



SHAPING INDIAN CITIES

Planning and Design with Smart City Technologies



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Alankrita Sarkar

Graduation Thesis Report

MSc Thesis Report

Shaping Indian Cities

Planning and Design with Smart City Technologies

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July 2017



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Please feel free to contact me for any interest in this graduation project!

Alankrita Sarkar
TU Delft
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PREFACE

Rapid urbanization is a global phenomenon. Current estimates suggest that by 2030, over 60 per cent of the global population will be living in cities, increasingly concentrated in Africa, Asia and Latin America (Commission on Science and Technology for Development - United Nations 2016). With the emergence of the latest concept of smart cities, there is a rapid change of lifestyle and a mass migration to cities. At the same time, cities have high demands of infrastructure such as transport and building, and resources such as food, water, and energy, as well as issues like scarcity of adequate land, unapproachable government. All these are adding to the extreme need to find smarter solutions for cities, that can provide better liveable conditions for the citizens. The Indian government planned 100 smart city project to enter and compete with the new world and growing technologies. Many questions were raised by the citizens, researchers on the proposal point out for justification on appropriateness of proposal time, money, approach and objectives. In this project, I am evaluating the current proposal as an urbanist and using the opportunity to refine the project for a realistic and promising future, rather than creating a label of smartness. I explore the conditional development of smart cities, investigating various examples from different continents and producing an analytical framework towards the approach of making a city smarter. These examples are assisting me to set guidelines, to shape the Indian cities with its own definition of smartness. The focal point of this project is Delhi, but the other Indian cities will be able to learn from the process of selection of projects and principles. Although, due to lack of time, I would emphasis of few sectors of smartness, in selective neighbourhoods of Delhi.

Before the proposal and the evaluation, knowing the term smart and its scope in the city system was necessary. The concept of the smart city is elaborated with learnings from the present smart cities around the world (Chapter 3 and 4). Classic differences are visible towards the approach of smartness from city to city. Thus, the Indian context is more relatable with the cities of developing countries and Asian countries. Through this project I am trying to ingrate the concept of smartness in the government planning and development system of Delhi rather than keeping a separate smart project

or proposal. The chosen site for the project are two contrasting areas that require tailormade solutions to address the issues.

The primary research question is "How can global experience of smart city initiatives and technologies be incorporated into the Indian Smart Cities Proposal concerning the Planning and Design Strategies to upgrade the quality of urbanization and ground level interventions on diverse scales?" Thus the keywords and the vital part of the project are citizens, design strategies, and ground level interventions. The proposal for this project is to motivate the residents of an area to act smartly on the needed urban development. The focus of the project and the interventions suggested are based on the general needs of the city and location specific needs of the selected sites. Most of the interventions directs towards an environment friendly and sustainable solutions. The 2030 Agenda for Sustainable Development, the Addis Ababa Action Agenda and the Paris Agreement under the United Nations Framework Convention on Climate Change provide a supportive structure for addressing this priority theme. The 2030 Agenda places great importance on issues related to sustainable urbanization, particularly in Goal 11: make cities and human settlements inclusive, safe, resilient and sustainable. However, the challenge of urbanization is also intricately linked to the other Sustainable Development Goals. It is clear that there can be no sustainable development without sustainable urban development (Commission on Science and Technology for Development - United Nations 2016). Thus, the suitable development at this hour in Indian case is the small scale sustainable urban development. The smartness will lie in the process of implementation and collaboration between the stakeholders to implement better quality projects faster that can impact the whole city gradually.

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Acronyms and Abbreviations

CPWD- Central Public Works Department
 ISCM- Indian smart city mission
 DDA- Delhi Development Authority
 DMC- Delhi Metropolitan Council
 ENoLL- European Network of Living Labs
 NDMC- New Delhi Municipal Corporation
 MCD- Municipal Corporation of Delhi
 MoUD- Ministry of Urban Development
 ULB- Urban Local Bodies
 UN- United Nations

*Have a bias towards action- let's see something happening now. You can break that **big plan into small steps** and take the smart steps right away.*

-Indira Gandhi





INTRODUCTION

Source: <http://www.earthglance.com/post/50178526282/delhi>

I. INTRODUCTION

India is taking a leap of faith by proposing 100 smart cities (Development & India 2015). The first proposal was designed by the Ministry of Urban Development, Government of India in "Smart City Mission Transformation- Mission Statement and Guidelines" after the announcement of this project by Indian Prime Minister Mr. Narendra Modi. The project of smart cities is intended to answer questions raised by planners and designers about the preparedness of Indian cities to tackle future unplanned growth. It is predicted that there will be 100% rise of urban population over next thirty years in India. An amount of INR 7060 crore (India, September 2014) was announced by Modi to fund 100 smart city projects. Contradicting the suggested name of the project "100 Smart Indian Cities", this project orients itself to another direction. Generally the perception of smart cities are technologically driven and sustainability context, while in the Indian scenario, smart city is merely an upliftment of urban infrastructure to upgrade the quality of living of the citizens. The researchers are criticizing about the viability of such a process of investment, where technology is being integrated in the elementary urban development, and they feel that it still requires further investigation of its appropriateness in India.

It is now needed to understand the smart city's contribution in the overall urban planning and vice versa, to recognize urban planning offerings to a smart city context. This inspires the co-existence of the smart city and the urban space, and seeks to investigate the relation between the smart city and the urban planning, in terms of mutual support and benefit. (Anthopoulos & Vakali 2012). This project is an approach to find smart initiatives reinforcing the planning and designing techniques which can satisfy the basic needs of the city with a futuristic vision.

"Let us consider urbanisation as an opportunity. Gone are the days when it was seen as a challenge or obstacle,"
- Mr. Narendra Modi

Cities of the future? Indian PM pushes plan for 100 'smart cities'

By Casey Tolan, for CNN
updated 2:21 AM EDT, Fri July 18, 2014



A rendering of the planned 'smart city' Dholera, in southern Gujarat, India. Prime Minister Narendra Modi has pledged to build 100 smart cities across the country.

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Liveable Cities Mission is what we need

SACHIN KALBAG



"While there is emphasis on public transport and safety of women in India's Smart Cities Mission, there is no word on parking." Picture shows a Delhi Metro station.

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Smart Cities Mission: Flaws in a flagship programme

BHANTU JOSHI



"Not too smart?" "Rapidly growing urban areas and sprawling metropolitan areas are putting enormous pressure on the land and water. Building that not only smart but also smart, sustainable and livable, is clearly not a very simple task." PHOTO: N. VIGNA

Uniqueness of India's smart cities: Indian smart city efforts need to recognize the economic differences between its cities

Manisha Reddy and Prabhat Panchan - Friday, December 11, 2015

India moves on its smart city program

By Juan Pedro Tomás on JULY 27, 2016

APAC, Fundamentals, Internet of Things (IoT)



The government selected 83 smart city initiatives to be implemented in 20 initial cities

India's Prime Minister Narendra Modi recently launched a number of smart city initiatives under his government's Smart Cities Mission program.

The government said 83 smart city initiatives will be implemented in 20 cities in an initial phase of the nationwide program. The 20 selected cities are Bhubaneswar, Ludhiana, Pune, Jaipur, Surat, Kochi, Ahmedabad, Jabalpur, Visakhapatnam, Solapur, Dhavangiri, Indore, the New Delhi area, Coimbatore, Kakinada, Belgaum, Udaipur, Guwahati, Chennai and Bhopal.

The government confirmed the initial 83 projects will require a total investment of INR 17.7 billion (\$262.5 million). The participating cities have proposed INR 480 billion in total investment for area development and pan-city solutions. The cities have also proposed public-private partnerships for the initiatives. Ten of the 20 cities proposed to invest INR 85.2 billion under the PPP model.

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India launches its urban makeover plan with smart cities

Govt proposes to invest Rs50,802 crore on 20 cities under phase one of the plan to set up 100 smart cities

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Smart city initiative needs a reality check

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OPINION - EDITORIAL

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Giving cities the smart edge

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TOPICS

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The Central government's framework for 20 cities to become 'smart' over a five-year period can cover new ground if it makes intelligent use of information technology to deliver better civic services. Rapid and poorly regulated urbanisation has overwhelmed urban governments, rendering them incapable of providing even basic services such as clean water, sewerage, pedestrian-friendly roads, public transport, uninterrupted power, street lighting, parks and recreational spaces. So weak and uncoordinated is governance that commercial entities have wilfully violated building regulations and put up unauthorised structures — with severe impact on congestion, air quality and flood management — and governments have gladly regularised the violations later. The smart city plan now proposes to intervene and bring some order by upgrading the physical infrastructure in select enclaves, and incentivising the use of information and communication technologies. Urban Development Minister M. Venkaiah Naidu has come up with a generalised definition of a smart Indian city as one that "enables a decent life to the citizens, and green and sustainable environment, besides enabling adoption of smart solutions", but the exercise should lead to measurable outcomes.

Fig 1.1: Narendra Modi's Indian smart city on news
Source: Online Indian Newspapers; The Hindu, CNN, The Mint

As an urbanist, my question is how to insert the smarter elements in the city development plan from the beginning using the technology? Why the present cities are not considered as smart cities? The Athens charter, defines the objectives of city planning in terms of "four functions": housing, work, recreation and traffic. The functional city is the one where land planning would be based upon function based zones. So if we can include smarter initiatives, from the beginning, while planning the city development, all the cities can achieve the smartness. Through this project, I would like to include the smarter technologies in the steps of city development in the ongoing city projects in India.

In Fig. 2 the city growth have been portrayed in a traditional way. How the need arises and how a city starts functioning. Gradually with time, the architects and planners came into the picture, where they initiated city planning and guidelines.

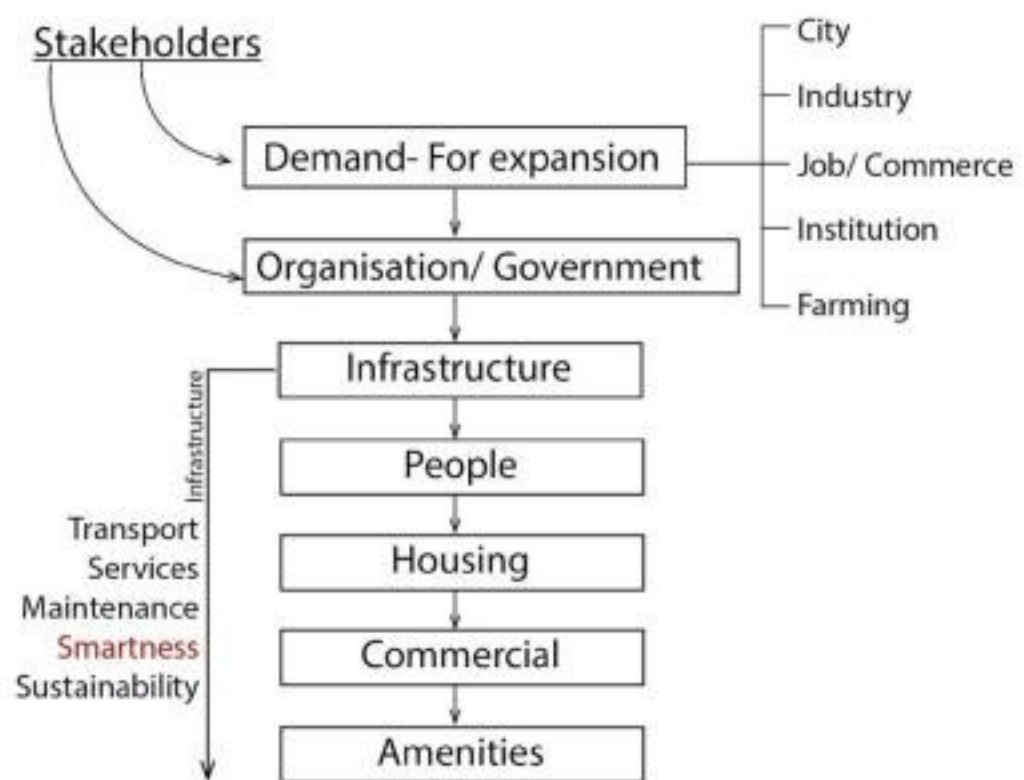


Fig 1.2: Traditional city growth steps
(Source: Drawn by Author)

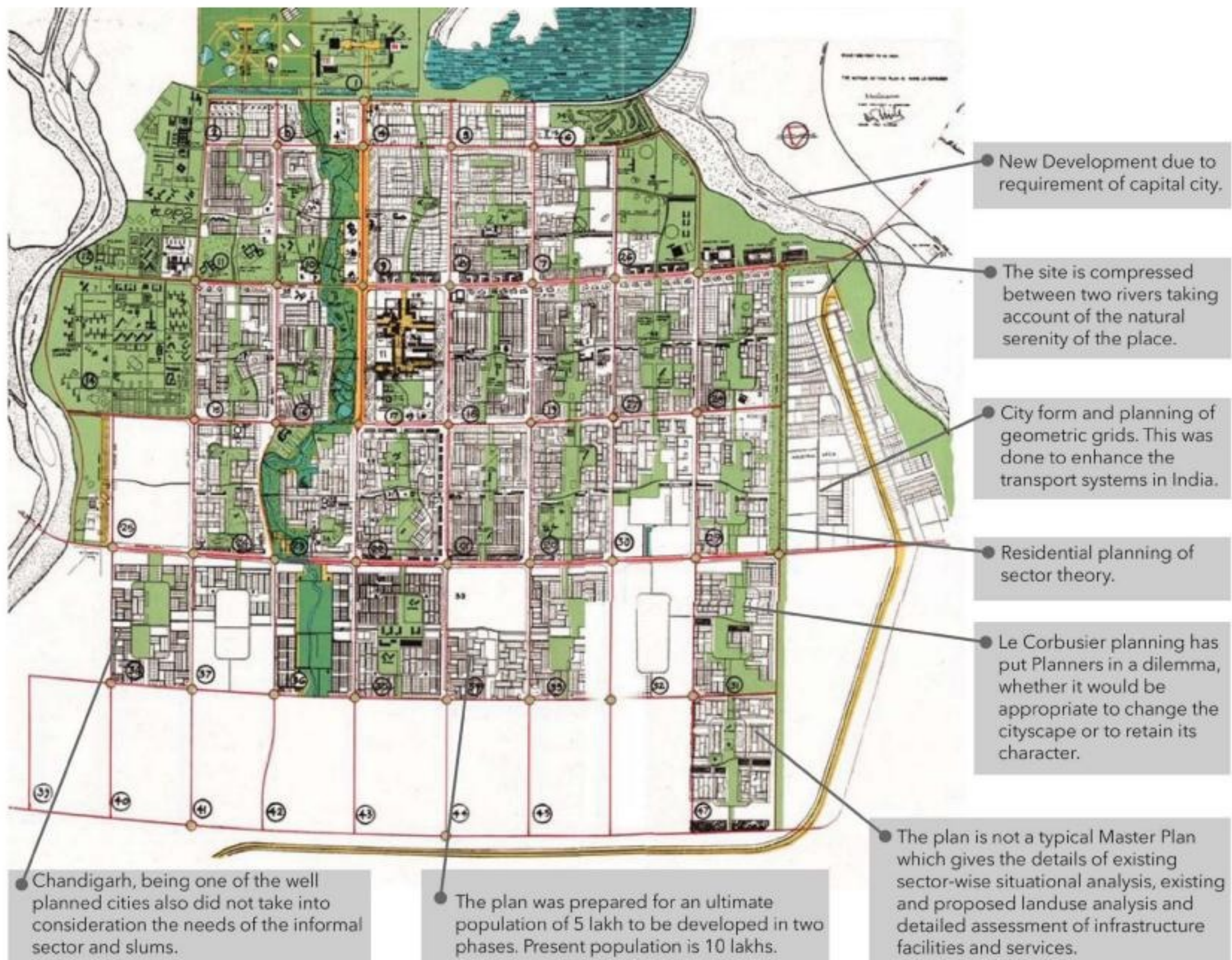


Fig 1.3: Chandigarh as an example of Planned city

Source: <http://architecturenow.co.nz/articles/shaping-places-a-role-of-urban-design>, Edited by Author

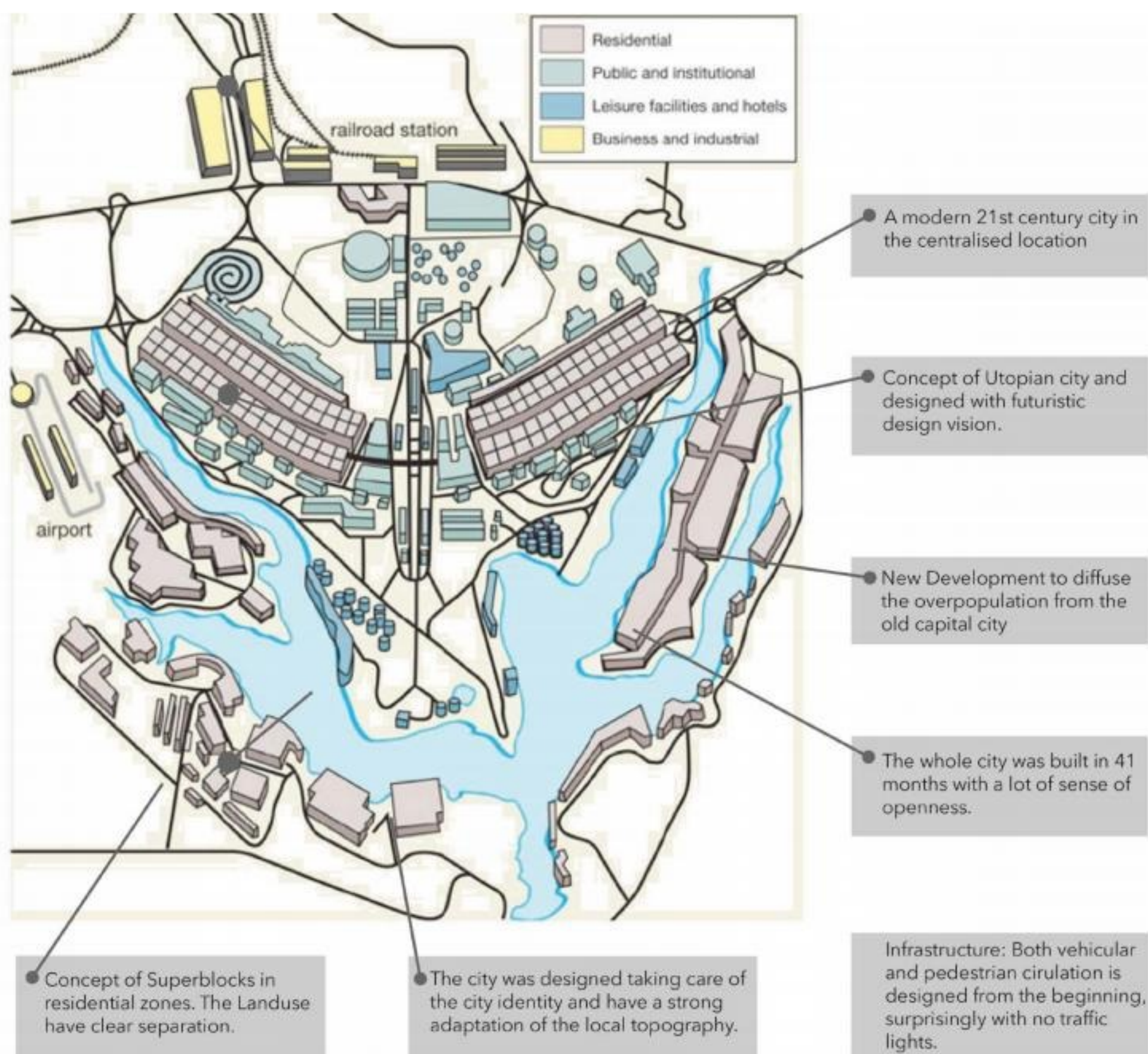


Fig 1.4: Brasilia as an futuristic city example
Source: Plan for Brasilia, 1957, Lucio Costa, <http://blogqpot.com>, Edited by Author

These cities were openly accepted and appreciated. The next stage was adding a futuristic vision to the planning to have an sustainable aspect (shown in Fig. 4). Later with the technology the term smart city arrived. So, if we can include smartness from the beginning, the city would be more user friendly and sustainable. But in Indian scenario, the challenge is how to retrofit the smartness in the densely populated settlements? In further chapters, I will be researching about the ambiguity of the concept of smart cities, their practical implications, the Indian smart city proposal and the Indian urban development and planning system. From those inferences, I will design smart projects for selected sites that can be anticipated as smart pilot projects to spread over the city.

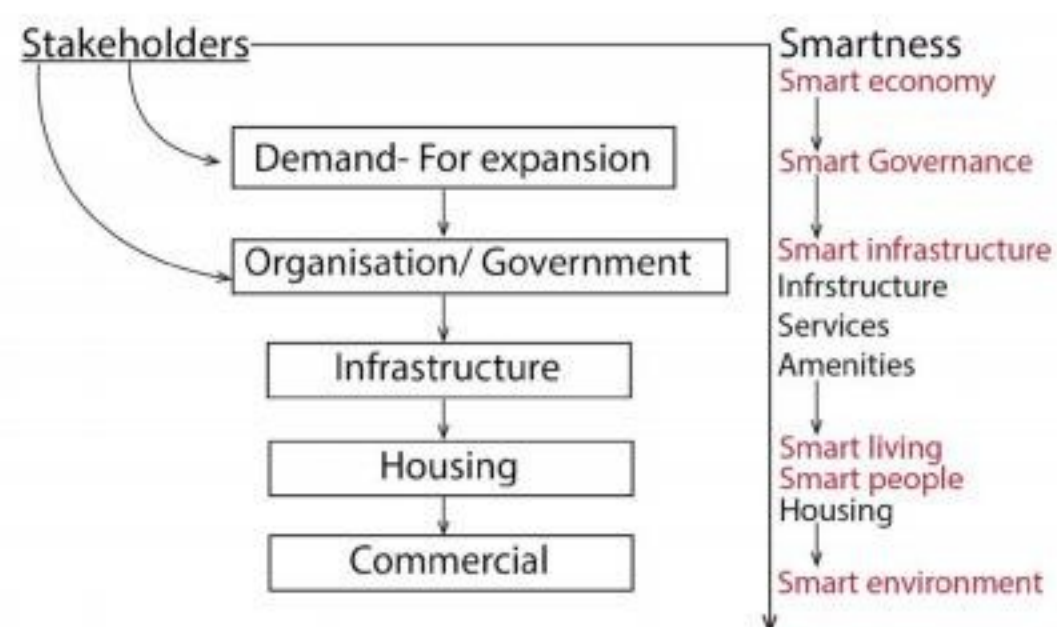


Fig 1.5: 'Smarter' city growth steps
(Source: Drawn by Author)

II. MOTIVATION

The topic of smart cities are extensively discussed in each corner of the world from the 2005 (Concept of smart city was originated in 2005). And moreover, India entering the league of smart cities, rises an overwhelming urge in me to research on this topic. Even after an year from the proposal initiation, there is a delusion among the Indian citizens as how much effective the concept will be in the present country conditions. The citizens are not sure about the solutions because of the drastic and radical criticism from various researchers, urban planners and the citizens themselves. What are they criticizing about? Why they think that India is not ready to enter a new journey for secured future growth? And also, the question is how the Indian government and the citizens perceive smart cities? Is it actually smart? Thus, when India, too, is on the road to building smart cities—what is it aiming for? A world-class, self-sustainable habitats with minimal pollution levels, maximum recycling, optimized energy supplies and efficient public transportation would be the ideal situation, but is it feasible?

Creating smart cities doesn't just mean deploying the right technological solutions, it means connecting policies across a wide range of areas, like energy efficiency, urban mobility, and ICT.

For example, Budapest is using ICT to gather precise data on the impact of refurbishing a building. In a pilot project, it collected detailed information on two identical buildings, one refurbished and one not, to compare and identify the advantages of refurbishment. This improves cost-effectiveness calculations and helps justify further investments.

Amsterdam is aiming to give citizens a better insight into the finances of its neighbourhoods using open data platforms and info-graphics-'Buurtbegroting' (neighbourhood budget). Citizens can visit the district website to find out what projects are being financed in their neighbourhood. They can visualise this information through simplified layers of data placed over Google maps. Buurtbegroting aims to communicate city finance and decision making clearly to citizens.

The variations in approaching the concept of smart cities is the encouraging factor behind this thesis project. The challenge is how India can adapt to the smart city initiatives in a unique way. What is right or wrong and what is practically possible in Indian scenario.

i) Personal Motivation- My personal motivation stems from the fact that my international studies and experiences should benefit my country in a positive way. After visiting Europe, I am inspired more to develop India as I can see a lot of potential factors for change. Noting the fact that I have stayed in India for almost 25 years, I experienced the ground level issues and have a critical approach to look at them as an urbanist, this project connects deeply at a personal level.

ii) Factual Motivation- Nearly 31% of India's current population lives in urban areas and contributes 63% of India's GDP (Census 2011), while the Indian Government is just investing 0.70 of the government money for the urban development. The prime minister took an innovative step to changing the mode of urbanization in India by the proposal of 100 smart cities. India needs to concentrate in constitution in forth-coming years under the vision of Prime Minister Shri. Narendra Modi to upsurge more gross domestic products (GDP). So the query is what are the strengths and weakness of smart cities around the world? Will the smart initiatives from global cities to serve the Indian needs?

iii) Societal Motivation- The societal motivation is mainly the question that arises in my mind as an Indian. Will the concept of smart cities work in Indian scenario, where, now there is only basic urban development? Why is there always an opposition or criticism regarding this concept? Is the Indian Smart Cities Mission² public friendly? Are the citizens welcoming the new technologies whole-heartedly? What are the loopholes in the Indian Smart Cities Mission and how it can be improved by adapting current global technology to the specific Indian context?

² Smart City Mission Transformation- Mission Statement & Guidelines by Ministry of Urban Development, Government of India



Fig 1.6: Amsterdam- focusing on cycle and pedestrian friendly
Source: Sustainability and livability: 3 smart city initiatives from Amsterdam, <https://inform.tmforum.org>



Fig 1.7: New Delhi- Palam flyover issues
Source: <http://stunningplaces.net/author/yasmin/>

The contrasting differences in the physical and social lifestyle of these two cities I have lived in is the strongest motivation.

III. LOCATION OF INTEREST



Fig 1.8: Project Location: India
Source: Drawn by Author

India: New Delhi, Ahmedabad, Pune

There are 100 cities selected for the new development of smart cities, proposed by Narendra Modi. Those 100 city projects are to be taken up in different phases. The first phase selection contains 20 cities. The 20 selected cities are Bhuvaneswar, Ludhiana, Pune, Jaipur, Surat,

Kochi, Ahmedabad, Jabalput, Visakhapatnam, Solapur, Dhavangiri, Indore, the New Delhi area, Coimbatore, Kakinada, Belgaum, Udaipur, Guwahati, Chennai and Bhopal. Out of which depending on the city identity and city hierarchy, I am selecting 3 cities for this project.

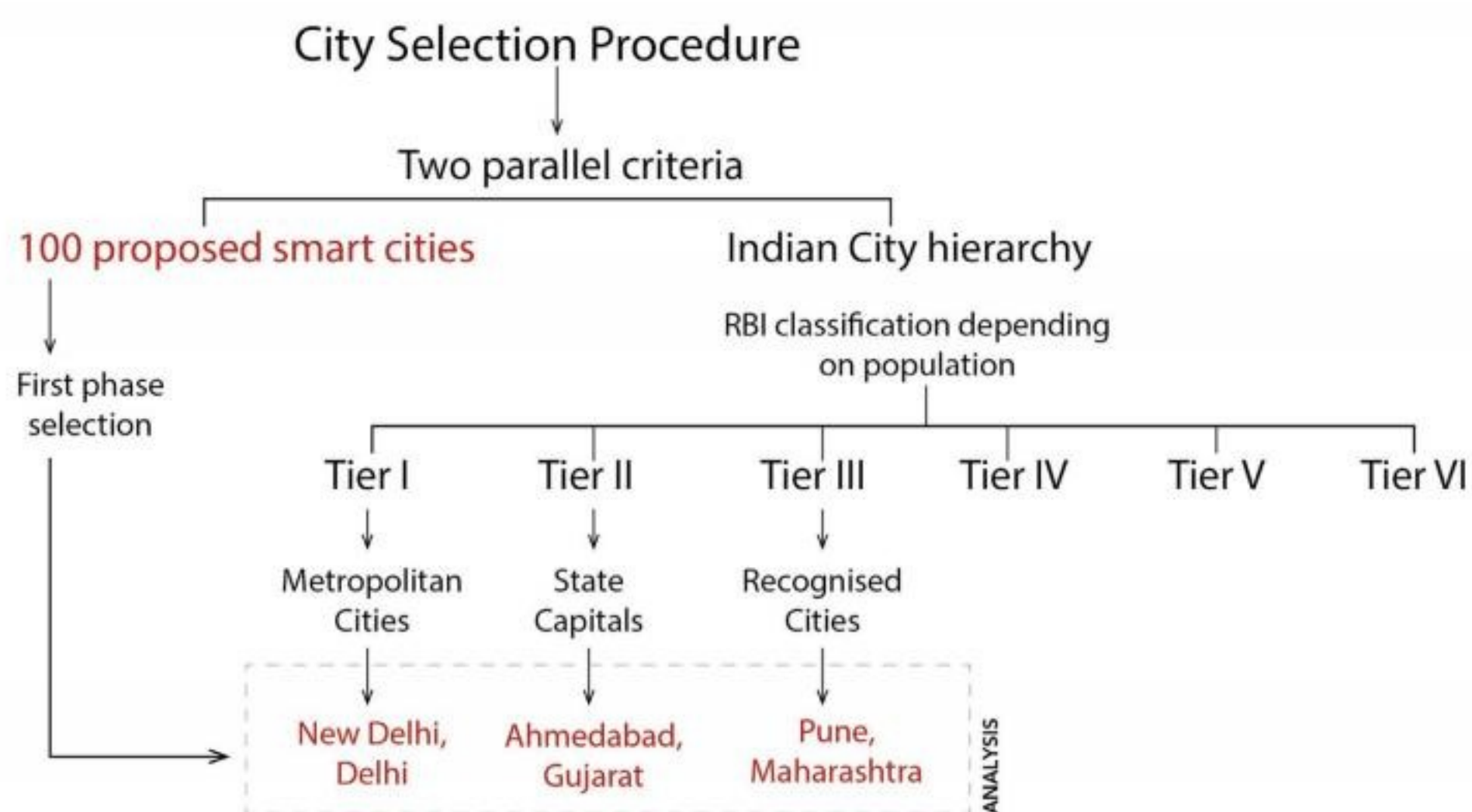


Fig 1.9: City selection diagram
Source: Drawn by Author

Classification of centres (tier-wise)

Population classification	Population (2001 Census)
Tier-1	100,000 and above
Tier-2	50,000 to 99,999
Tier-3	20,000 to 49,999
Tier-4	10,000 to 19,999
Tier-5	5,000 to 9,999
Tier-6	less than 5000

Table 1.1: Indian city hierarchy
Source: <http://censusindia.gov.in/>

The classification of Indian cities is a ranking system used by the Government of India to allocate House Rent Allowance (HRA) to public servants employed in different cities in India. HRA is also used by the Indian Revenue Service (IRS) to provide income tax exemptions. Cities are classified on the basis of their population, as recommended by the Sixth Central Pay Commission in 2008 and the Reserve Bank of India, respectively.

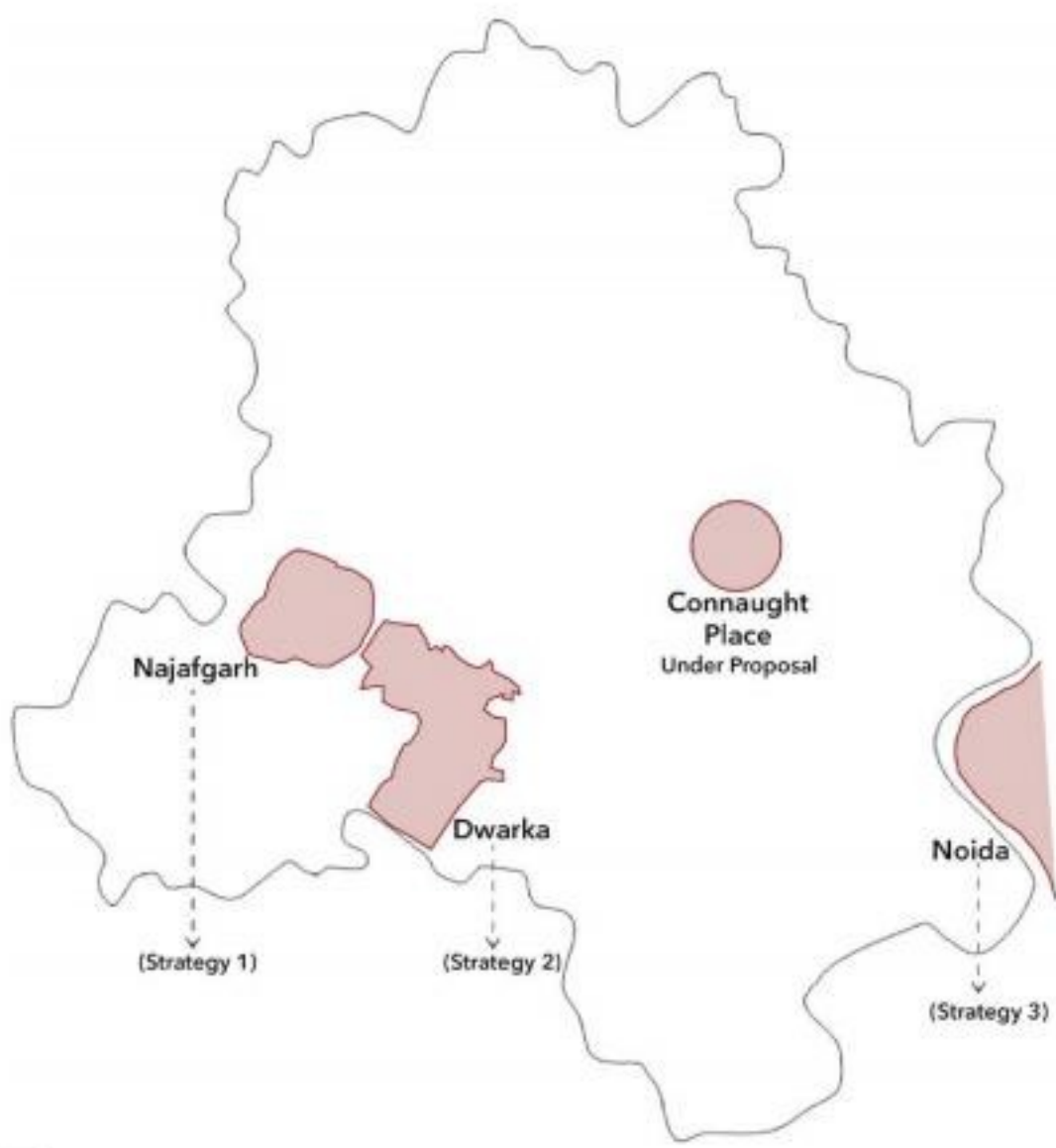
The Three Cities



City Identity		Different city identity and culture
Northern India New Delhi	Government Oriented	
Central India Ahmedabad	Economy Oriented	
Southern India Pune	Culture Oriented	

Fig 1.10: Importance of City Identity
Source: Drawn by Author

The Three New Delhi Sites



For the small scale design, I chose New Delhi out of the three example cities. In Delhi, 2 different sites has been chosen, based on the current problems and the Indian smart city strategies that can be inculcated from the grassroots level.

Presently, the central Delhi (Connaught Place) is in the proposal, proposed by the Delhi government. I will be working with two different strategies proposed by Indian Smart City Mission, named Redevelopment and Retrofitting. The third strategy is Greenfield. Greenfield focuses purely on the sector of housing which is entirely a different sector of study and research. I will be limiting my scope to other two strategies of Indian smart city proposal due to lack of time and my personal interest.

