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A METHODOLOGY TO DELINEATE PERI-URBAN SETTLEMENT TYPOLOGY IN THE CONTEXT OF CHANDIGARH REGION

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Abstract

This paper is an attempt to identify the planning parameters on the basis of which homogeneity among the peri-urban settlements around the city of Chandigarh can be analyzed, clustering of settlements can be formed and accordingly the settlement typologies can be defined and delineated in the proposed framework. The conventional method of Rural-Urban Classification fails to address the third tier of development - the transition area in-between these two realms of settlements. Thus, appears as the main cause of formation of peri-urban realm in an organic fashion with a haphazard and unorganized settlement structure in absence of statutory definition and Master Plan. With this overview, the paper argues that there is an urgent need to have settlement typologies and its delineation. The paper has elaborated the experiment in the unique context of Chandigarh, where the peri-urbanization has spreaded in the adjoining states of Punjab, Haryana and Himachal Pradesh. A total of 16 peripheral towns falls within the 16 k.m. radius peripheral boundary of Chandigarh, which are taken into consideration to frame the proposed clustering. 11 sets of variables are considered for which data has been collected. The collected data for each of the variables is graphically analyzed. The results are interpreted in spatial planning on the basis of commonality of values assigned to each variable and the clusters of settlements formed. The paper concludes with a methodological construct which can be followed in creating peri-urban settlement typologies for any urban growth center and delineating them in their regional context.

Keywords: Clustering of settlements, Homogeneity, Peri-urban realm, Rural-urban classification, Variables.

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I. INTRODUCTION

THE PERI-URBAN GROWTH DYNAMICS

Traditionally across the world, settlements are classified as 'Urban' and 'Rural', where the definition is predominantly based on population, density and occupational structure [1]. However, this conventional method of classification has tremendous drawback in addressing the Peri-Urban area, lying in-between [2]. Urban growth dynamics at peri-urban interfaces and their interaction with multiple variables are intrinsically complex and hence are a potential field of contemporary research in urban planning [3]. The peri-urban area is found as the most dynamic realm in the urban-rural system, which is subjected to continuous transformation within a span of time, thus difficult to delineate this ever-changing area [4]. The term 'Periphery' indicates to an area, which lies outside the official urban boundaries and urban administrative jurisdictions and this area accommodates the spillover urbanization of the core cities [5]. These areas generally are in some form of transition from strictly rural or urban. Peripheral settlements form an interface between urban and rural and gradually transform into a fully urban area [6]. Fringe area may be defined as that area outside the central city which has a strong functional, economic, social linkage with the central city and is characterized by higher degree of interaction between the city and its surrounding areas [7]. On ground where the city municipal limits end, the fringe begins. There is no separate administrative unit for the fringe neither do urban, rural or regional land uses have a category as a fringe [8]. If fringe is a transitional zone, then the fringe today would be core of the city tomorrow. Hence, there is no static fringe and therefore there can be no static delineation. It would be a part of the overall city dynamism. Hence, we need to plan not only the urban area, but the periphery as well [9]. The term Urban Sprawl refers to the growth of a metropolitan area through the process of scattered development of miscellaneous types of land use in isolated locations on the fringe, followed by gradual filling in of the intervening spaces of similar use [10]. From several literature, it is clear that a major drawback lies in the definition of peri-urban interface and the settlement classification system worldwide [11]. As stated by Brenner in [12], "While 'Urban' is often specifically defined, 'Rural' is treated simply as residual category. The criteria defining 'Urban' also differ from country to country". The research questions these parameters, defining 'Urban', also raises debate on: "can the 'non-urban' necessarily always be classified as 'Rural'?" The proposed categorization for peri-urban settlements may be included in Census of the country in future, which may help in reducing issues in urban planning, policy making and governance level and as a whole

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distribution of funds for urban development and projects across settlements can be ensured with a sense of justice and fairness [13].

Due to heterogeneous international data set to define 'urban' and 'rural' realms, certain questions come up: Should the 'Urban Area' be classified only on the basis of its specific administrative status? or should there be other significant parameter to define 'Urban', which will be more relevant parameter in the field of urban & regional planning? [14] As mentioned in [15], "What population density criterion, if any is appropriate as international benchmark to be 'Urban'? Should levels of non-agricultural employment figure appear into the definition of urban areas?" Should planning parameters be introduced in definitions, so that physical planning can be linked with governance, funding allocation etc. On the other hand, the most dynamic transition areas in between the Urban and Rural areas are never appear for discussion and seek for its specific identity [16]. A search into these questions necessitates this study.

