SN Soc Sci (2021) 1:171
https://doi.org/10.1007/s43545-021-00182-x

ORIGINAL PAPER

Development disparities across urban localities of Maharashtra: a multilevel analysis

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Received: 18 November 2020 / Accepted: 9 June 2021 / Published online: 6 July 2021

Abstract

Rising urbanization and economic inequality are concomitant in India and varies by type of urban localities such as Municipal Corporations, Municipal Councils and Census Towns. Studies on developmental disparities by type of urban localities are limited. Using data from 7229 wards of Maharashtra consisting of 2076 wards from Municipal Corporations, 4738 wards from Municipal Councils, and 278 wards from Census Towns, this study examined the variations in the level of development in the wards of urban Maharashtra. Principal component analysis was used to compute the development index using 19 selected variables. Descriptive statistics and multilevel analysis were used in the analyses. In the composite index of development, Cantonment Boards ranked first, followed by Municipal Corporations and Nagar Panchayats. The variations in the level of development were the highest among Municipal Councils (Mean − 0.69; SD = 2.92), followed by Nagar Panchayats (Mean 0.47; SD = 2.88), and Census Towns (Mean 0.05; SD = 2.34). Around 64% of the variability in the development was explained at the ward level in the multilevel analysis. The study found large variations in development within and between urban localities. It suggests multi-sectoral approach including allocating resources in urban localities based on the level of development and relative population size. Ward development needs to be prioritized to reduce the growing urban inequalities among all three urban localities.

Keywords Urban development · Disparity · Multilevel · Urban localities · Maharashtra

Abbreviations

ORGI	Office of the Registrar General of India
GDP	Gross Domestic Product
BMC	Brihan Mumbai Corporation

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PCA Principal Component Analysis
VPC Variance Partitioning Coefficient

Introduction

Increasing Urbanization and economic growth are global and national trends. The level, growth, and pattern of urbanization are distinct in developed and developing countries. According to the World Urbanization Prospects in 2018, out of the 4.2 billion population living in urban areas, about 76% lived in less developed countries, while 24% lived in developed countries (United Nations 2019). According to the United Nations population projections 2018, 68% of the world's population is projected to live in urban areas by 2050. Nearly 90% of the increase will be concentrated in the cities and towns of Asia and Africa (United Nations 2019; Chatterji 2019). Increasing urbanization is associated with rising income levels, greater educational attainment, and improving infrastructure. The national average of urbanization and development conceals large variations across states and by type of urban localities. The increasing share and size of the population in major cities and towns and the increasing disparity in the level of development have become a major policy concern in low-income and middle-income countries (Turok and McGranahan 2013).

Rising urbanization and development is associated with increasing economic inequality across households and geographies. With reference to household inequality, the urban population is more heterogeneous in terms of income level, expenditure pattern, housing, and access to services within and across countries (Cohen 2006; Calì 2008; Sadashivam and Tabassu 2016; Ha et al. 2019). For instance, the extent of economic inequality is the largest in the United States of America (New York City Independent Budget Office, NYIBO 2017), with the top 1% of the population holding about 40% of the national wealth. A similar pattern is observed in emerging economies like China and India (Nijman 2006, 2015). A systematic review of 50 developing countries suggested that spatial inequalities are high between geographically advantageous and disadvantageous regions (Kanbur and Venables 2005). Studies have shown that many developed countries have been experiencing an increasing trend in spatial inequalities in the housing system (Kolb et al. 2013; Lejeune et al. 2016; Abdi and Shafiee 2018). In London, the spatial inequalities in housing quality are large (Travers et al. 2016). In India too, a number of studies have been carried out to understand the spatial dimension of housing amenities and assets. For instance, evidence from the ward-level data on the Kolkata urban agglomeration suggests that there is a significant spatial heterogeneity in the development parameters which are also spatially related (Haque et al. 2020; Aliu and Adebayo 2010). Household amenities and assets vary across wards in other cities, such as Delhi and Hyderabad as well (Bhan and Jana 2015).

At more than 377 million population in 2011, about 31.14% of India's population lives in urban areas, which is projected to be 601 million (39.58%) by 2036 (ORGI 2019). The decadal growth rate of the urban population is at least twice as high as that of the rural population (31.8% in urban vs. 12.2% in rural areas).

While the natural increase in urban India is lower than in rural areas, migration from rural areas and reclassification of local areas to urban localities account for over half of the urban population growth. The demographic transformation in urban India, resulting from natural increase, rural–urban migration, and reclassification of urban areas, is leading to increasing disparity in development across urban localities (Bhagat 2019). Urbanization act as a catalyst for development and economic growth. The social and economic development, arising from the increasing urbanization, is clearly evident in cities and towns (Tripathi 2013). In 2011–2012, the Gini index of monthly per capita consumption expenditure (MPCE) in urban India was 0.37 compared to 0.29 in rural India. The index also differed by type of urban localities, namely, Municipal Corporations, Municipal Councils, Census Towns, Cantonment Boards, and Nagar Panchayats.

Article 243Q of the 74th Constitutional Amendment Act (74th CAA) gave constitutional recognition to urban local bodies as the third-tier of governance in India's administrative hierarchy. The amendment recognized three types of urban local bodies—Municipal Corporation or Nagar Nigam, Municipality or Nagar Palika, and City Council or Nagar (city) Panchayat (Biswas 2020). The wards are the lowest administrative unit across urban localities. A ward councillor elected through municipal elections represents each ward. Municipalities functions as institutions of self-government, with decentralization of roles and responsibilities from the State Legislature, with respect to the preparation of plans for economic development and social justice and the implementation of development schemes.