Fig 1.11: City selection diagram
Source: Drawn by Author

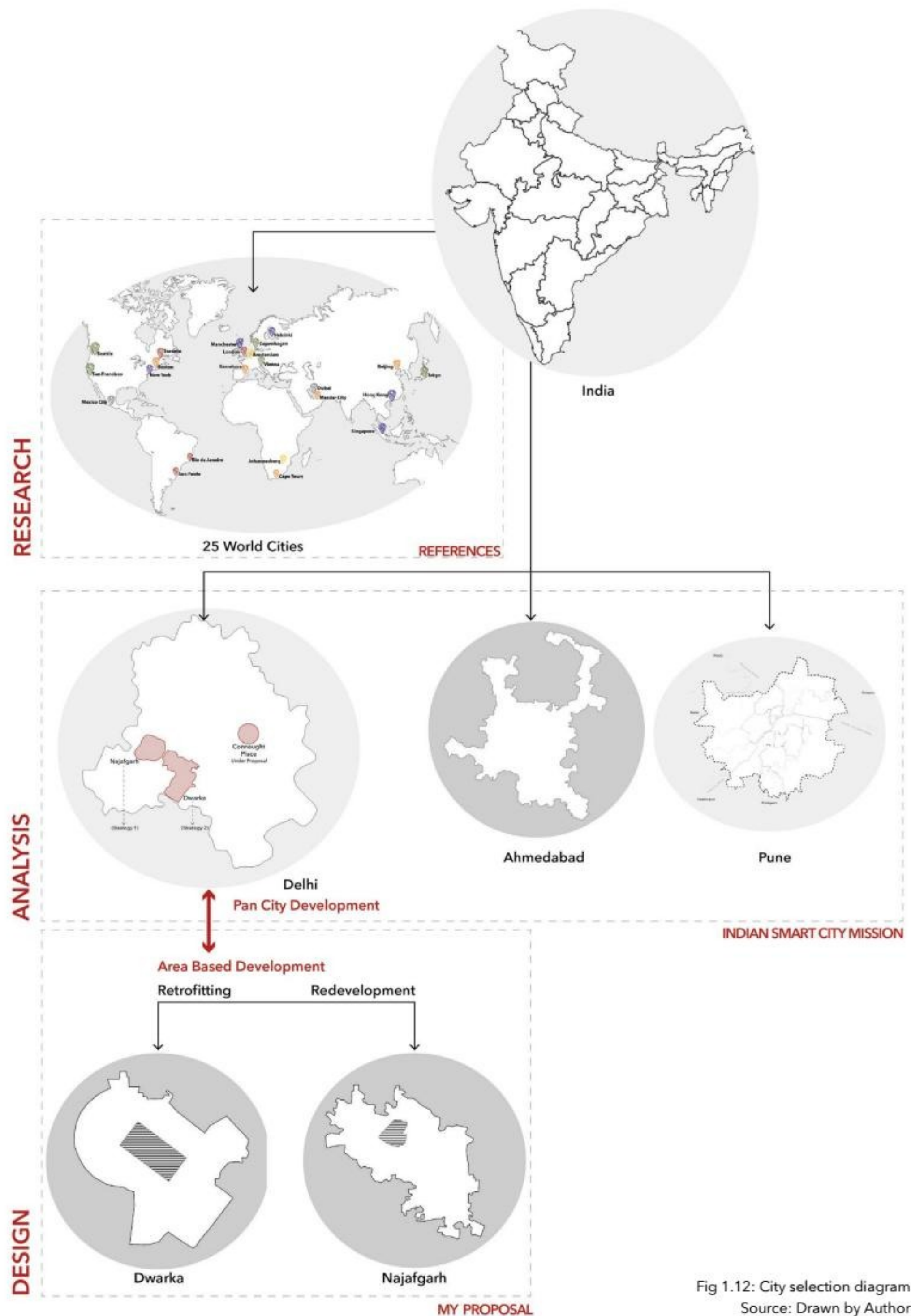
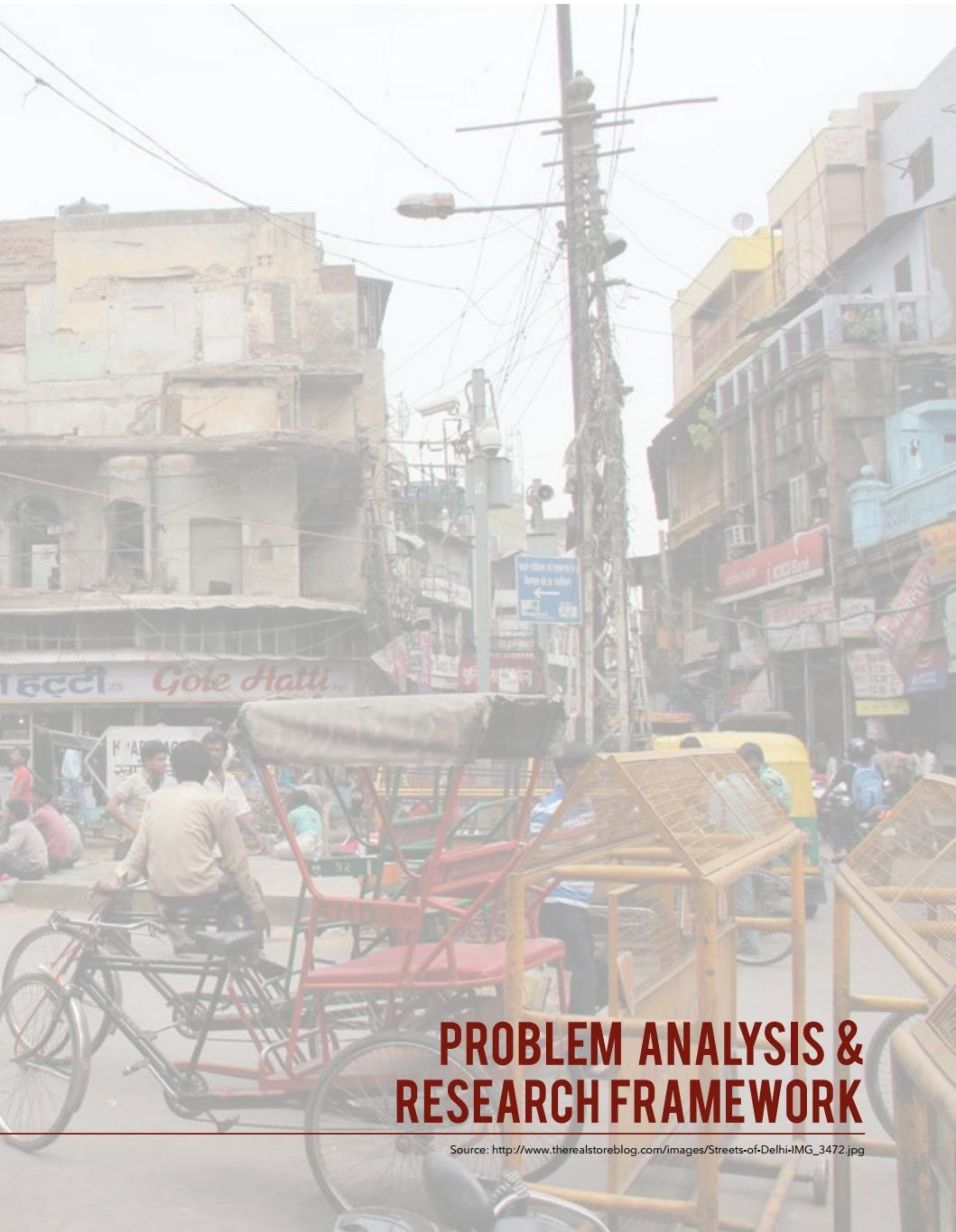


Fig 1.12: City selection diagram
Source: Drawn by Author





PROBLEM ANALYSIS & RESEARCH FRAMEWORK

Source: http://www.therealstoreblog.com/images/Streets-of-Delhi-IMG_3472.jpg

I. PROBLEM STATEMENT

Firstly, the proposal by Indian government for smart city mission is concentrating on the present need-based issues³ that the Indian citizens are facing. But in these initial stages of urbanizing, there is an opportunity to include the “smartness” taking help from global examples of smart city technologies and developments. In my graduation project, I will utilize this scope and try to critically evaluate the present Indian Smart Cities proposal made by the central government of India and propose new strategies to bridge the gaps in the present proposal in terms of strategic ground level interventions for Indian cities. I will follow the process of finding an opportunity to improvise the Indian Smart Cities Mission rather than finding issues to change it.

Secondly, there is a definitional impreciseness of the conditional or the conventional usage of the smart city term in Indian context. The term is being understood in different ways in many sectors by various actors. An urbanist, a government official, a student, a journalist, all have their own perspective or expectations from a smart city. For example, there are related terms like Intelligent city, Knowledge city, Resilient city, Digital City, Sustainable City, Virtual City, Ubiquitous City, Information City, Green City, Learning city, Livable

city etc. and all of them have a certain overlap among them. The terminology of ‘smart city’ does not provide enough clarity differentiating itself from these related terms. According to the conditions, every country, rather each city writes its own definition of smart city. Each city focus mainly on one of the key dimensions of smartness. For example, Vienna is focusing on the smart mobility while Seattle is known for its smart strategies of citizen inclusion in green technology. With this research, I will try to clarify what is important in the concept of Smart Cities for India’s future development.

All state projects now are of infrastructure, telecommunication, highways, freeways, rapid trains etc. Even smart cities are only talking in terms of infrastructure.

- Rahul Mehrotra

It’s not really as much about infrastructure changes, but how we interact with the infrastructure.

- Carlo Ratti

3 Need-Based Issues- Infrastructural or service related issues faced by the present populations without thinking about the future or growing trends.

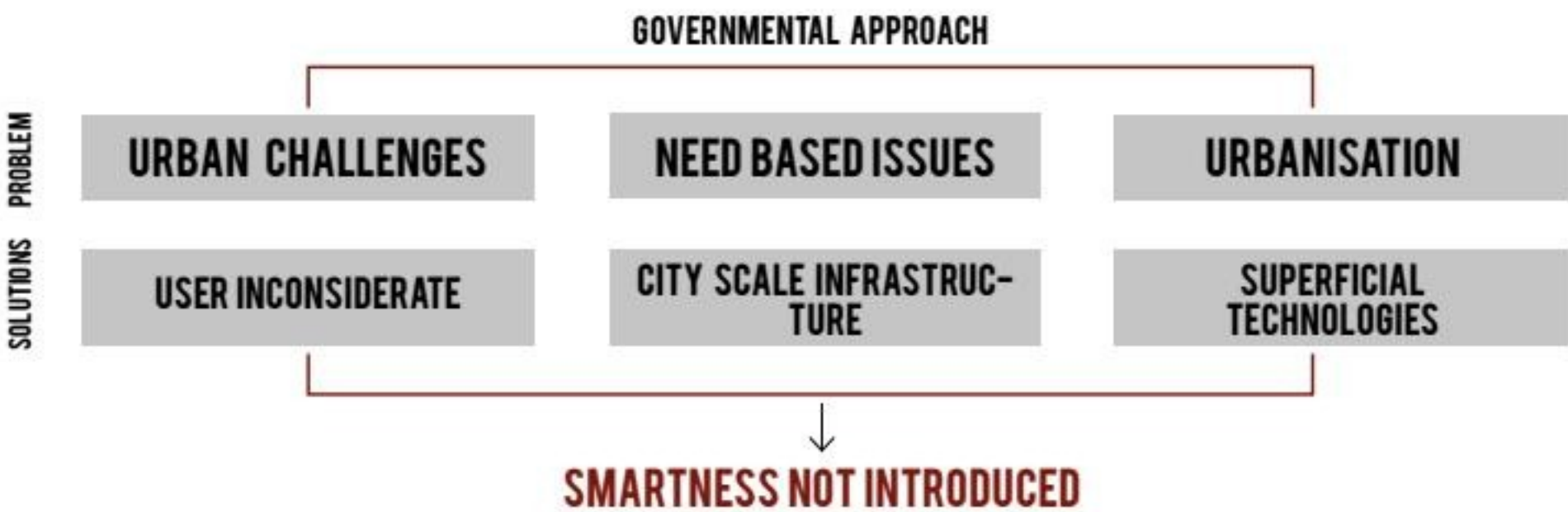


Fig 2.1: The Governmental Approach for smart cities
Source: Drawn by Author

II. PROBLEM FIELD

The ongoing research and projects in the complex city research group gives me the insight of viewing regional proposals critically and including comparative studies in a specific context. The Urban Metabolism and Smart city research group is directly working with the processes of the city by providing adequate services to increase the quality of life using smarter solutions. My project will be an amalgamation of both research groups.

3.1. Relation with Complex Cities: International Planning And Developing Regions, Regional Governance, Planning And Design; How well do spatial planning concepts travel? To what degree are planning concepts equivalent (or universal) and to what extent are they culturally-bound locally? How does this affect the policy transfer process and learning process, especially from west to east and south.

3.2. Relation with Smart Cities and Urban Metabolism: European Smart cities and comparison

3.3. How the basic infrastructure and services can be laid out or organized in a smarter way to decrease the unevenness in Indian cities?

As mentioned earlier about the definition impreciseness of smart city, the main problem is how to integrate that concept of smartness in the traditional Indian planning system. So, the question rises what is smart in India? The differences between the universal attributes and Indian attributes of the need for smart city are prominently visible in the following diagram.

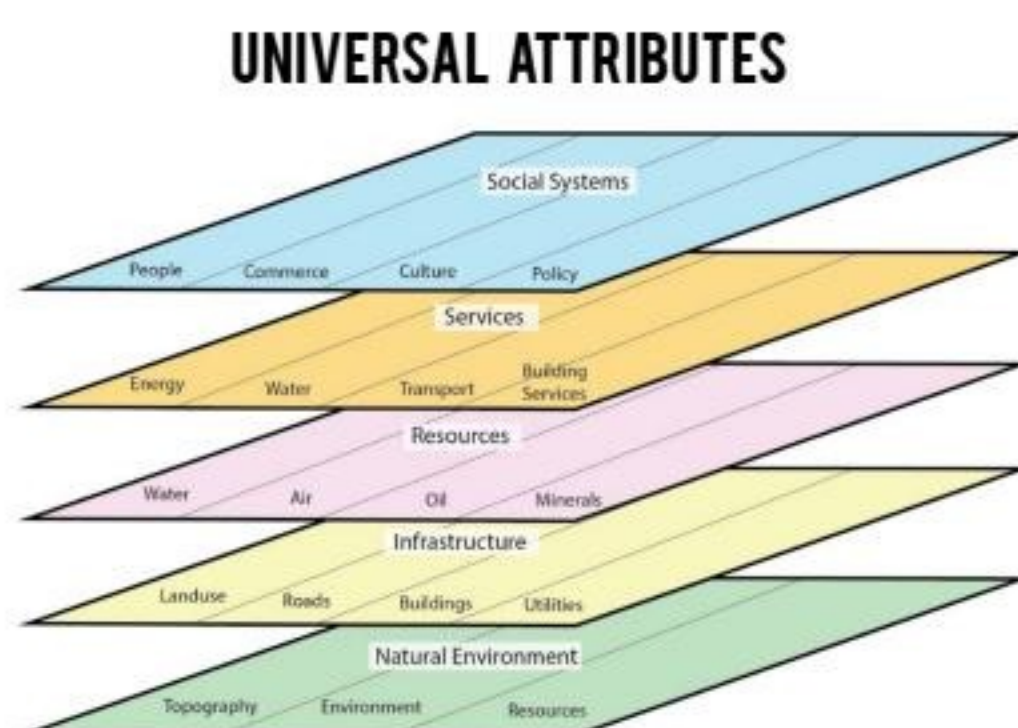


Figure 1: A simplified view of the Urban Information Model. Each plane represents a group of layers containing different, but related, types of information about the two-dimensional space.

Fig 2.2: Smart City Attributes

Source: A Theory of Smart Cities Harrison, C. and Donnelly, I. a.

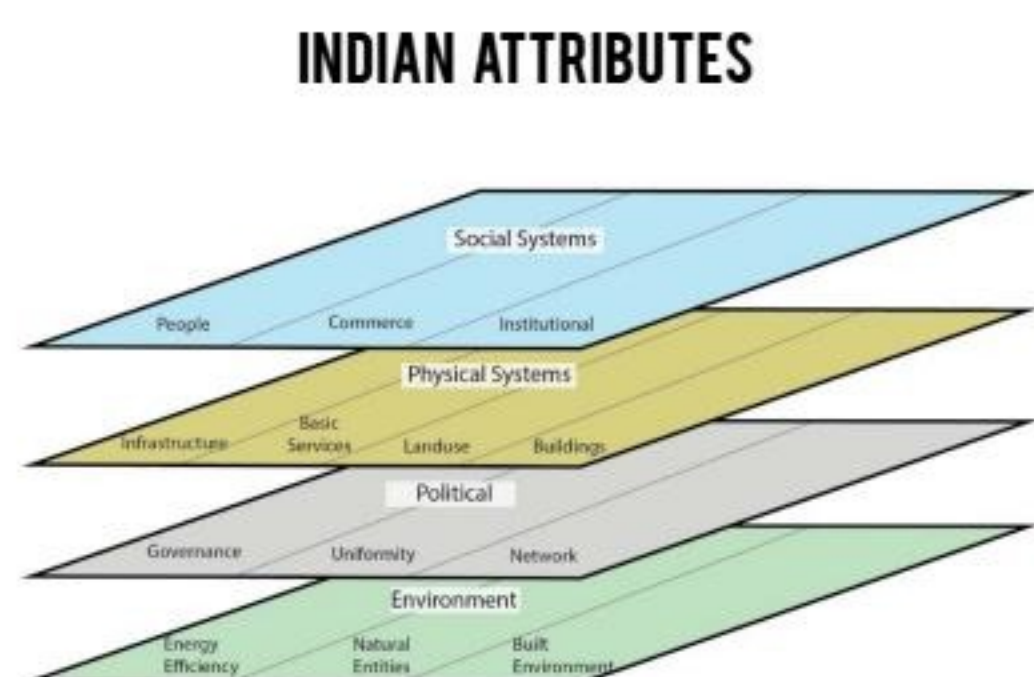


Fig 2.3: Smart City Attributes in Indian Context

Source: Drawn by Author (With reference to mentioned readings in bibliography)

III. PROJECT RELEVANCE

i) **Factual Relevance** (City Conditions): According to the governmental facts and figures ⁴, India struggles with a number of significant barriers that continue to hamper the development of urban infrastructure: complex leadership structures, land valuation challenges, capability gaps, and funding shortfalls are all part of the urban challenge that is effectively holding India back from a new round of dramatic economic growth. Apart from the complex societal issues on a larger scale, there are basic needs like satisfactory housing and adequate water supply to be satisfied. India needs to address the current problems of developing good infrastructure, solid waste disposal, flood management, storm water and sewerage system, urban decay, traffic gridlock and thereby a deteriorating quality of life for many of its citizens. This project will be relevant in order to enhance the quality of urbanization and provide recognition of Indian Smart Cities.

ii) **Societal Relevance**: In terms of society, culture and traditions, India stands at par with the strong ethics and identity. It is incorrect to develop a city without considering the city identity. Raising the urban development standards, comparing Indian scenario with other cities over the world is not a wise action. Every city has its own history, culture and identity. There is no doubt that we need to nurture, preserve and renew the urban fabric with changing times. Indian

Cities have their own societal background and level of willingness to absorb the change. We cannot force urban development in terms of technological change. The smartness here would be designing or planning the policies for each city individually, inculcating the historic background, the present culture and accommodating the future predictions/ changes.

iii) **Personal Relevance**: I believe the approaches I will be proposing through this project will have a lot of direct relevance for the actual proposed 100 smart cities in India. By doing this, the present proposal will be enhanced and the global experiences will be inculcated along with basic furnishing of the current issues.

iv) **Academic Relevance**: This study will initiate a comparative perspective for India looking at the refined examples around the world. The research will also lead to the Indian identity of smart cities. The proposal of 100 smart cities are on the news all over the world. But the in depth reading and evaluation will take another turn towards the challenges of the concept.

⁴ <http://www.ibef.org/> , <http://www.facts-about-india.com/> , <http://www.censusindia.gov.in/>

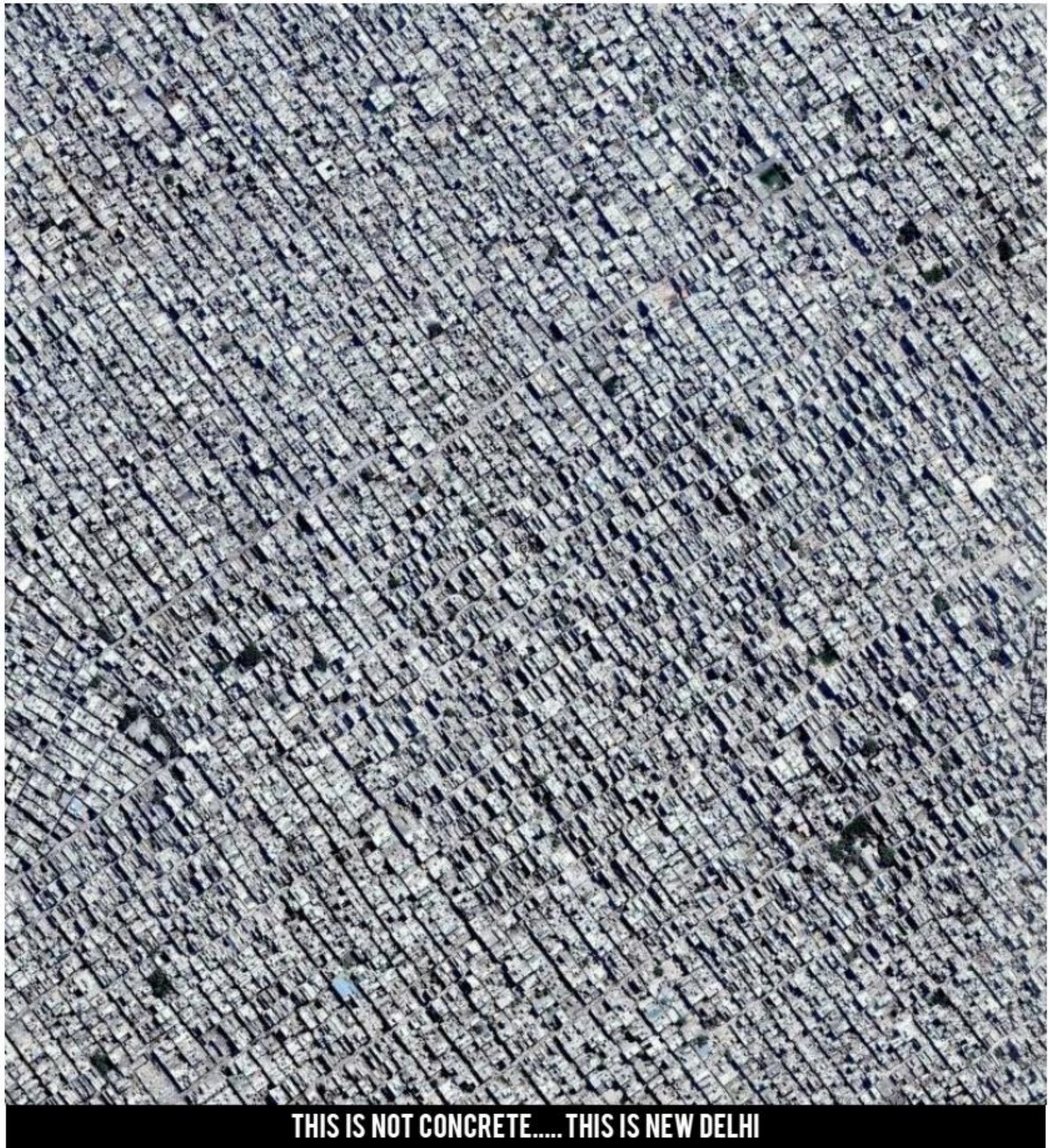


Fig 2.4: Urban form of Delhi- shows the urgent need of strategical management and smart growth
Source: <https://www.tumblr.com/>

IV. PLANNING CONTEXT AND DESIGN OBJECTIVE

The planning regulations and design approaches of India follows the top down approach, where government holds the highest rank. Because of the growing population and mismanaged resources, there is a need for the society to work towards the nation's urbanization and sustainability from the ground level. Each and every citizen is equally responsible and should have the rights to change or accept the changes towards smarter India. How the multi scalar government and public organizations can work together towards the same goal (urbanizing India)?

Thus, the question arises how the approach of planning and development can be combined or distributed among the government as well as the citizen. How citizen engagement will help to change the scenario of planning policies.

To have a clear focal point of effective sector/ area, I would like to reduce the scope of work, focusing more on the specific dimension of urban development in terms of infrastructure and services, to make an Indian city smarter using spatial planning and digitization.

As per a survey done in India, where 130 citizens answers to the question "what is a smart city", the answer is very clear among the citizens what they expect from a smart city? That is Citizen Engagement.

"Smart City is 'what citizens make of it' and what citizens want for themselves"

-Venkaiah Naidu, Minister of Urban Development, Govt. of India

The design objective should be clear in order to focus the study. As mentioned earlier, I am limiting the scope of urbanization in the infrastructure and services sector. The scope has been selected on the basis of the motives of current governmental proposal for smart city. The Smart Cities Mission of the Indian Government is a bold, new initiative. It is meant to set examples that can be replicated both within and outside the Smart City, catalysing the creation of similar Smart Cities in various regions and parts of the country.

The core infrastructure elements (Development & India 2015) in a smart city would include:

- adequate water supply,
- assured electricity supply,
- sanitation, including solid waste management,
- efficient urban mobility and public transport,
- affordable housing, especially for the poor,
- robust IT connectivity and digitalization,
- good governance, especially e-governance and citizen participation,
- sustainable environment,
- safety and security of citizens, particularly women, children and the elderly, and
- health and education

According to the needs of the selected area, I will be focusing on the processes and regulations of provision of basic services and amenities in Indian cities. The list above, which shows the objectives of Indian Smart Cities Mission, will direct me towards the design concentration.



5 Smart City Mission Transformation- Mission Statement & Guidelines by Ministry of Urban Development, Government of India

Fig 2.5: Citizen Survey results about smart cities
Source: <http://secure.mygov.in/>

V. RESEARCH QUESTION

How can **global experience of smart city initiatives**⁽¹⁾ and technologies be incorporated into the **Indian Smart Cities Proposal**⁽²⁾ concerning the **Planning and Design Strategies**⁽³⁾ to upgrade the quality of urbanization and **ground level interventions**⁽⁴⁾ on diverse scales⁽⁵⁾?

1. How does understanding of the 'smart city' concept vary around the world in relation to the conditions of the specific place? How can experiences of adapting technologies around the world be adapted in India?
2. How operational is the Indian Smart Cities Mission? What are the strengths and weaknesses of the proposed smart city plans in selected example cities? How can the current proposal be evaluated?
3. What are the present policies and strategies in terms of urbanization? How can the urbanization of Indian cities be made 'smarter' by modifying existing planning systems and spatial strategies and policies?
4. How can the aspect of citizen engagement in governmental policies and strategies, be included for Indian Smart Cities?
5. How can smart city technology be used to reduce unevenness in infrastructure and service distribution on a city scale? How can small-scale interventions help to deliver a smart city objective?

VI. METHODOLOGY FRAMEWORK

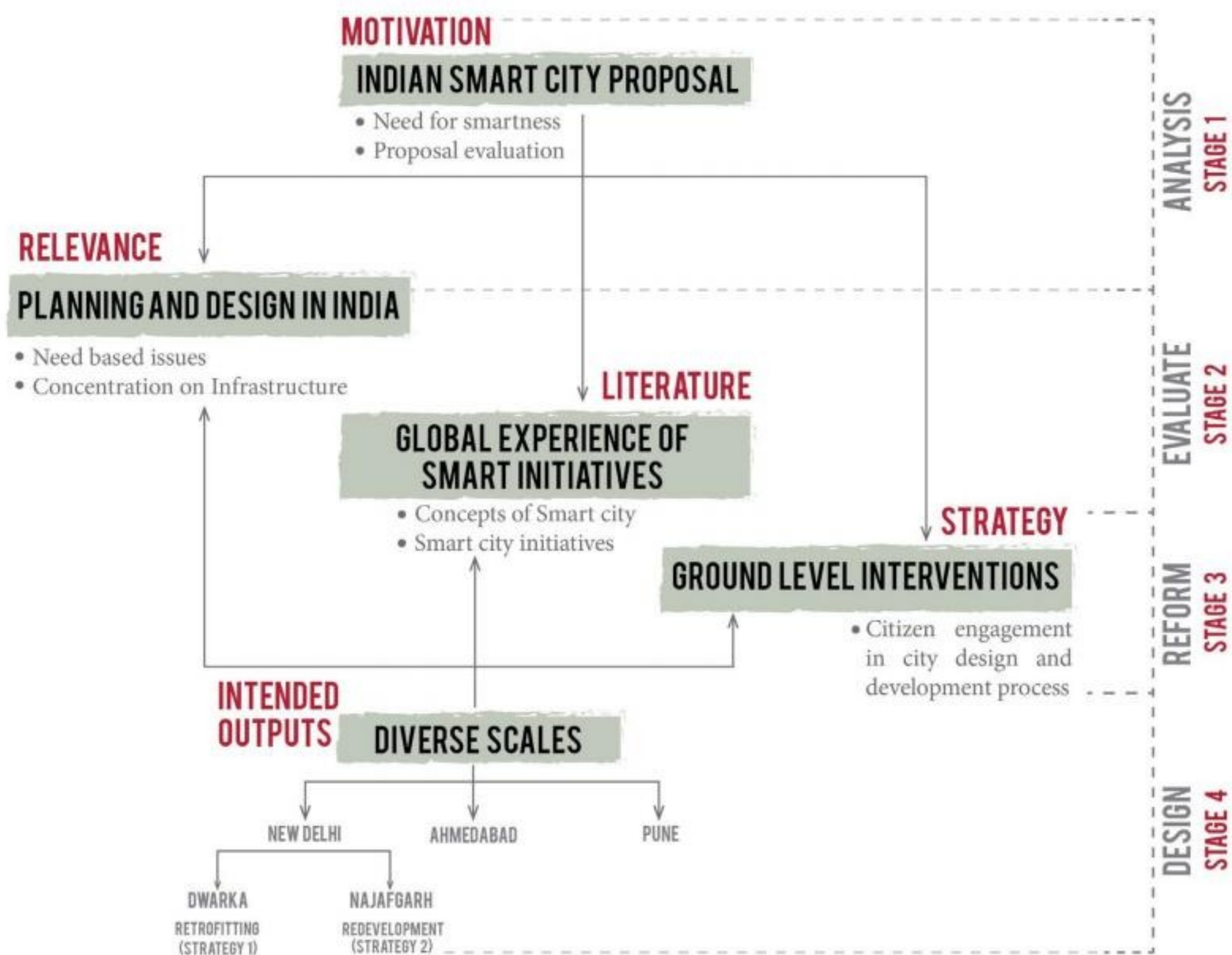


Fig 2.6: Project Methodology
 Source: Drawn by Author

The methodology is framed based on the 5 keywords from the research questions. The main stages are analysis, evaluation of current proposal, reforming the strategies and policies and design of a pilot project.

This illustrates that a design and planning process is never a linear process, rather there are stages where you have to go back and forth while taking a decision. The process began with the motivation by the new proposal proposed by the Indian prime minister, Mr. Narendra Modi. I got a lot of inspirations from the booming word of smart cities around the world as well. So, after accessing the Indian proposal, I moved towards the research analysis of smart examples worldwide. That lead towards the curiosity to analyse the present Indian needs and ongoing projects. From there, the further

steps are the intended outcomes in terms of planning and detailed design.

In order to answer the formulated research and sub research questions, several methods will be used, namely; literature review, case studies, mapping, personal observations, interviews and questionnaires. They will be the catalysts that will lead to conclusions for each sub-research question and that will finally make the design proposal possible.

Stage 1- Analysis

This stage comprises of two sections- motivation and relevance. To answer the questions of need for smartness and the type of smartness needed for India, the proposal evaluation was vital. Sub-research question

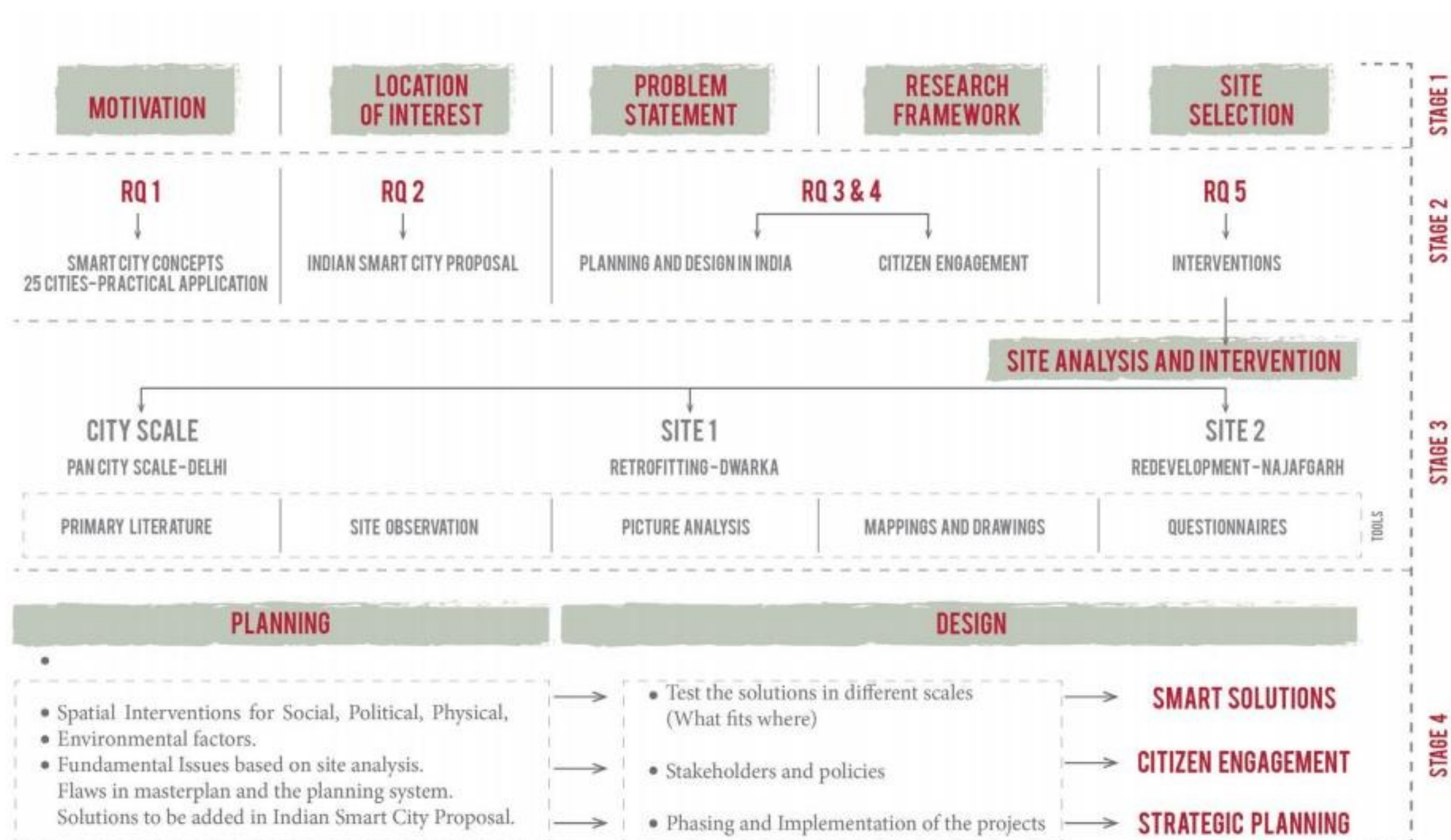


Fig 2.7: Design Stages
Source: Drawn by Author

(2), about the operational factors of the proposal has been answered in this stage (Chapter 5). The present planning and development system of India has been studied thoroughly in Chapter 6, which answered the sub research question (3).

Stage 2- Evaluate

The evaluation of the Indian smart city mission was the vital part. Along with that global examples are studied and evaluated (Chapter 4) to fit in the Indian scenario. This way I tried to answer the sub research question (1).