The research began to study various transformations happening in the peripheral towns around the selected case city in the span of last decade, the factors behind such transformations and their implications on the parent city, Chandigarh. However, it is felt that formation of settlement clusters / typologies and their delineation through a statutory Master Plan and relevant planning policy, to govern the unregulated growth at peri-urban realm is the need of the hour [17]. Such detailed study and analysis have created a strong base to identify the determinants governing the peripheral growth. Several variables have also been identified from previous literature studies, where the nature of transformation found similar. To derive the peri-urban settlement typologies for Chandigarh Region, eleven sets of variables / parameters under four major aspects along with their several sub-sets / indicators are selected based on the studies carried out by several researchers for different cities and towns of India and abroad [18]-[21] as well as context specific studies carried out by the author. The analysis of interrelation of these variables leads towards clustering of the peripheral settlements, while preparing Master Plans for cities. As a whole, this paper addresses the issue of peri-urban growth with a focus on the context of Chandigarh, analyses the interrelationship among various parameters responsible for the phenomenon of peri-urbanization, further leading towards categorization of city peripheral areas.

II. RESEARCH METHODOLOGY

A. Selection of Sample Settlements

The peripheral towns fall within the 16 k.m. radius peripheral boundary around Chandigarh have been taken into consideration to frame the proposed clustering as well as model. This includes 2 settlements at immediate periphery of Chandigarh Municipal Corporation, 7 settlements in the state of Punjab and 4 settlements in the state of Haryana. 3 other settlements in the state of Himachal Pradesh also lies just adjacent to

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the 16 k.m. peripheral boundary of UT and contributes significantly in the peripheral transformations as per the previous study and analysis of the research. Hence, they are also considered for the proposed scenario.

B. Overview of Data Sources and Methods

The entire dataset has been collected from both primary and secondary sources, includes household survey as well as data from various govt. departments and authorities of these 3 states along with Chandigarh UT, as elaborated later [22]. The data has been tabulated against each of the identified variables for these 16 selected peripheral towns. The range of values against each of the variables has been analyzed through graphical method, spatially mapped, leading towards clustering of settlements.

III. STUDY AREA & SELECTION OF VARIABLES

A. Physical Dimensions of the Study Area

The study is conducted in the context of Chandigarh and its periphery. The study, survey and analysis of the periphery includes the emerging settlements within the 16 k.m. boundary of Chandigarh UT and few other settlements in the state of Himachal Pradesh lies just adjacent to it and creates impact in the transformation of peripheral area. The settlements are shown in Fig. 1.

B. Aspects / Dimensions, Variables and their Respective Indicators Selected for Deriving Futuristic Model for Peri-Urban Interface

A no. of planning parameters is determined to create peri-urban settlement typologies. These parameters are so selected, that define the “Urban Tendency” or “Rural Tendency” of the settlement. Similar type of planning approach is observed for settlement categorization in many countries of Europe. Reports of PLUREL, ESPON, OECD etc. are studied to determine similar parameters for settlement classification, which may be relevant to Indian context [23], [24].

Apart from these literature reviews, certain other indicators are also added, which are found relevant specifically for Indian context. In the broader way, the parameters found are classified into 4 major aspects / dimensions - Physical, Social, Economic and Governance, under which the variables are determined [25]. The variables are further measured by nos. of indicators as appropriate. All these indicators along with their sources are listed in the Table 1.

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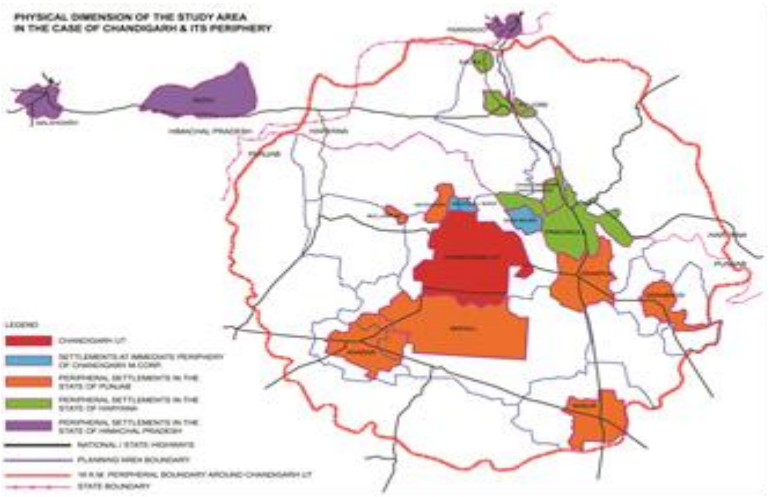