Urbanization in Maharashtra: a case study

Maharashtra, with 51 million urban inhabitants in 2011, is the third most urbanized state in India and exhibits large regional variations in socio-economic development. About 54% of its urban population lives in million-plus cities, and 23% resides in slums (ORGI 2011). It is one of the most progressive states of India and has recorded rapid economic growth. In 2016–2017, the State Domestic Product Per capita (SDPP) at current prices was estimated at ₹165,491, and making Maharashtra rank 7th among all the states and union territories in India. The growth rate of SDPP was 12% in 2015–2016 and 2016–2017, which was higher than that of many other states of India (Reserve Bank of India 2018). The life expectancy at birth was 72.2 years during 2012–2016, higher than the national average (ORGI 2018). In the composite index of human development, the state ranked 4th among 19 states of India (Suryanarayana et al. 2016). The state has also made significant improvements in the Human Development Index and Gender Development Index values over time (Chatterjee et al. 2019). However, the levels of poverty, inequality, and regional disparities continue to be large in the state. A recent study found large variations in community and household wellbeing in 27 Municipal Corporations of Maharashtra (Mohanty et al. 2020).

Maharashtra is divided into six administrative regions, with the Konkan region having the highest share of the urban population. A large proportion of the urban population in the state lacks basic services and infrastructure. The level of

development in the cities of Maharashtra is diverse. The Brihan Mumbai Corporation (BMC) is the largest and the richest municipal corporation in the country. There are ten million-plus cities in Maharashtra; all of them are classified as Municipal Corporations. These million-plus cities are the most urbanized and developed of all cities and have resources to provide basic services, infrastructure, transportation, and the like. Smaller cities and towns, with lower levels of development, have Municipal Councils rather than Municipal Corporations. Military areas are developed and maintained by Cantonment Boards.

Studies on developmental disparities by type of urban localities are limited. Urban localities vary in population size, distribution, growth, and resources. Living conditions differ not only among urban localities but also among different wards within a locality. In this context, understanding the level of development by type of urban locality is a useful exercise. Multilevel modelling gives insights into the effects of various contextual factors that simultaneously contribute to the large variations in development between and within the urban settlements. It provides a statistical framework to assess the development disparity across geographical hierarchies by partitioning the total variance in an outcome to different population levels (Mishra et al. 2019).

This paper aimed to examine the variations in the level of development in the wards of urban Maharashtra. We considered three levels—wards, urban localities, and administrative divisions—to understand variations in development across types of urban localities. These models permit interaction between population levels and individual level, and results indicate how much variation is attributable to different population levels.

Materials and methods

Data

Data from the Census of India, 2011 were used for the analysis. The Census of India is the only data source that provides information on certain key indicators by type of urban localities such as wards, towns, councils, and corporations (ORGI 2013). A master data file was prepared using variables from the Primary Census Abstract and the Household Amenities and Assets file. The Primary Census Abstract provides data on population size, population of 0–6 year olds, Scheduled Caste and Scheduled Tribe population, literacy, and working population by sex. The Household Amenities file provides the data on the percentage of liveable households, dilapidated households, households with no room, households living in a rented house, water by source, lighting by source, type of cooking fuel, type of toilet facility, open defecation, and the percentage of households having no drainage for wastewater management. In addition to this information, the Census of India provides ownership data on nine assets, namely computer, computers with internet, car/jeep, bicycle, motorcycle, telephone, mobile, television, and radio in each household. The unit of analysis in the present study was the wards of urban localities. A total of 7,229 wards were selected from urban Maharashtra.

Methodology

Descriptive statistics were used to understand the variations in development by type of urban localities. The analyses were done across five categories: Municipal Corporation, Municipal Council, Census Town, Cantonment Board, and Nagar Panchayat.

Composite Index

A set of composite indices was developed using 19 variables in three domains namely quality of housing; energy, water, and sanitation; and household assets—using simple average (unweighted) and principal component analysis (PCA). Each of the variables was standardized on a scale of 0 to 1. A score of 0 indicated a lower level of development, and a score of 1 indicated a higher level of development. The unweighted composite score varied between 0 and 19. Indices were also computed in each of the three dimension.

Principal component analysis

Principal component analysis (PCA) was used to compute the development index from the selected variables in the above discussed domains. PCA is a statistical technique used for data reduction. The leading eigenvectors from the Eigen decomposition of the correlation or covariance matrix of the variables describe a series of uncorrelated linear combinations of the variables that contain most of the variance (Jolliffe 2002). In addition to data reduction, the eigenvectors from a PCA are often inspected to learn more about the underlying structure of the data.

Multilevel analysis

We used a three-level random intercept linear regression model since our variable of interest was continuous in nature. Our data followed a three-level hierarchical structure with wards at level 1, urban localities at level 2, and divisions at level 3. Multilevel modelling was performed to calculate the group-level variance and to partition the variation because it gives more valid and authentic results than the traditional single-level model (Goldstein et al. 2002).

The model was estimated as follows:

$$Y_{klm} = \beta_0 + BX'_{klm} + \left(g_{0m} + f_{0lm} + v_{0klm}\right), \quad (1)$$

where Y_{klm} is the composite variable of development of the kth ward in the ith urban locality of mth division, and X'_{klm} represents the vector of all explanatory variables adjusted in the model.

The terms g_{0m}, f_{0lm}, and v_{0klm} are residuals at the division, urban locality, and ward levels, respectively, which were assumed to be independent and normally scattered with a mean of 0 and a variance of σ^2_{g0}, σ^2_{f0}, and σ^2_{v0}, respectively.