Stage 3- Reform

The key strategy of this project is to propose ground level interventions including citizens in the smart development. The studied theories of citizen

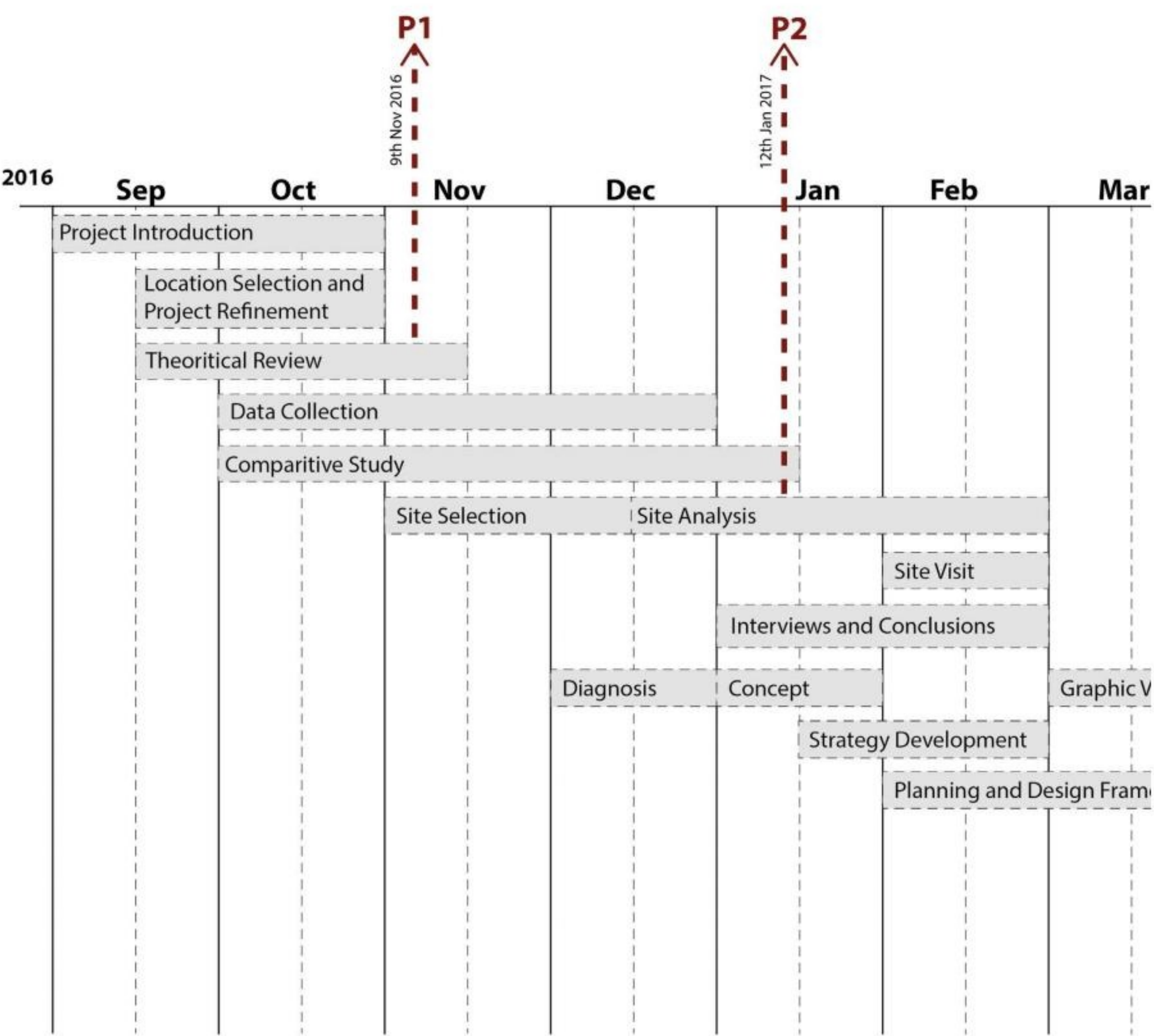
engagement and answers to sub research question (4) can be found in the Chapter 6 (section IV).

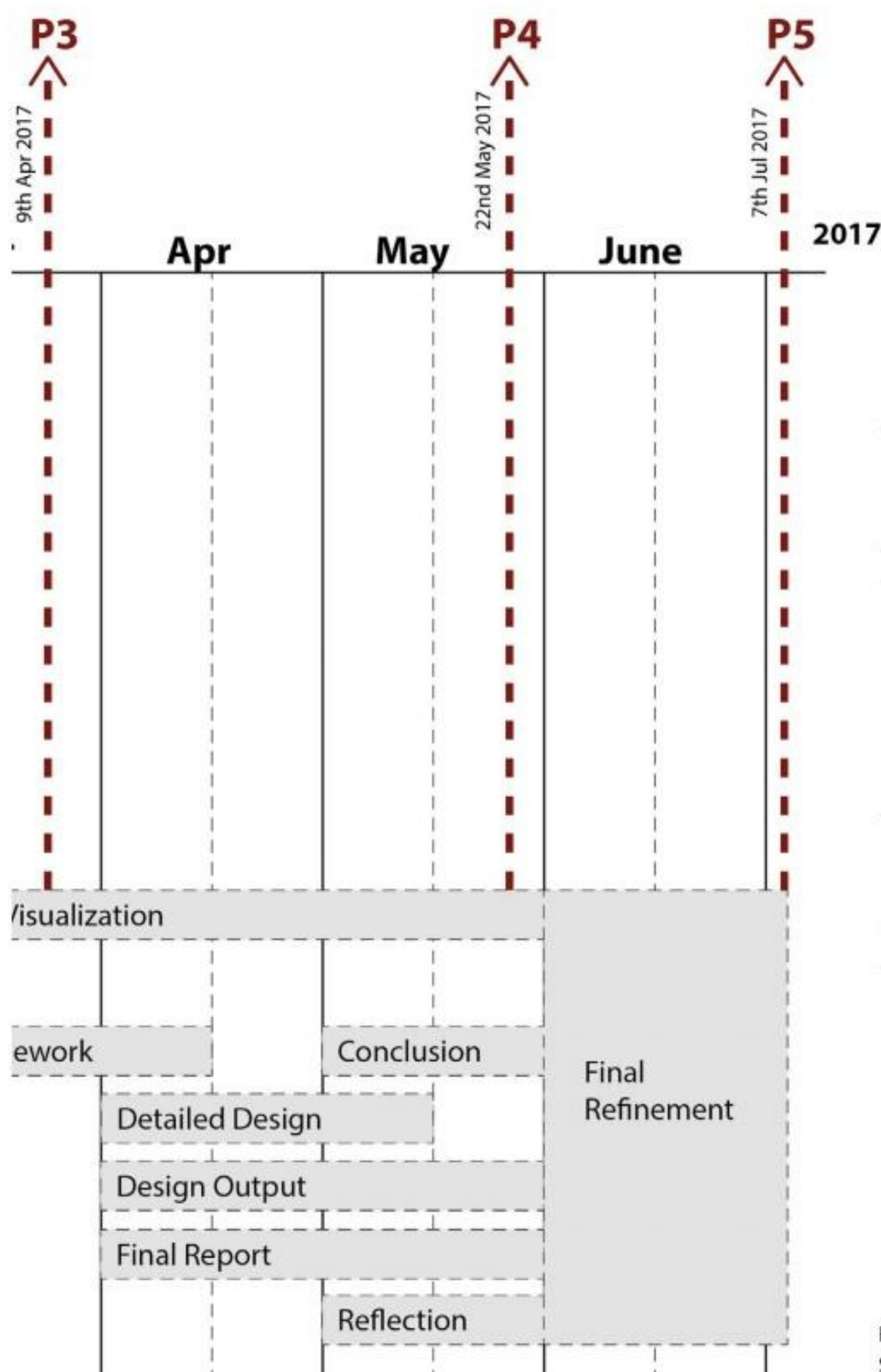
Stage 4- Design

In the last part of the methodology, I am designing small scale neighborhoods to imbibe all the learnt smart characteristics from previous chapters. The final proposal chapter (8) is the answer to sub research question (5).

Additionally, theoretical framework in particular served as a foundation for the thesis development. Each step of the research and design advancement was subjected to the theoretical consultation thus increasing the fruitfulness and the efficient use of the time available.

VII. WORKING TIMELINE






Working timeline is designed to complete the graduation project in the given 10 months' time. It was divided into 5 stages. Following are the project stages that I completed with each phase.

The P1 was intended to give a clear direction on the research of smart cities and collection of data about Indian smart cities. P2 was focused on creating a comprehensive methodology for the whole project and a direction towards the intended outputs. The preliminary site study was done and the structure for the site visit and interviews was drafted. The P3 stage was more attentive towards the local site. The site analysis lead to the preliminary design concepts, which was further refined into design proposals for P4. The fourth stage was mainly the design freezing stage with a strong framework and justification. Further for P5, I worked on the completion of the final report with fine illustrations. This stage is concluding the project with recommendations and reflection.

Fig 2.8: Project working time-plan
Source: Drawn by Author



3

The background of the slide is a blurred cityscape with various buildings and structures. In the foreground, there is a brick wall made of reddish-brown bricks with visible mortar lines.

How does understanding of the 'smart city' concept vary around the world in relation to the conditions of the specific place?

THE CONCEPT OF SMART CITIES

Source: by Viktor Hanacek
<https://picjumbo.com/>

I. ORIGIN OF SMART CITIES CONCEPT

The phrase Smart Cities has its origins in the Smart Growth (Bollier, 1998) movement of the late 1990s, which advocated new policies for urban planning. Portland, Oregon, is widely recognized as an example of Smart Growth (Caldwell, 2002). Later, two important phenomena have been emerging: urbanization and information and communication technologies (e.g. ICT). Eighties' and nineties' technological advancement and economic growth contributed to increase well-being, mainly in the greater urban centers (He et al. 2014). Interestingly enough, President Bill Clinton can take some credit for kick-starting this technology (Falk, 2012): Back in 2005, through his philanthropic organization the Clinton Foundation, the former US president challenged network equipment maker Cisco to use its technical know-how to make cities more sustainable.

As a result, Cisco dedicated \$25 million over five years to research the topic, spawning what it called the Connected Urban Development programme. This involved working with the cities of San Francisco, Amsterdam and Seoul on pilot projects to prove the technology's potential (Information Age, 2012).

The phrase has been adopted since 2005 by a number of technology companies [Cisco, 2005], [IBM, 2009] [Siemens, 2004] for the application of complex information systems to integrate the operation of urban infrastructure and services such as buildings, transportation, electrical and water distribution, and public safety (Harrison, C. and Donnelly 2011). It has since evolved to mean almost any form of technology-based innovation in the planning, development, and operation of cities, for example, the deployment of services for plug-in electric vehicles [Portland, 2011].

Today's cities demand 21st century solutions to accommodate their growing populations in ways that not only maintain the quality of life, but also improve it. That's where smart cities come in. Smart cities find ways to become more efficient, to deliver more services via mobile technology, to optimize existing infrastructure, and to leverage citizen participation to create better land-use decisions and to break down bureaucracy in order to stimulate a creative, entrepreneurial economy (Cosgrave & Doody 2014).

1992 - Smart Growth-this concept proposed that the concentration of growth in a city takes place in compact (mixed use) and walkable urban centres (range of transportation and housing options) where a community participates in making development decisions that are fair, predictable and cost effective.

2000- A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings can better optimize its resources, plan its preventive maintenance activities and monitor security aspects while maximizing services to citizens. (E 2000)

2004- A city where ICT strengthens the freedom of speech and accessibility to public information and services. (H 2004)

2007- A city well performing in a forward looking way in economy, people, governance, mobility, environment and living, built on the smart combination of endowments and activities of self-decise independent and aware citizens. (Giffinger 2007)

2010- An instrumented, interconnected and intelligent city. Instrumentation enables the capture and integration of live real-world data. Interconnected

means the integration of those data into a enterprise computing platform and the communication of such information among the various city services. Intelligent refers to the inclusion of complex analytic, modelling, optimization and visualization in the operational business process to make better operational decisions. (Harrison 2010)

2012- The rudiments of what constitute a smart sustainable city which we define as a city in which ICT is merged with traditional infrastructure, coordinated an integrated using new digital technologies. (Batty M 2012) The concept was initially conceived with the principles of efficiency and equity in the early 90s but with advancements in technology and it was inevitable for technology to be incorporated in the concept, since it always leads to greater efficiency. During the mid-2000s, another dimension was added to the concept, smart people and transparency. This basically meant that the citizens were aware and not blind to the things happening in their city. They must be responsible and active, in the sense that they participated in making the city smarter. Networked and integrated infrastructure were also considered to play roles in making a city smart.

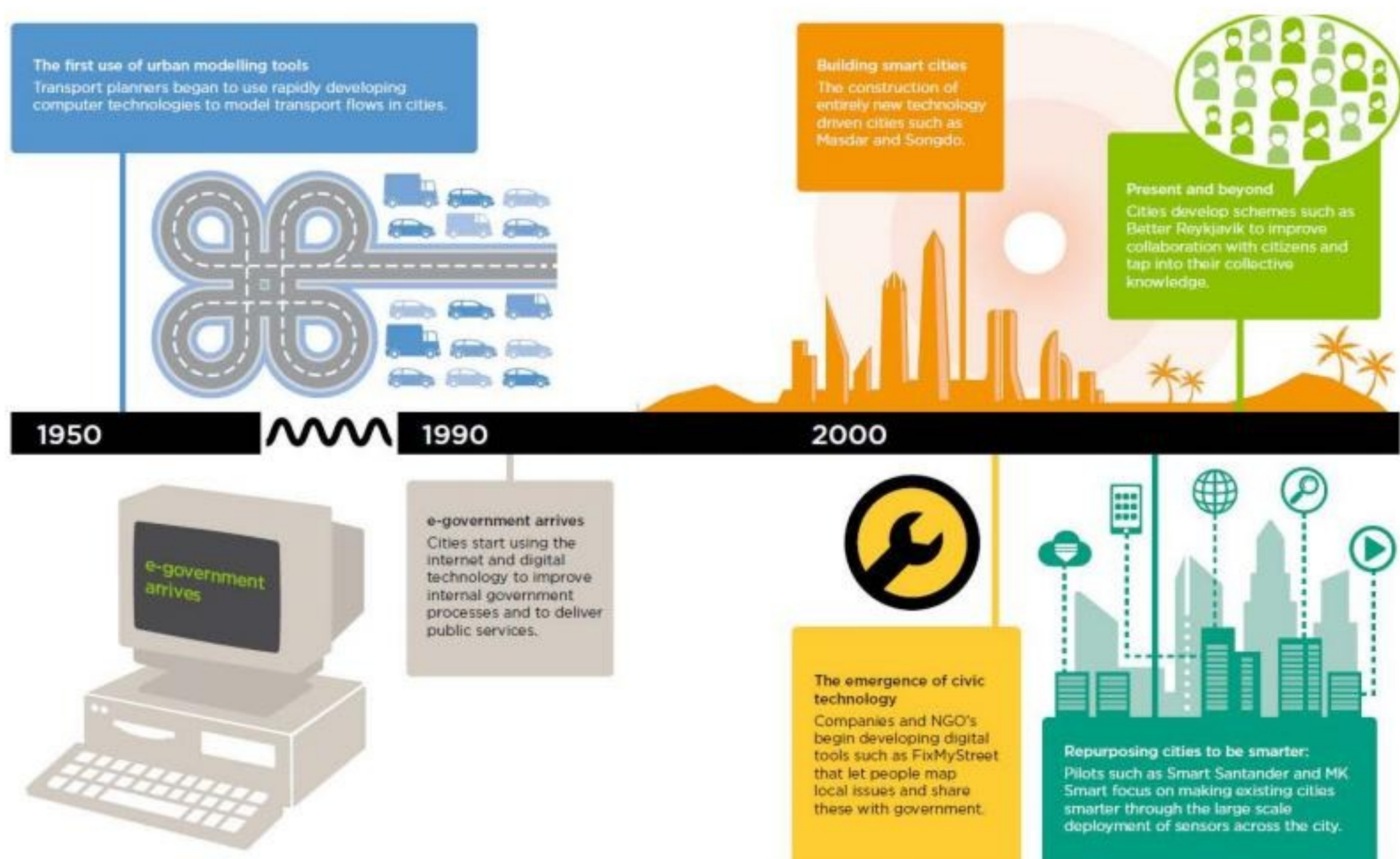


Fig 3.1: History of Smart Cities

Source: <https://www.smartcities.com/en/articles/smart-cities-futuristic-vision>

II. DEFINING SMART CITIES

Many definitions of smart cities exist. A range of conceptual variants is often obtained by replacing “smart” with alternative adjectives, for example, “intelligent” or “digital”. The label “smart city” is a fuzzy concept and is used in ways that are not always consistent. There is neither a single template of framing a smart city, nor a one-size-fits-all definition of it (O’Grady and O’Hare, 2012). The assumptions and perceptions of the term has always been questioned based on the profession or field of smartness. Thus, the definition of smart city differs depending on the person who is quoting it, like a designer will have a different outlook than a computer engineer or a government official. In a general way it can be quoted as “A smart sustainable city is an innovative city that uses ICTs and other means to improve the quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects.” as defined by the International Telecommunication Union (ITU)’s Focus Group on Smart Sustainable Cities (FG-SSC). While, another definition

of smart cities suggests “A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens. Smart city generally refers to the search and identification of intelligent solutions which allow modern cities to enhance the quality of the services provided to citizens” (Giffinger et al. 2007).

Apparently the smart city concept should revolve around the citizen needs and the quality of life. It is a people centric concept, where ideas like even distribution of resources and sustainability for future are communicated. Largely, among the public, the concept of smart cities are to be perceived as only technological expansion mostly with the ICT. People generally refer to terms like internet of things, big data, internetworking, data privatization and all technical terms, when they hear about smart city concept. Nam and Pardo (Nam & Pardo, 2011) investigated possible meanings of the term “smart” in the smart city context.

In particular, in the marketing language, "smartness" is a more user-friendly term than the more elitist term "intelligent," which is generally limited to having a quick mind and being responsive to feedback. Other interpretations suggest that "smart" contains the term "intelligent," because the smartness is realized only when an intelligent system adapts itself to the users' needs. Harrison et al. (2010), in an IBM corporate document, stated that the term "smart city" denotes an "instrumented, interconnected and intelligent city." "Instrumented" refers to the capability of capturing and integrating live real-world data through the use of sensors, meters, appliances, personal devices, and other similar sensors. "Interconnected" means the integration of these data into a computing platform that allows the communication of such information among the various city services. "Intelligent" refers to the inclusion of complex analytics, modelling, optimization, and visualization services to make better operational decisions (Harrison et al., 2010).

The concept of the smart city is far from being limited to the application of technologies to cities. In fact, the use of the term is proliferating in many sectors with no agreed upon definitions. This has led to confusion among urban policy makers, hoping to institute policies that will make their cities "smart" (Albino et al. 2015). In the urban planning field, the term "smart city" is often treated as an ideological dimension according to which being smarter entails strategic directions. Governments and public agencies at all levels are embracing the notion of smartness to distinguish their policies and programs for targeting sustainable development, economic growth, better quality of life for their citizens, and creating happiness (Ballas, 2013).

There are terms analogous to "smart cities" that add to the cacophony of terms relating to this phenomenon. There are many related terms, which emerged around the same time with smart city concept, which are quite interrelated in terms of their goals and often misused or interchanged by each other. For example, Information city, which is "Digital environments collecting official and unofficial information from local communities and delivering it to the public via web portals are called information cities" (Anthopoulos et al. 2010), while it is repeatedly being interchanged with the term Digital City, that says "The digital city is as a comprehensive, web-based representation, or reproduction, of several

aspects or functions of a specific real city, open to non-experts. The digital city has several dimensions: social, cultural, political, ideological, and also theoretical" (Couclelis et al. 2004). Similarly, there is a lot of difference between a Knowledge City and a Learning City. "A Knowledge City is a city that aims at a knowledge-based development, by encouraging the continuous creation, sharing, evaluation, renewal and update of knowledge. This can be achieved through the continuous interaction between its citizens themselves and at the same time between them and other cities' citizens. The citizens' knowledge-sharing culture as well as the city's appropriate design, IT networks and infrastructures support these interactions" (Ergazakis et al 2004). On the other hand, "The term 'learning' in 'learning cities' covers both individual and institutional learning. Individual learning refers to the acquisition of knowledge, skills and understanding by individual people, whether formally or informally. It often refers to lifelong learning, not just initial schooling and training. By learning, individuals gain through improved wages and employment opportunities, while society benefits by having a more flexible and technological up-to-date workforce" (OECD 1999).

Correspondingly, a lot of likeness are there between Green city and Sustainable City. But in case of smart city, it is a term that combines all these aspects together in one putting more focus on the people. Here's a quote from Smart City Switzerland.

"We define it as a city that offers its inhabitants a maximum quality of life with minimal consumption of resources based on intelligent interconnection of infrastructure. Such as transport, energy, communication on different hierarchical levels, such as buildings, districts, and the entire city. Intelligent does not necessarily equate information technology. Passive, or self-regulating mechanisms, are to be preferred to actively controlled approaches when having similar performance. Smart City is no new label, but describes a deepening engagement for the expansion of existing activities and projects of an innovative city."

Following is a list of definitions by prominent authors which will lead to extraction of smart city definition for Indian scenario.

III. DIMENSIONS OF SMART CITIES

From countless smart city definitions of previous section, we can unquestionably excerpt the core keywords related to the term. Most of the definitions are revolving around the term intelligent and digital, which means the use of ICT to make processes or outputs more efficient. Another frequently used word is sustainability, be it in terms of environment or economy. So, starting from the designing phase to the final implementation phase the aspect of sustainability is being taken care off. Other most common words were governance, infrastructure, mobility, living, policies and strategies etc. But most of them are concentrating on elevating the lifestyle of the people and calling it the people centric concept.

These keywords will support the categories of smart cities accepted worldwide as well as to evaluate the ongoing and completed projects and upcoming proposals worldwide under these attributes. These can be the universal aspects to evaluate a smart city.

Following are the smart aspects of the city that can be upgraded to get a smarter version;

- Smart Morphology
- Smart Governance and Policies
- Smart Mobility and network
- Smart Urban Infrastructure (Services)
- Smart Sustainability
- Smart Economy
- Smart Living (Lifestyle)
- Smart Society
- Smart People
- Smart Growth
- Smart Environment

But the most commonly used or universally accepted ones are six key dimensions which broadly covers all of them, namely, smart governance, smart mobility, smart environment, smart living, smart people and smart economy. These different aspects reflect the diversity of a city, and the purpose of the smart city.

Under smart economy, aspects such as innovation, entrepreneurship included a flexible labor market and the international network. Smart People is not just about training people in the city, but also encouraged and aware social interaction, and participation in public life. Smart governance means transparency of government, the availability of public and social services and the participation of citizens in decision-making. Transport

and technology (ICT) infrastructure are part of Smart Mobility, whereby access (both physical and digital) plays a major role. Smart Environment focuses on sustainable resource management, environmental protection and pollution problems. The final aspect in this series, Smart Living, focuses on quality of life, including culture, health, safety, housing and social cohesion fall. In all these six aspects play both government, business and civic role.

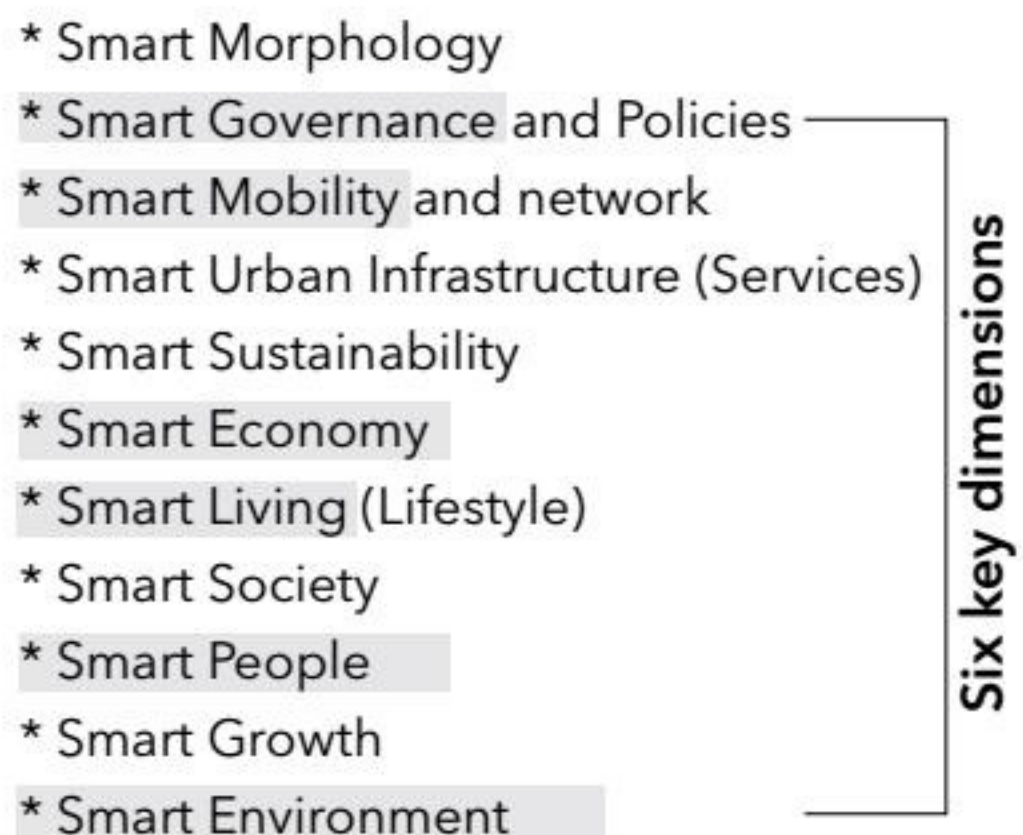


Fig 3.2: Aspects of smart cities
Source: Drawn by Author

These six dimensions are broader categorization of different problematic or potential sectors of a city. But if we go deeper into the study of components of smart city, there will be various associated components. Different smart cities have different levels of these smart components, depending on their focus. Thus, the city can assess their needs and goals and present their components of smart city structure. This is where the contextual definition helps the city to have an unique 'smart' aim.

SMART GOVERNMENT (Participation) 	<ul style="list-style-type: none"> • Participation in decision-making • Public and social services • Transparent Governance • Political strategies and perspectives
SMART ECONOMY (Competitiveness) 	<ul style="list-style-type: none"> • Innovative Spirit • Entrepreneurship • Productivity • Flexibility of Labour Market • International embeddedness • Ability to transform
SMART MOBILITY (Transport and ICT) 	<ul style="list-style-type: none"> • Local accessibility • (Inter-)national accessibility • Availability of ICT infrastructure • Sustainable, innovative and safe transport system.
SMART ENVIRONMENT (Natural resources) 	<ul style="list-style-type: none"> • Attractivity of natural conditions • Pollution • Environment protection • Sustainable resource management
SMART PEOPLE (Social and Human Capital) 	<ul style="list-style-type: none"> • Level of Qualification • Social and ethnic plurality • Flexibility • Creativity • Cosmopolitanism/ Open-mindedness • Participation in public life
SMART LIVING (Quality of life) 	<ul style="list-style-type: none"> • Cultural facilities and Education facilities • Health conditions and Individual safety • Housing quality • Social cohesion

1. Smart Governance: By Smart Governance we mean joined up within-city and across-city governance, including services and interactions which link and, where relevant, integrate public, private, civil and European Community organisations so the city can function efficiently and effectively as one organism. The main enabling tool to achieve this is ICT (infrastructures, hardware and software), enabled by smart processes and interoperability and fuelled by data.

2. Smart Economy: By Smart Economy we mean e-business and e-commerce, increased productivity, ICT-enabled and advanced manufacturing and delivery of services, ICT-enabled innovation, as well as new products, new services and business models. It also establishes smart clusters and eco-systems (e.g. digital business and entrepreneurship).

3. Smart Mobility: By Smart Mobility we mean ICT supported and integrated transport and logistics systems. For example, sustainable, safe and interconnected transportation systems can encompass trams, buses, trains, metros, cars, cycles and pedestrians in situations using one or more modes of transport. Smart Mobility prioritises clean and often non-motorised options.

4. Smart Environment: By smart environment we include smart energy including renewables, ICT-enabled energy grids, metering, pollution control and monitoring, renovation of buildings and amenities, green buildings, green urban planning, as well as resource use efficiency, re-use and resource substitution which serves the above goals.

5. Smart People: By Smart People we mean e-skills, working in ICT-enabled working, having access to education and training, human resources and capacity management, within an inclusive society that improves creativity and fosters innovation.

6. Smart Living: By Smart Living we mean ICT-enabled life styles, behaviour and consumption. Smart Living is also healthy and safe living in a culturally vibrant city with diverse cultural facilities, and incorporates good quality housing and accommodation. Smart Living is also linked to high levels of social cohesion and social capital. (Catriona MANVILLE et al. 2014)

Table 2.1: Characteristics of the key dimensions
Source: Drawn by Author

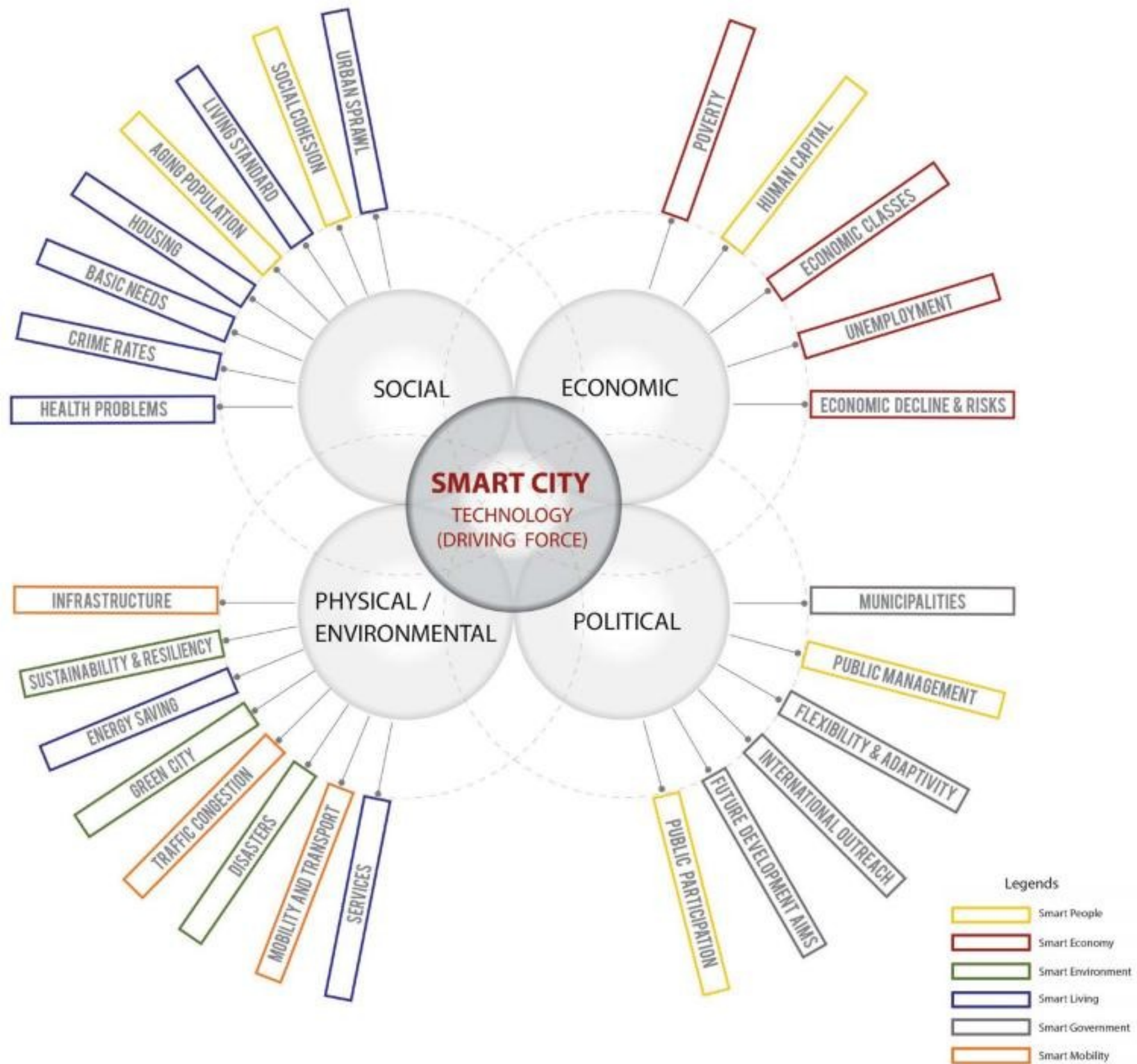


Fig 3.3: Challenges for smart cities
Source: Drawn by Author

After researching about the ideas and impressions of smart cities and learning about the dimensions, it can be sum up stating that the concept of smart cities aims To uplift the traditional systems and social identity of a city, in an organised manner and efficiently using technologies and following are the primary goals to resolve:

- developing a new understanding of urban problems;
- effective and feasible ways to coordinate urban technologies;
- models and methods for using urban data across spatial and temporal scales;
- developing new technologies for communication and dissemination;
- developing new forms of urban governance and organisation;
- defining critical problems relating to cities, transport, and energy;
- identifying risk, uncertainty, and hazards in the smart city.

IV. CRITICISM ON SMART CITIES

As Rachel Keeton from International New Town Institute argues, *"smart cities as we know them today are neither particularly clever, nor are they intended for everyone"*.

In today's competitive urban culture, established cities like Amsterdam, Boston and Stockholm are sticking 'smart city' into all their marketing materials. In new, master-planned cities springing up around the global south, the 'smart city' narrative is incorporated from the very first speculative conversation—"What if we built a city here? It would have to be a smart city"—all the way through to the final designs (Keeton 2017). If everybody is so amused with the thought of making a city smarter, where exactly we are lacking? What are the points where we fail to execute?

They are into following four categories: administrative and legal barriers, technical and infrastructural barriers, economic and market

barriers and social acceptance and political barriers. One of the most challenging ones is that cities have limited and often reducing financial resources for providing governance and various services. Often it is hard to understand the real benefits and costs of investments, and evaluate their life cycle impacts in the long term. Other common barriers for many smart city developments are related to systems sub-optimisation and unclear vision. It is typical that there are many stakeholders involved from different sectors and backgrounds, which makes the integration of processes and systems complex, and communication and collaboration need lots of efforts. Another common barrier is that the relationship between data monitoring and services and the privacy and security of users' data is not clearly regulated (Miimu Airaksinen, Janne Porkka, Terttu Vainio, Aapo Huovila, Mari Hukkalainen & Ahvenniemi, Pirkko Rämä 2016).

	Administrative and legal barriers	Technical and infrastructural barriers	Economic and market barriers	Social acceptance and political barriers
Energy	Legal issues and lacking of new business models for local energy services and supply/demand matching. Development and changes are slow. Sub-optimisation.	Lots of actors makes interoperability and integration of processes and systems is complex. Limits of distributed energy (e.g. timing and fluctuation). Location affects to the accessibility and availability of RES.	High costs and long pay-pack times. Costs and efficiency still developing for some supply technologies, e.g. PV.	Legacy of design for central energy supply. Lack of common vision.
Buildings	Outdated regulations for renovation. Lack of policies for the integration of smart renovation measures. Retrofitting not integrated in district planning.	Lack of quality. Short term planning. Rare integration of smart products, services and technologies into wider city systems and tools. Huge renovation need. Building stock inertia. Maintenance reactive.	Doubts about ROI for investments. Smart renovation solutions not cost-efficient and focus on isolated buildings rather than district integration.	Lack of awareness and interest. Old habits.
Infrastructure	Decision making. Maintenance and renovation sub-optimised.		Long term investments vs. short term costs.	Lack of awareness and knowledge.
Mobility	Too much land use for transport and infrastructure (e.g. parking lots). Unnecessary trips.	Lack of public transportation and un-motorized options. Rarely linked to other city services.	Many cities develop uncontrollable.	Mistrust towards reliability of public transport.
Communities and users; citizens	Lack of possibility for involvement in decision making. Lack of information.	Security and privacy of data. Services, systems and interfaces that are not easy to use.	Affordability of housing. Lack of education and career opportunities.	Users resistance and mistrust towards new solutions.
Governance, policies, and land use	City decision making in silos. Development and changes are slow.	Sub-optimisation of the land-use. Inadequate evaluation of life cycle criteria.	Hard to see the impacts of the investment costs in the long term.	Dissatisfaction of people regarding the land use.
Interoperability and ICT	Data monitoring vs services vs privacy is not clear regulated	No common semantics and standardisation for communication and data exchange. Lack of open data.	Hard to calculate the benefits of investments.	Inadequate collaboration, communication and integrated planning.
Resource management; environment	Sub-optimisation.	Clean water scarcity.	Lack of ROI for environmental protection.	Competition for resources.

Table 2.2: Summary of main barriers for the targeted roadmap development areas and cross cutting themes.

Source: Smart City Roadmap and Vision

To sum up few prominent barriers mentioned by all the researchers are:

1. Starting with technology rather than urban challenges: Work on smart cities often begins with the question: what uses can be found for cutting edge technologies? This is because the primary goal of smart city pilots is often economic development: supporting companies to create and commercialise technologies that can be sold to cities around the world.

2. Insufficient use or generation of evidence: Despite the huge sums invested in smart cities worldwide, there is little published evidence showing that the solutions they offer help cities address real-world challenges. Installing sensors on infrastructure throughout the city or using data to predict traffic patterns might make cities more efficient and sustainable. Alternatively, it might cost more than it saves, especially when maintenance is factored in. Cities currently have no clear guidance regarding what technologies to invest in, and this will remain the case until smart city pilots start sharing their findings.

3. Lack of awareness of how others are trying to improve cities: The smart cities field is often too insular, with technologists talking to each other, but not linking to the work that others groups are doing to address urban challenges, such as those working within city government in areas from transport and planning to economic development and public participation.

4. Little role for citizen engagement: Many smart city strategies offer citizens little chance to engage in the design and deployment of new technologies. While citizens tend to be the implied beneficiaries of smart city projects, they are rarely consulted about what they want and their ability to contribute to making the city work better is often ignored.

5. Lack of collaboration - Smart city solutions typically require collaboration between various partners. To manage these collaborative partnerships specific governance models are needed.