Fig. 1 Physical dimension of the study area
(Source: Author)

C. Identification of Quantifiable and Non-Quantifiable Indicators for Deriving Futuristic Model for Peri-Urban Interface

The indicators are further categorized in terms of method of quantification, if possible. Certain planning parameters are found non-quantifiable using currently available planning tools and dataset of the context. This may be considered in future research, so that these indicators can be included in the process of classification of peri-urban realms. The quantifiable indicators ([1]) are mentioned in the Table 1.

Table 1. List of aspects, variables & indicators for deriving peri-urban typology

Aspects	Variable	Indicators (I)	Source
Physical	**Spatial Planning**	% of Houses Located in Main Built-Up Area (HBUA)	*a
		Distance from the Nearest Core Urban Area (DCUA)[1]	*a
		Distance between Main BUA & Separate Area (DBMS)[1]	*a
		Contiguity of Houses - Avg. Distance between Houses (DBH)	*a
	Land-Use / Land Cover	Change in Area between 2001 and 2011 (%) (CA)[1]	*a

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		Residential Land-Use Changes between 2001 and 2011 (%) (RLUC)[1]	*a
		Land Cover Variety - Ratio of Built v/s Open (RBO) (1:x)[1]	*a
		Area of agricultural land (%) (AL)[1]	*a
		Area of non-agricultural land (%) (NAL)[1]	*a
	Density	Housing Density (Residential Units / sq. k.m.) (HD)	*b
		Population Density (People per sq.k.m.) (PD) - 2011 Census[1]	*c
		Household Density (HHs per sq.k.m.) (HHD) - 2011 Census[1]	*d
	Natural Elements	Change (Increase / Decrease) in Green Cover between 2001 and 2011 (%) (CGC)	*a
		Change (Increase / Decrease) in Area / Length of Water Courses between 2001 and 2011 (%) (CWC)	*a
		% of Area Occupied by Green Elements / Green Covers (includes all kind of open spaces) (GC)[1]	*e
	Mobility / Accessibility	Car Dependency/1000 pop. (CD)	*a
		Travel Time in Public Transport to the Core Urban Area (min) (TTPC)[1]	*e
		Commuting - % of Total Pop. Commute to Core City for Work / Study / Other Purposes (TPC)[1]	*a
	Road Infrastructure (RI)	Black Road Length/1000 pop.	*a
		Ratio of Surfaced Road Length to Unsurfaced Road Length	
		Ratio of Asphalt Roads to the Total Area of Roads	*b
		Ratio of Paved Roads to the Total Area of Roads	
		Road Density/1000 pop.	*a
	Social / Civic Infrastructure (CI)	Nursery and Primary Schools[1]	*d

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	Educational	Senior Secondary School[1]	
		College Campus[1]	*a
	Health Care	Hospital (500 / 200 / 100 bedded)[1]	*b
		Primary Health Centre / Poly-clinic[1]	*a
		Nursing home / Child Welfare[1]	
		Dispensary[1]	*d
	Socio-Cultural Facilities	Sports Facilities	*a
		Library and Community Hall[1]	*a
		Recreation Club[1]	*d
		Art & Cultural Centre[1]	*a
		Meditation & Spiritual Centre[1]	*d
	Other Civic Needs	Banks	*a
		Local Everyday Shops	*a
		Police Post[1]	*a
		Fire Station[1]	*a
	Communication and Information Facility (CIF)	Telephone Connections / Mobile Connections/1000 pop.	*a
		No. of Post Offices and Private Couriers	
	Physical & Housing Infrastructure (HI)	% of Houses Electrified	*a
	Housing	% of Pacca Houses[1]	
	Water Supply	Coverage of piped water supply connections[1]	*e
		Per capita supply of water[1]	
		Extent of metering of water connections[1]	
		Extent of non-revenue water (NRW)[1]	*d
		Continuity of water supply[1]	