The variance partitioning coefficient (VPC) for level z was computed to quantify the variation in the composite development attributed to each level (Goldstein et al. 2002) as follows:

$$\mathrm{VPC} = \sigma^2_z / \left(\sigma^2_{g0} + \sigma^2_{f0} + \sigma^2_{v0} \right). \tag{2}$$

Sensitivity analysis

Sensitivity analysis was carried out by replacing urban locality by districts, for which wards were assumed to be nested within districts, and districts were assumed to be nested within the divisions. This allowed evaluation of the changes in variance estimates and VPCs by considering district level variations. STATA 16 was used for the analysis.

We have also examined the geographical clustering of development index in the district of Maharashtra, using univariate local Moran's *I* and Local indicator of Spatial Association (LISA) cluster maps. We created the spatial weight matrix (w) of order one using the Queen's contiguity method (neighbours sharing a common boundary of non-zero length) to quantify the spatial proximity between each possible pair of observational entities. Moran's *I* takes values in between -1 to $+1$, and a positive spatial autocorrelation indicates that points with similar attribute values are closely distributed in space whereas negative spatial autocorrelation indicates that closely associated points are more dissimilar. A zero indicates a random spatial pattern with no spatial autocorrelation. Univariate LISA measures the correlation of neighbourhood values around a specific spatial location. It determines the extent of spatial randomness and clustering present in the data.

Results

Table 1 presents the descriptive statistics for the selected indicators at the ward level in urban Maharashtra. The indicators are broadly segregated into three domains: quality of housing; energy, water, and sanitation; and household assets. In the housing domain, seven indicators relating to the quality of housing on the wall, roof, structure, and kitchen were selected. Households with rudimentary walls had the highest mean of 20.06%, with a standard deviation of 18.90, followed by households with a rudimentary floor, with mean of 16.92% and a standard deviation of 17.41. In the energy, water, and sanitation domain, households with unimproved cooking fuel were the highest in number (33.82%), with a standard deviation of 25.17, followed by households with unimproved sanitation with a mean value of 33.18% and a standard deviation of 25.47. About 6.17% of urban households did not have any

Table 1 Descriptive statistics for the selected indicators by urban locality at the ward level in Maharashtra, 2011

Variable (percentage)	Cantonment Board		Census Town		Municipal Council		Municipal Corporation		Nagar Panchayat		Urban Maharashtra	
	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD
Quality of housing												
Dilapidated resident	1.47	1.37	2.82	2.99	3.05	4.20	1.73	2.47	3.34	4.39	2.66	3.77
Rudimentary roof	4.74	6.17	2.92	3.35	5.19	9.71	2.65	4.12	3.62	6.32	4.35	8.32
Rudimentary wall	15.35	11.30	17.07	14.39	24.59	19.93	10.45	12.52	15.44	14.10	20.06	18.90
Rudimentary floor	7.27	7.83	16.60	14.11	21.56	18.44	6.64	9.23	16.17	14.88	16.92	17.41
Household with no room	4.70	5.22	3.22	3.16	2.82	4.52	4.60	4.77	5.26	7.37	3.39	4.67
Ownership status (rented)	36.85	19.70	32.79	16.10	21.01	12.07	27.85	12.06	33.10	14.44	23.68	12.94
Household with no kitchen	13.18	10.15	15.60	14.88	19.94	19.51	16.34	16.38	17.82	21.15	18.67	18.55
Energy, water, and sanitation												
Unimproved source of light	3.09	2.95	6.44	5.97	7.96	8.87	2.86	3.62	5.03	6.85	6.36	7.91
Unimproved source of cooking	17.89	12.03	34.12	19.08	38.14	25.77	24.36	21.76	32.22	25.46	33.82	25.17
Unimproved source of water	5.20	6.38	40.77	27.91	26.28	28.74	9.67	15.12	50.92	33.54	22.20	27.04
Unimproved source of sanitation	32.11	24.14	29.87	19.95	36.67	25.33	26.09	24.85	23.40	25.43	33.18	25.47
Open defecation	5.79	13.70	19.11	18.29	19.97	23.73	4.79	9.47	15.65	22.33	15.42	21.49
Household with no bathroom	3.72	4.75	7.11	7.97	7.20	9.53	3.72	6.80	6.97	10.82	6.17	8.90
Household assets												
Household without television	14.68	7.97	29.38	13.47	31.79	17.30	21.15	16.16	26.50	15.72	28.46	17.48
Household without telephone/mobile	31.04	10.43	38.09	12.32	40.10	13.59	36.40	12.74	35.86	13.77	38.85	13.41
Household without computer/laptop	78.73	11.96	87.30	8.49	89.03	10.34	76.85	15.90	84.26	12.62	85.34	13.36
Household without motorcycle	47.32	13.46	64.42	15.83	69.10	17.25	63.35	21.08	63.30	15.62	67.04	18.60
Household without car/jeep/van	89.36	7.11	93.80	4.70	94.52	5.30	90.37	9.66	91.26	5.38	93.22	7.10
Household not availing banking services	18.54	13.08	31.79	16.03	35.06	21.77	27.75	22.68	24.07	19.12	32.59	22.06
Independent variable												
Child population aged 0–6 years	10.50	1.95	11.78	2.29	11.46	2.33	11.07	2.54	11.64	2.39	11.36	2.40

Table 1 (continued)

Variable (percentage)	Cantonment Board		Census Town		Municipal Council		Municipal Corporation		Nagar Panchayat		Urban Maharashtra	
	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD
Child sex ratio	888	129.4	901	68.7	898	161.5	899	72.9	865	154.9	898	138.6
Female literacy	87.99	4.89	82.82	6.49	82.04	9.72	85.15	7.98	83.92	8.83	83.03	9.22
Female marginal worker	13.08	10.26	23.62	12.18	18.05	15.50	14.02	7.81	15.69	12.83	17.04	13.72
Schedule Caste	18.61	14.13	14.65	10.00	12.52	14.77	11.89	12.76	12.10	12.50	12.46	14.05
Schedule Tribe	2.91	3.31	7.40	9.36	4.49	8.47	2.67	4.62	1.60	2.56	4.03	7.60
N	52	278		4738			2076		85		7229	

bathroom facility. In the household assets domain, 67% of households did not have a computer/laptop, and only 7% households had a car/jeep.

