

Urban Regeneration: Construction of Factor model

Sumana Jayaprakash,¹ [Asst Professor, Malnad College of Engineering, Hassan. Email: sj@mcehassan.ac.in] and
Dr. Vimala Swamy,² [Professor, School of Architecture, REVA University, Bengaluru. Email: vimalaswamy@reva.edu.in]

Abstract: Urban regeneration decision-making is a complex process, as it involves a wide range of decision-makers, public-private partnerships in finance and implementation, including the inevitable considerable amount of risk on a long-term basis. There are a multitude of stakeholders, the citizens being the key stakeholders. It is necessary to involve the citizens in the planning process. Such involvement allows the communities to express their needs and aspirations, which is useful in the policymaking, delivery of planning programs, and in the monitoring process. In such a context, Factor analysis was the statistical technique used (1) Carry out factor analysis based on the principal component analysis method using the software XLSTAT 2021.4.1.1205 - (2) Construct a factor model of Urban Regeneration. (3) Interpret and label the factor dimensions. The results of the analysis indicated that the first two principal components accounted for 60.04% of the total variance of the original dataset. All variables seemed to be, positively correlated to each other and contributed similarly to principal components PC1 & PC2. The observations were well clustered; except for very few outliers. The limitation of the work was that the perceptions of the citizens were limited to the variables derived by the researcher.

Keywords: dimensionality reduction, citizens' perception, factor model, variables, urban regeneration.

Introduction:

Urban Regeneration is defined as the “comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area that has been subject to change.” (Roberts, 2000) Urban regeneration rather than a discipline-based on a solid body of theory; is an empirical field of policy and practices. It operates in a complex environment with multiple actors and inherent conflicting issues. The urban problems and opportunities from historical phases of urban development portray the relationship between physical conditions and social, economic, and environmental response and the need for restructuring of the cities as the basis of Urban Regeneration. (*Regenerating Urban Land*, n.d.). Current regeneration practice goes beyond physical redevelopment, to stimulation of economic growth, together with the increase in community cohesion. Environmental sustainability and climate change issues have considerable prominence as objectives of regeneration policy. Urban Regeneration Intervention is based on a detailed analysis of the physical, social, economic, and environmental conditions of the area. (Blake, 1997) (Childers et al., 2014) The integrated strategy of planning and implementation is developed by making the best use of the existing features on-site and clear quantifiable objectives. The components of the physical factor include buildings, land and sites, urban spaces, open spaces and water, utilities and services, communications, infrastructure, and transport. Economic regeneration aims to attract and stimulate investment, create employment

opportunities, and improve the environment of cities to make the best possible use of urban land and to avoid unnecessary sprawl. (Garau & Pavan, 2018) The use of Public-private partnerships in urban regeneration is associated with diverse contractual models, which require a wide range of institutions to support them. (De Magalhaes, 2015) (Shenvi & Slangen, 2018) It involves partnerships created from national and local government, the private and voluntary sectors, and members of local communities. The policy framework, the institutional structure, the financial and regulatory mechanisms, and the political forces shape the context of Intervention. These are powerful tools for advancing an Urban Regeneration Intervention. Community participation in the planning of development projects is fundamental for project success and sustainability. It allows the communities to express their needs and aspirations and is useful in the policymaking, delivery, and monitoring process. (Ruá et al., 2019) (Martí et al., 2019) The preference of the citizens needs to be represented by the limited number of characteristics or a reduced number of variables if they have to be efficiently integrated into the planning process. (Dr. Vimala Swamy, 2020)

1. Methodology:

Large datasets are increasingly widespread in a comprehensive questionnaire survey in attempting to understand citizens' point of view in urban matters. To interpret such large datasets, methods are required to drastically reduce their dimensionality in an interpretable way, such that most of the information in the data is preserved. Many techniques have been developed for this purpose, but principal component analysis (PCA) is one of the oldest and most widely used. (Jorge, 2016). In the present work, a total of 45 variables were derived from nine Urban regenerations parameters, namely image and identity, Land use, open spaces and building form, transportation and movement network, activity support, environment, social, economic factors, financial and regulatory mechanisms. These parameters were based on a literature review. To organize this large database and construct a factor model, the principal component analysis was applied to each level to reduce the dimensions of the sample and derive the results of the analysis. The steps included: 1. Derivation of variables from the Urban Regeneration parameters. 2. Citizen questionnaire survey. 3. Dimensionality reduction by application of the principal component method. 4. Derivation of the factor dimensions. 5. Construction of the five-factor model of Urban Regeneration.