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		Cost recovery in water supply and sewerage services[1]	
	Sewage Management	Coverage of Toilets[1]	
		Coverage of sewerage network[1]	*a
		Adequacy of sewage treatment capacity[1]	
		Extent of Reuse and Recycling of Waste Water[1]	
	Solid Waste Management	Household level coverage of solid waste management services services[1]	
		Efficiency of Collection of Municipal SW[1]	*d
		Extent of Segregation Of Municipal SW[1]	
		Extent of municipal solid waste recovered[1]	
		Extent of scientific disposal of municipal solid waste[1]	
		Cost Recovery in SWM Services[1]	
	Drainage	Coverage of Storm Water Drainage Network[1]	*a
Social	**Demography**	Sex Ratio (SR)	*d
		Dependency Ratio (DR)	*b
		Population (P) - 2011 Census[1]	*c
		Growth Rate of Population 2001-2011 (%) (GRP)[1]	*a
		Household Size (HHS) - 2011 Census[1]	*a
	Labour Force Characteristics	Main Workers, Marginal Workers (Male & Female) (MW & MRW)	*d
		Non-Workers (Male & Female) (NW)	
	Live Stock (LS)	Concentration of Live Stock	*d
	Literacy (LT)	Percentage of Literates (Male, Female & Total)	*d
	Community Dimension / Social Cohesion	% of Joint Family Houses per 1000 pop. (JFH)	*e
		% of Multicommunal Agglomeration (MCA)[1]	*a

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		% of Single / Nuclear Family Houses per 1000 pop. (SFH)	*e
Economic	**Sector-wise Employment**	Employment in Agricultural Sector, % of working pop. (Male, Female and Total) (EAS)[1]	*a, *e, *d, *b, *c
		Employment in Non-Agricultural / Manufacturing / Other Sector, % of working pop. (Male, Female and Total) (ENAS)[1]	
Governance		Present Administrative Body[1]	*a, *c

[a.] Author's own research, [b.] [18], [c.] [19], [d.] [20], [e.] [21].

[1] Quantifiable Indicator (QI).

D. The Quantifiable Indicators and their Respective Values for Selected Peripheral Settlements within 16 k.m. Boundary of Chandigarh UT

Data has been collected for each of the selected indicators against each of the peripheral settlements and these values are graphically analyzed further to examine the commonality of the selected settlements.

IV. ANALYSIS AND RESULTS

A. Graphical Analysis of each of the Indicators

Graphs have been plotted for each of the indicators v/s selected settlements and results are tabulated in form of group of settlements against a certain value range (few of them are shown in Fig. 2 & 3.

B. Result - Formation of Settlement Clusters & Proposed Hierarchy for Peri-Urban Area

A total of 36 graphs have been plotted to understand the relationship among settlements, their degree of familiarity with respect to all the selected indicators. In each case, the settlements are grouped against a certain value range. As a whole, it is analyzed that how many times two / three specific settlements are being repeated in the same / adjoining clusters. Cumulatively, this analysis reveals that on the basis of homogeneity (80% case of repetition), the settlements can be grouped into total 5 clusters and can be mapped with respect to their distance from the core urban area, Chandigarh. In this analysis, it is also observed that there may be one or more peripheral settlements, which cannot be grouped with others in terms of their heterogeneity in values. Such settlements are considered as ‘Exceptional Outcome’ of the research, like Chandimandir Cantonment,

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which may be termed as ‘Peripheral Independent Centre’. For rest of the peripheral settlements, to frame their hierarchy; terminologies are proposed with respect to their distance from the core urban area. The findings are shown in Table 2.

V. DISCUSSION AND CONCLUDING REMARKS

Such hierarchy of settlements is mapped spatially to prepare the Proposed Regional Plan for Chandigarh & Periphery, shown in Fig. 4. Since the inception of Chandigarh, the 16 k.m. peripheral boundary around the city was envisioned as ‘no construction zone’ and to protect agriculture & dairy to serve the city people. However, due to absence of effective regulatory framework, planning policy this 16 k.m. peripheral boundary is diluted, lost its significance and violated continuously. The research has already investigated the relevance of this boundary at present time, where the developments have already sparred out beyond and continuously create impact over the core urban area. Therefore, the proposal takes a Regional Planning approach, considering the parent city and periphery as a whole. In present time, Chandigarh is solely being developed and boosted with several urban development funds, as it comes in the list of Statutory Towns as per Census of India and all the peripheral towns are considered like other towns under ‘Rural’ category. They are deprived from getting funds like Chandigarh being the Census Towns, though they are facing comparable amount of urbanization and related issues. In this context, the proposal has created hierarchy among these peripheral settlements on the basis of their degree of urbanization measured by selected planning parameters, instead of considering all of them under one category like ‘Census Town’. Thus, the further categorization of ‘Urban’ has been derived for the case of Chandigarh Region. Accordingly, the Regional Plan can be considered as ‘Statutory Plan’ to regulate plan preparation, fund distribution and governance of all these peripheral towns in future.