Table 1 also presents the descriptive statistics for the selected indicators by type of urban locality in the wards of urban Maharashtra. The proportion of dilapidated residence was the highest in Nagar Panchayats (3.34%), followed by Municipal Councils (3.05%). The proportion of households with rudimentary roofs varied from 2.65% in Municipal Corporations to 5.19% in Municipal Councils, whereas that of rudimentary walls varied from 10.45% in Municipal Corporations to 24.59% in Municipal Councils. The proportion of households with rudimentary floors varied from 6.64% in Municipal Corporations to 21.56% in Municipal Councils. Use of unimproved sources of water was the highest in Nagar Panchayats (50.92%) and the lowest in Cantonment Boards (5.20%). Use of unimproved sources of light was the highest in Municipal Councils (7.96%). The proportion of households with unimproved sanitation varied from 23.40% in Nagar Panchayats to 36.67% in Municipal Councils. About 38% of households in Municipal Councils had an unimproved source of cooking. Open defecation was the highest in Municipal Councils (19.97%), followed by Census Towns (19.11%). Households without television were the most numerous in Municipal Councils (31.79%) and the least numerous in Cantonment Boards (14.68%). Households without computer/laptop varied from 76.85% in Municipal Corporations to 89.03% in Municipal Councils. The share of households without car/jeep and motorcycle was the highest in Municipal Councils.

Female literacy was the highest in Cantonment Boards (87.99%), followed by Municipal Corporations (85.15%) and was the lowest in Municipal Councils (82.04%). The child sex ratio was the lowest in Nagar Panchayats (865) and the highest in Census Towns (901). The share of the Scheduled Caste population was the highest in Cantonment Boards (18.61%) and the lowest in Municipal Corporations (11.89%), whereas the percentage of the Schedule Tribe population was the highest in Census Towns (7.40%) and the lowest in Nagar Panchayats (1.60%).

Table 2 shows the descriptive statistics for the unweighted index by type of urban locality in Maharashtra. The mean value of the overall unweighted average index varied from 0.64 in Census Towns to 0.72 in Cantonment Boards. The mean

Table 2 Mean and standard deviation of the unweighted index by type of urban locality in Maharashtra, 2011

Type of urban locality	Unweighted average index		Index on housing domain		Index on basic services		Index on assets		*N*
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Cantonment Board	0.72	0.03	0.77	0.04	0.82	0.04	0.55	0.08	52
Census Town	0.64	0.06	0.77	0.04	0.70	0.09	0.43	0.10	278
Municipal Council	0.64	0.07	0.78	0.05	0.72	0.10	0.40	0.12	4738
Municipal Corporation	0.69	0.06	0.78	0.04	0.80	0.06	0.48	0.13	2076
Nagar Panchayat	0.64	0.07	0.75	0.05	0.68	0.08	0.47	0.11	85
Urban Maharashtra	0.66	0.07	0.78	0.04	0.74	0.10	0.43	0.13	7229

SD standard deviation

Table 3 Mean and standard deviation of weighted composite index by type of urban locality in Maharashtra, 2011

Types of urban locality	Weighted index-simple average		Index housing domain		Index on basic services		Index on assets	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Cantonment Board	2.10	1.71	1.05	1.06	0.96	1.01	1.66	1.35
Census Town	0.05	2.34	0.43	1.39	−0.25	1.61	−0.03	1.43
Municipal Council	−0.69	2.92	−0.43	1.69	−0.40	2.03	−0.40	1.74
Municipal Corporation	1.50	2.30	0.89	1.06	0.93	1.27	0.85	2.05
Nagar Panchayat	0.47	2.88	0.42	1.74	−0.05	1.96	0.50	1.67
Urban Maharashtra	0.00	2.90	0.00	1.64	0.00	1.92	0.00	1.91

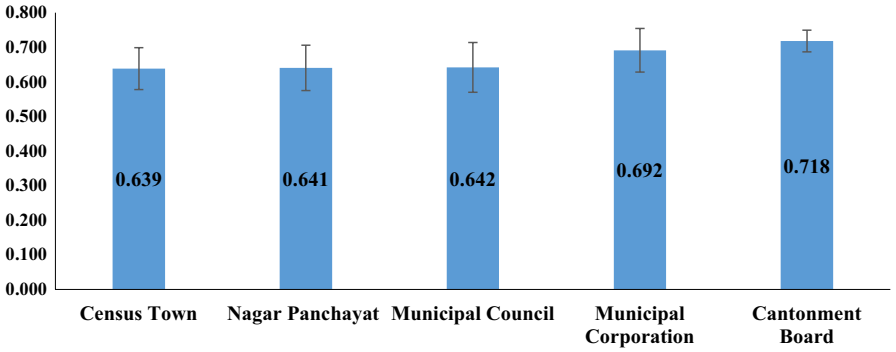

Fig. 1 Composite index based on 19 variables by urban locality in Maharashtra, 2011

index value for basic services was the highest for the Cantonment Boards (0.82), followed by Municipal Corporations (0.80) and Municipal Councils (0.72). The mean value of the household assets index was the lowest for Municipal Corporations (0.40) and the highest for Cantonment Boards (0.55).

