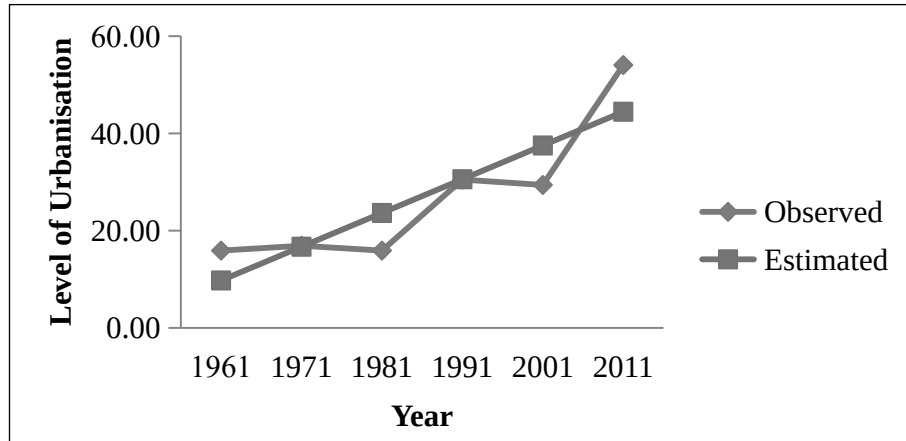


Figure 4: Linear Trend Line for Alappuzha

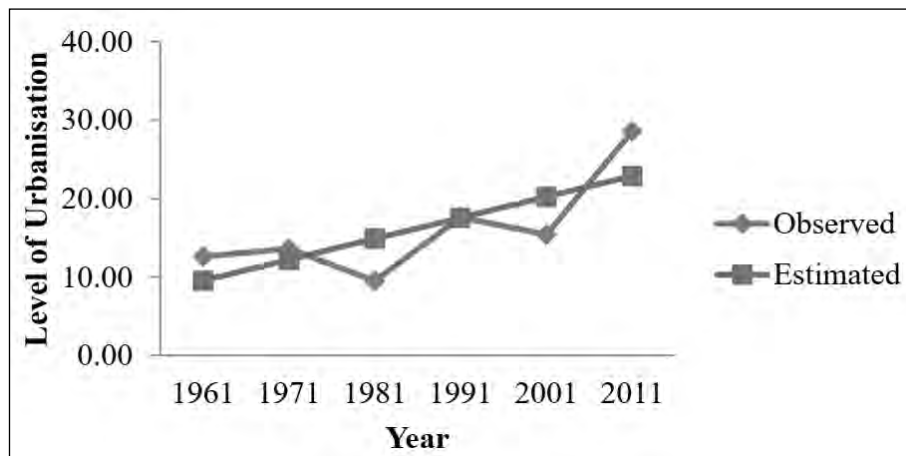


Figure 5: Linear Trend Line for Kottayam

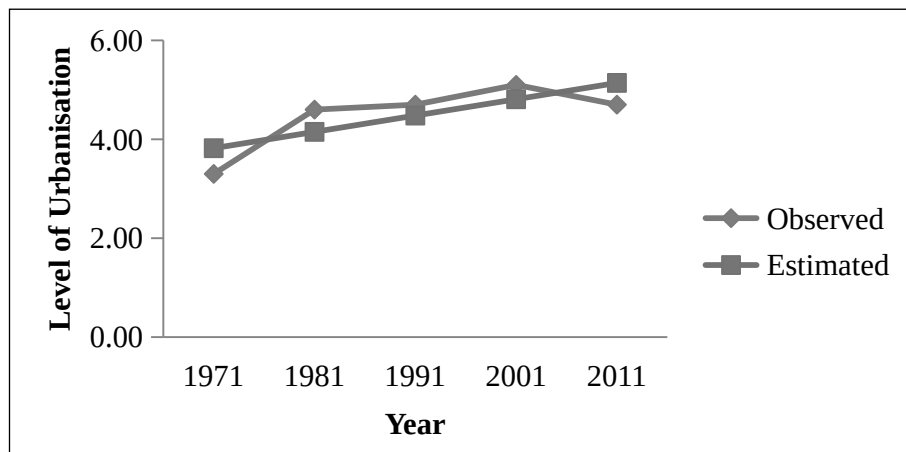


Figure 6: Linear Trend Line for Idukki

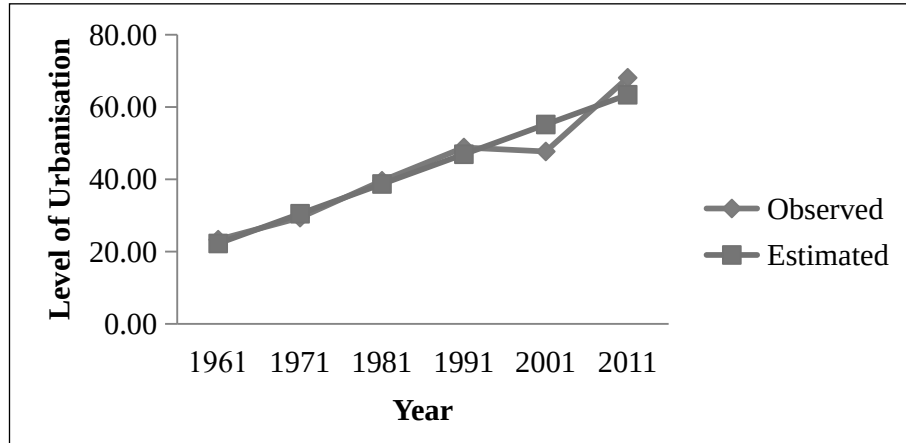