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Table 2. Findings: derivation of peri-urban settlement typology (Source: Author)

Clusters found on the basis of Commonality of Values assigned to Each Parameter	Cities under Each Cluster	Proposed Terminology for Settlement Typology
Cluster 1	Panchkula & Mohali	Extended Urban Centre - TriCity Urban Agglomeration
Cluster 2	Mani Majra, Khuda Ali Sher, Nayagaon, Mullanpur	Adjacent Urban Node
Cluster 3	Zirakpur, Derabassi, Kharar	Peripheral Urban Centre - Tier I
Cluster 4	Pinjore, Kalka, Banur	Peripheral Urban Centre - Tier II
Cluster 5	Baddi, Nalahgarh, Parwanoo	Peripheral Urban Centre - Tier III
Exceptional Outcome	Chandimandir Cantonment	Peripheral Independent Centre

This research evolves a context specific proposal for derivation of peri-urban settlement typologies. However, the similar approach may be adopted for other urban areas to formulate such settlement categories and regional plan to govern them as a whole.

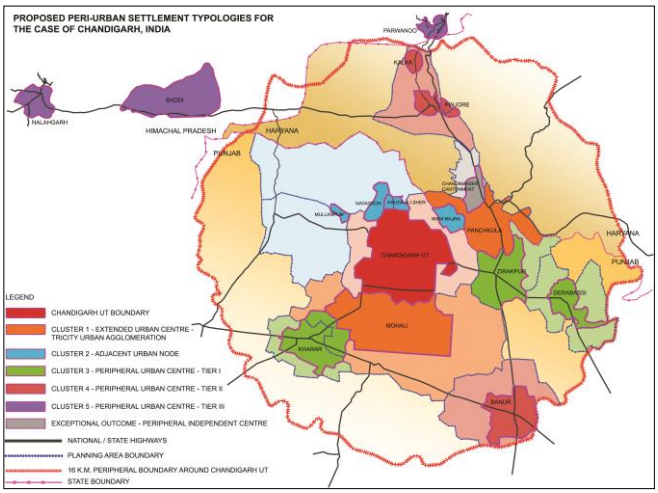

Fig. 4 Proposed regional plan for Chandigarh & its periphery – formulation of peri-urban settlement typologies (Source: Author)