Table 3 shows the descriptive statistics for the weighted composite index of housing domain, basic services, and household assets by type of urban locality in urban Maharashtra. The average weighted index varied from − 0.69 in Municipal Councils to 2.10 in Cantonment Boards. The average index value for housing, basic services, and assets was the highest for Cantonment Boards followed by Municipal Corporations.

Figure 1 shows the average index value based on 19 variables in three dimensions by urban locality in Maharashtra. The average index value in urban Maharashtra was 0.657, which varied from 0.718 in Cantonment Board to 0.639 in Census town.

Appendix A1 presents the factor score derived from the principal component analysis. Four components were derived from PCA, using 19 variables, and

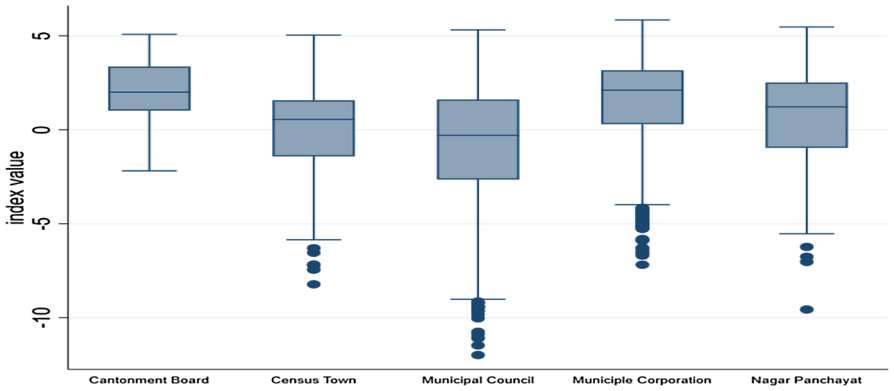

Fig. 2 Box plot of composite index of development by type of urban locality in Maharashtra, 2011

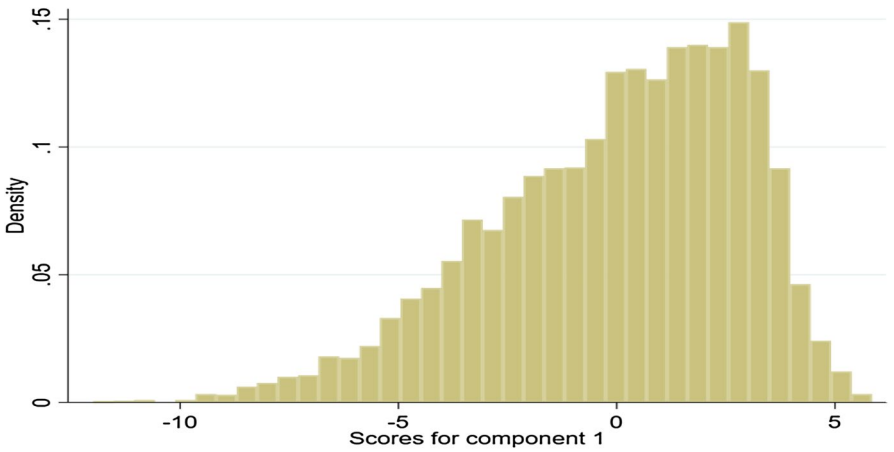

Fig. 3 Histogram plot of development index in the wards of Maharashtra, 2011

explained 66% of the total variance. The first component had a positive loading for all the variables except the indices of rudimentary walls (−0.2411), unimproved sources of sanitation (−0.2745), and ownership status (rented) (−0.1586). The second component had a negative loading for the indices of unimproved sources of sanitation, dilapidated residence, rudimentary floor, unimproved sources of light, unimproved sources of water, open defecation, households with no bathroom, and household assets telephone/mobile. Thus, the second component distinguished sensitivity. The third component had negative associations with the indices of unimproved sources of sanitation, unimproved sources of water, and households with a computer/laptop. Finally, the fourth component had a large negative loading for the index of rudimentary roof and a large positive loading for the index of unimproved sources of water.

Table 4 Levels of development by type of urban localities in wards of Maharashtra, 2011

Types of urban locality	Level of development						
	Low	Medium	High	Total	Mean of development index	SD	No. of wards
Cantonment Board	1.92	36.54	61.54	100.0	2.10	1.71	52
Census Town	28.78	48.20	23.02	100.0	0.05	2.34	278
Municipal Council	41.85	34.61	23.53	100.0	−0.69	2.92	4738
Municipal Corporation	15.70	28.32	55.97	100.0	1.50	2.30	2076
Nagar Panchayat	23.53	34.12	42.35	100.0	0.47	2.88	85
Maharashtra	33.34	33.34	33.32	100.0	0.00	2.90	7229

SD standard deviation

Figure 2 shows the distribution of the composite index derived using PCA by type of urban locality in Maharashtra. The dispersion in the composite index was the highest in Municipal Councils and the least in Cantonment Boards.

Figure 3 shows the histogram of the composite index in the wards of urban Maharashtra. The histogram plot shows that the development index is skewed to the right.