Figure 7: Linear Trend Line for Ernakulam

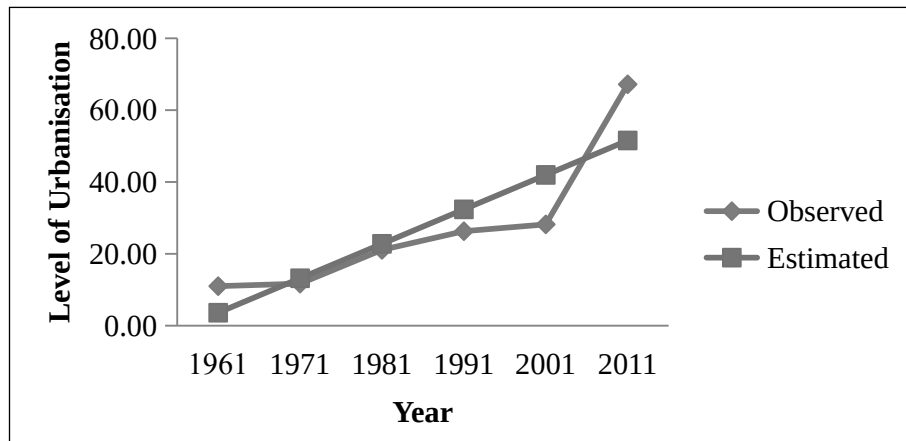


Figure 8: Linear Trend Line for Thrissur

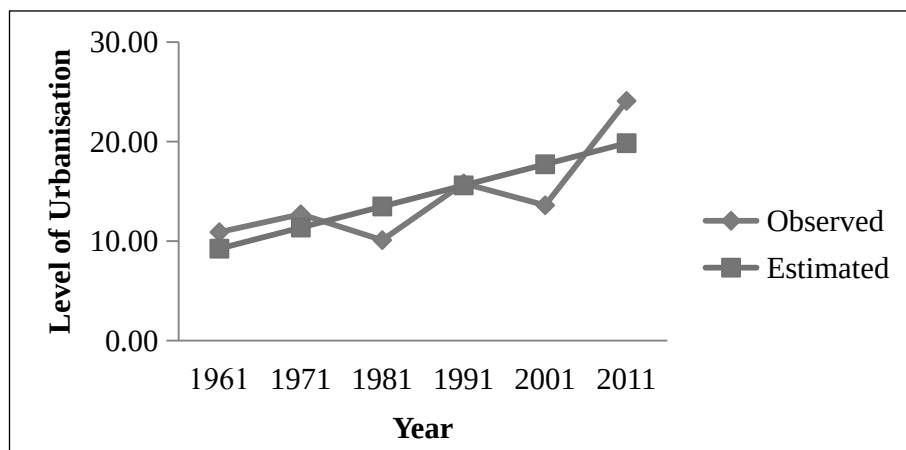


Figure 9: Linear Trend Line for Palakkad

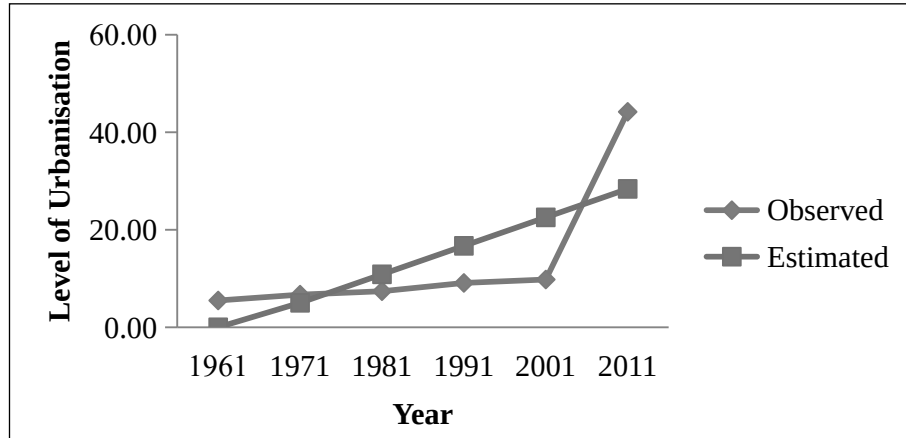


Figure 10: Linear Trend Line for Malappuram