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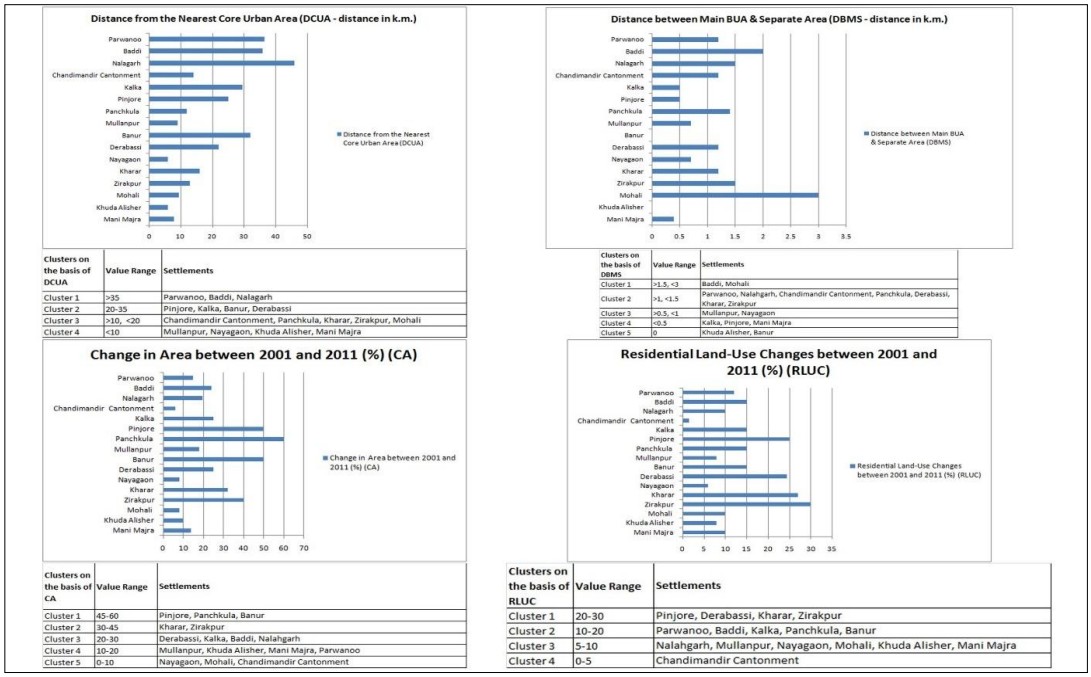
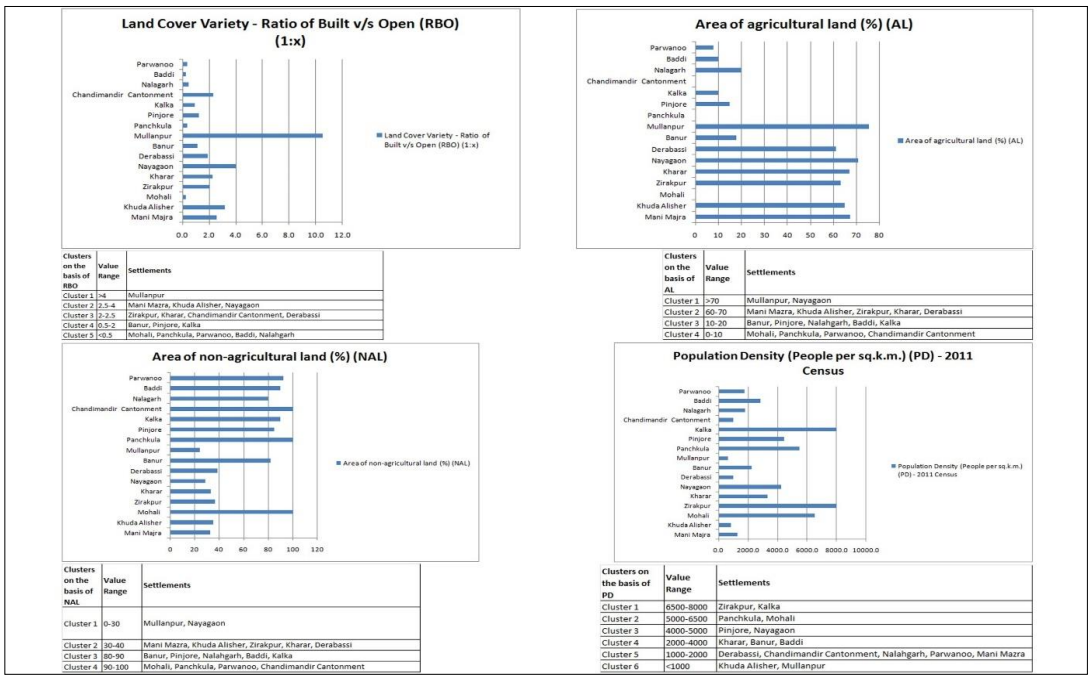


Clusters on the basis of DCUA	Value Range	Settlements
Cluster 1	>35	Parwanoo, Baddi, Nalagarh
Cluster 2	20-35	Pinjore, Kalka, Banur, Derabassi
Cluster 3	>10, <20	Chandimandir Cantonment, Panchkula, Kharar, Zirakpur, Mohali
Cluster 4	<10	Mullanpur, Nayagaon, Khuda Alisher, Mani Majra

Clusters on the basis of DBMS	Value Range	Settlements
Cluster 1	>1.5, <3	Baddi, Mohali
Cluster 2	>1, <1.5	Parwanoo, Nalahgarh, Chandimandir Cantonment, Panchkula, Derabassi, Kharar, Zirakpur
Cluster 3	>0.5, <1	Mullanpur, Nayagaon
Cluster 4	<0.5	Kalka, Pinjore, Mani Majra
Cluster 5	0	Khuda Alisher, Banur

Clusters on the basis of CA	Value Range	Settlements
Cluster 1	45-60	Pinjore, Panchkula, Banur
Cluster 2	30-45	Kharar, Zirakpur
Cluster 3	20-30	Derabassi, Kalka, Baddi, Nalahgarh
Cluster 4	10-20	Mullanpur, Khuda Alisher, Mani Majra, Parwanoo
Cluster 5	0-10	Nayagaon, Mohali, Chandimandir Cantonment

Clusters on the basis of RLUC	Value Range	Settlements
Cluster 1	20-30	Pinjore, Derabassi, Kharar, Zirakpur
Cluster 2	10-20	Parwanoo, Baddi, Kalka, Panchkula, Banur
Cluster 3	5-10	Nalahgarh, Mullanpur, Nayagaon, Mohali, Khuda Alisher, Mani Majra
Cluster 4	0-5	Chandimandir Cantonment