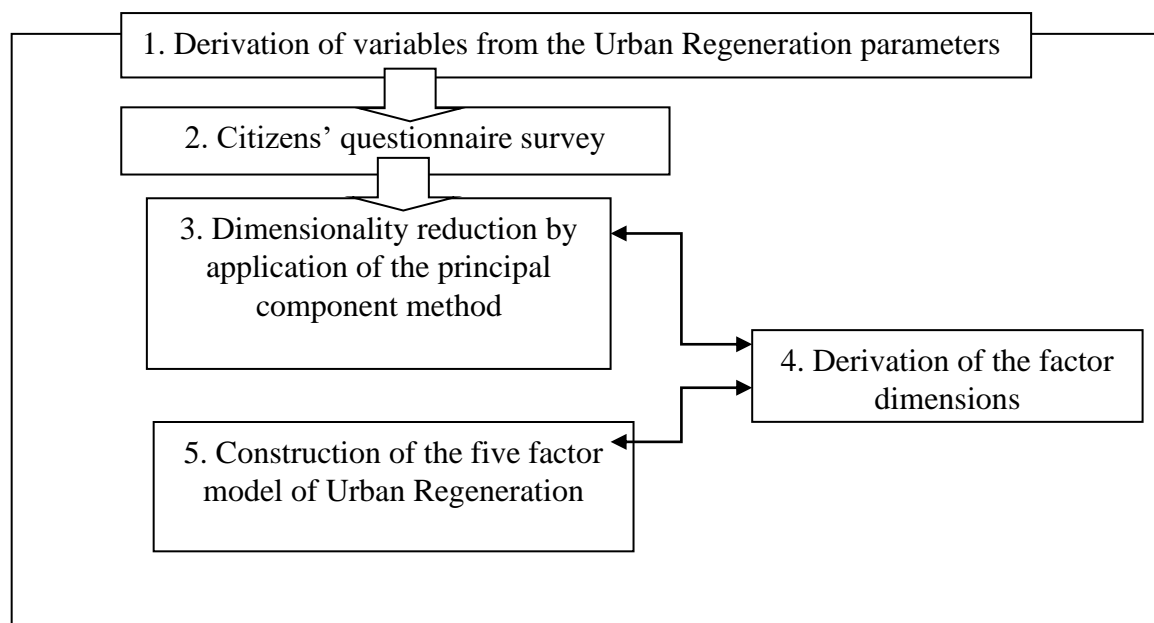


Fig 1: Flow chart of the methodology

2.1: Derivation of 45 variables from Urban Regeneration Parameters.

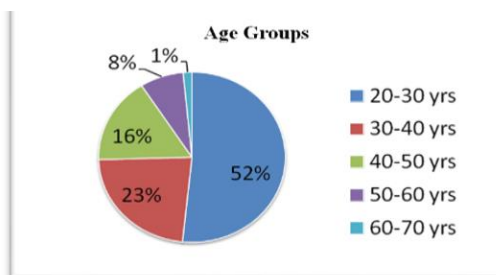
Parameters	Variables
1. Identity and Image	1. City Image / visual appeal.
	2. Historical monuments and buildings are important.
	3. Old Temples are important.
	4. Historical Tourist places of attraction
	5. Preservation of old valuable buildings and areas
2. Land-use	6. Houses close to workplaces.
	7. Parks near residences.
	8. Industries located away from the city
	9. Markets and shopping centers close to homes.
	10. Preservation of water bodies etc.
3. Open Spaces and Building Form	11. Landmarks like the clock tower, fountains, etc
	12. Wide walking footpath spaces along the roads.
	13. Character of the area like temple zone etc.
	14. Availability of shopping, recreation and food courts
	15. Uniform building fronts
4. Transport & Movement Network	16. No wastage of urban land area
	17. Less travel time to office
	18. Well connected local buses within the city.
	19. Private car /scooter services like ola for travel within the city.
	20. Vacant land use for parking etc.
5. Activity Support	21. Street vendors appropriately accommodated
	22. Walkable pedestrian zones within the city
	23. Efficient waste management and garbage disposal
	24. Efficient use of Renewable energy sources like solar
	25. Private owned publicly used spaces.
6. Environmental Factors	26. Good quality of air and water
	27. Open spaces and gardens
	28. Eco-friendly buildings
	29. Walking and cycling paths within the city
	30. Pollution free environment within the city
7. Social Factors	31. Citizen participation in planning
	32. Places for people of all age groups
	33. Gender equality
	34. Appropriate /accessible social infrastructure like schools & hospitals.
	35. People friendly places within the city
8. Economic Factors	36. Financial investment for city development
	37. Economic viability Profitability
	38. Varied Sources of funding
	39. Citizen's investment in city development and regeneration
9. Financial and Regulatory Mechanism	40. Financial sustainability
	41. Government role
	42. Importance of Building Byelaws