6. Citizen Inclusion: Even if cities are increasingly interested in providing citizens with opportunities to participate in decision making, lack of actions and tools to implement this attempt still constitute a major barrier. If the citizens feel that the city is not willing to involve them and provide sufficient amount of information, this might lead to frustration and passive or negligent behaviour regarding their surroundings.

The most important disadvantages of developing new smart cities include:

There is an imminent risk of slow progression due to a variety of problems ranging from budgetary issues to insufficient planning and failure to attract residents and/or capital. Therefore they require generous investments and a conducive governance model (Alawadhi et al., 2012; Copenhagen Cleantech Cluster, 2012). Singular focus on efficiency could cause a restricted view of societal values, such as social cohesion and quality of life, questioning the 'sustainability' dimension of new cities (Bria, 2012; Lind, 2012; Ratti & Townsend, 2011). The replication of technological solutions entails risks. The same solution may not be suitable for all cities (Pike Research, 2011; Sassen, 2011; Townsend, Maguire, Liebhold, & Crawford, 2010)

The most important disadvantages of applying a smart city strategy to an existing city are:

Complex ecosystems of people, institutions and stakeholders require extreme effort to organize and discipline (Bélissent, 2010; Ratti & Townsend, 2011). An existing city's infrastructure could be old and outmoded, hindering the realization of the smart city vision (Bélissent, 2010; Pentikousis, Zhu, & Wang, 2011). Besides becoming 'smart', existing cities have many problems that must be addressed and which compete for a share of the city's resources. Therefore, it is not possible to address all aspects of a smart city; the strategy has to be highly selective and based on a laborious prioritization process (Bélissent, 2010)

V. URBANISM PERSPECTIVE ON SMART CITIES

Smart cities represent a conceptual urban development model based on the utilization of human, collective, and technological capital for the enhancement of development and prosperity in urban agglomerations (Angelidou 2014). The current scenario requires cities to find ways to manage new challenges. Cities worldwide have started to look for solutions which enable transportation linkages, mixed land uses, and high-quality urban services with long-term positive effects on the economy (Albino et al. 2015).

Before designing the changes, it is mandatory to find out the loopholes in the present city working system. As an urbanist, we need to look for possibilities of change and scenarios that can occur also, questioning on the current situation. Firstly, why the cities are not behaving smart currently? It is hard to believe that not just the forthcoming cities, but also the planned cities (which were planned and designed before) are trying to get a label of 'smartness' for them. What was lacking in the previous planning? What are the conditions that creates the need of smart city? What aspects to be added to make them smarter? "An essential strand in my approach is to use ICT to engage the community through diverse instruments and initiatives that build upon online engagement in solving the key problems of cities, using the kinds of computer-based tools, techniques, methods and organisational structures that we will research here" (Batty et al. 2012). Thus, it can be said that the two things which were missing in previous

planning are technology and citizen engagement, which are the main components of the concept of smart city. Yet the sustainability of this approach, based on mostly standalone programs, is questioned.

To conclude this section of relation between smart cities and urban development, this would be the right approach as Stephen Marshall mentioned in one of his articles.

"Moreover, the city is more like an ecosystem than an individual organism; it comprises a series of components (such as roads, buildings, land uses, institutions, and so on) that are co-evolving. Therefore urban change is more like evolution than development, and planners should pay attention to the mechanisms by which urban evolution could be steered through a combination of generative processes and selective controls. This is not to say that cities should not be planned; but it implies a kind of planning that is less like the design of a finite object such as a building. It implies attention to the way that design codes and development control, but without necessarily fixed master plans. Although a master plan may promise order rather than chaos, it may be too rigid to have a fixed physical product at a given time in the future, but it may be preferable to have something whose overall form is not fixed in advance, but whose components exhibit ordered relationships, that ensure flexibility and functionality into the future" (Marshall 2009).

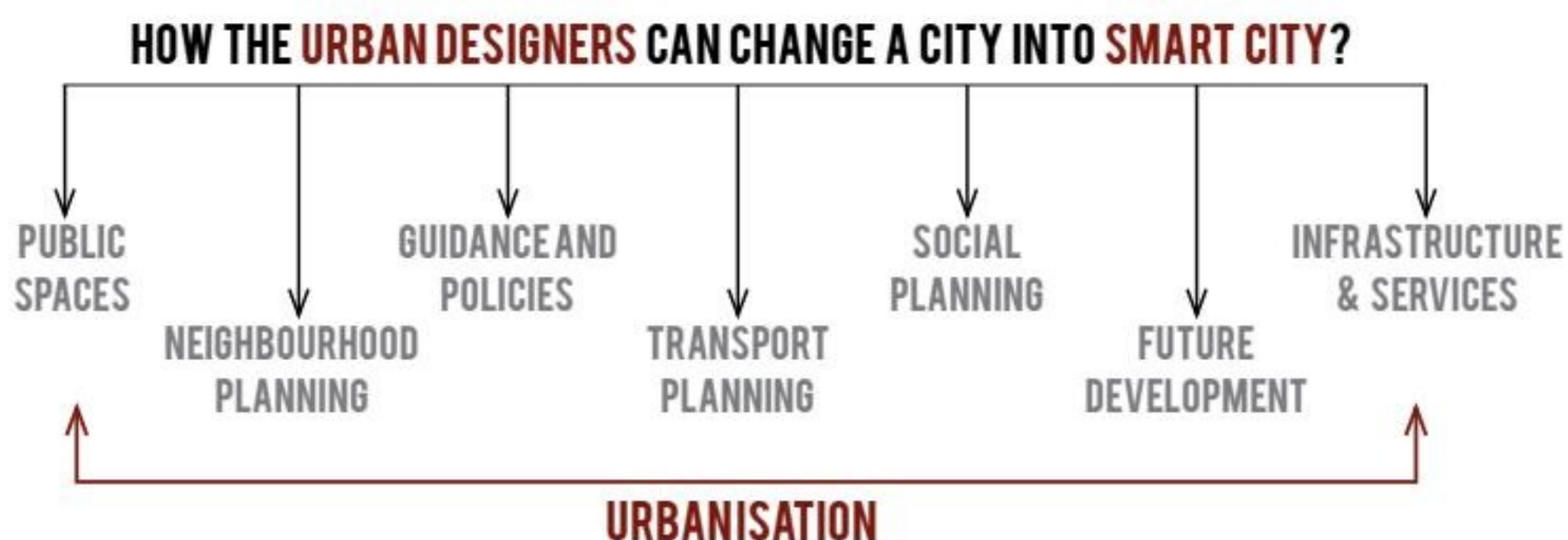


Fig 3.4: Urbanist's perspective
Source: Drawn by Author

VI. REFLECTION

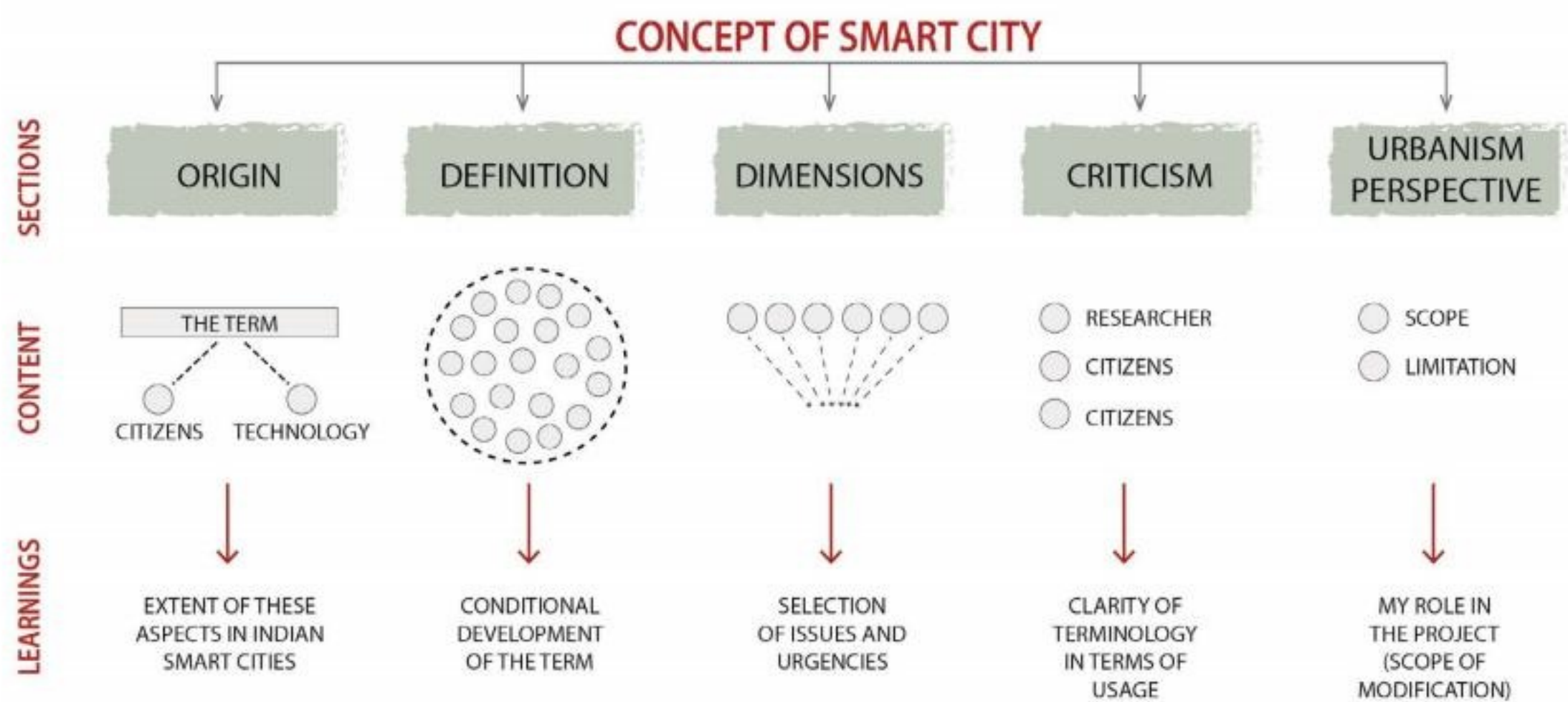



Fig 3.5: Reflection on Smart Cities
Source: Drawn by Author

This chapter was focused on the various theories and direction that a smart city can work. There are no clear distinctions between the definitions, all of them have something in common and a lot of overlapping aspects. The challenge was to understand all the theories and to be able to pick up the most relevant one that fits the Indian scenario. Also, this will help to develop a clear definition for the Indian smart cities and its aims. The study of key dimensions will help me to access the issues and urgencies of India, that is to be considered in the project. Other than understanding the historical growth of the term smart cities, different definitions and dimensions, it was really helpful to study about the

criticism. This was it will be easier for me to evaluate the Indian proposal. And finally the last section of the chapter teaches me my role as an urbanist in any smart city project. This more or less defines the scope and limitation for this project as well. By studying this part, it became easy for me to know the possibility of variations in the definitions and dimensions of smart city concept that can be explicated for Indian scenario.





How can experiences of adapting technologies
around the world be adapted in India?

PRACTICAL APPLICATION OF SMARTNESS

Source: <https://danielmiessler.com/images/the-real-internet-of-things.jpg>

I. SMART GROWTH TRENDS

From the last section, it is evident that why generalization of the concept can be harmful. The variation in the growth and the development style of a city plays a vital role in coining this term specifically for that place. The conditions that triggers the modifications in the definition can be social, economic, cultural, governmental, environmental, geographical or historical aspects. Though the cities have their own direction or working style towards smartness, the countries and continents can be clubbed and generalized on the basis of their main sectoral focus of performance for the smart label. All the continents have their own way of working towards smartness. Where American cities are focussing on energy efficiency and green development, Europe is using technology to enhance the infrastructure, Middle East is trying to create smart cities from scratch including all the key aspects of smartness and the Asian cities are following other cities to buck-up with the infrastructure and services and current issues.

Hence, all the cities are planning using different aspects and attributes to make their city smarter. The article- 'Smart cities of the future' written by M. Batty, -suggests few goals for the smart city like a new understanding of urban problems; effective and feasible ways to coordinate urban technologies; models and methods for using urban data across spatial and temporal scales; developing new technologies for communication and dissemination; new forms of urban governance and organization; defining critical problems relating to cities, transport, and energy, and lastly, risk, uncertainty and hazard in the smart city. All these theories question the role of urbanism. How urban design and planning is helping the cities to be smarter. Or how urban development or urbanism have different goals compared to the smart city goals? It seems that there are a lot of overlaps. There are lot many newly derived terminologies like urban coding, new urbanism, pattern language, space syntax theory etc. which confirms that the planning sector have similar goals as the concept

of smart cities. All the sectors, institutions, theories and concepts are trying to provide a better lifestyle for the people. Thus, they have alike goals in mind. It is just the inclusion of technology and the citizen centric methods which separates the concept of smart cities from others.

In this section we put more light on the urbanisation of Asian countries as my location of interest are Indian cities.

Most of the cities in Asian countries are struggling with major problems of pollution, traffic congestion, growing and uncontrollable population, lack of services, poor environment etc. And need not to mention the economic dynamism influences a lot while taking decisions for a better environment of a liveable city. The motive behind the concept of smart cities in Asian countries are to create a balance between the economic growth and generating liveable spaces. (Thuzar n.d.) Urbanization is not fulfilling or catering the basic needs of the residents. Highly growing population is reducing the chances of adequate employment, literacy, shelter, security, infrastructure and services to the urban as well as rural population. The strategies the government or the developers using in Asia are progressing the cities as engines of development, inclusive urban development, connecting the cities with the environment, urban and regional connectivity, governance and decentralization.(ISEAS 2010) Thus, smart cities in Asian countries have more connection to the urban development and governmental strategies and policies to create a liveable environment, rather than focusing on the ICT sector.

Based on the following map and the focus elements of smartness, the objectives of the continents are quite clear. The six universal key dimensions explained in Chapter 3 are useful to categorise the continents in terms of prominent smart interventions. This would help to recognize the differences in the continent focus and specific city focus (explained in next section).

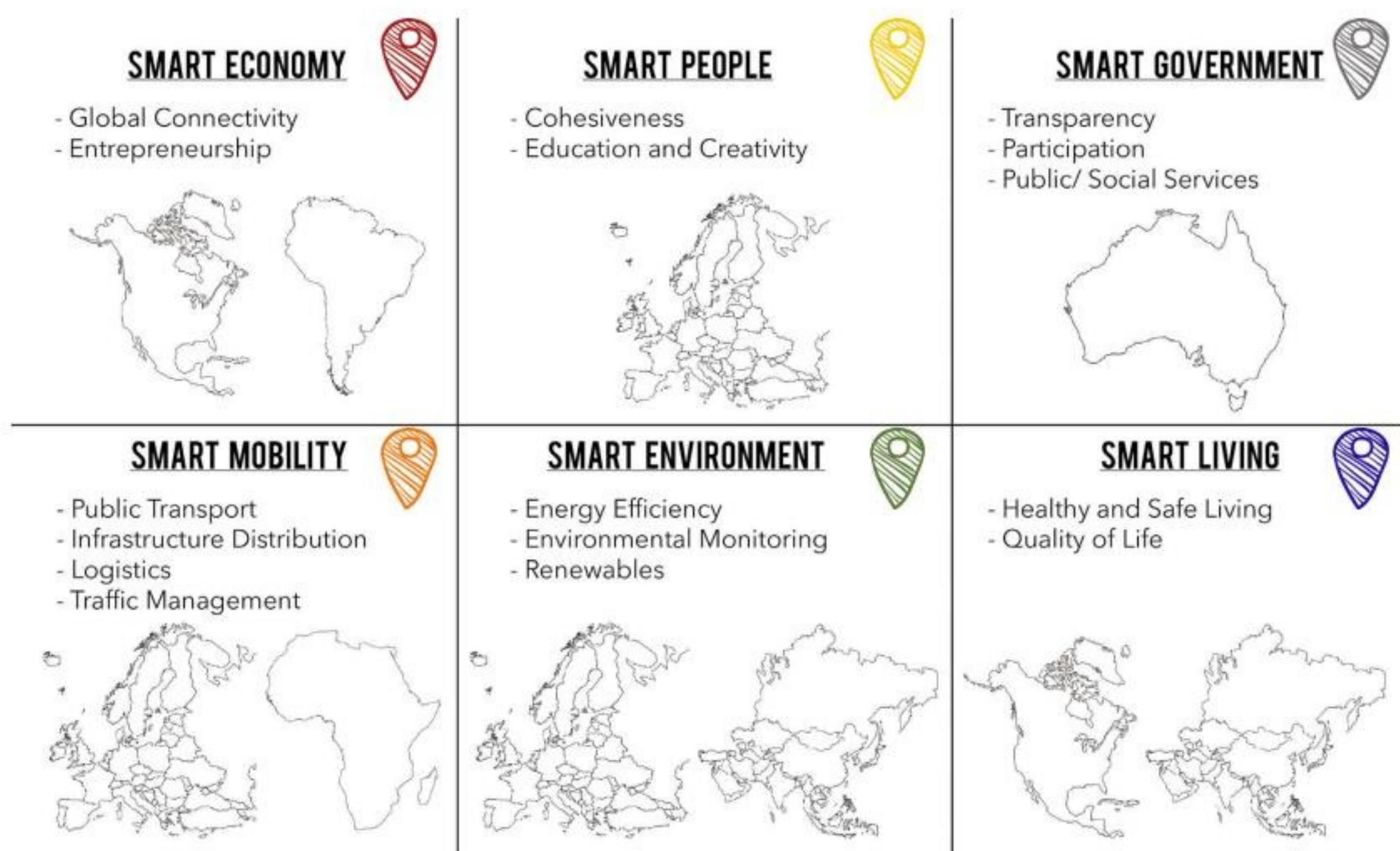


Fig 4.1: Smart Key dimensions and objectives
Source: Drawn by Author

A GROWING GLOBAL TREND



The following map lists few smart cities and their smart city strategies based on the continent impact.

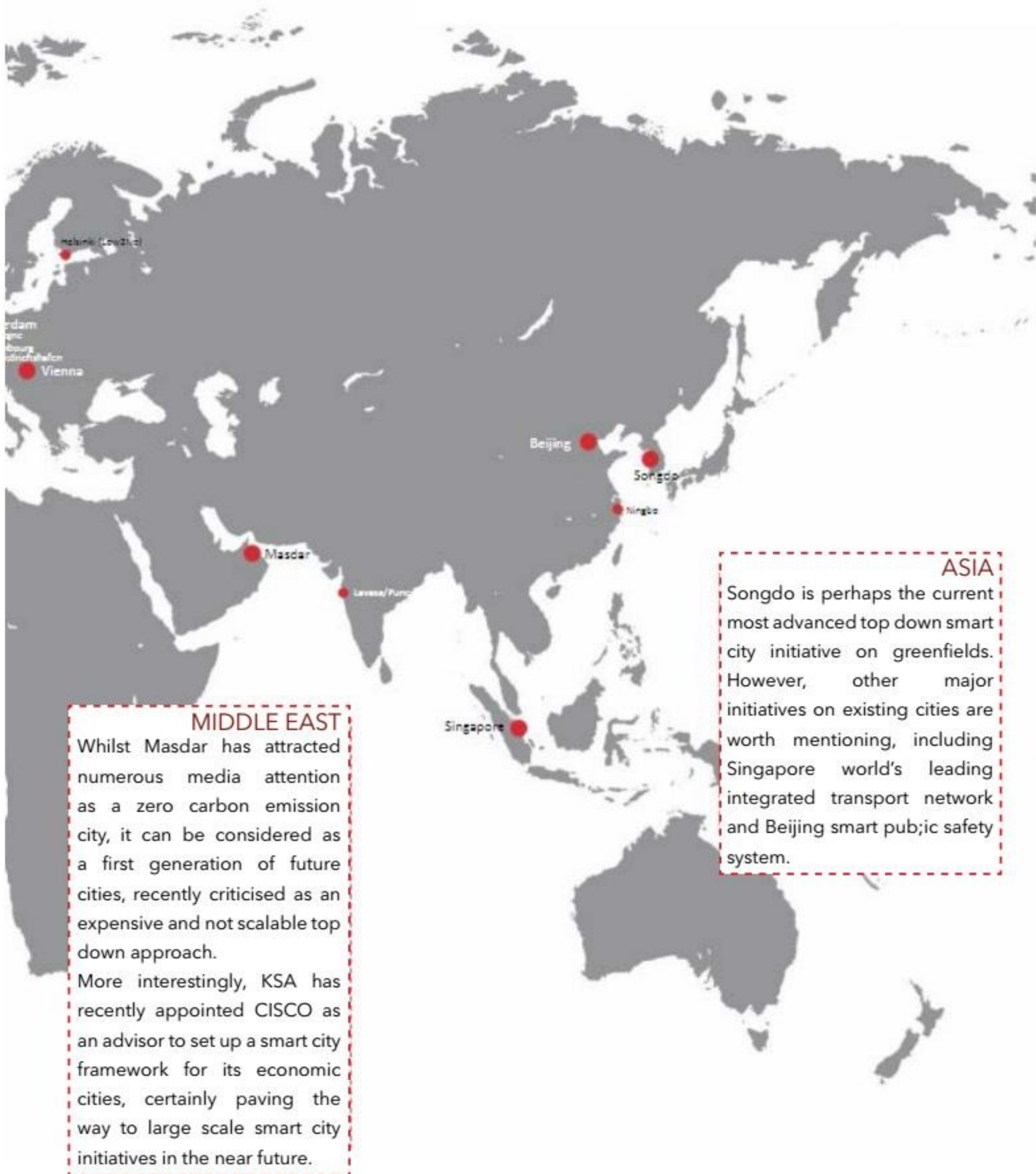


Fig 4.2 : Continents having different smart city approach
 Source: "Towards Smarter Cities" for Dar Group, prepared by FUD

II. INTERNATIONAL SMART CITIES

The 25 cities around the world are selected from all the continents to access the differences in their smart city applications. The 25 cities are mostly representative smart cities of the continents. To use these examples in my initiatives, I started categorizing and clustering them under various attributes.

Firstly, I started with the general typology analysis and further moved towards characterizing the cities in terms of smart objectives and dimensions. Later I will be studying one relevant smart project from each 25 cities and try to connect them to Indian context. How they are relevant? what useful methods or principles can be used in Indian cities?

Table 4.1: Smart city typologies
Source: Drawn by Author

S.No.	Continent	Country	City
1	Europe	Austria	Vienna
2		Netherlands	Amsterdam
3		Spain	Barcelona
4		England	London
5		Denmark	Copenhagen
6		Finland	Helsinki
7		England	Manchester
8	America	Washington	Seattle
9		California	San Francisco
10		USA	New York
11		Massachusetts	Boston
12		Canada	Toronto
13	South America	Brazil	Rio De Janeiro
14		Mexico	Mexico City
15		Brazil	Sau Paulo
16	Africa	South Africa	Cape Town
17		South Africa	Johannesburg
18	Australia	State of Victoria	Melbourne
19		New South Wales	Sydney
20	Asia	China	Beijing
21		United Arab Emirates	Dubai
22		China	Hong Kong
23		Singapore	Singapore
24		Abu Dhabi	Masdar City
25		Japan	Tokyo

Characteristics

Area (Km sq)	Population	Population Density (per Km sq)	GDP (\$ BN)	Divisions	Government
414.65	1,863,881	4,326.10	183.7	23	republican-democratic , federalist structure
219.32	844,667	4,908	320.6	8	Constitutional Monarchy
101.4	1,604,555	16,000	171	10	Constitutional Monarchy
1,572	8,673,713	5,518	542	32	Constitutional Monarchy
86.4	601,448	7,000	127	10	Constitutional Monarchy
715.49	629,512	2,945.09	77.1	33	parliamentary republic
115.6	520,215	4,498	92.3	10	parliamentary constitutional monarchy
177	681,170	4,308	300.827	8	constitutional federal republic
600.6	864,816	7,124	411.969	11	constitutional federal republic
141,300	19,795,791	159	1,558.518	5	constitutional federal republic
232.14	667,137	5,344	382.459	3	constitutional federal republic
630.21	2,615,060	4,149.50	304	6	constitutional federal republic
1,221	6,453,682	2,705.10	209.366	33	federal presidential republic
1,485	8,918,653	6,000	403.6	16	federal presidential republic
1,221	11,967,825	7.858,13	477.005	31	federal presidential republic
400.28	433,688	1,100	58.9	11	parliamentary republic
334.81	957,441	2,900	82.9	9	parliamentary republic
9,990.50	4,529,500	453	253.1	23	parliamentary democracy
12,367.70	4,921,000	400	319.5	24	parliamentary democracy
16,411	21,700,000	1,300	506.1	16	communist state
4,114	2,657,000	408.18	82.9		Absolute monarchy
2,755	7,234,800	6,544	310.07	18	communist state
719.1	5,610,000	7,797	308.05	28	Unitary dominant-partyparliamentary republic
6	50000 (planned)				federation of monarchies
2,187.66	13,617,445	6,224.66	1699	23	parliamentary constitutional monarchy

Study of 25 Cities

S.No.	Continent	Country	City	Initiation Year	Smart Key Dimensions			
					Smart Governance	Smart Mobility	Smart Economy	Smart People
1	Europe	Austria	Vienna	2011				
2		Netherlands	Amsterdam	2009				
3		Spain	Barcelona	2012				
4		England	London	2013				
5		Denmark	Copenhagen	2014				
6		Finland	Helsinki	2012				
7		England	Manchester	2015				
8	America	Washington	Seattle	2015				
9		California	San Francisco	2015				
10		USA	New York	2011				
11		Massachusetts	Boston	2012				
12		Canada	Toronto					
13	South America	Brazil	Rio De Janeiro	2010				
14		Mexico	Mexico City	2012				
15		Brazil	Sau Paulo	2015				
16	Africa	South Africa	Cape Town					
17		South Africa	Johannesburg	2011				
18	Australia	State of Victoria	Melbourne	2010				
19		New South Wales	Sydney	2016				
20	Asia	China	Beijing	2013				
21		United Arab Emirates	Dubai	2014				
22		China	Hong Kong	2014				
23		Singapore	Singapore	2014				
24		Abu Dhabi	Masdar City	2010				
25		Japan	Tokyo	2005				

		Smart Approach	Smart Initiatives/ Projects
Smart Living	Smart Environment		
		Sustainability	Largest biomass powerplant in Europe Smart Grid- Solar Panels
		Technological/ Innovation	Ship-to-grid (green energy) Open Data Amsterdam Climate street Smart building management systems (ITO Tower Project) Health Lab
		Technological/ Innovation Public Centered	Control of lighting zones Smart parking Media-tic Building E-governance
		Economy Centered	Open Data
		Sustainability	Copenhagen Wheel Intelligent Street Lighting Smart Neighborhood
		Technological/ Innovation	Open Data Platform Living Labs
		Inclusive city	Digital inclusion – EastServe The Digital Home Environment Energy Management System
		Green building practices	Sustainable Seattle Happiness Initiatives
		Sustainability	Smart grid
		Smart Urban Regeneration, Digitalization	bike-sharing initiatives places smart screens throughout the city
		Sustainability	Reduce carbon emissions Reduce traffic congestions
		Private and Government partnership	Smart commuting system
		Private and public sectors partnership, economy	
		Central and equitable city	
			Auto Lobby Biking Trails
		Infrastructure	Digital infrastructure strategy
		Utilising smart technology	Smart Electricity
		Planning Policies	largest business precincts
		Sustainability	Clinton Foundation's C40 Cities initiative
		Sustainability	Smart Grid
		communication, integration and cooperation	collaboration between the public and private sectors
		Neighborhood Planning	Kowloon East neighbourhood
		connect, collect, and comprehend	Vertical smart city
		Concept city	'City of the future' laboratory
		Sustainability	Renewable resources and energy consumption

Table 4.2: Sectoral focus on different cities
Source: Drawn by Author

The 25 selected smart cities

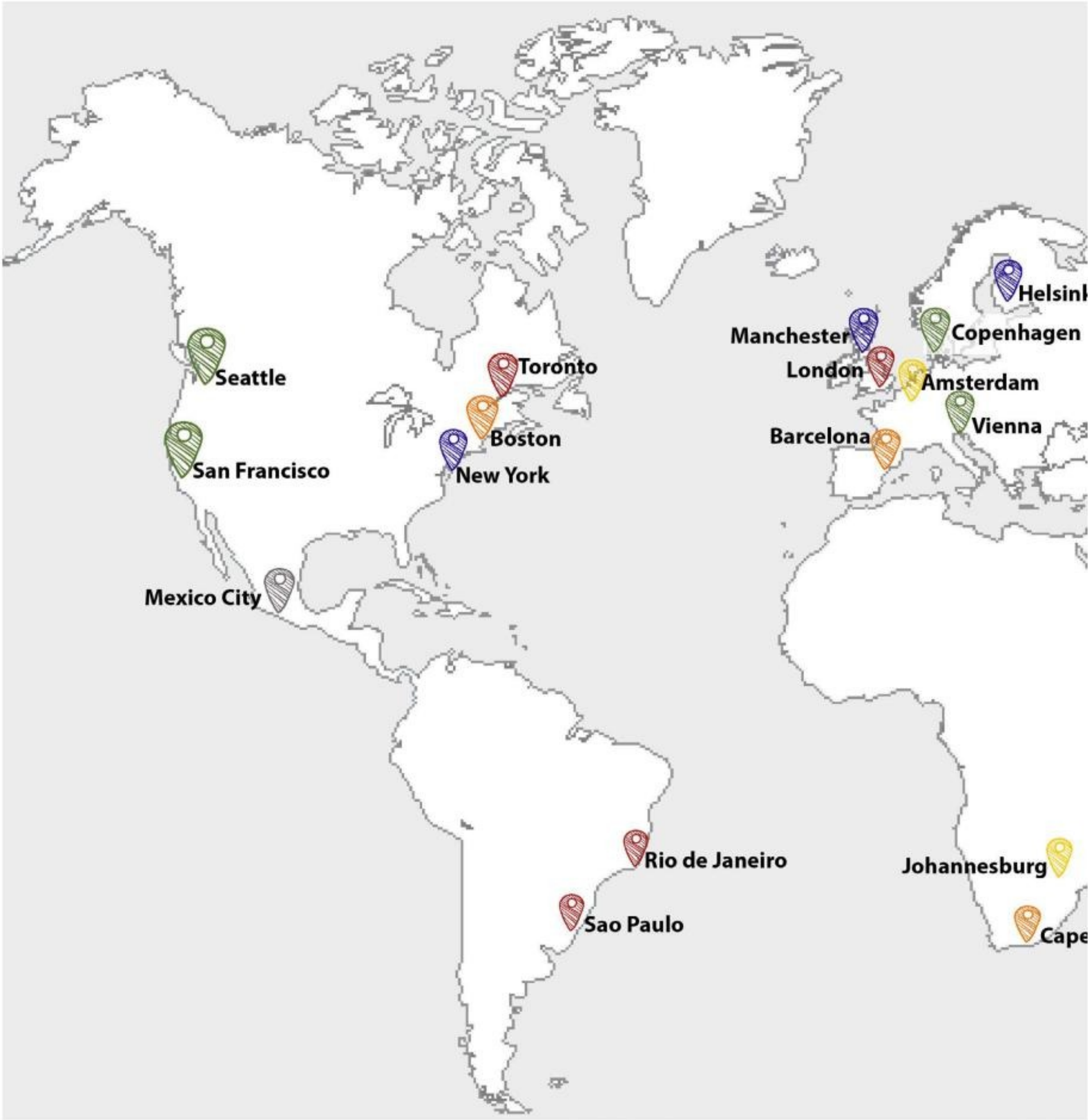




Fig 4.3: The 25 cities for focus sector on smart cities
Source: Drawn by Author

Selected project from 25 cities

1. Vienna: Smart Campus

The Smart Campus is the new headquarter of Wiener Netze. The building combines smart building technology, photovoltaic modules and passive house standards.

Relevance: Similar pilot projects can be implemented in India to upraise the sustainable knowledge among common people. The government buildings can demonstrate this approach of smartness.



Fig 4.4: smart campus

Source: <https://smartcity.wien.gv.at/site/en/smart-campus/>

2. Amsterdam: Sustainable Neighborhood

Can citizens be persuaded or convinced to use less energy? Could technology help to raise awareness on current usage levels and make savings? These were the questions to be answered in the Sustainable Neighbourhood project, a pilot project (2009 - 2011) in the Geuzenveld neighbourhood in the western part of Amsterdam, now part of Amsterdam Smart City's urban living lab New West.

Relevance: The concept of Living Lab can be used from this project in Indian context. Couple of sites can be developed as living labs which will leave a scope for other areas to follow the systematic approach.



Fig 4.5: Smart Campus Vienna

Source: <https://admin.dezwijger.nl/wp-content/uploads/2016/11/AUAS-Organising-Smart-City-Projects-Amsterdam.pdf>

3. Barcelona: Internet of Everything (IoE)

They decided to try to connect municipal buildings with optical fiber. Now there are more than 500 kms of cooperating network. The powerful network is giving the ability to develop and test the smart services in the city.

Relevance: The governmental system of Indian cities are complicated and opaque in terms of sharing data. This intervention can help to extend the data support and sharing of governmental offices.

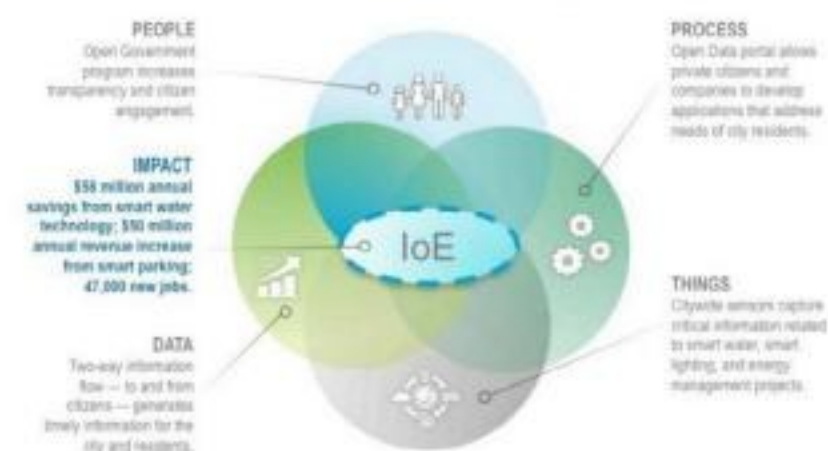


Fig 4.6: Barcelona IoE connections

Source: <http://www.cisco.com/>

4. London: Mapping London's Underground Infrastructure Assets

This project aims to develop new collaborative models and digitisation of London's underground infrastructure. This will provide an invaluable asset to urban planners and infrastructure owners, enabling efficient investment decision making.

Relevance: A lot of infrastructural projects are happening in India. But there are clashes during the construction due to unavailability of collaborative data.

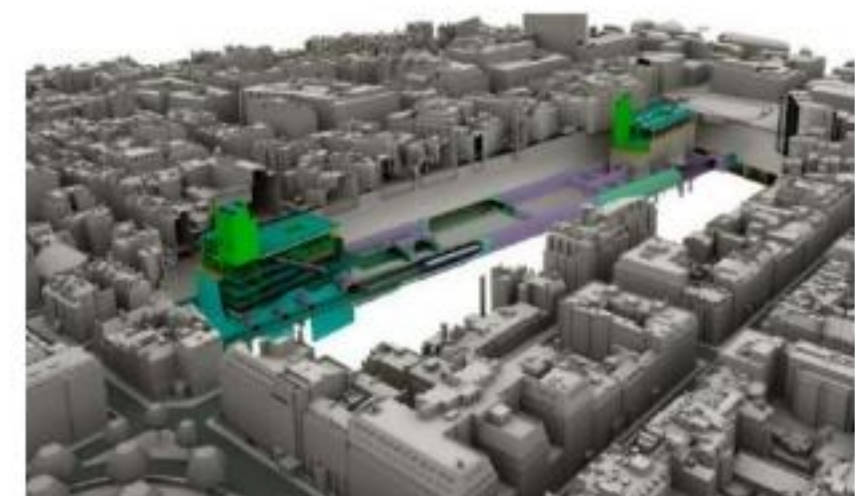


Fig 4.7: Barcelona IoE connections

Source: <https://www.london.gov.uk>

5. Copenhagen: Street Lab

The cases that have been selected for testing in the first phase of the project are: Smart parking, waste management, air quality and noise monitoring, water management, mobility monitoring, city wifi for tourists, data offloading, asset tracking, services for citizens and tourists.

Relevance: This project can not be replicated in India totally but parts of the project can be included in the urbanisation process.



Fig 4.8: Street lab Copenhagen

Source: <http://cphsolutionslab.dk/street-lab/>

6. Helsinki: Valuable city data for anyone

Open data can be used by citizens, businesses, universities and municipal administration. Open data is useful raw material in research and development activities, decision-making, visualisations, data journalism and in developing user-driven mobile apps.