Clusters on the basis of RBO	Value Range	Settlements
Cluster 1	>4	Mullanpur
Cluster 2	2.5-4	Mani Mazra, Khuda Alisher, Nayagaon
Cluster 3	2-2.5	Zirakpur, Kharar, Chandimandir Cantonment, Derabassi
Cluster 4	0.5-2	Banur, Pinjore, Kalka
Cluster 5	<0.5	Mohali, Panchkula, Parwanoo, Baddi, Nalahgarh

Clusters on the basis of AL	Value Range	Settlements
Cluster 1	>70	Mullanpur, Nayagaon
Cluster 2	60-70	Mani Mazra, Khuda Alisher, Zirakpur, Kharar, Derabassi
Cluster 3	10-20	Banur, Pinjore, Nalahgarh, Baddi, Kalka
Cluster 4	0-10	Mohali, Panchkula, Parwanoo, Chandimandir Cantonment

Clusters on the basis of NAL	Value Range	Settlements
Cluster 1	0-30	Mullanpur, Nayagaon
Cluster 2	30-40	Mani Mazra, Khuda Alisher, Zirakpur, Kharar, Derabassi
Cluster 3	80-90	Banur, Pinjore, Nalahgarh, Baddi, Kalka
Cluster 4	90-100	Mohali, Panchkula, Parwanoo, Chandimandir Cantonment

Clusters on the basis of PD	Value Range	Settlements
Cluster 1	6500-8000	Zirakpur, Kalka
Cluster 2	5000-6500	Panchkula, Mohali
Cluster 3	4000-5000	Pinjore, Nayagaon
Cluster 4	2000-4000	Kharar, Banur, Baddi
Cluster 5	1000-2000	Derabassi, Chandimandir Cantonment, Nalahgarh, Parwanoo, Mani Mazra
Cluster 6	<1000	Khuda Alisher, Mullanpur

Fig. 2 Graphical analysis of selected indicators (Source: Author)

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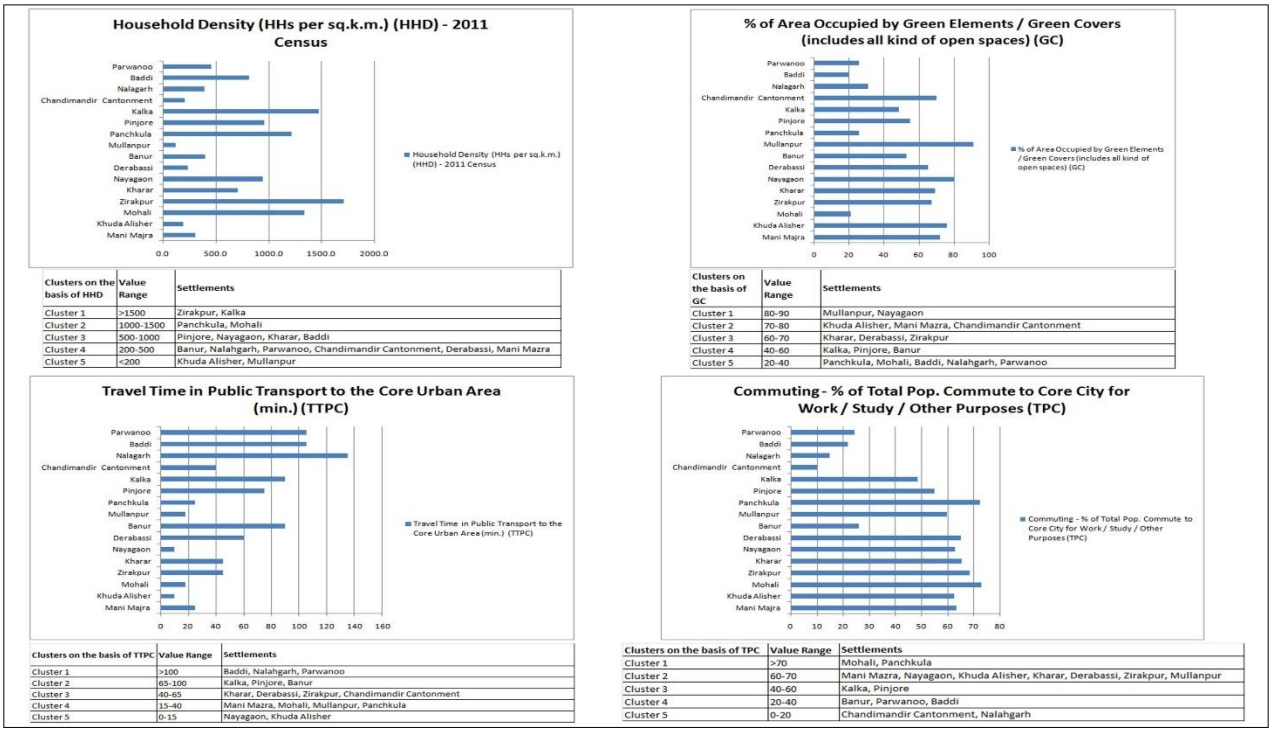