Table 4 presents the level of development in the wards of Maharashtra by urban localities. Among 4738 wards in the Municipal Councils in Maharashtra, 41.85% were classified as having a low level of development, 34.61% as having a medium level of development, and 23.53% as having a high level of development. Among

Table 5 Multilevel analysis of development at the Urban locality and Division level by socio-demographic Characteristics

Development Index	Coefficient	95% Confidence interval
Child population aged 0–6 years	−0.1924***	[−0.2131, −0.1718]
Female literacy	0.1965***	[0.1912, 0.2017]
Female marginal worker	−0.0141***	[−0.0169, −0.0113]
Child sex ratio	−0.00096***	[−0.0012, −0.0007]
Schedule Caste	0.0000143	[−0.00001, 0.00004]
Schedule Tribe	0.000196***	[0.0001, 0.0003]
Random-effects parameters	Estimate	95% Confidence interval
Division		
Variance	0.9444	[0.2507, 3.557]
Urban locality		
Variance	0.5059	[0.2483, 1.0305]
Variance (residual)	2.5594	[2.4772, 2.6444]

Coefficients; 95% confidence intervals in brackets

LR test vs. linear model: $\chi^2(2) = 2894.18$, Prob > $\chi^2 = 0.0000$

Number of divisions = 6 (level 1); number of urban locality = 26 (level 2); total number of wards = 7229

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

2076 urban wards in Municipal Corporations, 15.70% were classified as having a low level of development, 28.32% as having a medium level of development, and 55.97% as having a high level of development. Cantonment Boards (61.54%) of Maharashtra had the highest level of development, followed by Municipal Corporations (55.97%) and Nagar Panchayats (42.35%).

Table 5 presents the results of the multilevel analysis of development at the urban locality and division levels by socio-demographic characteristics. Female literacy was positively and significantly associated with the level of development. By contrast, population aged 0–6 years, female marginal workers, and child sex ratio were negatively and statistically significantly associated with the development index. The analysis showed that the variance at the urban locality level (0.51) was lower than at the administrative division level (0.94).

Figure 4 illustrates the proportion of variation in the composite development index that is attributable at the ward, urban locality, and division levels. In the null model, wards accounted for the largest variation (76.72%) in development, followed by urban localities (15.11%) and divisions (8.17%). After adjusting for the socio-demographic factors, the pattern remained similar: 63.83% of the variation was attributable to the ward, 12.62% was attributable to the urban locality, and 23.55% to the division.

Table 6 presents the results of the robustness analysis by using ward, district, and division as geographical hierarchies in the multilevel analysis. The findings of the robustness analysis were similar to those of the multilevel analysis. Population aged 0–6 years, female marginal workers, and child sex ratio were negatively and statistically significant with the development index.

Figure 5 illustrates the proportion of variation in the composite development index that is attributable to the ward, district, and division levels. In the null model, wards accounted for the largest variation (77.92%) in development, followed by districts (6.15%) and divisions (15.93%). After adjusting for the socio-demographic factors, the decomposition pattern remained similar, 63.22% of the variation being attributable to the ward, 10.32% being attributable to the district, and 26.45% to the division.

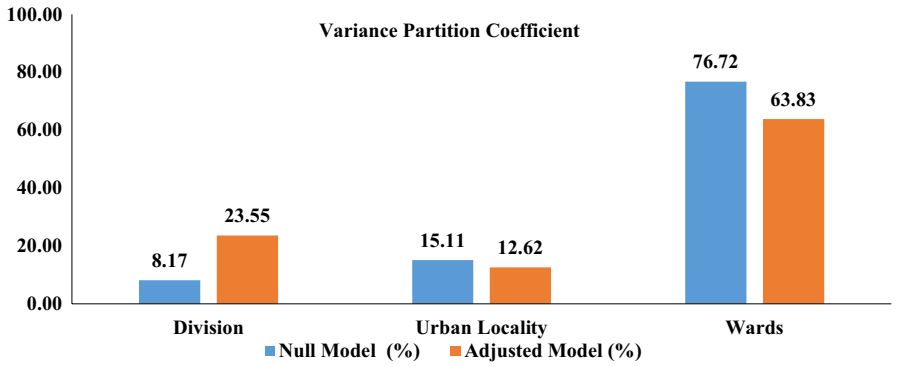

Fig. 4 Variance partition coefficient of development index in urban Maharashtra, 2011

Table 6 Multilevel analysis of development at district and division level by socio-demographic characteristics

Development index	Coefficient	95% Confidence interval
Child population aged 0–6 years	−0.2157***	[−0.2367, −0.1947]
Female literacy	0.2045***	[0.1991, 0.2098]
Female marginal worker	−0.01425***	[−0.0170, −0.0115]
Child sex ratio	−0.00079***	[−0.0011, −0.0005]
Schedule Caste	0.00007***	[0.00005, 0.0001]
Schedule Tribe	0.00031***	[0.0002, 0.0004]
Random-effects parameters	Estimate	95% Confidence interval
Division		
Variance	1.0331	[0.3048, 3.5016]
District		
Variance	0.4031	[0.2349, 0.6916]
Variance (residual)	2.4691	[2.3898, 2.5512]

Coefficients; 95% confidence intervals in brackets

LR test vs. linear model: $\chi^2(2) = 3112.03$, Prob > $\chi^2 = 0.00$

Number of division = 6 (level 1); number of districts = 35 (level 2); total number of wards = 7229