	43. Public Private partnerships
	44. Political leadership
	45. Planning and Implementation

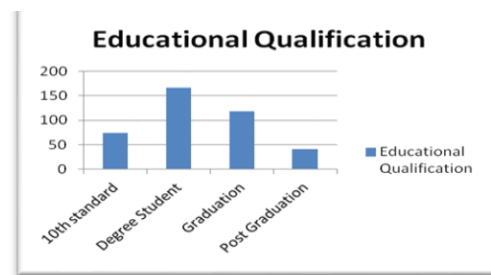
Table 1: List of Urban Regeneration Parameters and Variables

2.2. Citizens' Questionnaire survey:

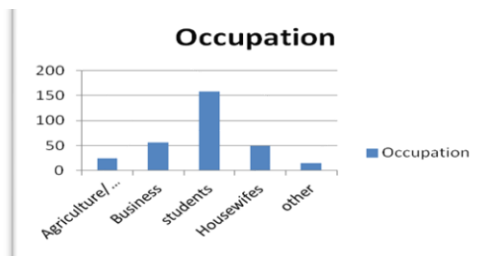
The Citizens' questionnaire survey was carried out on 430 citizens of Hassan. A total of 30 responses were discarded as the persons who responded were not from Hassan district. Hence a total of 400 respondents were considered for the research project. The respondents were to score the variables given in the form of a question, on a scale ranging from 1-10. A score of 10 meant a very important or preferred variable. The lowest score of 1 meant the least important variable. Google forms were used for this purpose. Following was the composition of the respondents in terms of age, occupation, and educational qualification.



Graph 1: Age groups (Source: Primary data)



Graph 1: Educational Qualification (Source: Primary data)



Graph 1: Occupation (Source: Primary data)

2.3: Dimensionality reduction by application of the principal component Analysis

Total Variance explained by the 5-factor Matrix

	Initial Eigenvalues			The extracted sum of squared loadings			The rotated sum of squared loadings		
	Total	variability%	Cumulative %	Total	variability%	Cumulative %	Total	variability%	Cumulative %
F1	25.209	56.019	56.019	25.209	56.019	56.019	15.543	14.511	14.511
F2	1.808	4.019	60.038	1.808	4.019	60.038	15.634	14.246	28.756
F3	1.327	2.949	62.987	1.327	2.949	62.987	14.468	12.707	41.464
F4	1.159	2.575	65.562	1.159	2.575	65.562	17.054	17.128	58.592
F5	0.999	2.219	67.781	0.999	2.219	67.781	11.888	9.189	67.781

Table 2: Total Variance explained by the 5-factor Matrix

XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

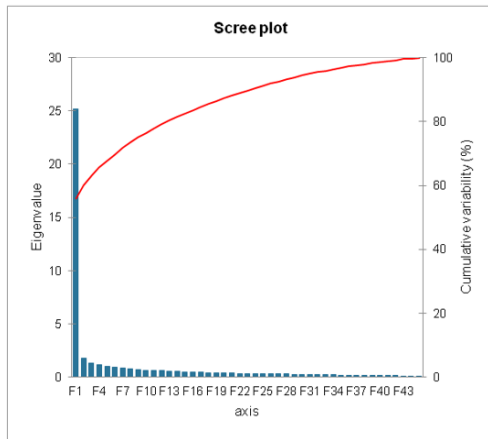


Fig 2: The Scree Plot

Principal Component Analysis:

	F1	F2	F3	F4	F5	F6	F7	F8	F9
Eigenvalue	25.209	1.808	1.327	1.159	0.999	0.913	0.866	0.773	0.693
Variability (%)	56.019	4.019	2.949	2.575	2.219	2.028	1.924	1.718	1.539
Cumulative %	56.019	60.038	62.987	65.562	67.781	69.809	71.733	73.451	74.990

Table 3: XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

2.4: Derivation of factor dimensions.