Relevance: For Indian situation and citizen mindset, this kind of project might take a while to adjust, but definitely would be a good opportunity for research.



Fig 4.9: Valuable city data

Source: Picture by Tussitaikurit Oy

7. Manchester: CityVerve

CityVerve is Manchester's smart cities demonstrator that unites 21 organisations from both public and private sectors to help create a smarter, innovative and inspiring city. The project combines industry's brightest minds and latest Internet of Things (IoT) technologies, to identify and address the city's real issues and tackle genuine societal challenges.

Relevance: This is more economy and industry oriented project to increase the efficiency in the business model. India can learn a lot from this project.



Fig 4.10: Cityverve

Source: <http://www.cityverve.org.uk/>

8. Seattle : MetroLab Network

The MetroLab Network is a national consortium of City-University pairs working to advance civic tech, smart cities, urban scholarship, and data-driven governance. The Seattle MetroLab Studio manifests our participation in the national community, which will help ensures external visibility of our work, idea and solution exchange with our metropolitan areas, and influence over the national conversation.

Relevance: The lesson from here is the collaboration among a lot of stakeholders to initiate a smart movement among the citizens.



Fig 4.11: Metrolab projects

Source: <http://metrolab.uw.edu/>

9. San Francisco: Shared, Electric, Connected, Automated Vehicles

Autonomous technology will be used for a shared fleet instead of private ownership. By moving our modes of transportation to a shared model, transportation will belong to everyone and all San Franciscans, regardless of class or ability, will share in the benefits.

Relevance: Shared connected vehicles will be able to provide more space on streets to active transportation and will also help for traffic management. Similar needs in Indian metropolitan cities.



Fig 4.12: Shared autonomous vehicles
Source: <http://smartcitysf.com/>

10. New York: Responsive Traffic Management

Active Traffic Management" to detect the presence, distance, and speed of vehicles in real time, and can sense the pace and flow of traffic. Communicating with a central transportation control hub, the timing of all the traffic signals in the area is adjusted to optimize traffic flow. As a result, congestion is reduced by 10% or more, according to current estimates.

Relevance: Indian citizens can be free from chaotic traffic issues, if this project gets implemented. But this will need a lot of investment.



Fig 4.13: Responsive traffic management
Source: <http://fastforward.unl.edu/issues/issue3/talas.html>

11. Boston: Wicked Free Wi-Fi

Wicked Free Wi-Fi is Boston's outdoor wireless network, which you can use to find places to shop, eat, or connect with other inhabitants in the city.

Relevance: This kind of project might be helpful in India after couple of years, as there are other urgent issues to focus on.



Fig 4.14: Wicked Wifi
Source: <http://www.builtinboston.com>

12. Toronto: Google Fix

Google aspires to built Toronto from the ground up promises not just the convenience that comes with new technologies, but also the potential of environmental sustainability, health benefits, and even affordability of housing. The vision entails self-driving cars, ride-sharing, and sensors throughout that automate the way people engage with their surroundings, making everything from street lights to air conditioning smarter and more efficient. Toronto's underdeveloped waterfront could be a perfect location for Google to begin developing a smart city.

Relevance: The learning from this project would be taking smaller steps of development and creating bigger impact.



Fig 4.15: Waterfront Toronto
Source: James MacDonald/Bloomberg

13. Rio De Janeiro: Centro de Operações

In 2010, the Rio de Janeiro municipality government opened its Centro de Operações for Center of Operations, in an effort to promote the quality of its policies through the use of technology and connectivity. The center receives video feeds from over 500 surveillance cameras installed in the city.

Relevance: This might prove to be an appropriate monitoring system for the Indian cities.



Fig 4.16: Center of Operations
Source: <https://innovationhouserio.wordpress>

14. Mexico City: Smart Grid Program

Smart Grid Network to Connect Cabinet-Based Meters Across Central Mexico City and Help CFE Reduce Energy Loss, Ensure Revenue Protection, and Improve Reliability in High-Growth Market.

Relevance: A lot of infrastructural support would be need at the first stage before such project can instrumented in India.



Fig 4.17: Smart grid program
Source: <http://new.abb.com/smartgrids>

15. Sau Paulo: Smart Eco House

In partnership with over 50 companies, built the first Smart Eco energy-autonomous House of Latin America, integrating cutting-edge technology and sustainable solutions for energy, water and automation.

Relevance: These are the small projects that should be initiated soon in Indian context to share the knowledge of smartness among the citizens.



Fig 4.18: The traditional solar panels
Source: <https://www.smartcities.com/en/cities/sao-paulo-smart-living>

16. Cape Town: Smart Park

The Smart Park concept is aimed at providing for inclusivity, social interaction and the integration of communities. The concept of Smart Parks was one of the City's World Design Capital projects demonstrating how, by applying design-led thinking, the quality of life of residents can be improved.

Relevance: Lessons for citizen engagement.



Fig 4.19: Smart Park
Source: <http://futurecapetown.com>

17. Johannesburg: Smart Citizen Commute

Smart Citizen Commute is a standalone transport app that is easily integrated into Smart Citizen and provides citizens with a real-time view of location-specific public transport services.

Relevance: Will be very helpful in Indian condition, but an organised transport system will be need first.



Fig 4.20: Smart Citizen Project
Source: <https://digitalsmartcitizen.com/citizen-engagement/>

18. Melbourne: Urban Forest Visual

This website enables you to explore this dataset and some of the challenges facing Melbourne's Urban Forest. Each Urban Forest Precinct Plan contains a planting schedule which shows when urban forest planting will take place in each street over the next ten years. The schedule for planting is based on a range of factors, including community priorities shared in the local precinct workshops.

Relevance: For my project, this project will be highly relevant looking at the conditions green blue infrastructure in Delhi.



Fig 4.21: Smart Citizen Project

Source: <http://melbourneurbanforestvisual.com.au/>

19. Sydney: Macquarie Park

Macquarie Park is one of the largest business precincts outside the Sydney and North Sydney CBDs. It has built a reputation as a technology, communications and biomedical hub and is an important employment generating area.

Relevance: Already few business parks pioneered in India (especially in the metropolitan cities). The inclusion of technology will help for further efficient growth.



Fig 4.22: Happiness meter app

Source: <http://www.sydneyimages.com.au/>

20. Beijing: Bohai Innovation City

Beijing Bohai Innovation City represents a new model of compact, environmentally enhanced urban design for the rapid development of satellite cities along Chinese high-speed-rail corridors.

Relevance: Indian cities should learn the rapid development method in smaller scale rather than planning the whole city.



Fig 4.23: Happiness meter app

Source: http://www.som.com/projects/beijing_bohai_innovation_city

21. Dubai: The Happiness Meter

As the world's first, city-wide, live sentiment capture engine, the meter represents a measurement gauge for the happiness goal. However, the Happiness Meter is to collect experience feedback: through the centralised data dashboard a map of happiness across the city can be created, which allows private sector and government entity hosts of Happiness Me.

Relevance: It is highly required to get the feedbacks on the implemented project, directly from the citizens rather than evaluation done by the same authority. Also, this will engage citizens in the development.

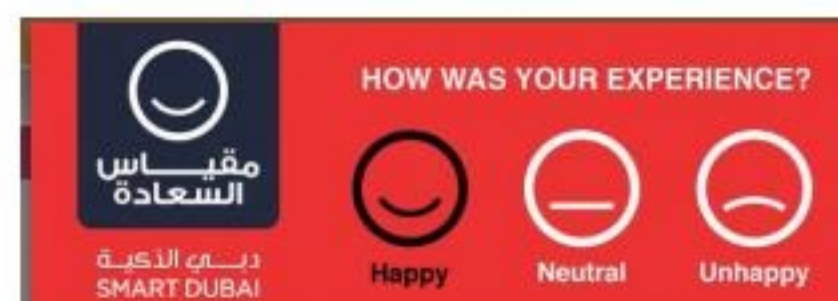


Fig 4.24: Happiness meter app

Source: http://www.smartdubai.ae/story_one.php

22. Hong Kong: **Project Breathe**

'Project Breathe' aims to reduce the reliance on motor transport in Hong Kong so as to reduce carbon dioxide emissions. It intends to change the infrastructure of Hong Kong to incorporate a city wide cycle route to encourage citizens and commuters to use a bicycle to travel around the city, as opposed to using cars and buses.

Relevance: The public transport system in India is growing continuously but still unable to control the amount of private vehicles which causes a lot of pollution. Some project like this can encourage people to use non-motorised vehicles and public transport.



Fig 4.25: Air pollution in Hongkong
Source: <https://hksmartcity.wordpress.com/future/>

23. Singapore: **OneService**

OneService refers to a community of government agencies, Town Councils and citizens working together to address municipal matters and improve the living environment for all. The OneService App and the OneService Portal make it more convenient for the citizens to notify on municipal matters, without having to find out which agency is in charge.

Relevance: The Indian government and authority system is quite confusing and makes it complicated for the citizens to approach the government. This project can be a good initiative to create an active relation between the citizens and government.



Fig 4.26: OneService
Source: <https://www.oneservice.sg/home>

24. Masdar City: **Smart Master Plan**

"The Phase 2 DMP encourages creativity and collaboration in one of the world's hottest climates, and is a replicable and market-friendly model for sustainable urbanism that is aligned with local regulation guidelines, yet maintains its identity as a truly walkable and comfortable city," explain CBT.

Relevance: The project focuses on 4 key principles Identity, Walkability, Sustainability and Replicability. These aspects are majorly missing in the Indian cities. Lessons can be gained from this project.



Fig 4.27: Smart Masterplan (Phase 2)
Source: <http://www.archdaily.com/873748/construction-underway-on-masdar-citys-community-oriented-phase-2-masterplan?>

25. Tokyo: **Tokyo Gas's Isogo Smart House**

Demand Response is a structure of controlling electricity use by end-use customers by requesting customers to curb electricity use at times of tight electricity supply. The control response includes maximizing generation from a household fuel cell known as Ene-Farm (short for energy farm), and delivering an energy-saving request to each household via a household energy management system.

Relevance: Enabling the citizens to manage their own usage of resources is a smart way to control and monitor the resources.

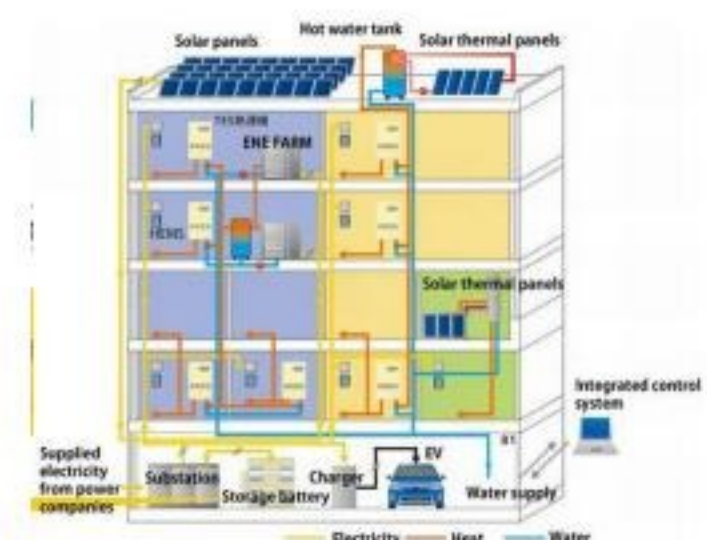


Fig 4.28: Ene-Farm
Source: Tokyo Gas Co.

III. SMARTNESS IN DEVELOPING COUNTRIES

Harita Salvi, discusses about scope of smart cities in developing countries and suggests the need for sustainability. Cities create tremendous opportunities for economic development - 80% of the world's Gross Domestic Product is created in cities; for career development - urban citizens earn on average three times the income of their rural counterparts; and for sustainability - people living in larger cities tend to have smaller energy footprints, require less infrastructure, consume less resources, and have higher productivity levels. For example, a city of 8 million has 15% more productivity and 15% less infrastructure needs than do two cities of four million each.

Whereas Jorge Alberto mentions in his essay of Smart Cities a solutions for developing countries, "The adoption of technology is also important for the development countries where the literacy rate is not enough for adequate understanding of technology. The technology can play an important role to become a smart city for development countries. The key to success of smart city is awareness of the citizen, availability of the basic needs, easy way of transportation, and one stop communication."

In a presentation at Yokohama smart city week about Smart Cities a solutions for developing countries, Hiroki Suzuki, an urban specialist in the World bank points out few prominent issues and their smart approaches needed in developing countries (Smart & Week 2012). This list can help India to manage its sources in a better manner.

Issues:

- Unsustainable urban growth
- Automobile dependent urbanization
- Extreme energy consumption leading to climate change
- Poverty is Urbanizing
- Inequality is increasing

Solutions:

- Smart city requires systematic integrated approach
- Sustainable Urban Development and triple bottom line (Economic, Social, Environmental)
- Stakeholder Collaboration is critical
- Investment Framework that values sustainability
- TOD empowered by TDM
- Urban and street design matters
- Compact mixed landuse

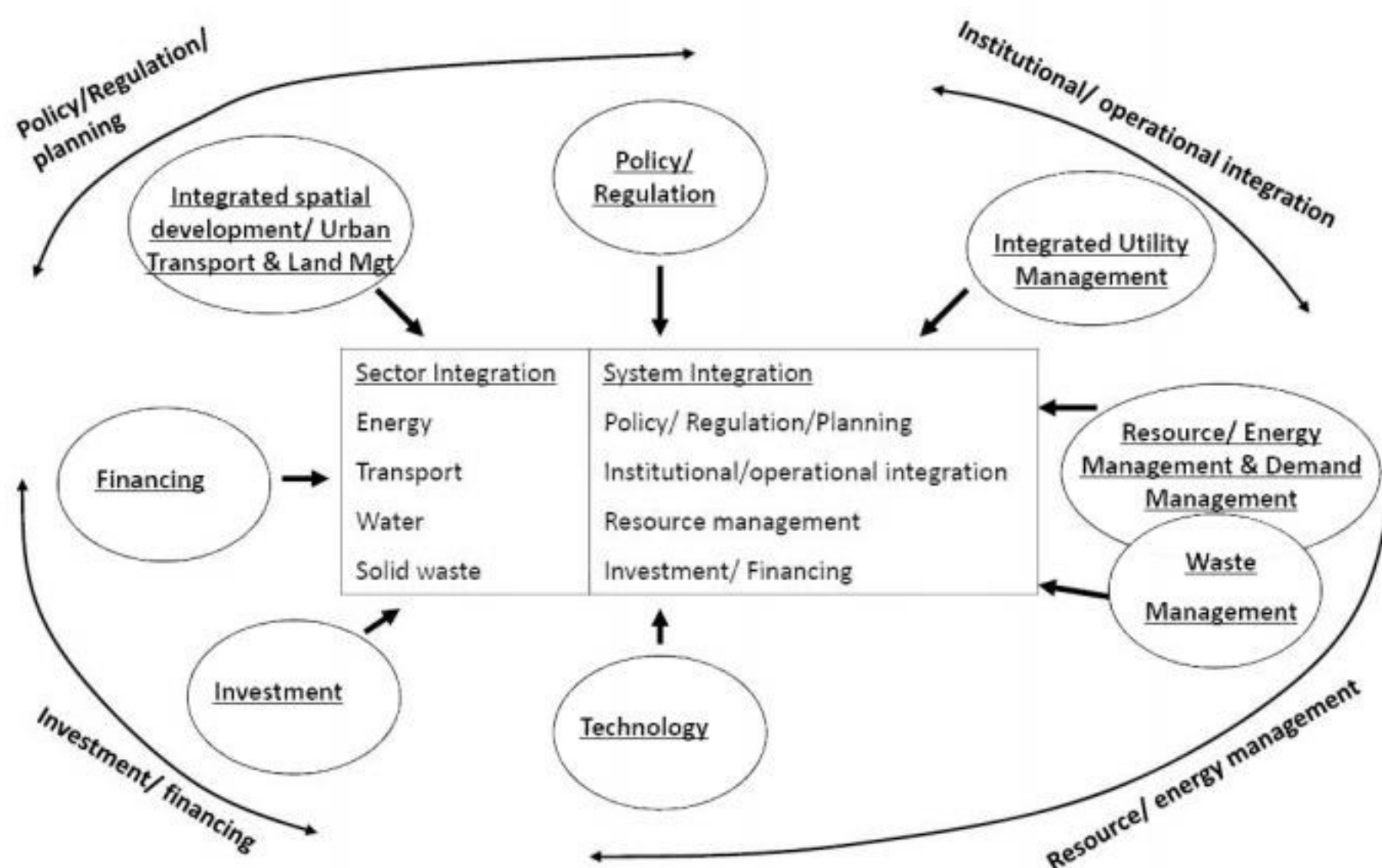


Fig 4.29:Key elements of City's System Integration
Source: Smart Cities in Developing Countries, The World Bank

China, which can be easily compared with the Indian conditions (in terms of issues, area, population) is planning to rebuild 300 cities or towns to be national pilot smart cities. China assures that they will implement a new type of people centered urbanization and address the bifurcation between urban and rural areas(Wan et al. 2015). Following are few smart examples China is processing.

1. One City One Policy:

The indicator system of China's smart city project contains six aspects of smart city: standards, infrastructure, construction and liveable, management and services, industry and economy, and security and maintenance. It can be divided into five levels and covers 18 technical areas, including 126 professional standards of industries. But China also advocated "One City One Policy", will not judge all pilot cities with same standards and evaluation indicators in future.

2. Smart Tourism: Smart tourism involves using advanced technologies such as cloud computing, Internet of things, mobile communications, intelligent application, high performance information processing, data mining, and other ICT technology, to build a smarter application system for visitors, travel agencies, departments of Tourism Administration.

3. Low Carbon Society and Eco City: Yunlong (one of the pilot smart cities) made six detailed plans for its development: 1) green traffic, 2) low carbon energy, 3) ecological and environmental protection, 4) comprehensive utilization of water resources, 5) low carbon industrial, 6) urban management. Using the concept of smart city and technical tools, it will enhance the capability of urban infrastructure, command operations, ability to respond emergency events, better public service, etc.

4. Smart Public Service: Panyu District in China aims to develop smart city to promote people's livelihoods and provide better information services. Panyu plans to implement four projects related to people's livelihood: 1) file management plan, 2) livelihood service cards, 3) service points, 4) livelihood services.

5. Smart Agriculture: Yangling (China) Demonstration Zone believes that it is very important for modern agriculture to control whole agricultural industry chain of quality and safety and to improve food safety production.

6. Focus on industries: Through the IOT industry and other new ICT innovation with other industries, Lecong promotes the upgrading and transformation of traditional industries and the development of urban area. It has become a model of smart development in China's small cities and towns (Wan et al. 2015)

Smart City Indicator System (Pilot, SCI)		
First Level	Second Level	Third Level
Guarantee system and infrastructure	Guarantee system	Planning outline, implementation scheme, organization guarantee, policy and regulation, funds guarantee, management of operation
	Network infrastructure	Wireless network, broadband network, next-generation broadcasting network
	Common platform and database	City common basic database, city common information platform, information security
Smart construction and livability	Administration of city construction	Urban and rural planning, digital city administration, construction market administration, house property administration, landscaping, historical and cultural preservation, building energy conservation, green building
	Promotion of city function	Water supply system, drainage system, water conservation application, gas system, garbage classification and disposal, heat supply system, lighting system, underground pipeline and spatial integrated administration
Smart Administration and Service	Governmental service	Decision support, information disclosure, online service, governmental service system
	Basic public service	Basic public education, labor employment service, social insurance, social service, medical and health service, public culture and sports, service for disabled, basic housing guarantee
	Special service	Smart transportation, smart energy, smart environmental protection, smart land administration, smart emergency, smart security, smart logistics, smart community, smart house and home, smart payment, smart finance
Smart industry and economy	Industry planning	Industry planning, innovation investment
	Industry upgrade	Industrial factors agglomeration, traditional industry transformation
	Development of emerging industry	High and new technology industry, modern service industry, other emerging industry

Tab 4.3: Smart city indicator system, China
Source: Smart City Development in China: One City One Policy, MOHURD

IV. CASE STUDIES OF SMART CITIES FROM INDIA

a) Gift City: Ahmedabad

The Gujarat International Finance Tec-City ("GIFT") is planned as a financial Central Business District (CBD) between Ahmedabad and Gandhinagar. This greenfield project is being developed as a global financial and IT/ITeS hub of Gujarat, a first of its kind in India.

The aim is "To develop a global financial hub for international and domestic financial services which will serve as a paradigm for Next Class Development in terms of Quality of Life, Infrastructure and Ambience, utilizing Land as a precious resource". GIFT Master Plan has three major land use components including commercial, residential and social infrastructure. Other than these predominant land uses, areas for transport, logistics, utilities, greens and open spaces have also been provided within the GIFT master plan area.

The vision for GIFT area can be achieved by following actions, which are enumerated as:

- To develop a new format for globally benchmarked Integrated Financial Centre.
- To aggressively target all the financial services opportunity suitable for centralization, ranging from back office operations and IT support to high end jobs in evolved product markets like trading, private banking etc.
- To make a financial centre hugely scalable in each & every aspect for a distant future and create a much larger carrying capacity.
- To derive a format from fast changing lifestyles & new technologies.
- To achieve an image of Global financial hub, that keeps pace with modern technologies



Fig 4.30: The GIFT city master plan
<http://www.wtcgiftcityahmedabad.in>

b) Lavassa: Pune

Lavasa is a private, planned city being built near Pune. It is stylistically based on the Italian town Portofino, with a street and several buildings bearing the name of that town.

A 25,000 acres (100 km²) or 8,000 acres (32 km²) project being developed by HCC, this as-yet-incomplete city has been controversial for multiple reasons including procurement of land, harm to the environment, and loans acquired through political corruption.

The overall Lavasa development includes three self-sustaining towns: Dasve, Gadle and Dhamanohol.

The master plan (current development plan - 18,000 acres) incorporates the principles of New Urbanism that brings together all the components essential to daily life in a more organized manner. It is broadly based on a town planning principle known as the "transect model", where the development follows a natural pattern of high density core surrounded by successive layers of descending densities and transcending character from urban to rural.

Overall goal and vision of the Master Plan is to create a world-class hill city that will promote new economy in a remote and backward area of the state, offering high quality facilities and environment for living. This would be achieved by harnessing the natural assets of the place and without adversely impacting the environment.

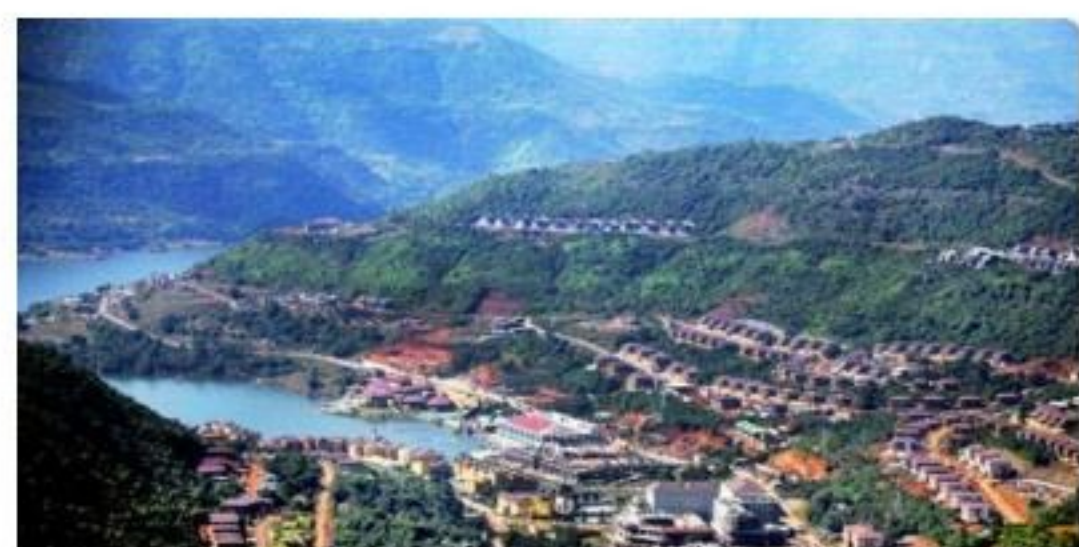


Fig 4.31: Lavassa city aerial view

Source: <http://www.thehindubusinessline.com/economy/ministry-refuses-green-nod-for-lavasas-hill-station-project/article2538090.ece>

V. REFLECTION

DIMENSIONS		LEARNINGS
GOVERNANCE	→	SUPPORT SMART INITIATIVES FINANCIALLY AND ADMINSTRATE
MOBILITY	→	ALREADY ONGOING INFRASTRUCTURAL PROJECTS
ECONOMY	→	REVENUE GENERATING PROJECTS AS SMART PROJECTS
PEOPLE	→	CITIZENS AS ACTORS OF SMART CITY
LIVING	→	EQUALITY IN LIFESTYLE TO BE ENCOURAGED THROUGH SMART INITIATIVES
ENVIRONMENT	→	USE OF TECHNOLOGY FOR SUSTAINABILITY

This chapter began with the learnings of the concepts of smart cities. The six key dimensions were very clear in their own ranges, but the applications were explored in this chapter. How those attributes of the smart dimensions are converted into practical projects in different corners of the world? The study of smart city applications gave a design and planning direction to my project in terms of implementation and feasibility. This way I found the loopholes in the present structure of Indian smart city proposal and help me to decide that what and where I need to fill in with small projects and policies. As shown in the figure with each key dimension, I realized the need for the hour in Indian context. As shown in the figure with each key dimension, I realized the need for the hour in Indian context. For instance, smart governance in India should focus on supporting the initiatives by private stakeholders and monitor the growth of the city. While in terms of mobility, parts of India needs lot of infrastructure while cities like Delhi can suffice with present infrastructure easily. Moreover, there are many ongoing projects based on infrastructure and mobility, so for now I can skip that sector in this project.

Fig 4.32: Lessons from global experiences of smart cities
Source: Drawn by author



5



How operational is the Indian Smart Cities Mission?
What are the strengths and weaknesses of the
proposed smart city plans in selected example
cities? How can the current proposal be evaluated?

INDIAN SMART CITY

Source: Various sources (Mentioned in Appendix)

I. INDIAN SMART CITY DEFINITIONS

As quoted by Anil Menon (Global President - Smart + Connected Communities, CISCO Systems), Indian smart city concept: "Smart cities have nothing to do with digitization, technology, cameras, or sensors. Planning a smart city would involve an understanding of the soul of the city and managing it for the future of citizens".

Also as quoted by H. Chourabi in Understanding smart cities: An integrative framework. Proceedings of the Annual Hawaii International Conference on System Sciences- "In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of Smart Solutions. The focus is on sustainable and inclusive development".

While some other researcher cited "Smart cities as an opportunity to rethink the notion of urbanization with a more systemic approach, reintegrating the concept of sustainable development into the urban context."

In the proposal developed by the government, A Smart City has basic infrastructure, uses 'smart' solutions to make infrastructure and services better, and relies on Area based development.

In other documents of the same proposal there are few other definitions found, for example;

1) Smart cities are technology -driven and use planned infrastructure to improve the standard of living.

2) A smart city aims to improve resident's quality of life , provide a clean and sustainable environment and facilitate application of smart solutions. The focus is on sustainable and inclusive development.

But from the projects proposed by different cities built on area based development or pan city development, the definitions don't reflect well. It seems that the theories are kept aside and practical solutions are influenced by other factors like finance, stakeholders, political upfronts etc. The issues faced by the citizens and the facts and figures by the researchers (can be seen in figure below) are also forcing the proposal to deviate from the actual quoted definitions.

According to me, from what I learnt from all the definitions, I can define Indian smart city as:

Smart designing and planning in terms of distribution of resources to reduce the unevenness of infrastructural services. And the smartest way to reach this goal would be inclusion of citizens in the process of making the city smarter. The users should be able to access the city in a smarter way otherwise there is no point to include technology in not-so-urban areas.

Thus, through this project I would try to do justice to this definition through projects and policies.



Fig 5.1: Need of the hour for Indian smart cities
Source: Urban Age report, Foundation for futuristic cities, India

II. INDIAN SMART CITY MISSION

i) What is expected? Why it is introduced?

According to experts who researched on the topic of smart cities and looked at the Indian conditions commented that India should first start with smart planning, seeking solutions, and having regulations. Also, what we learnt from previous section about the definition changes the perception of smart cities in India. It is confirmed that India is not looking forward to a technology focused smart city but a technology supported smart city. We need to understand the issues or the thought behind the concept of Indian smart cities. Nearly 31% of India's current population lives in Urban areas and contributes 63% of India's GDP (Census 2011), while the Indian Government is just investing 0.70 for urban development. The main challenge in front of Indian government is to urbanize the country on a bigger scale. Development of smart cities is a step in that direction.

It was only in the last two decades that a growing "concern" about urban development, regional planning, spatial planning and so on has been felt in India. And this concern has resulted in

- a) studies of existing urban problems within the given state of conditions, and
- b) studies of problems which would transform into various degrees of intensity in future (Das 1981).

But, urbanisation poses its own challenges which need to be addressed to harness its full potential. With the rising urban population in cities, there is increased pressure on the basic infrastructure and services like water, sanitation, waste management, housing and transportation. Cities lack severely in holistic spatial plan preparation, implementation and enforcement and this is leading to sprawling, low density and haphazard development. The existing infrastructure in Indian cities is overstretched and creaking and cities are not able to deliver basic amenities like clean water, sanitation, housing and public transport to all the citizens particularly the urban poor. As per census 2011, only 71 percent of urban households has access to piped water supply and 12 percent households are covered by sewer connection. About 17 percent of urban population is living in slums, which is a cause of concern as it can lead to social unrest. There is shortage of about 2 crore houses in urban areas and a major part of this i.e. 96 percent is in economically weaker sections and low income groups. (Mehta & Kant, 2016)

How they are different from other cities?

There is no universally accepted definition of smart cities. It depends on various factors of growth and development of the city. In fact, we cannot even generalize this term for all the Indian cities. Each city having their own characteristics and identity proposes new elements or follow new methods to upgrade their urbanization. There is no doubt that we need to nurture, preserve the identity and renew the urban fabric with changing times. However, there is also a need to build new cities. A city is an economy of agglomeration; it provides various advantages and opportunities. That is why we all flock to the cities in search of a better future. However, there would be limits beyond which things would become very difficult to sustain. India struggles with a number of significant barriers that continue to hamper the development of urban infrastructure: complex leadership structures, land valuation challenges, capability gaps, and funding shortfalls are all part of the urban challenge that is effectively holding India back from a new round of dramatic economic growth. India also needs to address the current problems of developing good infrastructure, solid waste disposal, flood management, storm water and sewerage system etc. resulting in urban decay, traffic gridlock and thereby a deteriorating quality of life for many of its citizens. So the Smart City Mission creates a set of guidelines to be followed in all the cities. But the final approach of the city can be different.

ii) The proposal and mission statement

Proposed by: Ministry of Urban Development,
Government of India

Proposed on: June 2015

Effective period: 30 years

The main issue which every dweller of India is facing is the uneven distribution of infrastructure and services all over the country. Thus India, is on the road to building smart cities—world-class, self-sustainable habitats with minimal pollution levels, maximum recycling, optimized energy supplies and efficient public transportation. In the smart city mission, the designers and the planners are aiming towards quality infrastructure as a reflection of urbanized places. The goal is to develop the entire urban eco-system, which is represented by four pillars of comprehensive development- institutional, physical, social and economic infrastructure. This is a long term goal and the method will be putting layers of smartness to the developed comprehensive infrastructural layers.

The objective behind the mission was to provide a higher quality of life, clean and sustainable environment to the citizens including smart solutions. Initially the Indian Prime Minister, Narendra Modi, who was former chief minister of Gujarat, proposed to develop Ahmedabad (capital city of Gujarat) as a model city, which can be replicated over other aspiring cities in India. Later, the notion was extended to a greater level as Indian smart cities, where he proposed 100 smart cities in India from all the states and different regions of the country. As per as the Census 2011, there are 495 cities with population above 100,000. There are 4,041 statutory towns and 3,894 census towns. These proposed 100 smart cities will be model cities, whose concepts can be replicated and used in all other urban and rural areas of India.

The core infrastructure elements in an Indian smart city would include:

- i. adequate water supply,
- ii. assured electricity supply,
- iii. sanitation, including solid waste management,
- iv. efficient urban mobility and public transport,
- v. affordable housing, especially for the poor,
- vi. robust IT connectivity and digitalization,
- vii. good governance, especially e-Governance and citizen participation,

viii. sustainable environment,

ix. safety and security of citizens, particularly women, children and the elderly, and

x. health and education

Selection of 100 cities

Indian central government shortlisted 100 potential smart cities and asked for specific city proposals from the state government. On which the state government consulted all the associated professionals and prepared a proposal/ masterplan and responded to the central government. Evaluation was done on the basis of feasibility in terms of resources, economy and practicality by a panel of experts. All the proposals were scored on common grounds. From where, the first 20 cities were selected to start with the implementation process. Other proposals were sent for further improvement.

1. Bhubaneswar, Odisha
2. Pune, Maharashtra
3. Jaipur, Rajasthan
4. Surat, Gujarat
5. Kochi, Kerala
6. Ahmedabad, Gujarat
7. Jabalpur, Madhya Pradesh
8. Visakhapatnam, Andhra Pradesh
9. Solapur, Maharashtra
10. Davangere, Karnataka
11. Indore, Madhya Pradesh
12. New Delhi Municipal Corporation
13. Coimbatore, Tamil Nadu
14. Kakinada, Andhra Pradesh
15. Belagavi, Karnataka
16. Udaipur, Rajasthan
17. Guwahati, Assam
18. Chennai, Tamil Nadu
19. Ludhiana, Punjab
20. Bhopal, Madhya Pradesh

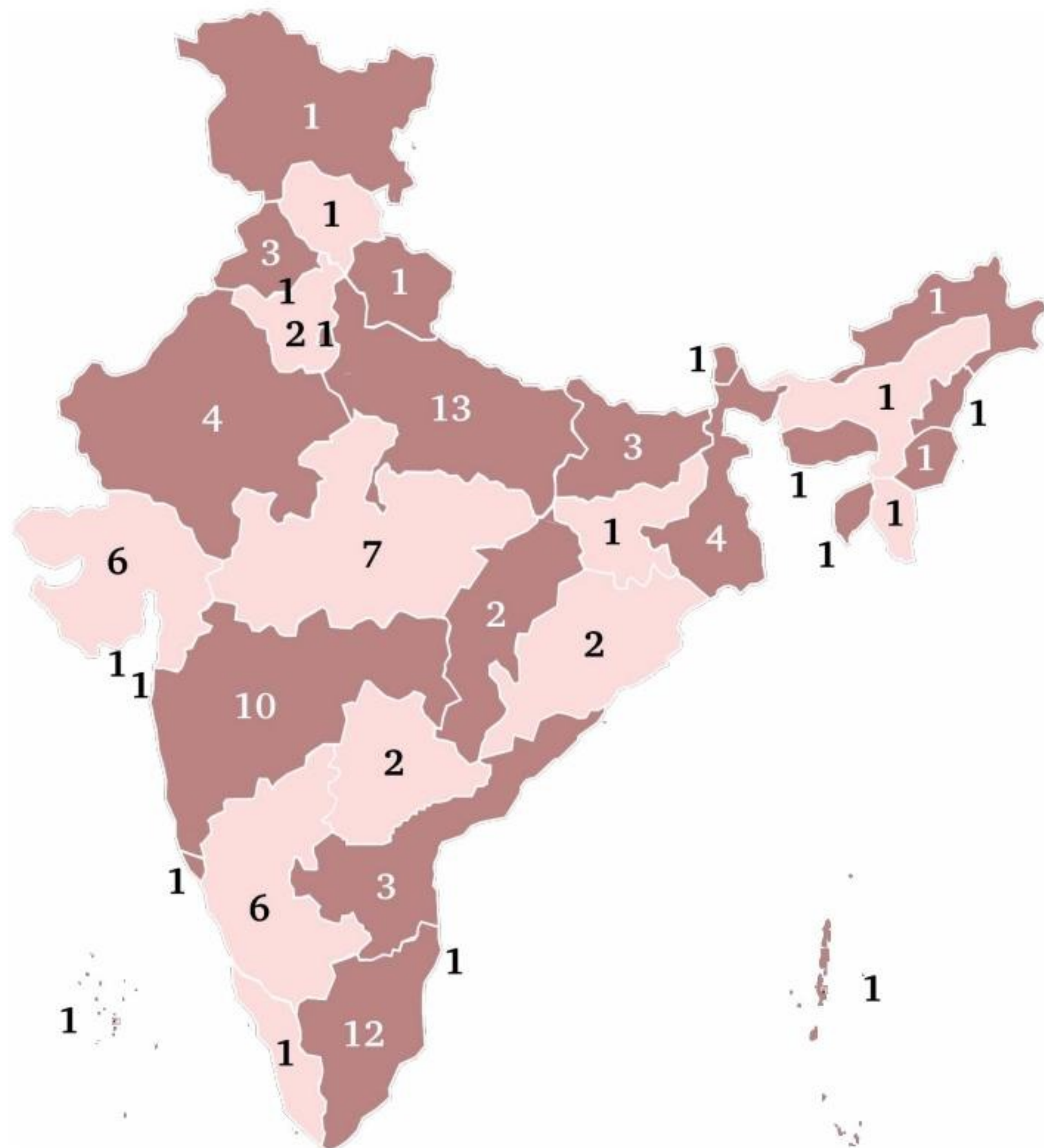


Fig 5.2: Indian smart city lists from each states
Source: Ministry of Urban Development, Government of India, Smart Cities:
Mission Statement & Guidelines, June 2015

iii) Strategies and features

The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes. Area-based development will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving liveability of the whole City. New areas (greenfield) will be developed around cities 7 in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive Cities. (Development, 2015)

The smart city proposal enlisted two development strategies: Pan-City development and Area-based Development. Pan-city development envisages application of selected smart solutions to the existing city wide infrastructure. This would be refining and managing the existing infrastructure and services

for affective productivity. Second is the area-based development which consists of three strategic components; Retrofitting, Redevelopment and Greenfield.