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

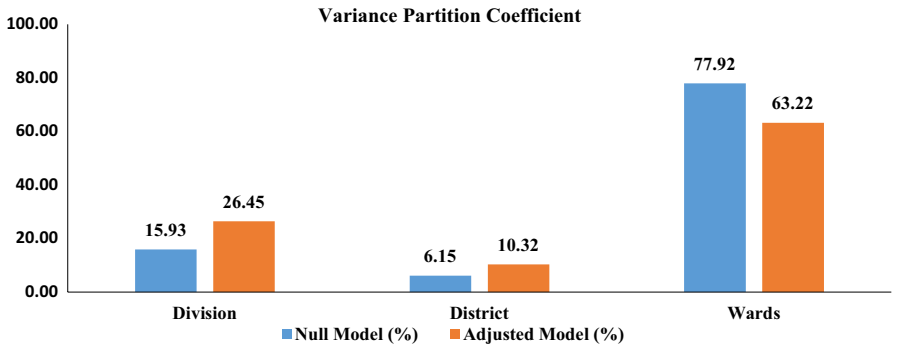

Fig. 5 Variance partition coefficient of development index at the district level in Urban Maharashtra, 2011

Figure 6 presents a Moran's *I* scatter plot, which suggest a high level of spatial autocorrelation across 36 districts of urban Maharashtra, i.e. a significantly high level of spatial dependence (Moran's $I = 0.74$, p value = 0.001) of the development index.

Figure 7a, b depicts a univariate LISA cluster and significance map revealed that all the hotspots were located in western districts like Mumbai Suburban, Raigarh, Mumbai, Thane, and Satara; however, most of the cold spots were present in central and eastern districts, like Hingoli, Yavatmal. Akola, Buldana, and Jalgaon.

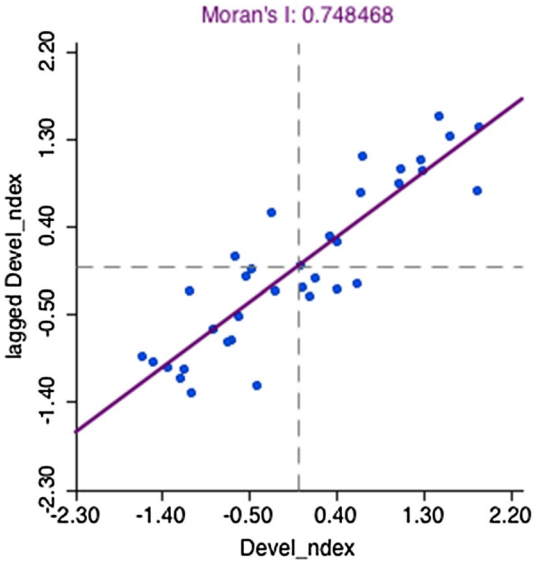

Fig. 6 Univariate Moran' *I* statistics depicting the extent of spatial autocorrelation of development index in the district of Maharashtra

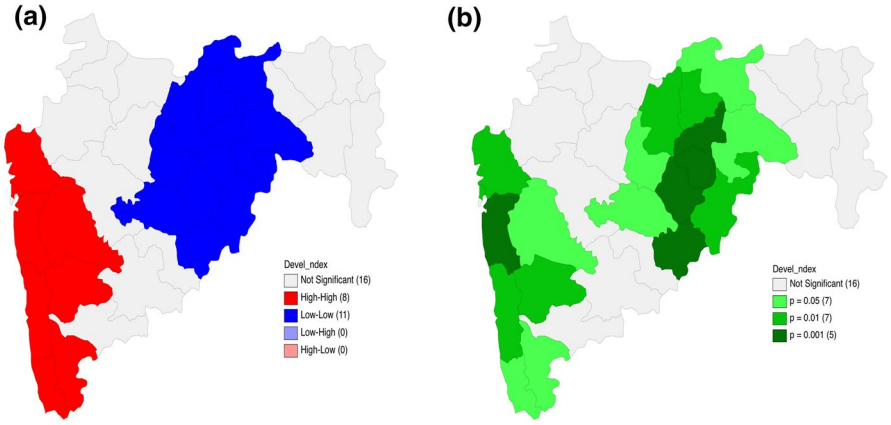

Fig. 7 Univariate LISA clustering and significance map of level of development in the district of Maharashtra

Discussion

This is the first-ever study to have examined the variations in the level of development in urban wards by type of urban locality in Maharashtra. Data from 7, 229 wards on 19 variables in three domains—namely quality of housing; energy, water, and sanitation; and household assets were used in the analysis. The following are the salient findings.

First, among the five types of urban localities, the Cantonment Boards were the most developed, followed by Municipal Corporations. Municipal Councils had the lowest value in the composite index of development. These results are confirmed by

the unweighted composite index as well as by the PCA-based composite index. Second, the disparities in the level of development were more diverse in the Municipal Councils compared to the Cantonment Boards and Municipal Corporations. Municipal Councils that account for 22.1% of the urban population, showed the largest variations in the level of development. Cantonment Boards had the least variations among all the urban localities in Maharashtra. Municipal Corporations that account for 69% of the population, also showed large variations in the level of development. Third, urban localities varied considerably not only in the composite index but also differed in each component. Among all the domains, the largest variations were found in access to basics services. Municipal Corporations and Cantonment Boards reported a lower proportion of households with unimproved sources of energy, water, and sanitation among all the five types of urban localities in Maharashtra. Similarly, in terms of household assets, Municipal Corporations and Cantonment Boards were better off as compared to other urban localities. Fourth, the multilevel analysis suggests that variability in the level of development was the highest at the ward level, followed by urban locality and administrative division level.