FACTOR D1	VARIABLES	FACTOR LOADINGS	COMMUNALITY %
22.	Walkable pedestrian zones within the city	0.682	75.9%
23.	Efficient waste management and garbage disposal	0.658	64.0%
21.	Street vendors appropriately accommodated	0.652	75.4%
24.	Efficient Renewable energy sources like solar	0.641	72.6%
20.	Vacant land use for parking etc.	0.622	74%
26.	Good quality of air and water	0.555	71.4%
18.	Well connected local buses within the city.	0.545	65.6%
25.	Private owned publicly used spaces.	0.508	62.5%
12.	Wide walking footpath spaces along the roads.	0.491	73.3%
	variability		14.511
	Cumulative %		14.511%

Table 4: Factor Dimension 1 Source: Research Survey Data

XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

Factor Dimension 1:

A total of 9 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 14.511%.

Label: Qualitative public spaces. (Well managed, environmentally friendly, pedestrian zones with open spaces)

FACTOR D2	VARIABLES	FACTOR LOADINGS	COMMUNALITY %
	9. Markets and shopping centres close to homes.	0.677	65.4%
	14. Availability of shopping, recreation and food courts	0.649	68.7%
	15. Uniform building fronts	0.643	64.6%
	13. Character of area like temple zone etc.	0.571	72.7%
	6. Houses close to work places.	0.552	58%
	7. Parks near to residences.	0.539	57.8%
	19. Private car /scooter services like ola for travel	0.507	54.7%
	16. No wastage of urban land area	0.503	59.9%
	17. Less travel time to office	0.466	61.7%
	8. Industries located away from city	0.439	47.6%
	variability		14.346
	Cumulative %		28.756%

Table 5: Factor Dimension 2 Source: Research Survey Data

XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

Factor Dimension 2:

A total of 10 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 14.346%.

Label: Qualitative Individual spaces with the neighborhood character (Convenient, utilitarian, recreational, ease of movement, inherent character)

FACTOR D3	VARIABLES	FACTOR LOADINGS	COMMUNALITY %
	34. Appropriate /accessible social infrastructure like schools and hospitals.	0.669	71.6%
	33. Gender equality	0.646	75.0%
	31. Citizen participation in planning	0.628	77.5%
	32. Places for people of all age groups	0.612	76.7%
	30. Pollution free environment within the city	0.607	72.7%
	35. People friendly places within the city	0.587	71.5%
	29. Walking and cycling paths within the city	0.466	67.8%
	28. Eco-friendly buildings	0.437	59.9%
	10. Preservation of water bodies etc.	0.427	68.0%
	variability		12.707
	Cumulative %		41.464

Table 6: Factor Dimension 3 Source: Research Survey Data

XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

Factor Dimension 3:

A total of 9 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 12.707%.

Label: People-Friendly environmentally healthy places and accessible social functions (Participatory, accessible to all, pollution-free, pedestrian-friendly places and associated activities)

FACTOR D4	VARIABLES	FACTOR LOADINGS	COMMUNALITY %
38.	Varied Sources of funding	0.741	79.2%
40.	Financial sustainability	0.729	73.1%
39.	Citizen's investment in city regeneration	0.721	70.2%
37.	Economic viability Profitability	0.661	67.5%
36.	Financial investment for city development	0.640	71.9%
44.	Political leadership	0.637	62.2%
45.	Planning and Implementation	0.619	63.1%
42.	Importance of Building Byelaws	0.617	69.4%
43.	Public Private partnerships	0.603	72.1%
41.	Government role	0.596	68.5%
	variability		17.128%
	Cumulative %		58.592%

Table 7: Factor Dimension 4 Source: Research Survey Data

XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

Factor Dimension 4:

A total of 10 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 17.128%.