1. Retrofitting model is the planning of an existing built up area (consisting of more than 500 acres) considering objectives of that place to achieve smart city objectives, to make the existing area more efficient and liveable.

2. Redevelopment is creating a new layout for and existing area (more than 50 acres) with enhanced infrastructure, using mixed use and increasing density. This kind of layout will support the new policies of mixed landuse, higher FSI and high ground coverage.

3. Greenfield is to develop a previously vacant area (more than 250 acres) into affordable housing for the poor. This should be done using innovative planning, plan financing and implementation tools like land pooling, land reconstitution etc. This will help the city expansion in an organized manner.

Smart city features

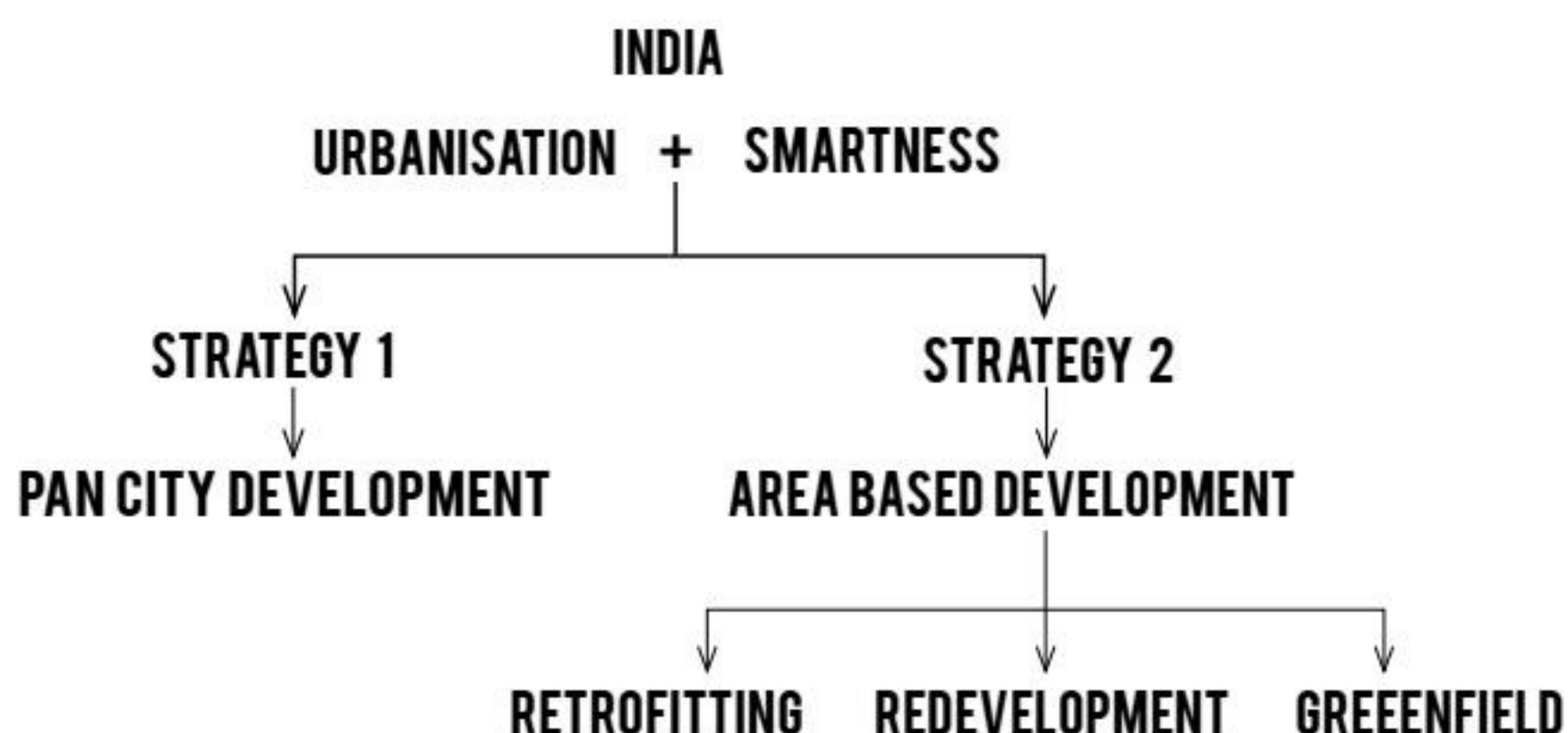




Fig 5.3: Area-Based Development Strategies

Source: World Economic Forum, Shaping the Future of Urban Development & Services and PwC research

In the Indian smart city proposal, there are few typical features enlisted which are stepping stones to basic urban development. Before implementing any technological initiative, it is mandatory to keep a check on developments if they are catering the basic needs of the dwellers and the city.

1. Promoting mixed land use
2. Expanding housing opportunities
3. Creating walkable localities; pedestrian and cyclist friendly paths
4. Preserving and developing open spaces
5. Variety of transport options; focusing on regional connectivity
6. Citizen-friendly and cost effective government
7. Preserving or creating city identity
8. Smart solutions to infrastructure and services.

The Government envisages the following elements as integral parts of every Smart City:

- Assured electricity supply with at least 10% of the energy requirements met through renewable energy.
- Adequate water supply with the recycling of waste water, harvesting and the reuse of storm water.
- Adequate urban transport with an emphasis on nonmotorized transport, pedestrian-friendly pathways, intelligent traffic management and smart parking facilities.
- Enhanced citizen experiences with engaging usage of open spaces and a safe environment for women, children and the elderly.

iv) Financing the Smart Cities

Funding and execution will be a huge challenge for companies under the centre's ambitious smart city project, according to a study.

"The mission is expected to improve the quality of life for citizens of these cities. For government, the focus is on sustainable and inclusive development and the idea is to look at compact areas and create a replicable model. However, the issue lies in the execution," Equirus Securities Executive Director Pankaj Sharma said in a statement.

Under the mission, it will be operated as a centrally sponsored scheme and the centre will give financial support to the extent of Rs 48,000 crore over five

years, which is on an average Rs 1,000 crore per city per year."An equal amount, on a matching basis, will have to be contributed by the state and urban local bodies. If we look at the list of cities which have been designated as smart, many of them would already have annual municipal budgets running into multiple times of this figure. Also, the track record of Public-Private Partnership (PPP) projects is at best mixed and when there would be multiple parties involved like the centre, states, local bodies and private entities, the task would be even more challenging,"

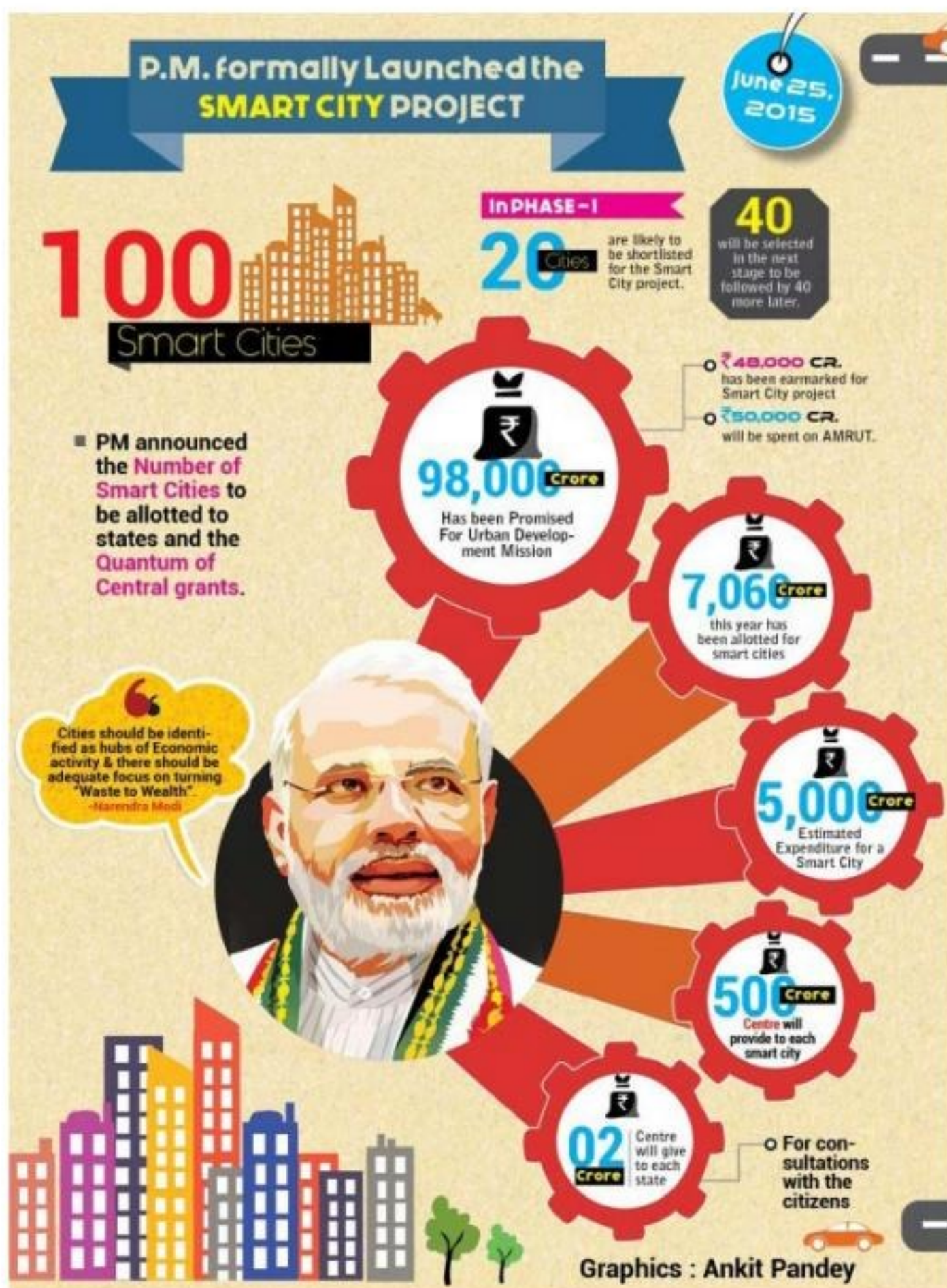


Fig 5.4: Financial announcement of the smart city mission
Source: Smart city guidelines, MoUD

As per the residents of India,

"The NDA government has be fooled the people of India by declaring smart city mission. The poor states in the country can hardly dare to execute the costlier projects like smart city mission. If the NDA government was in short of finance, then, it should not have talked of any big projects like smart city mission. The smart city project will have to be 100% centrally funded."

INDIA TO SPEND \$580 MILLION TO DEVELOP FIRST 20 'SMART CITIES'

INDIA'S GOVERNMENT WILL PROVIDE 40 BILLION RUPEES (\$580 MILLION) TO UPGRADE THE INFRASTRUCTURE OF THE FIRST 20 CITIES SELECTED UNDER PRIME MINISTER NARENDRA MODI'S SMART CITIES PROGRAM, ACCORDING TO A STATEMENT FROM THE MINISTRY OF URBAN DEVELOPMENT ON SATURDAY.

Six cities — Jabalpur, Indore and Bhopal in the central state of Madhya Pradesh, and Jaipur and Udaipur in the state of Rajasthan — have set up special purpose vehicles to implement the government's plan to promote digital and information technology and best practices in urban planning. This is the first phase of the government's plan to convert 100 cities in the country by 2020 to so-called smart cities as a push toward improving quality of life through urbanization. India will invest more than 500 billion rupees in the drive over the next five years.



AS SMART CITIES TAKE SHAPE, MOUD SEEKS RS 6,400-CRORE PUSH

IN THE SECOND YEAR OF THE SMART CITIES MISSION, THE MINISTRY OF URBAN DEVELOPMENT (MOUD) IS SEEKING A RS 6,400 CRORE PUSH TO ONE OF PRIME MINISTER NARENDRA MODI'S PET INITIATIVES. WITH 60 CITIES IN DIFFERENT STAGES OF IMPLEMENTING THE PROGRAMME, THE MINISTRY IS LOOKING TO INCREASE ITS OUTLAY BY NEARLY 80%.

The urban development ministry has written to the finance ministry that the outlay of Rs 3,600 crore for the current fiscal is insufficient and needs to be increased to Rs 10,000 crore at the revised estimates stage, terming the enhanced outlay "critical" funding over the next four months.



- ◆ To underline the urgency, the ministry has also written to the Prime Minister's Office to weigh in, officials said. Of the 100 cities under the mission, 28 were selected last year through the 'India Smart Cities Challenge'.
- ◆ In the second year, these 28 cities need to be given Rs 100 crore each by the Centre. This translates into a commitment of Rs 2,800 crore. This year, a second fast track round was conducted to choose 13 cities, which need to be given Rs 200 crore each, or Rs 2,600 crore in all.
- ◆ The last round, concluded in September, threw up another 27 cities, which again need Rs 200 crore each, or support amounting to Rs 5,400 crore.

“The total outlay should be Rs 10,000 crore but the mission has been earmarked only Rs 3,600 crore. The shortfall of Rs 6,400 crore needs to be made good. This is why we have sought additional funds. It is critical to the progress of the mission. We have reached the halfway mark and now cities will be implementing projects. Funds are critical here.”

A Senior Ministry Official Told ET.

The official further said, Since the PMO is closely monitoring the flagship programme, the ministry has impressed upon it that the funds are necessary for its timely implementation, the official said.

Source: ET

India has also been inviting foreign partnership in developing the smart cities and has signed deals to build eight cities – three with Germany, three with the US, and one each with Spain and Singapore.

The “unique approach” of India’s Smart Cities mission is the reason why Germany has decided to partner with three Indian “Smart Cities” - Bhubaneswar, Kochi and Coimbatore – according to Martin Ney, German ambassador to India. Inaugurating “CityScapes 2016”, a three-day conference in the National Capital organised by DWIH (German House for Research and Innovation), he said: “Germany brings to the table not only decades of expertise and experience with city planning, but also the technological solutions that German companies have to offer in the area of energy, water, waste treatment, and traffic solutions.”

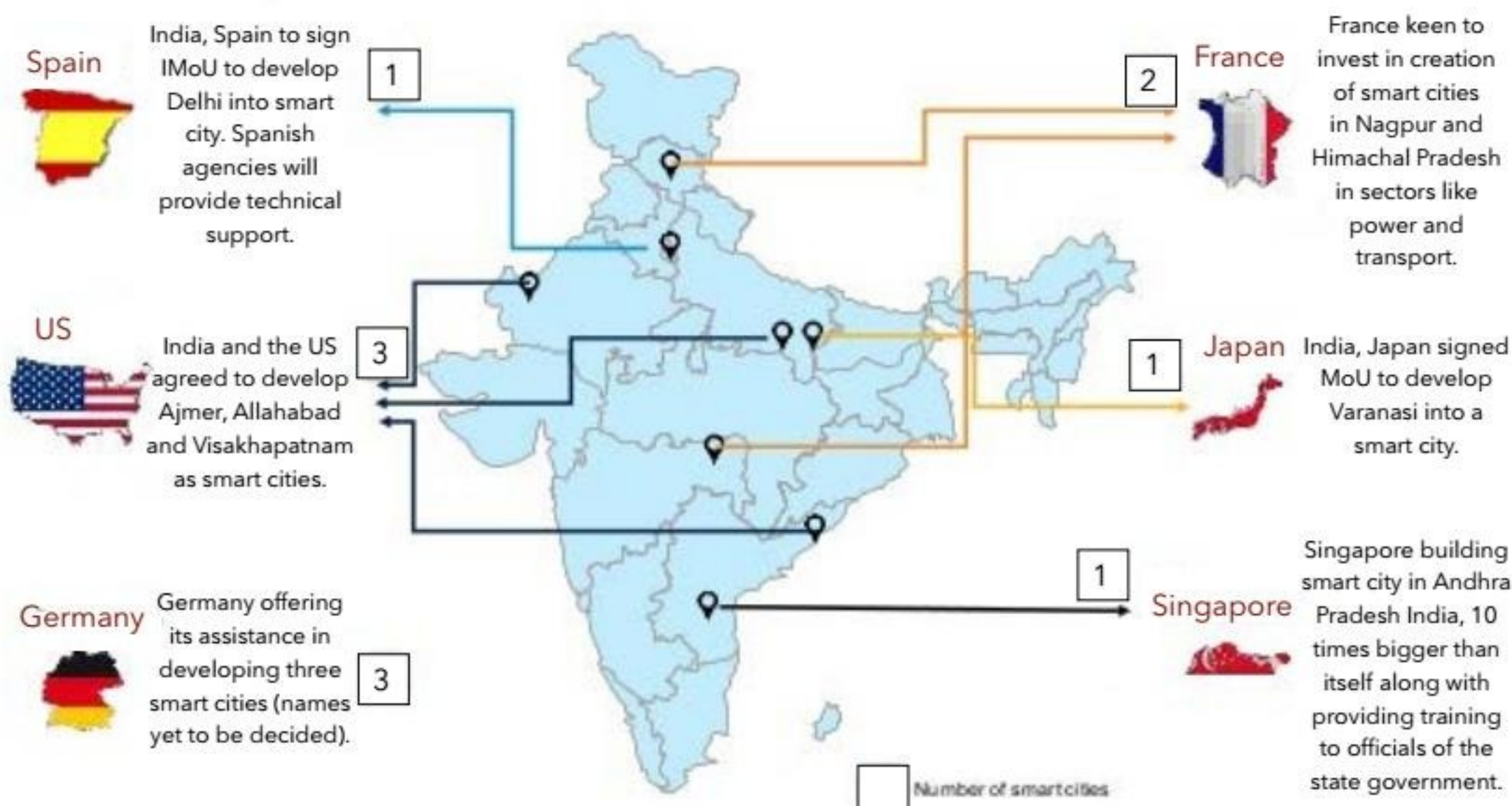
Fig 5.5: Financing Indian smart cities in news

Source: Economic Times

Fig 5.6: Foreign investments on Indian smart cities

Source: Smart city guidelines, MoUD

Multiple foreign countries are looking forward to invest and participate in the development of smart cities in India



III. CRITICISM ON INDIAN SMART CITY MISSION

From lack of infrastructure to concentrated poverty, megacities—urban areas of 10 million or more people—present significant challenges for any local government. Concerns over social inequality have also long been a fixture of the discourse around megacities, especially so in India where there are six such metropolitan areas amid a culture defined by the hierarchies of the caste system. At the moment, however, the issue of urban exclusion in India is now coalescing around that nation's burgeoning smart city movement (ASSINK 2017).

Indian smart city efforts need to recognise the economic differences between its cities. Only improvement of infrastructure, especially road network is being talked about in the government proposal, which is not exactly is the accurate way to plan for the future. There is a need of understanding the basics of creating the smart city by all the related actors, stakeholders and users. Few points where the people are perceiving the concept wrong in Indian scenario are:

1. the "Smart City" isn't a technology concept; it's the political challenge of adapting one of the most powerful economic and social forces of our time to the needs of the places where most of us live and work.
2. Cities won't get smart if their leaders aren't involved in actively driving their institutions to adopt new business cases and operating models.
3. Smart cities aren't top down or bottom up. They're both.
4. No-one will do this for us - we have to act for ourselves.

Indian smart city proposal is majorly criticized on the following points:

1. Urban planning approaches - new or expand existing?

There is always a question to argue upon whether it is better to create a new city from the scratch or expanding an already developed and growing city. New cities typically take between 20-30 years to develop into sustainable communities. But according to the ISCM, the additional smartness to a grown city will take 30 years as well.

2. Definition of a smart city

Instead of hi-tech definitions, the SCM guidelines specifically stated that there is no universally accepted definition of a smart city. Indeed, a smart city would have a different connotation in India than, say, Europe. Thus, no definition is clearly mentioned. But a personalized definition is still needed to spread the objectives and goals of the proposal.

3. Scope - tech or people focus?

Perhaps the best thing about the SCM guidelines was the focus on a decent quality of life to its citizens, with smart solutions as a secondary contributor. Here as well there is a difference between the explained theory and practical projects proposed.

4. Limited financing and geographical coverage

Critics said that Rs 500 crores over 5 years (about USD 80 mn) would be insignificant for a large city, and in any case, taking a small area was not significant enough. Thus the project should introduce smart small scale smartness rather city scale infrastructures.

5. Rural-urban priorities

Some critics said that instead of smart cities, India should develop smart villages.

There are some scope for improvement in SCM, of course. I will try to find out opportunities to make the proposal more suitable from citizens point of view.

Without hard work and attention to justice, this model could end up excluding those who would most benefit from it, or worse, divert funds from other distressed places. In India's rush to transform, build, and even engineer entire new cities, critics are right to raise concerns about citizenship and access (ASSINK 2017).

IV. EVALUATION OF THE PROPOSAL

India is urbanising very fast and as per UN Habitat Report of 2016, about 32 percent (420 million people) of population is living in urban areas. As per projections, the urbanisation level is expected to cross 50 percent by 2050 when one out of every two Indians would be living in cities. There is a mega wave of urbanisation on the anvil that needs to be managed well so that cities can attract investments, become hubs of growth, talent, creativity and innovation, thereby creating vibrant habitats for millions of citizens, including those moving from rural to urban areas in anticipation of promising opportunities. (Mehta & Kant, 2016)

So, introducing the smart city proposal is a thoughtful approach to direct the growth towards a positive unchaotic and liveable country. Thus, in my opinion the proposal stands right at the development stage, but in terms of impact and implementation, maybe there are scope for betterment. The global definitions and the specific Indian definitions clearly confirms the differences between the key focus universally and for a specific context. Here, in this section I will try to generate a list of criteria to evaluate the Indian smart city proposal based in the global and local aspects.

1. **Objectives-** The objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'smart' solutions.' I feel this fits perfectly according to the need and the current situation of India, but the problem is with the project proposals, which are not following these objectives.
2. **Strategy and its extents-** The broad division of two strategies are pan city development and area based development is a good approach as they work on three models of greenfield, redevelopment and retrofitting. In my opinion, pan city development would be less successful as the Indian cities are too big (in terms of area) to be tackled at the same time. That will need a lot of investment of time and money.
3. **Definitional Appropriateness-** The definition stated by the government is merely a combination of strategies and objectives. But there is a lack of detailed focus that is to be followed by the projects of smart city. Because

of this inappropriateness, the proposals are not matching the quoted objectives.

4. **Citizen Inclusion:** The mission statement suggests that there will be an establishment of City Advisory form containing District Collector, MP, MLA, Mayor, CEO of SPV, local youths, technical experts, and representative of Associations. The other smarter city approach towards citizen engagement is way different than including them only for advices. From the study of smart city applications and the theory of citizen enagement, I would say, the population (which is a lot in India) should be used in developing the cities in real projects.

5. **Financing of the project:** How does a limited amount of Rs 500 crores over 5 years in a small area make a city smart? The amount quoted by the government is too less to cover the large city areas. But the positive part is the international assistance that the prime minister is trying to get to finance the smart city projects. This seems to be a good opportunity for India to learn from those countries as well. Other than this, the number of stakeholders for each project can be increased to have a shared economy and faster implementation.

6. **Project monitoring:** There are organizations created at the national level, state level and city level to monitor the projects and implications. But there should be small scale authorities to enage the citizens in this process as well. The actual change (positive or negative) due to the project can be only assessed by the users and not bigger authorities.

7. **Impact of proposal on the City:** If all the city scale projects can be carried out properly then the impact of the proposal would be countable, otherwise big infrastructure change in patches create chaotic situations in the city, if not planned well.

8. **Impact on the Citizens:** The citizens seems interested in the project and are ready to be a part of it. But the proposed projects are not including citizens in an accurate manner. Thus, the citizens are complaining and criticizing the Indian smart city mission.

V. EXAMPLE CITIES

a) New Delhi

The New Delhi Municipal Council (NDMC) is one of three statutory urban regions within the state of Delhi, the other two being the Municipal Corporation of Delhi (MCD) and the Delhi Cantonment Board (DCB). The NDMC lies within the urban agglomeration of Delhi Metropolitan and since the urban region is part of the National Capital Region, it is jointly governed by local municipal as well as the state and federal governments. The area within the NDMC covers central parts of Delhi which were planned and developed by British architect Sir Edwin Lutyens as the British capital of India which was inaugurated in 1931. Today, this area remains the seat of government for the India, and continues to house government offices and diplomatic missions. Although New Delhi is the largest commercial centre in northern India, parts of the NDMC face considerable challenges with air pollution, traffic congestion, and densification.

Hard Facts:

Population - 257803

Population Density (person per sq Kms) - 6032

Area - 42.74 Kms

Overall liveability:

- Well Connected
- Good infrastructure and services
- High Job Opportunities
- Quick Growth
- Reachable and supportive government

Identity-

- Mixture of all cultures and traditions
- Multi national companies
- All class people- specific areas
- Hindu: Muslim- 80:20%

Issues:

- Scarcity of area
- Traffic Congestion
- Overloading population
- Migration from other small towns and cities
- Uneven distribution of resources

Potentials

- Equitable Growth in all the sectors
- Supportive Government
- Modern people: technology acceptance
- In-house Resources

Government:

The institutional framework for urban management in Delhi has a multiplicity of agencies, both central and state. They also look after various functions relating to urban infrastructure and its management. The New Delhi Municipal Council is one of the 5 Urban local bodies in National Capital Territory (NCT) of Delhi. The Central Government has retained most of the controlling powers over the NDMC, except that the Government of NCT of Delhi can also prescribe discretionary functions for the committee through general or specific orders. The GNCTD can also get the accounts of the committee audited. The Chairman who is the executive head of NDMC is accounts of the committee audited. The Chairman who is the executive head of NDMC is appointed by the Central Government, in consultation with the Chief Minister of the NCT. The NDMC is responsible for providing basic civic amenities. It also ensures various social, cultural, educational and medical facilities, especially to the government/ municipal employees and other weaker sections of society.

The Delhi Development authority (DDA), a body corporate, has been set up in 1957. The functions and powers of the DDA is to formulate a master plan for covering the present and future growth of Delhi; preparing schemes and advising the concerned authorities departments and agencies in formulating and undertaking schemes for development agriculture, horticulture, floriculture, forestry, transport, communication, schooling, etc; institutional & industrial development as part of city building, to acquire, hold, manage and dispose of property; acquire land for public purpose under the provisions of land acquisition act 1984.

The administrative responsibilities of the National Capital Territory of Delhi (NCT) are shared by five governing bodies



Fig 5.7: New Delhi governmental administration
Source: NDMC website

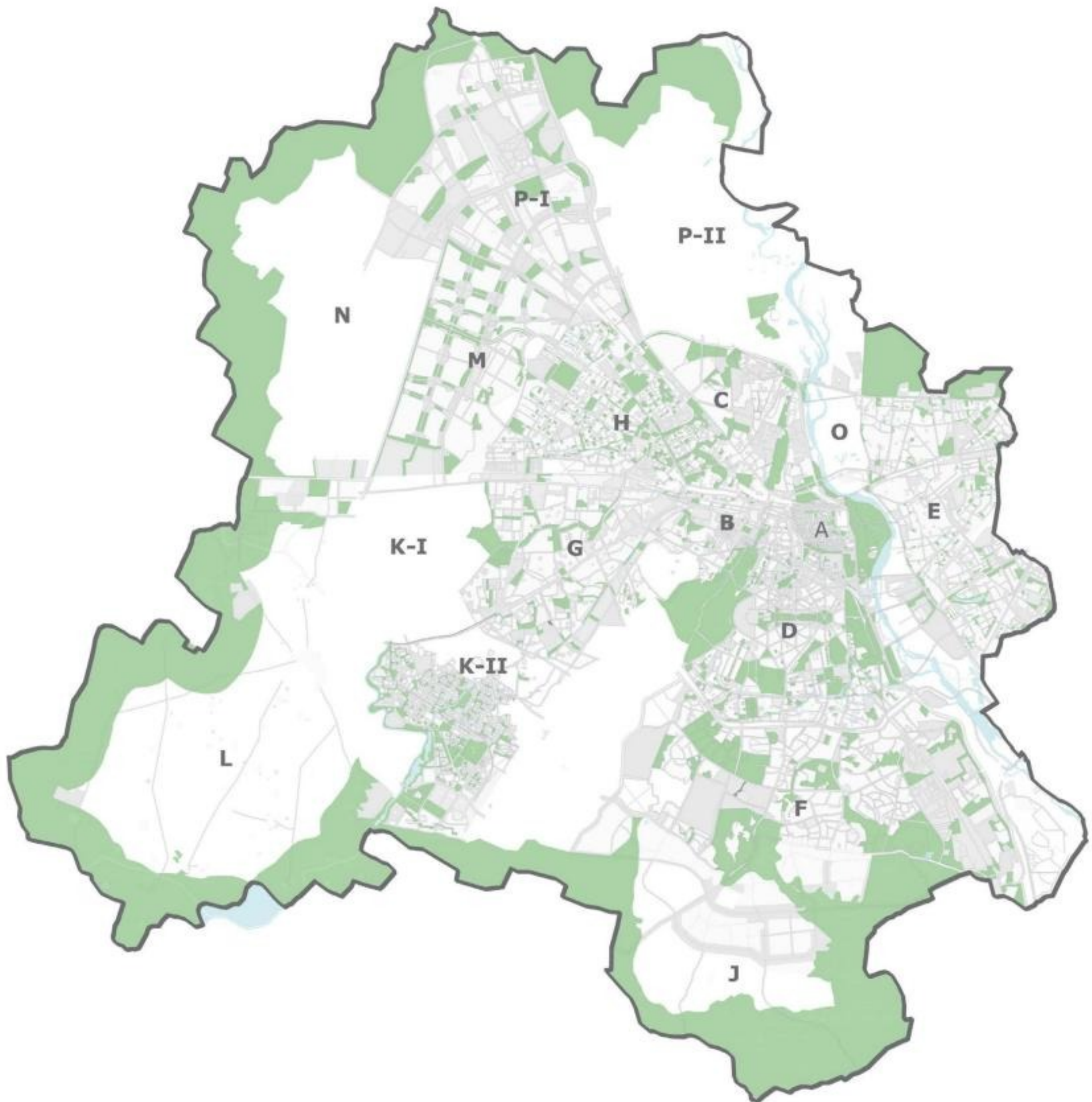


Fig 5.8: New Delhi map
Source: Open street Map, Edited by Author



Fig 5.9: New Delhi Issues and citizen concerns

1) Citizens expressing their awareness about increasing pollution in Delhi

Source:

2) Traffic Congestion on an normal day.

Source:

The Endless City

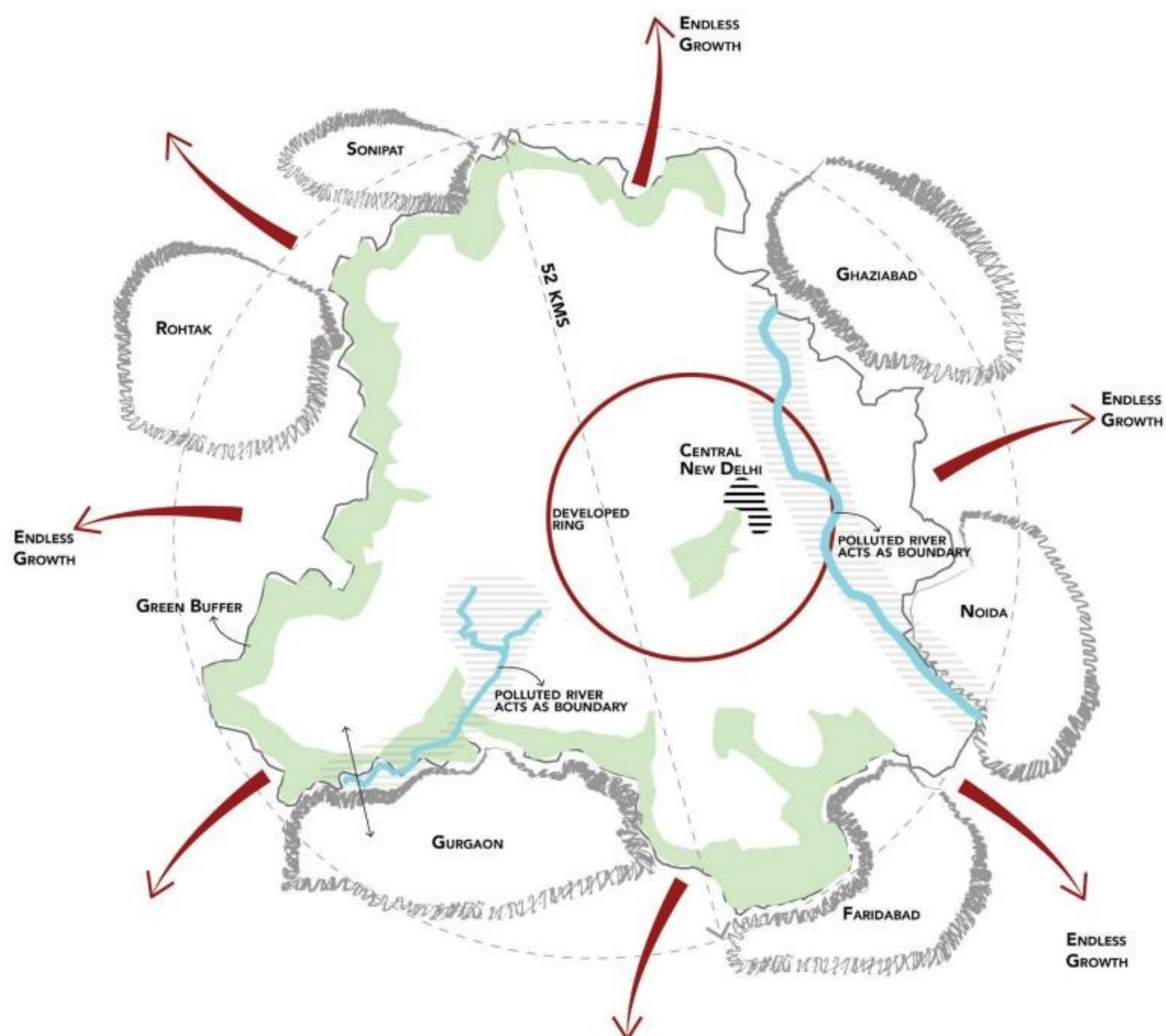


Fig 5.10: New Delhi analysis map
Source: Drawn by Author

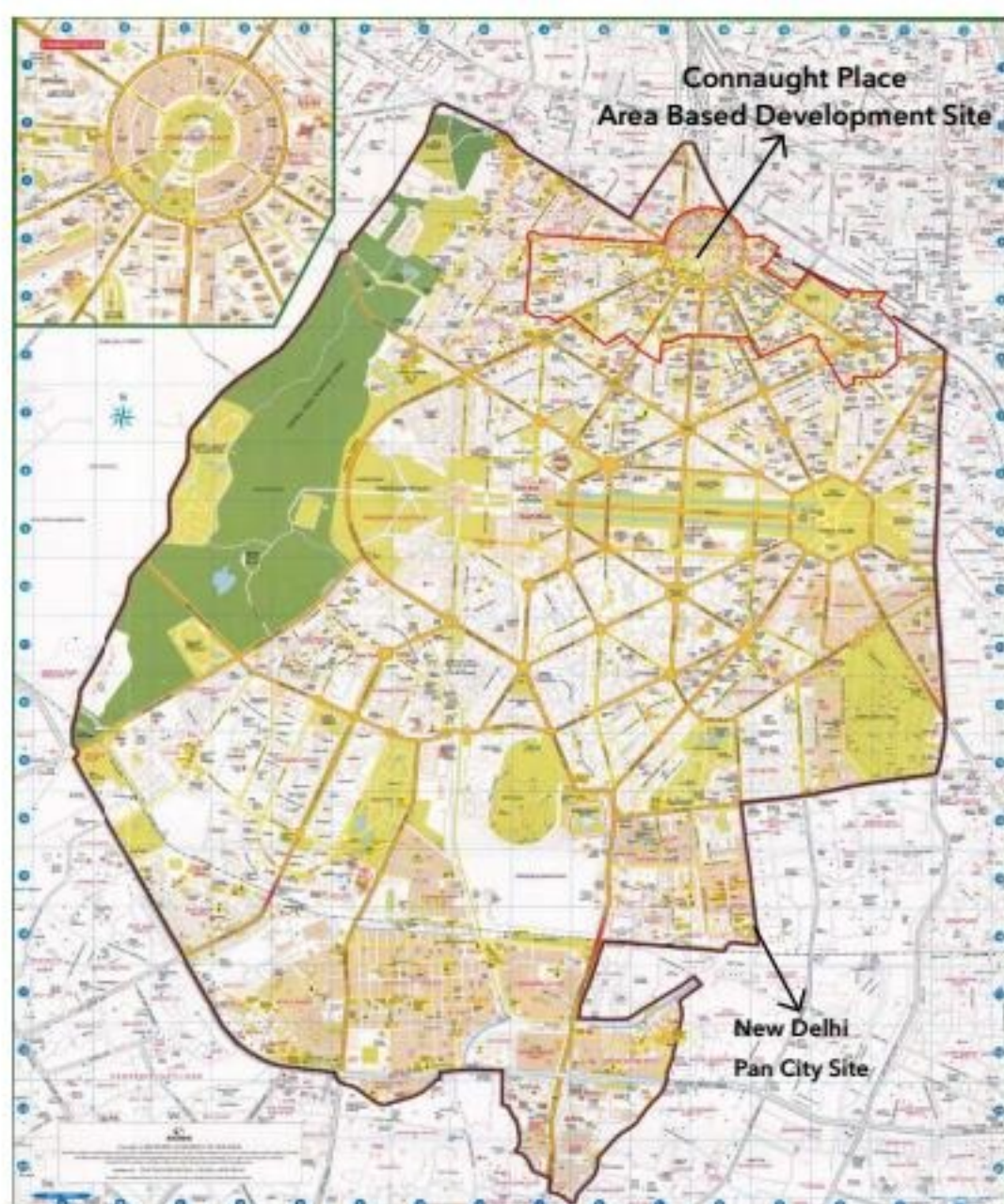
The city of New Delhi is known as the migration centre of India. People from all over the country visit or reside in Delhi due to standard of living, facilities and amenities, job opportunities etc. But because of this reason the city growth is endless. The population density is insanely high and all the infrastructure distribution is going down. The present infrastructure (mobility and transport or services) are unable to cater

the needs of the crowd. The extension is happening in an orderly manner, where small suburb cities are growing along the edges of Delhi which are with time being included in the NCR (National capital region). So the services which were meant for a certain amount of people are used by endless people residing along the edges. Thus, the most important steps or strategies towards Delhi should be focussed on this issues.