We put forward some of the plausible explanations for disparities in development across different urban localities. First, the Cantonment Boards are the most developed because they are governed, maintained, and financed by the Government of India. They are under the Ministry of Defence and are inhabited by employees of the central government (Directorate General Defence Estates, DGDE 2001; Rumi 2006). These localities get similar facilities across India and maintain for lush greenery, cleanliness, and a disciplined lifestyle. Second, different urban local bodies perform through different mechanism depending upon the structure of power bestowed upon other administrative bodies. There is a huge resource disparity across urban localities. Municipal Corporations levy various taxes. Among them, property tax is one of the largest sources of revenue, which is not available to Municipal Councils and Nagar Panchayats. For example, the budget of BMC which is one of the biggest Municipal Corporations of India, is larger than that of many smaller states of India. The allocation and utilization of the funds varies according to the interests of the local political power. Third, Municipal Corporations enjoy greater autonomy than other forms of local government. The higher level of development seen in Municipal Corporations may be due to the financial resources they have, the administrative autonomy they enjoy, and the administrative efficiency with which they perform. There is a huge resource gap in Municipal Councils or smaller municipalities as they have restricted local autonomy compared to Municipal Corporations. Studies suggest that only the bigger Municipal Corporations are in a position to take advantage of the available resources (Mohan and Dasgupta 2004). It is also worth noting that Census Towns being non-municipal towns are mostly governed by Gram Panchayats and are dependent on the funds allocated by the Ministry of Rural Development (Bhagat 2005). In general, most of this funding is availed by Gram Panchayats through centrally funded rural development schemes such as the *Total Sanitation Campaign*, the *National Rural Health Mission*, and the *Mahatma Gandhi National Rural Employment Guarantee Scheme*.

India's urban policy and programmes favours bigger cities, which are essentially governed by Municipal Corporations. For example, the smart city initiative of the

Government of India is mostly limited to cities that fall under Municipal corporations. Most Municipal Councils and Nagar Panchayats are left out of the centrally sponsored urban development programmes (Bhagat 2014). They also lack the capacity to generate their own funds and are more dependent on the state government. The ward-level differentials in the development indicators may be because of multiple factors. These include residential factors, share of slum population, political representation, and administrative efficiency. Literature suggests that residential segregation across the wards is associated with the prevalent housing conditions and the availability of water and sanitation irrespective of regions of India (Choudhary et al. 2020; Vithayathil and Singh 2012). Wards which are dominated by the urban slums have a poor level of housing, water, and sanitation (McFarlane 2008).

Based on the results, we suggest the following for reducing disparities across different urban localities. First, additional funds may be allocated to the less developed wards for undertaking the provision of basic services. Second, the financial transfer from state to local bodies may be based on backwardness of geography and regions. Third, the provision of services such as water and sanitation may be monitored regularly in coordination with the state governments. Finally, urban development programmes, such as the Padhan Mantri Awas Yojana (PMAY) that are spread across urban localities may be promoted.

Despite these findings, we put forward the following limitations. The analysis was limited due to data constraints. Some of the variables, such as type of employment, economic activities, and level of industrialization, were not available. Second, spatial analysis could not be undertaken across the type of urban localities and wards due to the unavailability of the shape file. Field-based studies may throw light on the reasons of underdevelopment in the wards of urban localities. Despite this limitation, this paper brings out the developmental patterns across urban localities and wards.

Conclusion

The study reiterates that Municipal Councils, Nagar Panchayats, and Census Towns need more resource allocation from the central and state governments based on their level of development and the relative share of the population. A higher weightage should be given to the less developed Municipal Councils and Nagar Panchayats, followed by Census Towns. This would help to stem the growing inequality in the urban areas. Besides, the provision of specific services and housing should be prioritized. We also suggest identifying the least developed wards to plan for area-specific planning and development.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s43545-021-00182-x.

Acknowledgements We thank Mr. Debashish Chakraborty, Additional Chief Secretary, Department of Planning and Mr. R. R. Shinge, Director, Directorate of Economics and Statistics, Government of Maharashtra for their valuable suggestions. We also thank Mr. Kanchan Dyuti Maiti, PME specialist, Dr. Abhay Pethe, Professor Mumbai University, and Udaya S. Mishra, Professor, Center for Development

Studies, Thiruvananthapuram, Kerala for their valuable insights, and guidance relating to issues and challenges of urbanization.

Disclaimer Publications produced by the UNICEF India are contributions to global knowledge on children and may not necessarily reflect UNICEF's policies or approaches. The views expressed are those of the authors and not of UNICEF.

Author contributions SKM: conceptualization, methodology, investigation, formal analysis writing, reviewing and editing; RBB: Reviewing, and editing; SKS: Formal analysis and draft preparation; AN: Reviewing and editing; RM: Data preparation, and analysis.

Funding This research did not receive any specific grant from any funding agency, commercial entity or not-for-profit organization.

Data availability The data used in this study are available in the public domain of the Office of the Registrar General of India (ORGI), Census. https://censusindia.gov.in/2011-common/censusdata2011.html.

Declarations

Conflict of interest The authors declare no conflict of interest.

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Notes *Census Town:* Census Town is defined as, a minimum population of 5000, at least 75% of the male main working population engaged in non-agricultural pursuits, and a density of population of at least 400/km^2.
Nagar Panchayat: A Nagar Panchayat or Notified Area Council in India is a settlement in transition from rural to urban and therefore a form of an urban political unit comparable to a municipality. An urban centre with more than 11,000 and less than 25,000 inhabitants is classified as a Nagar Panchayat.
Municipal Council: A Municipal Council is constituted for a smaller urban area with a population of 5000 to 150,000.
Municipal Corporation: A Municipal Corporation is constituted for a larger urban area with a population of 50,000 to 500,000.
Cantonment Board: Cantonments boards are small and the institutions of central government.

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