Label: Varied Sources of funding (Sustained financial management, public-private partnerships, conducive political climate, economically viable context, appropriate policies, citizen participation, planning, and implementation)

FACTOR D5	VARIABLES	FACTOR LOADINGS	COMMUNALITY %
3.	Old Temples are important.	0.790	45.2%
2.	Historical monuments and buildings are important.	0.692	70.4%
4.	Historical Tourist places of attraction	0.653	79.7%
5.	Preservation of old valuable buildings and areas	0.509	73.3%
1.	City Image / visual appeal.	0.437	62.2%
	variability		9.189%
	Cumulative %		67.781%

Table 8: Factor Dimension 5 Source: Research Survey Data

XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser normalization) / Number of factors = 5

Factor Dimension 5:

A total of 5 variables out of 45 are found loaded on this factor. Out of 67.781% of communality, this factor represents 17.128%.

Label: Historical conservation and tourism potential (Preservation and appropriate use, exploration of tourism potential, and city image building)

2.5. Five-factor model of Urban Regeneration.

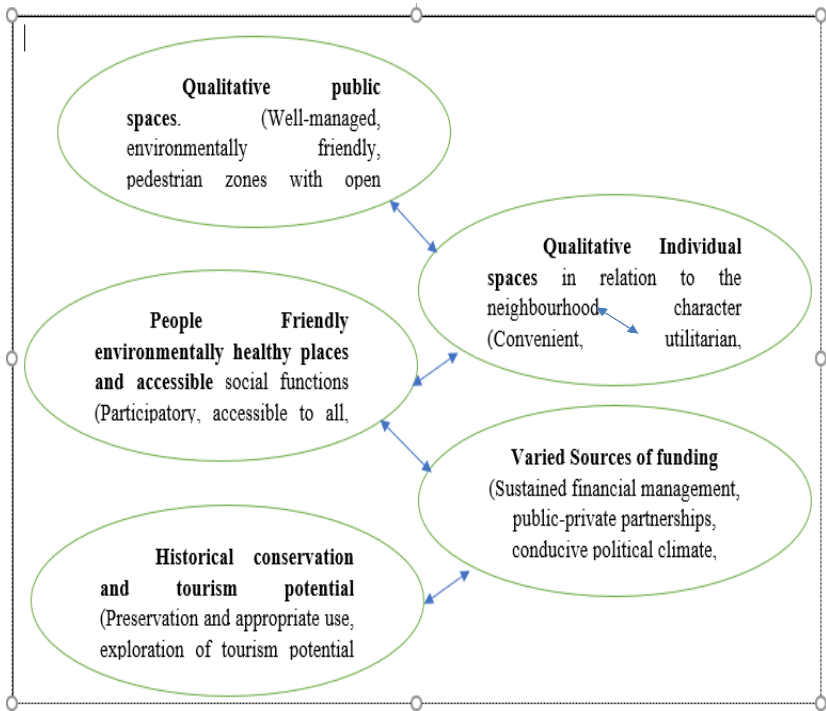


Fig 3: Five-factor model of Urban Regeneration.

3. Discussions and Conclusions:

Factor Dimension 1:

A total of 9 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 14.511%.

Label: Qualitative public spaces. (Well managed, environmentally friendly, pedestrian zones with open spaces)

22. walk able pedestrian zones within the city. The importance given to walk able pedestrian zones within the city is the highest by the citizens. This factor focuses on the holistic experiential public dimension as understood by the citizens. Loadings: 0.682. Individual variance: 75.9%. All the other variables within this factor are in support of the enhancement of the quality of public spaces.

23. Efficient waste management and garbage disposal. The importance of well-managed public spaces has been pointed out. Loadings: 0.658. Individual variance: 64%.

21. Street vendors appropriately accommodated. This variable hinders the movement and quality of the public, although it is useful. Loadings: 0.652. Individual variance: 75.4%.

24. Efficient Renewable energy sources like solar. This environmental sensitive variable has been highlighted by the citizens, which improves the quality of urban public spaces. Loadings: 0.641. Individual variance: 72.6%.

20. Vacant land use for parking etc. Improper parking leads to crowdedness, which hampers the space available for citizens' movement. Loadings: 0.622. Individual variance: 74%.

26. Good quality of air and water: The inevitability of this variable and its importance for the environmental sustainability of the public spaces is portrayed. Loadings: 0.555. Individual variance: 71.4%.

18. Well-connected local buses within the city: City-level movement of citizens needs to be efficient, which reduces individual use of vehicles. This is the easiest and cheapest means of safe travel within the city. Hence it has been considered important by the citizens. Loadings: 0.545. Individual variance: 77.9%.