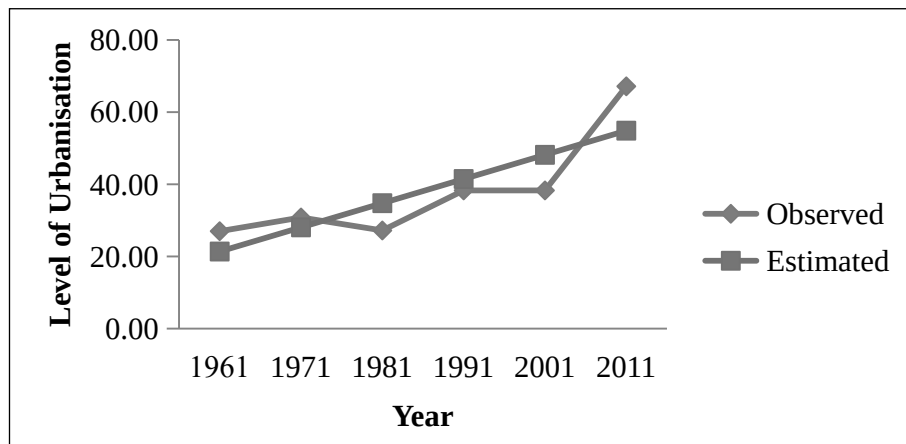


Figure 11: Linear Trend Line for Kozhikode

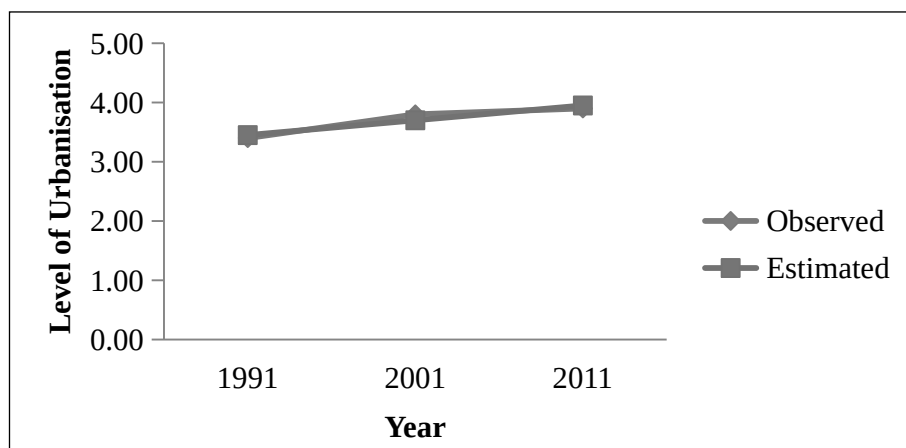


Figure 12: Linear Trend Line for Wayanad

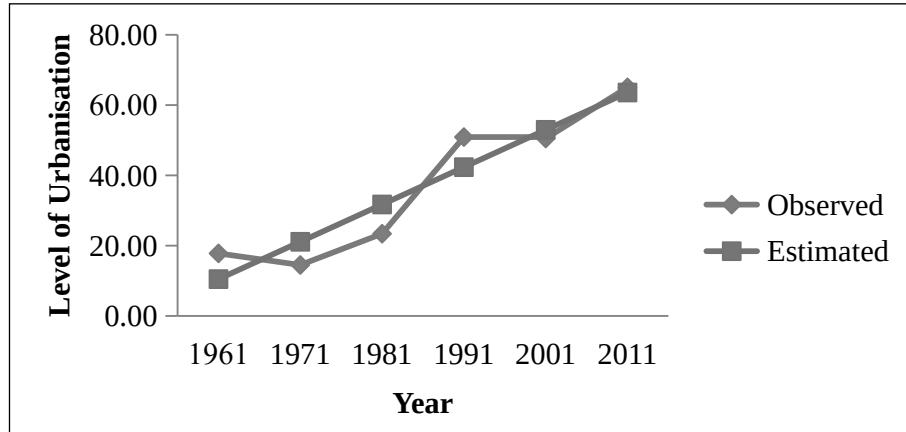


Figure 13: Linear Trend Line for Kannur