Clusters on the basis of HHD	Value Range	Settlements
Cluster 1	>1500	Zirakpur, Kalka
Cluster 2	1000-1500	Panchkula, Mohali
Cluster 3	500-1000	Pinjore, Nayagaon, Kharar, Baddi
Cluster 4	200-500	Banur, Nalahgarh, Parwanoo, Chandimandir Cantonment, Derabassi, Mani Mazra
Cluster 5	<200	Khuda Alisher, Mullanpur

Clusters on the basis of GC	Value Range	Settlements
Cluster 1	80-90	Mullanpur, Nayagaon
Cluster 2	70-80	Khuda Alisher, Mani Mazra, Chandimandir Cantonment
Cluster 3	60-70	Kharar, Derabassi, Zirakpur
Cluster 4	40-60	Kalka, Pinjore, Banur
Cluster 5	20-40	Panchkula, Mohali, Baddi, Nalahgarh, Parwanoo

Clusters on the basis of TTPC	Value Range	Settlements
Cluster 1	>100	Baddi, Nalahgarh, Parwanoo
Cluster 2	65-100	Kalka, Pinjore, Banur
Cluster 3	40-65	Kharar, Derabassi, Zirakpur, Chandimandir Cantonment
Cluster 4	15-40	Mani Mazra, Mohali, Mullanpur, Panchkula
Cluster 5	0-15	Nayagaon, Khuda Alisher

Clusters on the basis of TPC	Value Range	Settlements
Cluster 1	>70	Mohali, Panchkula
Cluster 2	60-70	Mani Mazra, Nayagaon, Khuda Alisher, Kharar, Derabassi, Zirakpur, Mullanpur
Cluster 3	40-60	Kalka, Pinjore
Cluster 4	20-40	Banur, Parwanoo, Baddi
Cluster 5	0-20	Chandimandir Cantonment, Nalahgarh

Clusters on the basis of CI (Nursery & Primary School)	Value Range	Settlements
Cluster 1	>70	Mohali, Panchkula
Cluster 2	10-20	Zirakpur, Mani Mazra
Cluster 3	5-10	Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Kalka, Pinjore, Chandimandir Cantonment
Cluster 4	0-5	Banur, Baddi, Nalahgarh, Parwanoo

Clusters on the basis of CI (Sr. Secondary School)	Value Range	Settlements
Cluster 1	>40	Mohali, Panchkula
Cluster 2	3-5	Mani Mazra, Chandimandir Cantonment
Cluster 3	0-3	Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Kalka, Pinjore, Zirakpur, Banur, Baddi, Nalahgarh, Parwanoo

Clusters on the basis of CI (Sr. Secondary School)	Value Range	Settlements
Cluster 1	>40	Mohali, Panchkula
Cluster 2	3-5	Mani Mazra, Chandimandir Cantonment
Cluster 3	0-3	Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Kalka, Pinjore, Zirakpur, Banur, Baddi, Nalahgarh, Parwanoo

Clusters on the basis of CI (Hospital - 500,200,100 bed)	Value Range	Settlements
Cluster 1	0	Nayagaon, Khuda Alisher, Kharar, Derabassi, Mullanpur, Pinjore, Banur, Nalahgarh, Parwanoo
Cluster 2	1	Kalka, Baddi, Zirakpur, Chandimandir Cantonment, Mani Mazra
Cluster 3	>1	Mohali, Panchkula

Fig. 3 Graphical analysis of selected indicators (Source: Author)

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AUTHOR CONTRIBUTION

First author and corresponding author did the main conception. All other authors assisted in area mapping, field survey, data collection and preparation of maps. First and corresponding authors contributed in data analysis. First author principally wrote the manuscript, corresponding and other authors did the formatting work. All authors read and finalized the manuscript.

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