25. Private-owned publicly used spaces: Exploration of newer ways to solve the crowdedness and increase the usability of land for public use irrespective of ownership has been highlighted. Loadings: 0.508. Individual variance: 62.5%. 0.491 73.3%

12. Wide walking footpath spaces along the roads: Loadings: 0.491. Individual variance: 73.3%.

Factor Dimension 2:

A total of 10 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 14.346%.

Label: Qualitative Individual spaces with the neighbourhood character (Convenient, utilitarian, recreational, ease of movement, inherent character)

9. Markets and shopping centres close to homes.

The importance is given to the presence of markets and shopping centres close to homes.

is the highest by the citizens. This factor focuses on the holistic experiential neighbourhood character as understood by the citizens. Loadings: 0.677. Individual variance: 65.4%.

All the other variables within this factor are in support of enhancement of the quality of neighbourhood like

14. Availability of shopping, recreation, and food courts

The importance of convenient neighbourhood spaces has been rightly pointed out by the citizens. Loadings: 0.649. Individual variance: 68.7%.

15. Uniform building fronts: This variable, without which there will be haphazard development and hampers the quality of the neighbourhood spaces. Hence it has been considered important. Loadings: 0.643. Individual variance: 64.6%.

13. Character of the area like temple zone etc. This variable addresses the aesthetic sense of belonging to the place. It is the psychological need. Loadings: 0.571. Individual variance: 72.7%.

6. Houses close to workplaces. The need for connectedness and proximity in the life of citizens is emphasized by the citizens in this variable. Loadings: 0.552. Individual variance: 58%.

7. Parks near residences: The importance of environmental sustainability of the neighbourhood spaces is highlighted. Loadings: 0.539. Individual variance: 57.8%.

19. Private car /scooter services like ola for travel: Exploration of newer ways of movement in the city is welcomed here. Loadings: 0.507. Individual variance: 54.7%.

16. No wastage of urban land area: The consciousness of the citizens is obvious here, in the need to efficiently use urban land. Loadings: 0.503. Individual variance: 59.9%.

17. Less travel time to office: As the city is of small size, this variable has not yet been a cause of concern, yet its importance has been portrayed to a certain extent, as the citizens. This variable is considered important in respect to the daily travel by citizens from other taluks to Hassan.

Loadings: 0.466. Individual variance: 61.7%.

8. Industries located away from the city: As the city is not industrial based, this variable is not a serious cause of concern for the citizens. But as a future precaution, the importance of it has been stated. Loadings: 0.439. Individual variance: 47.6%.

Factor Dimension 3:

A total of 9 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 12.707%.

Label: People-Friendly environmentally healthy places and accessible social functions (Participatory, accessible to all, pollution-free, pedestrian-friendly places and associated activities)

34. Appropriate /accessible social infrastructure like schools and hospitals. The importance given to the accessibility to essential aspects of life is the highest by the citizens. This factor focuses on the holistic experiential neighbourhood character. Loadings: 0.669. Individual variance: 71.6%.

All the other variables within this factor are in support of the enhancement of the social and environmental dimension of experience in the city.

33. Gender equality: Emphasis has been laid on this variable pointing to the direction of the safe and healthy environment of the city. Loadings: 0.646. Individual variance: 75.0%.

31. Citizen participation in planning: The interest level in city planning is evident here. Citizens are aware of their rights and duty to participate. Loadings: 0.628. Individual variance: 77.5%.

32. Places for people of all age groups: This variable addresses the present lack of such places in the urban environment adding to the sense of belonging to the place. It is the psychological and physical needs of the citizens. Loadings: 0.612. Individual variance: 76.7%.

30. Pollution-free environment within the city: The need for pollution-free places for a fulfilling experience of life is evident in the level of importance emphasized by the citizens.

Loadings: 0.607. Individual variance: 72.7%.

35. People-friendly places within the city: At present citizens make their way in between traffic for their movement. All elements other than people have gained importance. There is a dire need for people-oriented places. Loadings: 0.587. Individual variance: 71.5%.

29. Walking and cycling paths within the city: Exploration of newer ways of movement in the city is welcomed here by the citizens. Loadings: 0.466. Individual variance: 67.8%.

28. Eco-friendly buildings: The consciousness of the citizens is obvious here, in the need to efficiently exploit the resources of the environment. Loadings: 0.437. Individual variance: 59.9%.