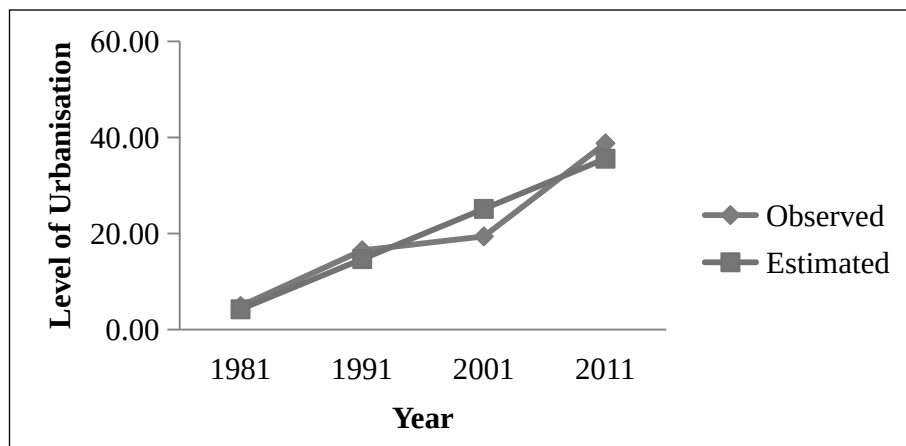


Figure 14: Linear Trend Line for Kasaragod

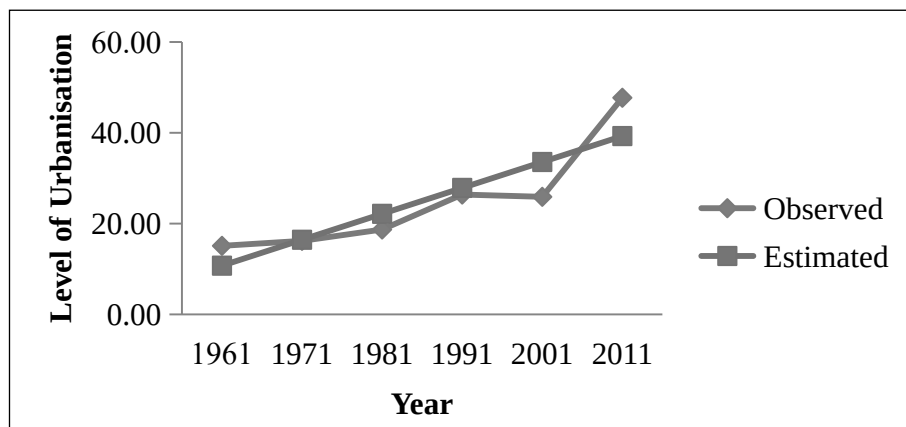


Figure 15: Linear Trend Line for Kerala

Plotting the observed values of the LoU against time may not produce straight line but straight stretches can be seen from Figures 1 to 15.