Smart City : New Delhi

PHYSICAL INFRASTRUCTURE The Pan City proposals 1. Smart Grid and Energy Management Smart Grid Implementation 2. Smart Water and waste Management	SOCIAL INFRASTRUCTURE 1. Smart Education 2. Smart Health	VALUE INFRASTRUCTURE 1. E-governance 2. Citizen Feedback System
The Area Based Development proposals 1. Urban Mobility & Smart Parking 2. Sensor based Common Service Utility Duct 3. Transformation of electric- Poles in to Smart Poles 4. Hierarchical Command and Control Centre 5. Rooftop Solar Panels 6. Happiness area for the cultural and social needs of citizens 7. Transforming sub-ways into vibrant spaces 8. Signature Giant Smart Digital Screen 9. Municipal Solid Waste Management	1. Transforming Public Toilets into Smart Public Amenities Centre 2. Financial, Identity, Ticketing & Access inclusion	1. Introducing signature initiative to the city's Identity and Culture 2. Behavioural transformation

Table 5.1: New Delhi Smart City Proposal
Source: Drawn by author



Smart City Proposal Vision: Smart city as smart people

Smart City Mission:

The goals emerging from the city vision are:

- 1) Urban mobility
Enhanced access to sustainable public transport, smart parking, non-motorized vehicles (NMVs) and last mile connectivity.
- 2) Inclusive city
Addressing the needs of the most vulnerable citizens including women, children, disabled and transgender individuals
- 3) City planning and design
Improved quality of life through citizen focused planning
- 4) Social development
Focus on improved education and healthcare through incorporation of ICT
- 5) World's capital
Setting global standards to meet citizens aspirations

Fig 5.11: Map of New Delhi Smart City Proposal
Source: New Delhi Municipal Council (Developed for Round 1 - Stage 2 of Smart City Challenge, December 2015)

**MAP for Area based Proposal,
New Delhi City Center (NDCC)**



The central part of New Delhi, which is also one of the most high maintained areas in Delhi is a huge commercial and institutional centre. It serves as the most prominent public activity space in Delhi. The reason behind selection of this place by the government is to create an ideal model of public space in the city, which can be followed in other parts as well. The main change in the proposal is to create a pedestrian friendly zone, eliminating the vehicular access around the square, which will need a lot of transportation planning as well, being the most centralized area connected to all the parts of the city. Following is the detailed projects that NDMC proposed on a specific area.

Area Based Projects

- Parking/EV-Charging User Charges
- Advertisements / Kiosk rental from public amenities centres
- Advertisements through Signature Giant Smart Digital Screen & Smart Poles
- Advertisements/User charges from Global Capital Cities Awards
- Sponsorship from laser & sound show
- Share of transactions from single card access
- Sale of gas from green to gas plants
- Electricity tariff revenue from solar rooftop

- Cost savings to NDMC due to AT&C loss reduction;
- Water tariff revenue to NDMC
- Saving of water charges to NDMC through usage of grey water using mini STPs
- Selling of power to grid through installation of 40 MW Solar Plants

Source: New Delhi Municipal Council (Developed for Round 1 - Stage 2 of Smart City Challenge, December 2015)

b) Ahmedabad

Ahmedabad is the largest city in Gujarat, and the administrative capital of Ahmedabad district. It serves as the seat of Gujarat High Court and is the seventh largest metropolitan area in India. Ahmedabad is an important economic and industrial hub and is reported to be one of the fastest growing cities of the decade (Forbe's 2010).

Hard Facts:

Total Population- 5577940

Population Density (person per sq Kms.)- 11895

Area (sq. Kms)- 468.92

Overall livability:

- Well Connected
- Successful BRT's- Scope of improvement
- Developed riverfront
- Riverfront as a growth factor for the whole city
- Segregated and planned lanes for transportation
- Successful radial pattern planning
- Good mobility and infrastructure- Ring roads

Identity:

- Mostly residents are business class people, but not economy oriented people.
- Earlier the economy was based on cloth mills.
- Presently Handicrafts and khadi is a small part of it.
- More richer class people
- Culture oriented people
- Hindu: Muslim- 80:20%

Issues:

- Water logging problems during rains.
- Less job market
- Extremely bad water quality
- Dead city in the nights
- No natural surroundings
- Not citizen involvement

Potentials

- Education sector is growing. Too many technical universities in the city having potential for city expansion and economy growth.
- Recreation places in the city
- Modern people: technology acceptance

Valued city:

- Good transport system
- Adequate water supply
- Adequate electricity
- Effective and accessible Municipality
- Effective political involvement
- Safe city

Government:

The Ahmedabad Municipal Corporation (AMC) is headed by a Municipal commissioner, appointed by the government of Gujarat. He is the administrative head. The city is at present divided into six zones namely, central, east, west, north, south and new west zone. Each zone is further split into nine wards. There are 64 wards. Each ward is represented by 3 Corporators. An election is held to elect Corporators to after every 5 years. The mayor heads the party with the largest number of Corporators elected.

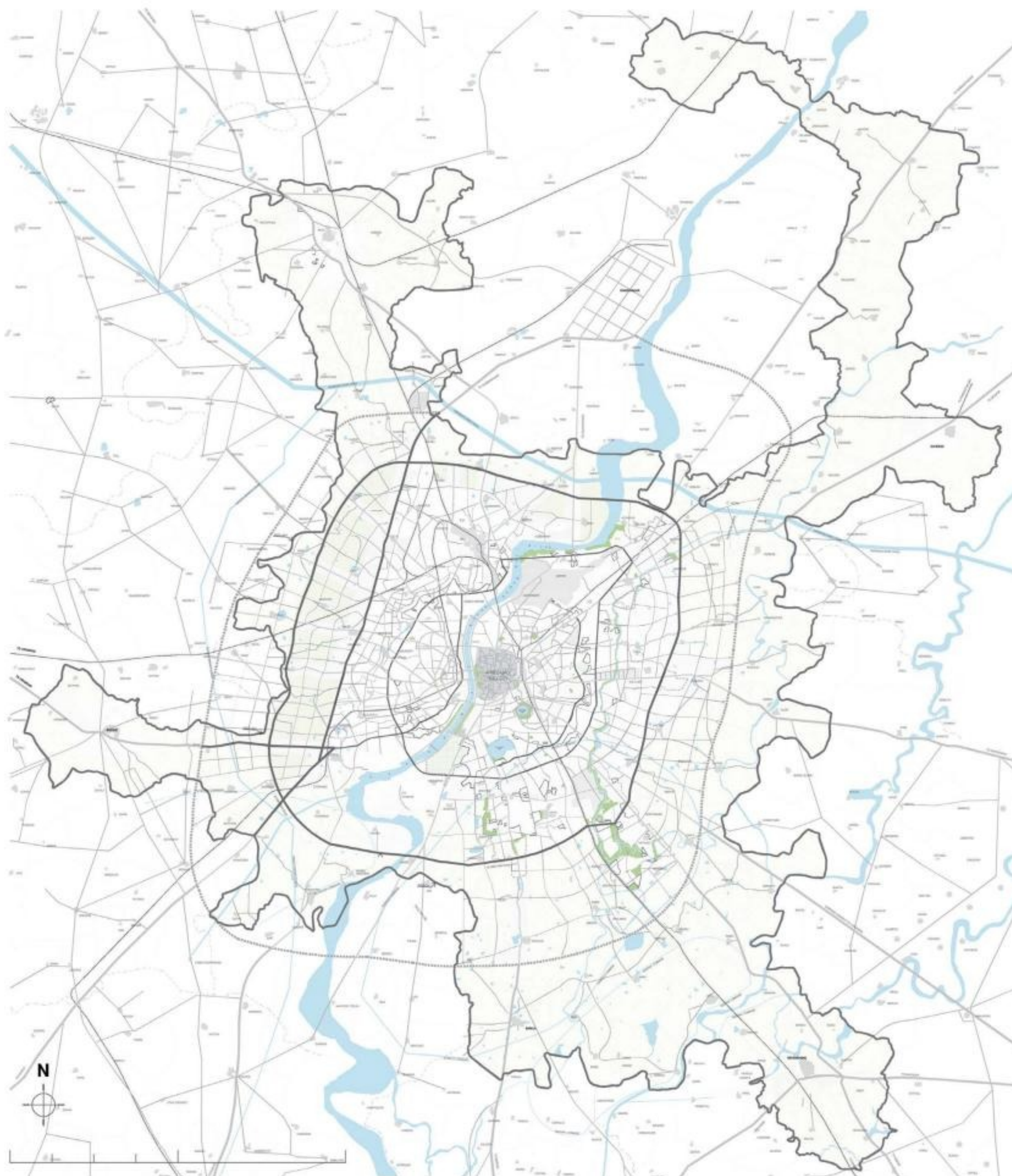


Fig 5.13: Ahmedabad City Map
Source: Drawn by author



Fig 5.14: Ahmedabad city positives and negatives

1. Water flooding due to excessive rain

Source:

5. Public friendly riverfront

Source:

The Fragmented City

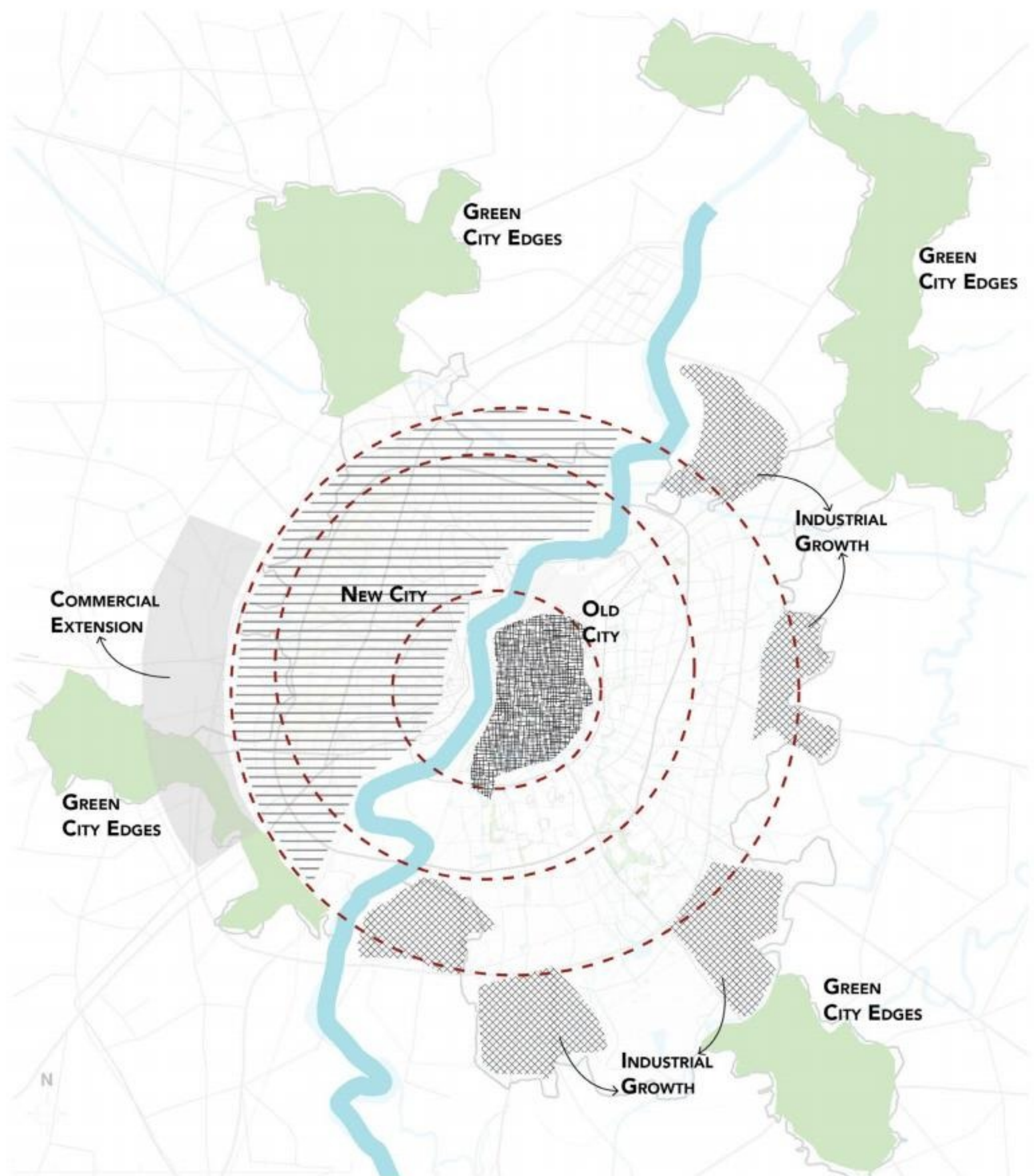


Fig 5.15: Ahmedabad City analysis Map
Source: Drawn by Author

Ahmedabad, being the capital city of Gujarat holds a lot of potential in terms of quality of life. The governmental structure works really well when it comes to the infrastructure and mobility of the city. The Sabarmati river cutting the city from the middle plays a vital role in providing the urban life as well as fragmenting the city

into two. The changes can be felt in terms of services, infrastructure, cultural differences etc. between the two halves. The main motive of designing of any kind of strategies or policies for this city would be the providing a strong connection between the fragments.

Smart City : Ahmedabad

Vision:

Providing Efficient, Affordable, Equitable and Customized Governance for the Citizens of Ahmedabad

Mission:

- Targeted solutions for different sections, areas and population segments.
- Addressing requirements and problems for different segments differently.
- Employing smart and innovative measures to address common pan-city problems.
- Tackling foreseeable issues by employing proactive measures.



Fig 5.16: Ahmedabad Smart city Objectives and Initiatives
Source: Smart city proposal, Ahmedabad Municipal Corporation

Pan City Development: Ahmedabad

Two projects are taken up as Pan City Proposals for Ahmedabad as follows:

(a) Smart Transit - Integrated Transit Management Platform with Common Card Payment System - a web and mobile based application to ease access to public transit systems, provide real time tracking and plan trips & journeys. It intends application of smart solution - technology, information and data - to the existing and proposed transit infrastructure (BRTS, AMTS, GSRTC and proposed Metro) to improve public transit

(b) Command Control Centre (CCC) with OFC network

- The CCC will be an integrated system that will operate and manage multiple city service operations including real time monitoring and help in improving services delivery & governance. OFC's primary function will be to connect all AMC offices, city civic centers, urban health centers, schools and municipal buildings, thus reducing future bandwidth costs. Other applications are:

- Integration of existing control rooms - Traffic / AMTS / BRTS / E-governance / Pollution
- Emergency & Disaster Response System - Incident Management System with support from Fire, Police, Traffic, AMC and other departments
- Traffic control: Traffic management, offence tracking at major junctions & smart parking
- Environment & Climate monitoring - air quality monitors and automatic rain gauge stations

In line with the strategic principles of compact development and inclusive development, the area chosen is a contiguous ~590 acre area situated in Wadaj region near the Gandhi Ashram - an icon of the City of Ahmedabad. The project comprises of two major components -

1. Retrofitting Of ~515 Acres Of Transit Oriented Zone In Wadaj

The earmarked area extends 200m on either sides of the BRTS corridor. As per GDCR, FSI would be increased from 1.8 to 4. The project focuses on retrofitting of existing physical infrastructure for the densified development as well as extension of public realm in the area.

2. Redevelopment Of ~75 Acres Of Wadaj Slum

The project focuses on in-situ redevelopment of one of the largest slums (~8000 slum dwellers) by utilizing planning interventions, public-private partnerships & smart features. The project also involves creation of large public spaces and creation of an inter-modal transit hub to further encourage the use of public transport.

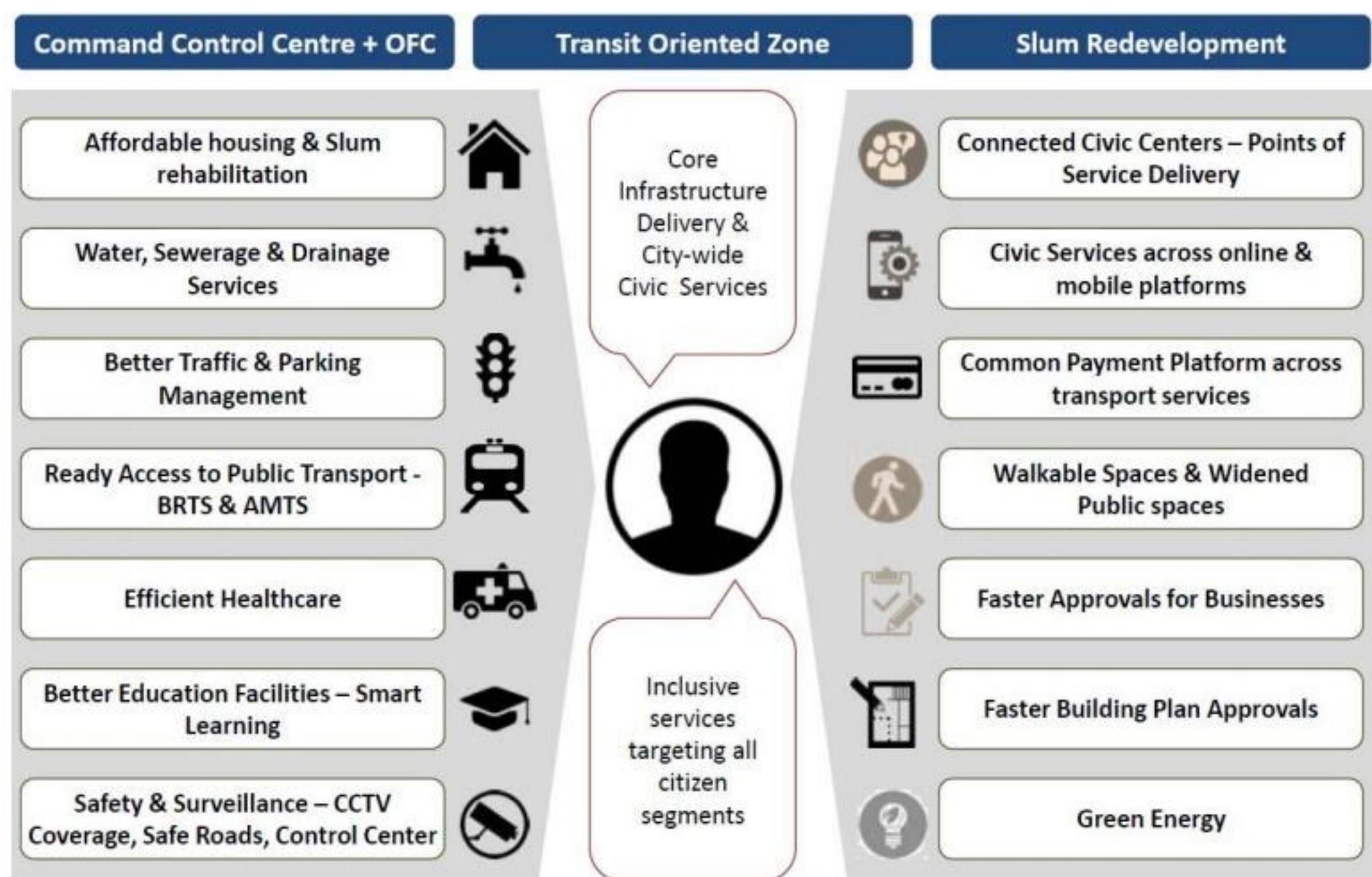


Fig 5.17: Ahmedabad Smart city Proposal
Source: Smart city proposal, Ahmedabad Municipal Corporation

Ahmedabad Area Based Development

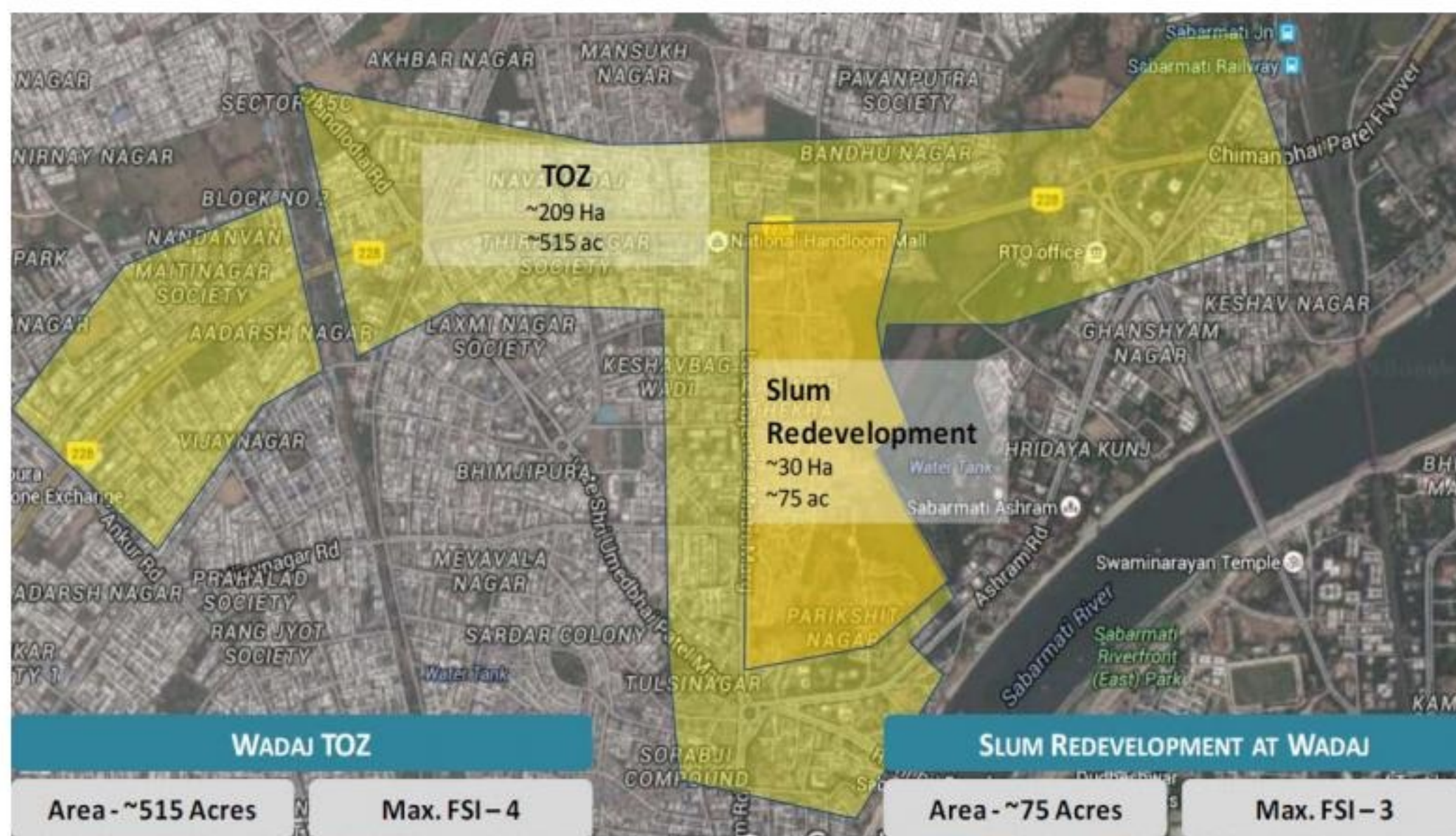


Fig 5.18: Ahmedabad Area based development proposal
Source: Smart city proposal, Ahmedabad Municipal Corporation

c) Pune

Pune is the second largest city in Maharashtra and the ninth most-populous city in India. The metropolitan area consists of two municipal corporations (including Pune) and three cantonments. Pune is located 150 km south-east of Mumbai, and the two cities are connected by an express highway. Pune has historically been an important economic hub in Maharashtra and continues to be so today, owing to the growing number of industries in the region: the automotive sector being most prominent.

Hard Facts:

Total Population - 3124458

Population Density (person per sq Kms.) - 11304

Area (sq. km)- 276.4

Overall livability:

- Pensula's Paradise
- Good climate
- Retired peaceful life
- Clean and well planned
- Good development and quick growth
- Natural serenity

Identity:

- Military base camps
- Service class People
- Modern people: technology acceptance
- Traditional people
- Hindu: Muslims - 70: 30%

Issues:

- No public transport
- Traffic congestion
- Failed BRT's
- No intra rail connections
- Unclean River
- Bad municipal corporation
- No preservations
- No accessibility to public spaces
- No citizen participation
- Very low water supply
- Inadequate electricity supply

Potentials

- Growing IT Sector
- Youth Centered
- Lots of natural surroundings
- BRT's tracks
- Effective potical involvement
- Safe city
- Government support

Valued city:

- Good transport system
- Adequate water supply
- Adequate electricity
- Effective and accessible Municipality
- Effective political involvement
- Safe city

Government:

The Urban Local Body governing Pune city is Pune Municipal Corporation. The Corporation is headed by an elected Mayor who presides over the Deputy Mayor. The Municipal Commissioner forms the administrative head. Pune Municipal Corporation is divided into 76 election wards or prabhags.

The Pune Municipal Corporation renders valuable like assessment and collection of property tax, building and maintenance of roads under its jurisdiction, primary health clinics and educational centres.

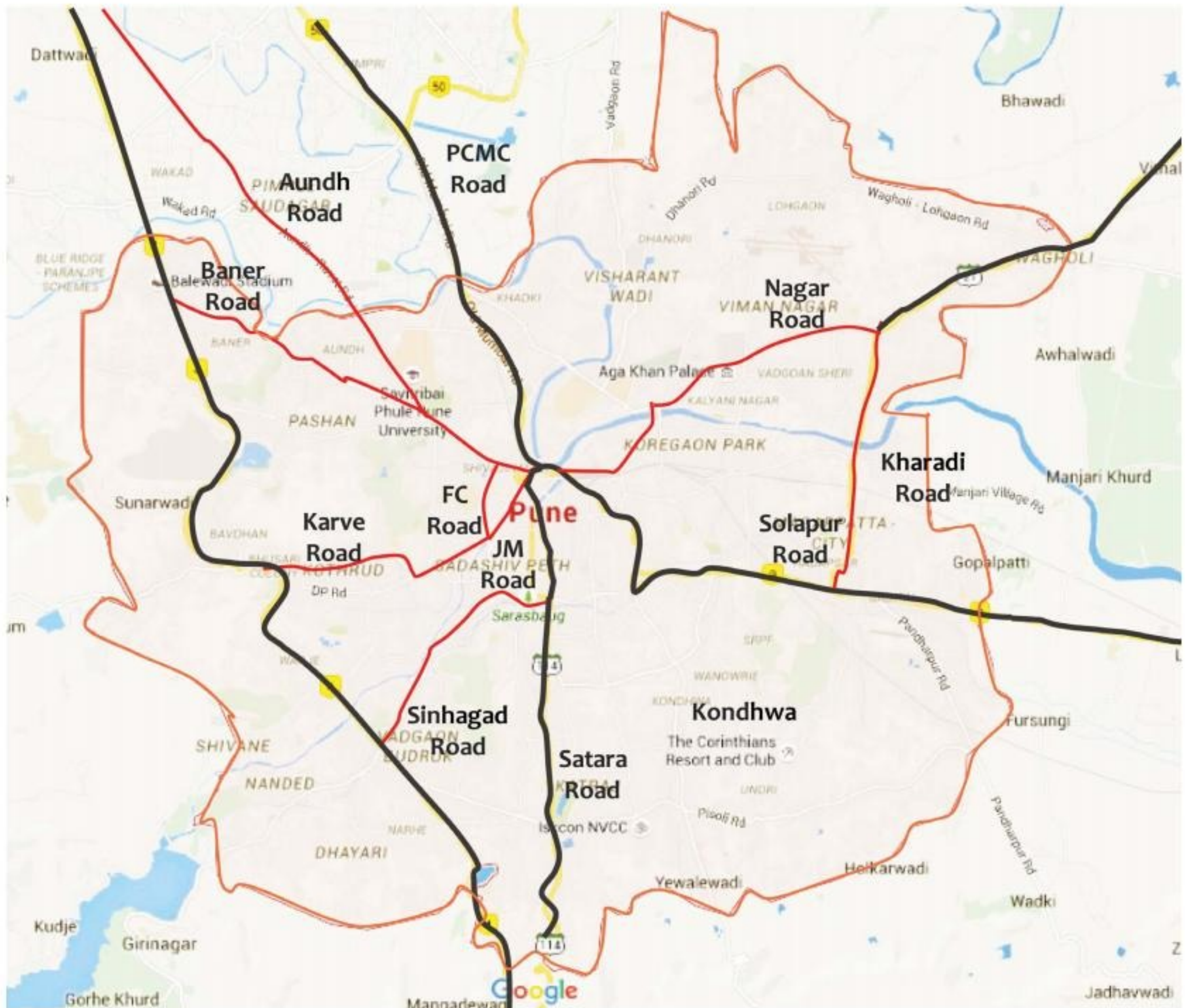


Fig 5.19: Present Pune City Map
Source: Drawn by Author, Google Maps

Pune holds an important place for Maharashtra and India

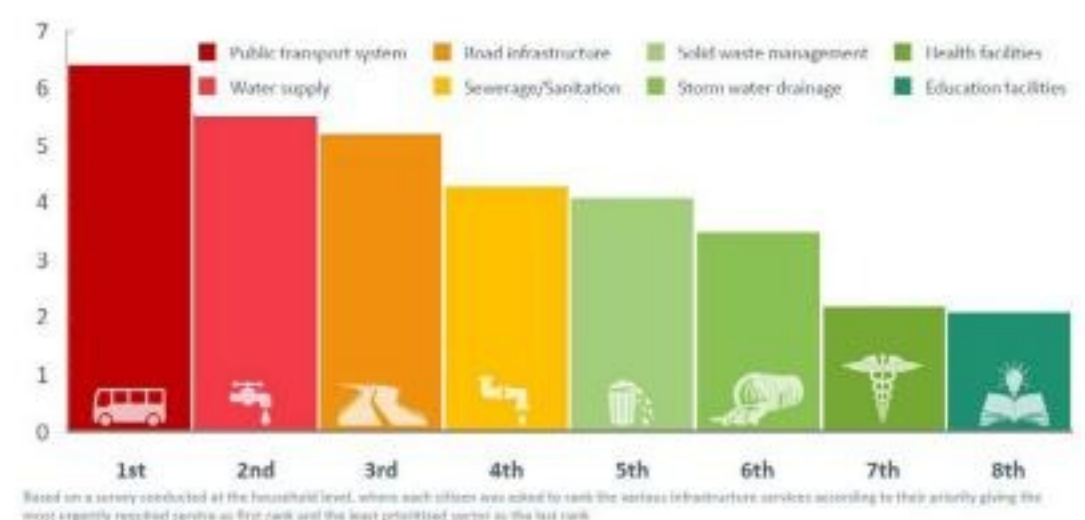
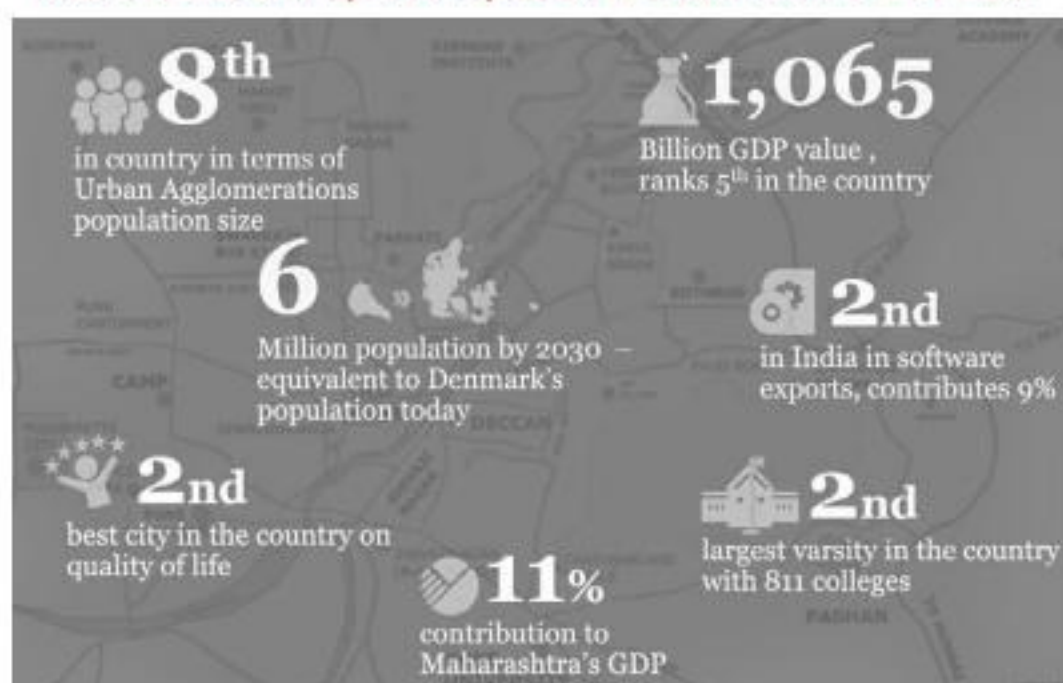


Fig 5.20: Pune City Hard Facts
Fig 5.21: Issues according to the Citizens
Source: Pune Towards Smart City, Government of Maharashtra



Fig 5.22: Pune polluted river water
Source:



Fig 5.23: Pune City Extensions
Source:

The Organic Extension

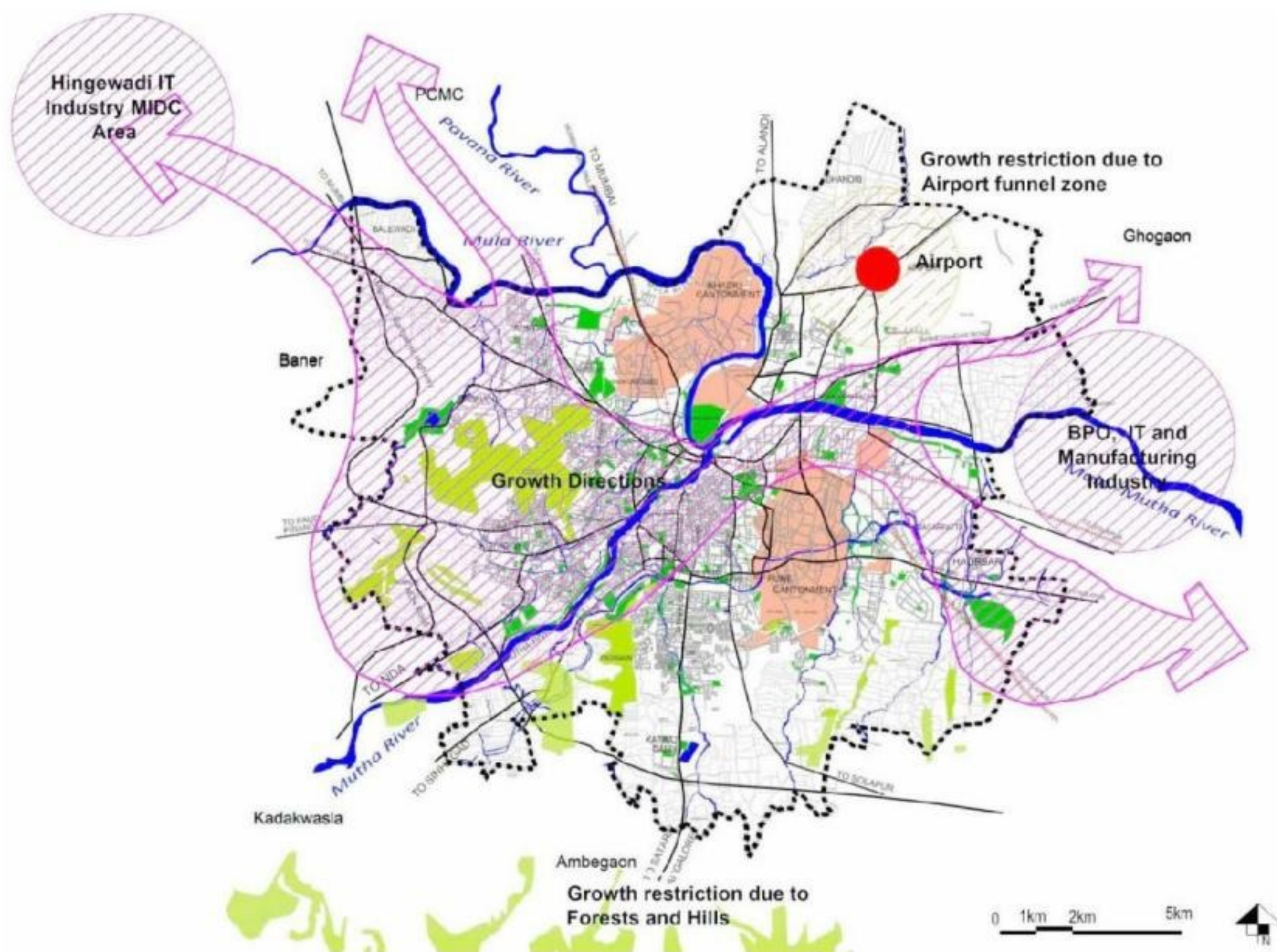


Fig 5.24: Pune City growth analysis Map

The third city being a Tier III city is not infrastructurally very well equipped. But in terms of cultural sustainability and futuristic growth, this city works really well. The citizens are adaptable to new changes, which is proven by a lot of new developments around the city. From the map below it is quite visible that the growth pattern

of the city is quite organic. It grew in between the big green patches and cantonment areas. With the lack of infrastructure and its organic growth, the city doesn't work well in terms of smooth connectivity and evenly distributed services. That would be the main focus while making policies for this city.