10. Preservation of water bodies etc: As the city is of small size, this variable has not yet been a cause of concern, yet its importance has been portrayed to a certain extent, as the citizens. This variable is considered important by the citizens in respect to the local planning area of Hassan. Loadings: 0.427. Individual variance: 68.0%.

Factor Dimension 4:

A total of 10 variables out of 45 are found loaded on the factor. Out of 67.781% of communality, this factor represents 17.128%.

Label: Varied Sources of funding (Sustained financial management, public-private partnerships, conducive political climate, economically viable context, appropriate policies, citizen participation, planning, and implementation)

38. Varied Sources of funding:

The importance given to varied sources of funding is the highest by the citizens. This factor focuses on the implementation strategies dimension as understood by the citizens.

Loadings: 0.741. Individual variance:79.2%.

All the other variables within this factor are in support of the feasibility of urban regeneration projects.

40. Financial sustainability: The importance of long-term efficient financial climate requirements has been rightly pointed out by the citizens. Loadings: 0.729. Individual variance: 73.1%.

39. Citizen's investment in city regeneration: The importance of the individual and collective role is emphasized here by the citizens. It also portrays the willingness of the citizens to financial investment in city regeneration. Loadings: 0.721. Individual variance:70.2%.

37. Economic viability Profitability: Exploration of newer ways to city regeneration can only take place in a climate of sustained economic profitability. Loadings: 0.661. Individual variance:67.5%.

36. Financial investment for city development: The financial variable has been highlighted, which is crucial for the project implementation. Loadings: 0.640. Individual variance:71.9%.

44. Political leadership: A conducive political leadership is a key to the successful planning and implementation of urban regeneration projects. The sustenance of the project policies is also dependent on efficient political leadership. Loadings: 0.637. Individual variance:62.2%.

45. Planning and Implementation:

Loadings: 0.603. Individual variance:72.1%. In this variable, the administrative facet has been given importance by the citizens. This varies with the other variables in the factor cumulatively account for successful projects. Loadings: 0.619. Individual variance:63.1%.

42. Importance of Building Byelaws: It is only in the context of appropriate policies, procedures, and rules that an urban project can be efficiently carried out. Inappropriate decision making etc has a direct impact on the development of the city.

Loadings: 0.617. Individual variance: 69.4%.

43. Public Private partnerships: This variable is in support of the decentralization and sharing of the power, authority, and responsibilities, in place of the government being the sole authority. It is in the best interest of the city. Loadings: 0.603. Individual variance:72.1%.

41. Government role: In the wake of increased importance given by the citizens to public-private partnerships, naturally the importance of the role of the government is relatively undermined. Loadings: 0.596. Individual variance: 68.5%.

Factor Dimension 5:

A total of 5 variables out of 45 are found loaded on this factor. Out of 67.781% of communality, this factor represents 17.128%.

Label: Historical conservation and tourism potential (Preservation and appropriate use, exploration of tourism potential, and city image building)

3. Old Temples are important: The importance given to the importance of old temples is the highest by the citizens. Here the local culture and religious aspect of the place has been the focus. It portrays the historical experiential character as understood by the citizens.

Loadings: 0.790. Individual variance:45.24%.

All the other variables within this factor are in support of the enhancement of the features of historical monuments.

2. Historical monuments and buildings are important: The importance of historical places and buildings which portray the culture and urban life of the past inherent and unique to the place has been highlighted by the citizens. Loadings: 0.692. Individual variance: 70.4%.

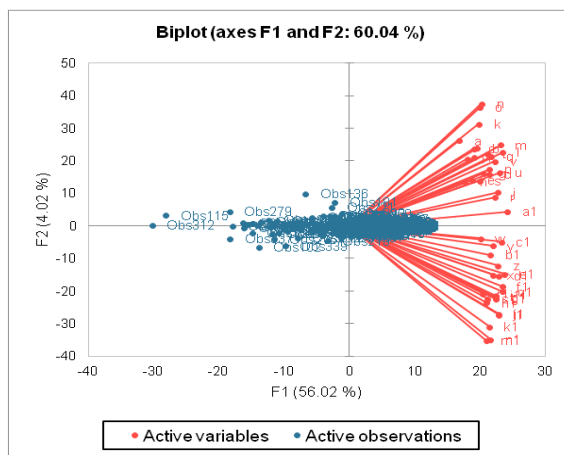
4. Historical Tourist places of attraction: This variable, associates the historical places to tourist places of attraction, making the activity economically viable. Hence it has been considered important by the citizens. Loadings: 0.653. Individual variance:79.7%.