Table 5: Projections of Urbanisation in Kerala and Districts

Districts	Level of Urbanisation(LoU)			
	2021	2031	2041	2051
Thiruvananthapuram	50.34	55.27	60.20	65.13
Kollam	40.59	46.91	53.23	59.55
Pathanamthitta	13.25	14.59	15.93	17.27
Alappuzha	51.40	58.34	65.28	72.22
Kottayam	25.56	28.23	30.90	33.57
Idukki	5.47	5.80	6.13	6.46
Ernakulam	71.63	79.86	88.09	96.32
Thrissur	61.15	70.74	80.33	89.92
Palakkad	21.96	24.08	26.20	28.32
Malappuram	34.23	40.07	45.91	51.75
Kozhikode	61.56	68.26	74.96	81.66
Wayanad	4.20	4.45	4.70	4.95
Kannur	74.20	84.82	95.44	100
Kasaragod	46.03	56.48	66.93	77.38
Kerala	44.99	50.70	56.41	62.12

Source: Computed

After testing the hypothesis statistically and accepting its reliability, the model used to project the LoU for all districts of Kerala and the state as a whole for four points of time. Table 5 presents the projected levels of urbanisation for various districts and for Kerala as a whole for the years 2021 to 2051. The results clearly indicated that the level of urbanisation (LoU) in Kerala decreased to 44.9 per cent in 2021 and then increased to 62.12 per cent by 2051, over a span of thirty years. But in certain districts such as Kannur, Ernakulam, Kozhikode, etc. urbanisation level has increased over time. It is clear that in the coming decades, districts of Kannur, Ernakulam, Thrissur, and Kozhikode will be the most urbanised districts as compared to other districts.

Policy Measures

To address urban sprawl, improve infrastructure, and integrate rural-urban planning, a comprehensive policy approach is essential. Controlling urban sprawl requires strict zoning regulations, urban growth boundaries, and the promotion of compact cities through vertical growth and mixed-use developments. Redeveloping underutilised urban spaces can optimise land use and reduce unplanned expansion. Infrastructure improvements should focus on upgrading basic services, such as housing, water

supply, and waste management, alongside investing in efficient public transport and adopting smart city technologies for better resource management. Climate-resilient infrastructure is crucial to safeguard urban areas from environmental challenges. Integrating rural-urban planning necessitates regional frameworks that consider socio-economic linkages, enhanced connectivity through road networks and public transport, and support for rural economic development through agro-industrial hubs and enterprises. Extending urban-level services like healthcare, education, and digital infrastructure to rural areas, while fostering collaboration between urban and rural governance bodies, can ensure balanced development. These measures collectively promote sustainable urban growth, reduce disparities, and strengthen the synergy between rural and urban regions.

Conclusion

The foregoing discussion shows that Kerala society is by and large urbanised. The urban population in Kerala has experienced a remarkable growth over the decade 2001-2011 due to the significant increase in census towns. The determinants of level of urbanisation were also identified through multiple regression analysis. It was proved that in Kerala, the level of urbanisation is significantly associated with economic and demographic factors under consideration. Therefore hypothesis in this regard was validated. Kerala's urbanisation pattern, marked by a rural-urban continuum and service-sector driven growth, offers opportunities but also presents significant challenges. To address these, actionable steps are essential. Strengthening urban infrastructure, particularly in newly urbanised and high-density areas, alongside smart city initiatives, can improve public amenities and governance. The future scenario of urbanisation was also predicted at the state level and across the districts. The results showed that Kannur will remain the most urbanised district, while Wayanad will remain the least urbanised district in the state. Regional disparities must be reduced through targeted investments in low-urbanised districts like Wayanad and Idukki, while enhancing urban-rural connectivity. Sustainable urban development should prioritise green practices, effective waste management, and eco-friendly transport options to mitigate environmental impacts. Promoting economic diversification through investments in the service and knowledge sectors and supporting small and medium enterprises can generate employment and strengthen urban growth. These steps will enable Kerala to achieve equitable, sustainable urban growth and enhance the quality of life for its residents.

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