5. Preservation of old valuable buildings and areas:

This variable addresses the responsibility and appreciation and the aesthetic sense of belonging to the old valuable buildings and areas. It is the psychological need of the citizens.

Loadings: 0.509. Individual variance:73.3%.

1. City Image / visual appeal: The need for image building of the city is not very much appreciated about the management, utilitarian value, and environmental sensitivity. It says that city is not something to visualize but to experience and live. Loadings: 0.552. Individual variance: 58%.



Graph 2: The Biplot (XLSTAT 2021.4.1.1205 - Principal Component Analysis (PCA) - PCA type: Correlation, Filter factors Maximum number = 5, Standardisation: (n) Rotation: Varimax (Kaiser Normalization) / Number of factors = 5)

All variables have positive values on the PC1 axis. In the PC2 axis half, the number of variables is negative. Since all variables are positive in PC1, the ones that restrain the system in PC2 lie in the opposite quadrant. Blue dots are PC scores, orange lines correspond to eigenvectors; data were standardized; the first two PCs account for 60.04% of the total variance of the original dataset. In the PC2 axis, the two sets of variables have opposite effects on the system. All

variables seem to be, positively correlated between each other and contributing similarly to PC1/PC2. The observation scores are well clustered; thus they all respond to the system quite uniformly, except some outsiders. The limitation of the work was that the perceptions of the citizens were limited to the variables derived by the researcher. Students were involved in collecting responses from the citizens. Therefore in the age groups involved, student number seems to be in excess. Hence the responses may have been partial to that age group. Some students from places other than Hassan, presently living in Hassan have responded to the questionnaire survey. Their understanding of the city of Hassan may be partial. This factor may have affected the results obtained. Overcoming these limitations in further work can bring out more accurate results and analysis.

References:

- Blake, R. (1997). *Nottingham City Challenge : Policies and Programmes, 1992-1997*. In: Hommes et Terres du Nord, 1997/1. Les politiques urbaines en France et au Royaume-Uni. <https://doi.org/https://doi.org/10.3406/htn.1997.2573>
- Childers, D. L., Pickett, S. T. A., Grove, J. M., Ogden, L., & Whitmer, A. (2014). Advancing urban sustainability theory and action: Challenges and opportunities. *Landscape and Urban Planning*, 125, 320–328. <https://doi.org/10.1016/j.landurbplan.2014.01.022>
- De Magalhaes. (2015). https://www.researchgate.net/profile/Claudio_De_Magalhaes/publication/304194249_Urban_Regeneration/links/5811da0608ae205f8102540b/Urban-Regeneration
- Dr. Vimala Swamy. (2020). *Smart Keys for smart eco-friendly cities*. BUUKS. <https://www.amazon.in/Smart-Keys-Eco-friendly-Cities/dp/9390507642>
- Garau, C., & Pavan, V. M. (2018). Evaluating urban quality: Indicators and assessment tools for smart sustainable cities. *Sustainability (Switzerland)*, 10(3). <https://doi.org/10.3390/su10030575>
- Jorge, J. I. T. and C. (2016). No Title. *Principal Component Analysis: A Review and Recent Developments Phil. Trans. R. Soc. A*.3742015020220150202.
- Martí, P., García-Mayor, C., & Serrano-Estrada, L. (2019). Identifying opportunity places for urban regeneration through LBSNs. *Cities*, 90(February), 191–206. <https://doi.org/10.1016/j.cities.2019.02.001>
- Regenerating Urban Land*. (n.d.). <https://openknowledge.worldbank.org/handle/10986/2174>
- Roberts, P. (2000). The evolution, definition and purpose of urban regeneration. *Urban Regeneration*, 9–36.
- Ruá, M. J., Huedo, P., Cordani, L., Cabeza, M., Saez, B., & Agost-Felip, R. (2019). Strategies of urban regeneration in vulnerable areas: A case study in Castellón, Spain. *WIT Transactions on Ecology and the Environment*, 238, 481–492. <https://doi.org/10.2495/SC190421>
- Shenvi, A., & Slangen, R. H. (2018). Enabling Smart Urban Redevelopment in India through Floor Area Ration Incentives. *ADB South Asia Working Paper Series*, 58(58). <http://dx.doi.org/10.22617/WPS189452-2>