Smart City : Pune

Leveraging its rich cultural and natural heritage, strong human capital and strong business environment as key strengths, Pune aspires to become one of the most liveable cities in India by solving its core infrastructure issues in a "Future Proof" way, and by making its neighbourhoods beautiful, clean, green, and liveable. Following are the sectors that Pune is focusing for smartness based on their issues.

i) Transport

Improve mobility by efficient utilization of existing stock and targeted interventions and investments

- Smart technology solutions to enhance efficiency
- Road widening and building across key stretches

ii) Water Supply

Ensure adequate water to All by reducing wastage, leakage coupled with better monitoring of supply

- 24X7 water supply, Reduce wastage and leakage
- Equitable distribution through District Metering Area (DMA)

iii) Sanitation/ Sewerage/ Waste mangement

Achieve service delivery benchmarks on Sanitation and Sewage in the next 3-4 years

- 100% Open Defecation Free (ODF)

- Decentralized Model of Waste Processing
- Strengthening Partnership with SWaCH

iv) Affordable Housing/ Slum Eradication

Scale up and expedite redevelopment and rehabilitation of slums by involving civil society

v) Health

Supplement smart technology solutions to improve the quality and coverage of health care facilities.

vi) Job Creation

Re-energize the job creation engine in the short-medium term by developing a new CBD and push untapped sectors like tourism

vii) Governance

Pune to maintain its headstart in good governance by leveraging technology

- leverage the use of ICT central data platform
- Initiate inter department competition
- Streamline and rationalize bureaucratic processes
- Use of automated systems like SCADA, GIS etc
- M - Governance

36 point program to kick start the process of urban renewal

Sectors	1-2 years	2-3 years	> 3 years
 Transport	<ul style="list-style-type: none"> ▪ Augment bus fleet via pvt. participation ▪ Extended BRT with Intelligent traffic management system: ▪ Congestion charge to discourage pvt. transport using automated payment system 	<ul style="list-style-type: none"> ▪ Construction of High capacity mass transport (HCMTR) corridor around CBD ▪ Road widening across key intersections and proposed metro corridors 	<ul style="list-style-type: none"> ▪ Construction of metro along 2 prioritized corridors
 Water	<ul style="list-style-type: none"> ▪ Differential water tariffs, Energy & Water Audits ▪ SCADA (supervisory control and data acquisition system) to monitor water plants 	<ul style="list-style-type: none"> ▪ Universal water metering to plug leakage, using 'smart' tools like GIS images ▪ Reduction in NRW 	<ul style="list-style-type: none"> ▪ District Metering Access in 5 most water starved wards ▪ 24X7 water Supply Scheme
 Sewage/ SWM/ sanitation/ SWD	<ul style="list-style-type: none"> ▪ 100% coverage of population with toilet facilities ▪ 100% Door to Door Garbage Collection ▪ C&D waste Management 	<ul style="list-style-type: none"> ▪ Increase MSW segregation to 100% ▪ 100% processing of waste ▪ Implementation of zero garbage model to all wards 	<ul style="list-style-type: none"> ▪ Achieving "Zero" Discharge in the River ▪ Recycling of Sewerage to be used for Irrigation Purpose
 Housing	<ul style="list-style-type: none"> ▪ Increase FSI ▪ Computerize and simplify land records and usage change 	<ul style="list-style-type: none"> ▪ In-situ redevelopment of tenable slums by collaborating with civil society 	
 Health	<ul style="list-style-type: none"> ▪ Bring in technology enabled health workers to deliver health services 	<ul style="list-style-type: none"> ▪ Beef up core infrastructure to deliver affordable and quality health care services 	
 Job creation	<ul style="list-style-type: none"> ▪ Conserve core areas and develop as tourist hotspots 	<ul style="list-style-type: none"> ▪ Ease of doing business and improvement of investment climate 	<ul style="list-style-type: none"> ▪ Creation of CBD ▪ Riverfront across Mula-Mutha
 Governance	<ul style="list-style-type: none"> ▪ Encourage participative democracy ▪ Rationalize bureaucratic processes through business process re-engineering ▪ Create a central data platform for real time monitoring and coordination 	<ul style="list-style-type: none"> ▪ Leverage tech. for better inter-departmental coordination ▪ Application of e-governance and m-governance ▪ Smart solutions for monitoring 	<ul style="list-style-type: none"> ▪ Setting of sustainable citizen consultation process

Table 5.3: Kickstart program for smart city Pune

Source: Pune Towards Smart City, Government of Maharashtra

VI. REFLECTION

What is the city, but the people? - William Shakespeare, The tragedy of Coriolanus

A range strategies for smart city development are proposed and planned in national and local level. A major differentiating characteristic among smart city strategies is whether they concern an entire country or nation, or they are focused on a more local level, be it a neighborhood, municipality, city, metropolitan area or even a region. Most applied strategies are built on the local level. In my opinion, there are more advantages of local-level smart city strategies than city scale or metropolitan scale. Of course there would be need for some organization and policies on a city scale but local scale development will be more faster and feasible practically in Indian cities.

Smart Thinking should be incorporated in the design and planning of the city, as approaching broader issues of society, the built and the natural environment with the mindset of being "smart" will naturally lead to the decisions and for example, the city should be planned and designed in such a way so it:

- Ensures strategic positioning and vision planning
- Encourages sound planning and sustainable development

- Promotes good architecture, urban design and place making
 - Encourages integrated mixed-use development and land uses
 - New development that is sensitive to urban regeneration and heritage conservation
- Spatial Enablement, (Spatially enabled city) (S. & Roche 2014)

From the evaluation of the current proposal (section IV), following inferences are extracted;

1. Firstly, this project is not a criticism of Indian smart city proposal, but seeking opportunity to fill in the gaps left in the proposal, by learning from international experiences.
2. The interlinkage between the scales of the proposal is highly missing. Random projects on different scales won't be successful, if they do not correlate to each other.
3. The objectives for my own project has been built based on the ISCM objectives and additions.
4. Inclusion of citizens in the planning and designing system in India, not just theoretically but in real solutions would be the greatest challenge for this project.

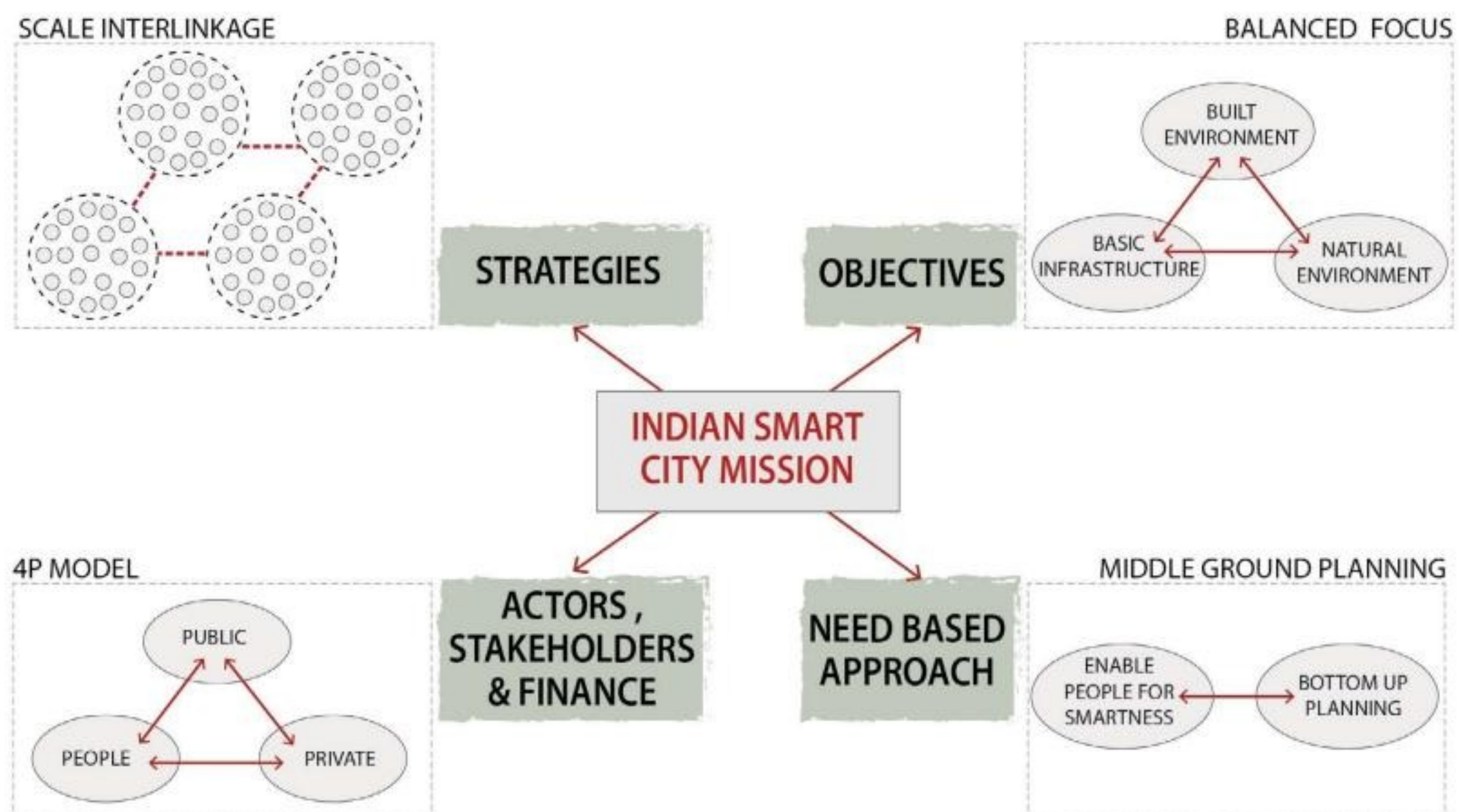
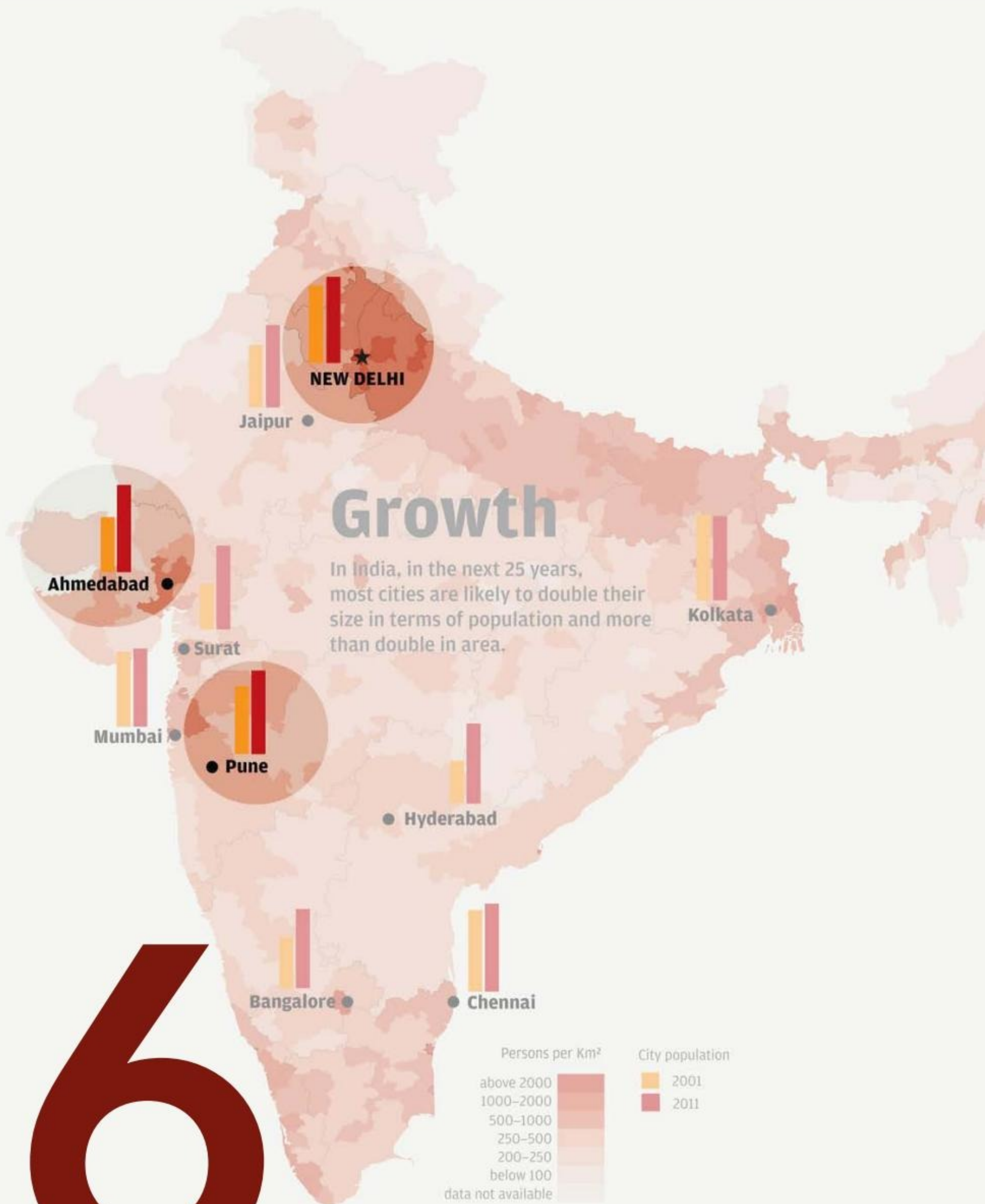


Fig 5.25: Lessons from Indian smart city proposal
Source: Pune Towards Smart City, Government of Maharashtra

6

Growth

In India, in the next 25 years, most cities are likely to double their size in terms of population and more than double in area.





What are the present policies and strategies in terms of urbanization? How can the urbanization of Indian cities be made 'smarter' by modifying existing planning systems and spatial strategies and policies?

URBANISATION IN INDIAN CITIES

Source: IBM

I. SPATIAL URBAN DEVELOPMENT IN INDIA

Urban Planning in India:

Development in all forms is essential for all countries, for this purpose various methods are adopted which include economic planning, spatial planning or/and any other suitable planning. Land use planning in India came with emergence of the need for planned development of towns and cities. It came into consideration to manage the activities taking place in different areas. The activities coming up are on bases of land use of the particular area which is generally given in master plan which governs the development of urban areas. The planning done is thus done called land use planning as it involves assigning the particular activity to a given parcel of land. Town or urban planning in India is relatively new. The importance of planning development is gaining attention as more and more people are exploring the ways for better quality of life. Urban planning in India is done through various types of development plans. One of such plan is master plan which is made for urban areas which governs the growth of the urban areas. Other popular plan include Town Planning Scheme or TP Scheme which is widely. The most important feature of all development plans dealing with spatial planning is land use planning. (Tank, 2017)



Types of planning in India:

There are different levels of development and planning, based on their scales of implementation and nature of details. Depending on the urban/ rural areas and the local/ central authority, the selection of the planning type is done. Following is the hierarchy of planning process.

i) **Master Plan**: As per the definition given by the DDA, "A Master Plan is the long term perspective plan for guiding the sustainable planned development of the city. This document lays down the planning guidelines, policies, development code and space requirements for various socio-economic activities supporting the city population during the plan period. It is also the basis for all infrastructure requirements." (Government, 2006).

Main functions of the plan:

- To develop the town or city as a combined unit and maintain a balance b/w the spatial allocations for the distribution of facilities
- Formulation of policies for the development of the town/city, aiming at the decentralisation of city centre
- Presenting broad circulation links, for inter-city & intra-city traffic and a multi modal mass transport system
- Preservation of the natural features of the city
- Division of the city in sub-divisions or zones. (Tank, 2017)

ii) **Zonal Plan**: According to Town and Country Planning Organisation, India, Zonal plan is a plan detailing out the proposals of Master Plan and acting as a link between Master Plan and the Layout Plan. It may contain a site plan and land use plan with approximate location and extent of land uses such as public and semi public buildings/works, utilities, roads, housing, recreation, industry, business, markets, schools, hospitals open spaces etc. It may also specify standards of population density and various components of development of the zone.

Functions of a zonal plan:

- A zonal development plan details out and elaborates the policies of the master plan.
- Acts as a link between the master plan and the layout plans.
- Contains a land-use plan for the development of the zone and show the approximate locations and extents of land-uses proposed in the zone.
- The schemes and layout plans indicating use premises should confirm to the master plan. (Tank, 2017)

iii) **Sector Plan:** A sector plan consists of a group of neighborhoods where it is possible to provide higher order facilities for larger population.

Functions of a local area plan:

- Each sector plan has to identify the various neighborhoods with population ranging from 3500-15000
- It is the lowest level plan for the implementation of the various levels of planning proposals extensively.

iv) **Local Area Plan:** Ministry of Urban Development, India defines Local area plan in the Urban and Regional Development Plans Formulation & Implementation Guidelines, 2014 as following; Local area plans are to be prepared to achieve development or re-development of land; conservation of buildings, physical features; providing improvements in the physical layout, making infrastructure and amenities available and managing the area to enhance health and safety of the occupants to support economic development as well as to enhance the quality of living, environment, and preparation of area specific regulatory parameters for the area covered. Local area plans are prepared to specify the implementation details to comply with the Government Policies (such as State urban housing, hi-tech township, rainwater harvesting, energy, disaster management, industrial and service sector investment, barrier-free environment for physically disabled, information technology, tourism & other policies). (Development, 2014)

Functions of a local area plan:

- A local area plans gives plot level detail
- It is also used to check if the master plan is confirming with land. (Tank, 2017)

Is this planning system too rigid and confusing for the citizens? Already in case of Delhi, the number of authorities increase due to the merge of Central and State government. Moreover, the clarity to reach the concerned authorities for information is a complicated story. So the rigidity in the planning process makes it harder for the citizens to follow the exact rules. And not just they are breaking the rules but the rules are not clear to be followed blindly because of the unnecessary hierarchy without clarity in their scope of intervention.

THE FOLLOWING TABLE SHOWS THE LEVEL OF DETAILS OF VARIOUS USES IN DIFFERENT LEVELS OF PLANS

CIRCULATION LINKS	RAILWAYS	NATIONAL / STATE HIGHWAY 90-100 m	ARTERIAL ROAD 50 - 60m R/W	SUB-ARTERIAL ROAD 30-40 m R/W	COLLECTOR ROAD 20-30 m R/W	LOCAL ROADS 9-20 m R/W
PLANNING LEVEL						
MASTER PLAN	●	●	●	●		
ZONAL PLAN		●	●	●	●	
SECTOR PLAN				●	●	
NEIGHBOURHOOD PLAN					●	●

OPEN SPACES	FOREST AREA / GREEN BELT	REGIONAL PARKS	DISTRICT PARKS	COMMUNITY PARK / PLAY GROUND	HOUSING AREA PARK	TOT-LOT
PLANNING LEVEL						
MASTER PLAN	●	●	●			
ZONAL PLAN			●	●	●	
SECTOR PLAN				●	●	
NEIGHBOURHOOD PLAN					●	●

OPEN SPACES	CBD	SUB-CBD	DISTRICT CENTRES	COMMUNITY CENTRE	LSC	CSC
PLANNING LEVEL						
MASTER PLAN	●	●	●			
ZONAL PLAN			●	●		
SECTOR PLAN				●	●	
NEIGHBOURHOOD PLAN					●	●

OPEN SPACES	GENERAL HOSPITAL	INTERM HOSPITAL A	INTERM HOSPITAL B	POLY CLINIC	NURSING HOME	DISPENSARY
PLANNING LEVEL						
MASTER PLAN	●	●	●			
ZONAL PLAN	●	●	●			
SECTOR PLAN				●	●	
NEIGHBOURHOOD PLAN					●	●

Table 6.1: Scope of various plans
Source: Planning Tank

Recommendations for the Government of India by the World Economic Forum:

India aims to achieve "Faster, More Inclusive and Sustainable Growth". Achieving inclusiveness involves addressing poverty reduction, group equality, regional balance, inequality and empowerment.

The FUDS (Future of Urban Development Services) Initiative provides three strategic recommendations for the Government of India to advance the debate around the newly announced policies and initiatives on urban development:

- Integrate spatial planning at all governmental levels: national, state and city
- Create a stable policy framework for private investment in urban infrastructure
- Create institutions to stimulate capacity building and attract talent to grow businesses

As next steps, it is suggested that the Indian administration continue its consultations with industry and infrastructure partners, as well as civil society, to get a balanced view of actions needed to achieve these plans. Fast, measurable and impactful action is necessary.

Living standards and business operations have been negatively impacted by India's inability to provide universal access to and continuity of basic urban services.

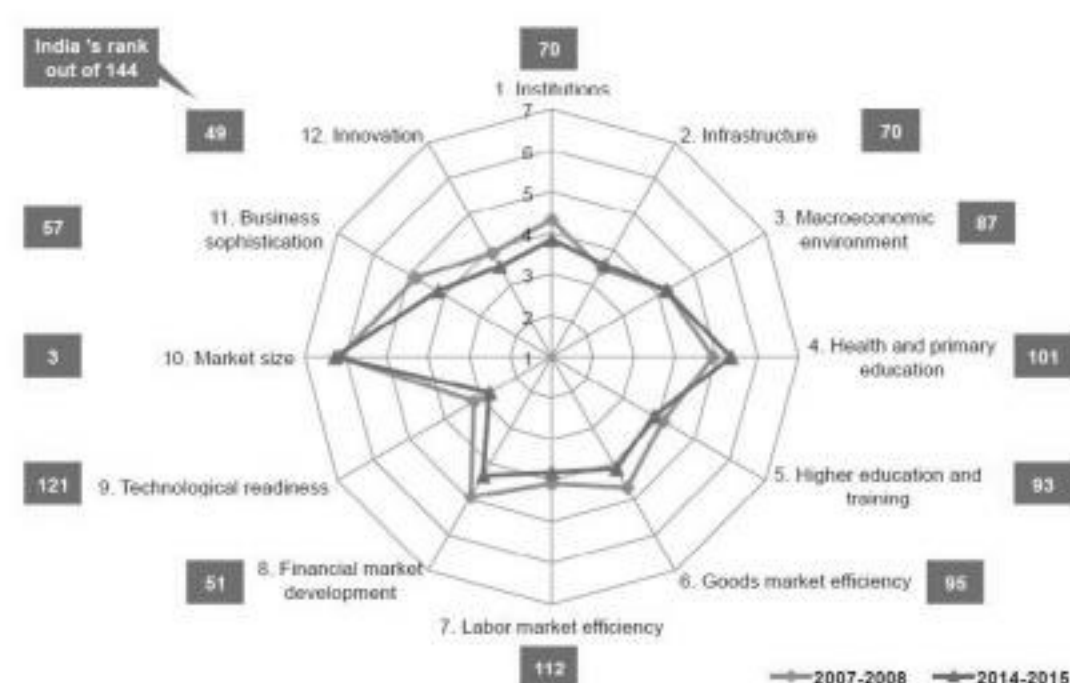


Fig 6.1: India in the 12 Pillars of the GCI
Source: The Global Competitiveness Index, 2014-2015

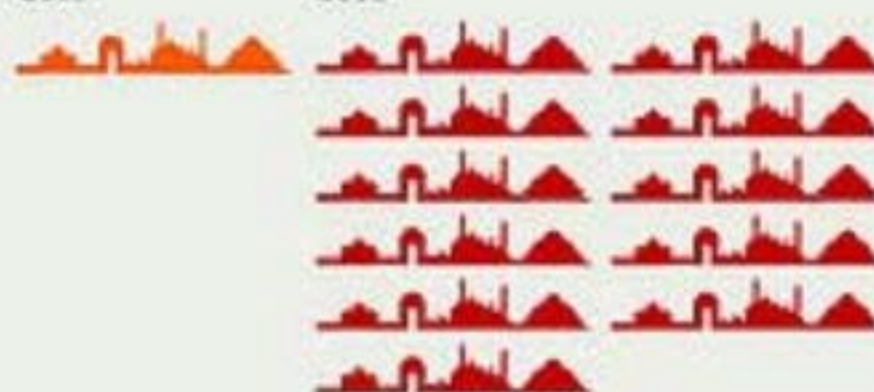
The Urban Effect

Cities

In 20 years, India's cities will have to accommodate 250 million to 300 million more people than they do today. That's the equivalent of 11 New Delhis.

2012

2032



Electricity

Of the 1.4 billion people of the world who have no access to electricity in the world, India accounts for over 300 million.



Water

Only 74% of urban households in India are served by piped water supply. No Indian city has piped water 24 hours a day, seven days a week—4 to 5 hours of supply per day is the average.



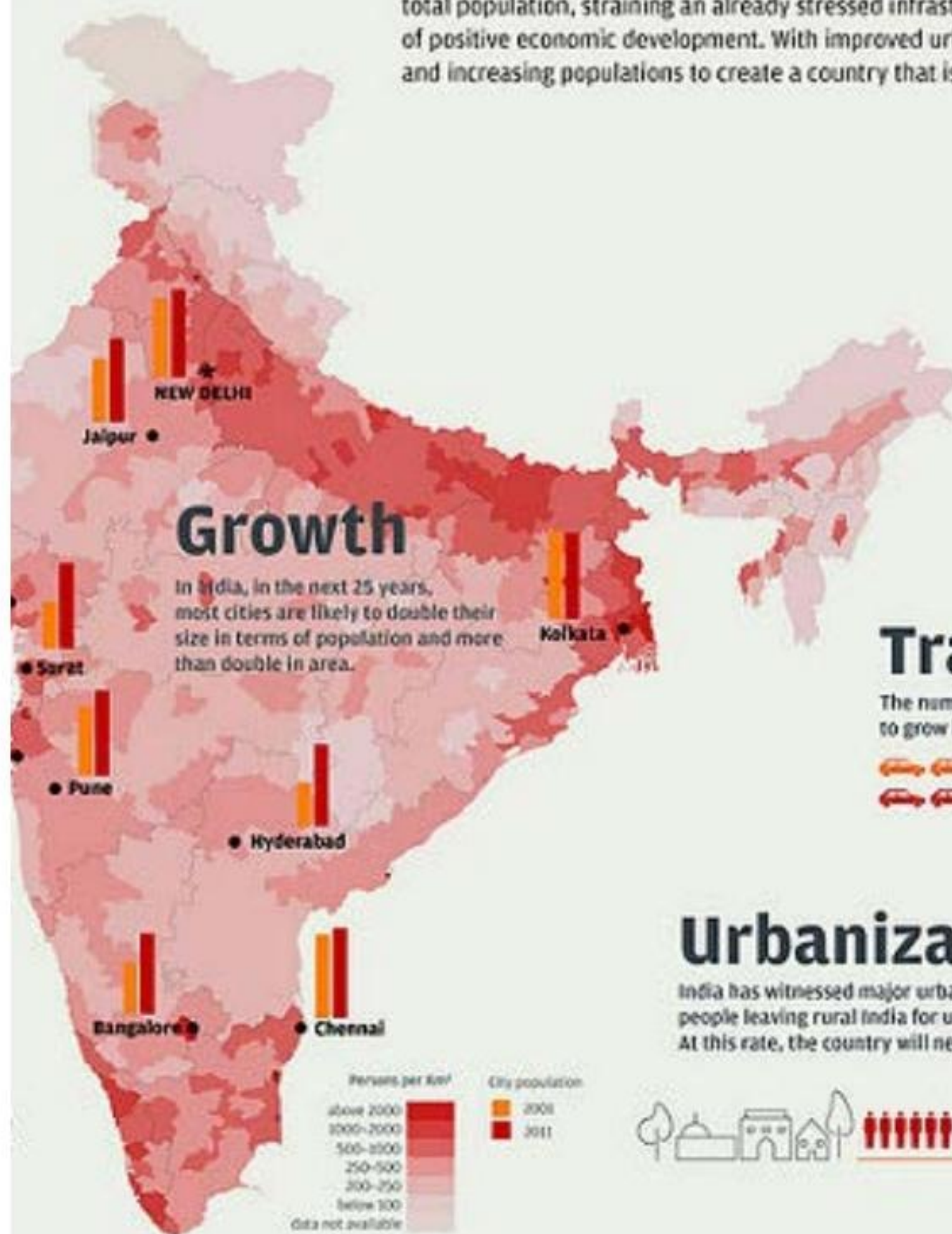
Infrastructure

Despite increased investments in infrastructure, an estimated \$1 trillion in infrastructure improvements will be required to meet the country's resource needs over the next 5 years.

ct

Sustaining Growth in India through Better Urban Planning

With a population of more than 1.2 billion, India is projected to be the world's most populous country by 2025. By 2050, it is estimated that India's urban population will constitute nearly half of the country's total population, straining an already stressed infrastructure. The good news: urbanization is an indicator of positive economic development. With improved urban planning, India can tackle urbanization challenges and increasing populations to create a country that is poised for sustainable growth.



1. CHINA

2. USA

3. INDIA

Pollution

By 2015, India is expected to become the world's third largest emitter of carbon dioxide—it ranked fifth in 2005.

Transportation

The number of private vehicles in India is expected to grow by more than 3 times by 2021.



Urbanization

India has witnessed major urbanization in recent times, with an estimated 30 people leaving rural India for urban areas every minute during the next 20 years. At this rate, the country will need some 500 new cities in the next two decades.



For more information on how IBM is helping to build smarter, more sustainable cities visit: www.ibm.com/smartercities

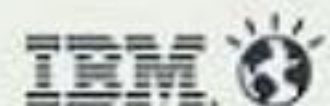


Fig 6.2: Present Indian Urban Development Scenario and Growth Pattern
Source: IBM

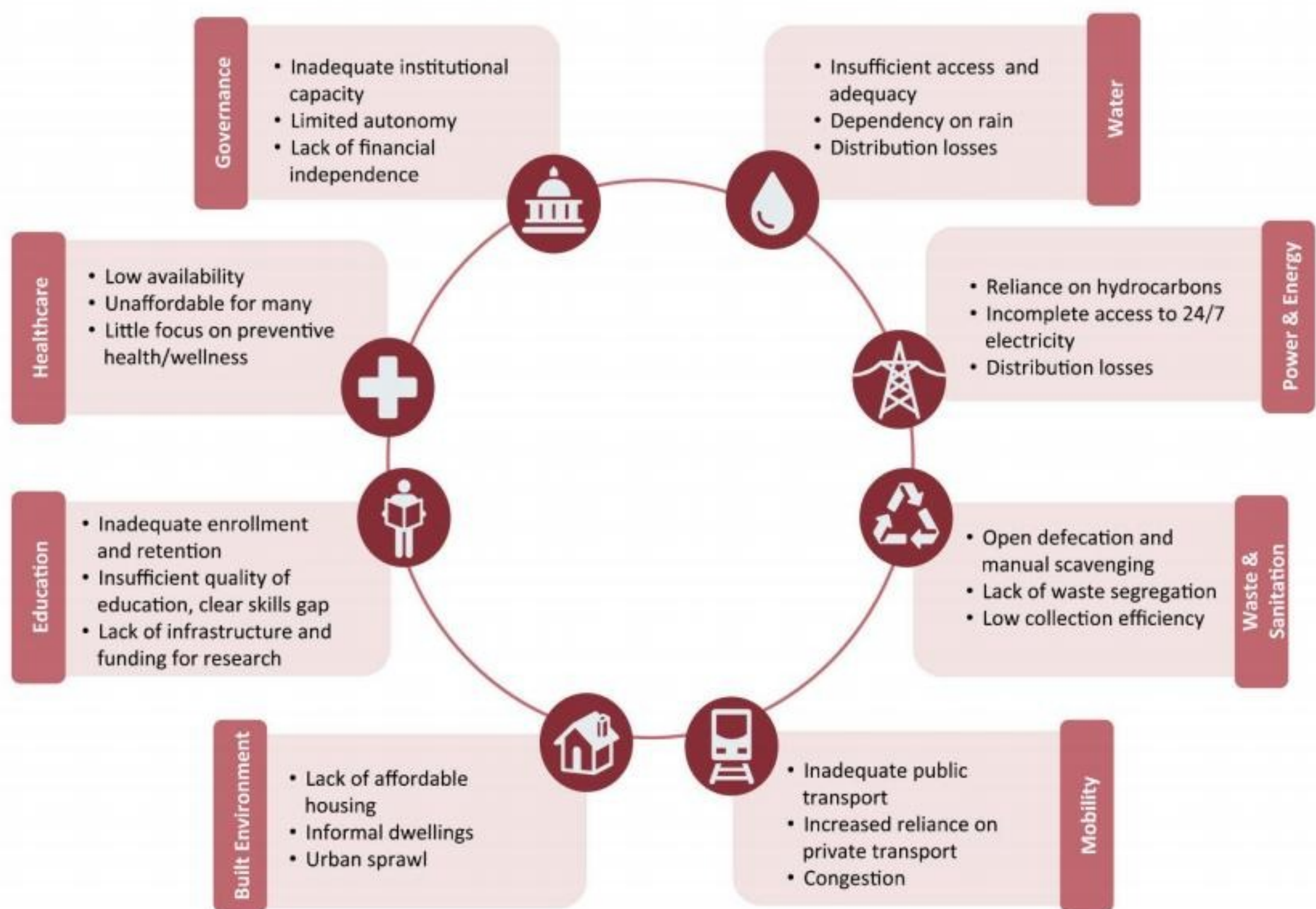


Fig 6.3: Challenges in Urban India
Source: World Economic Forum, Shaping the Future of Urban Development & Services

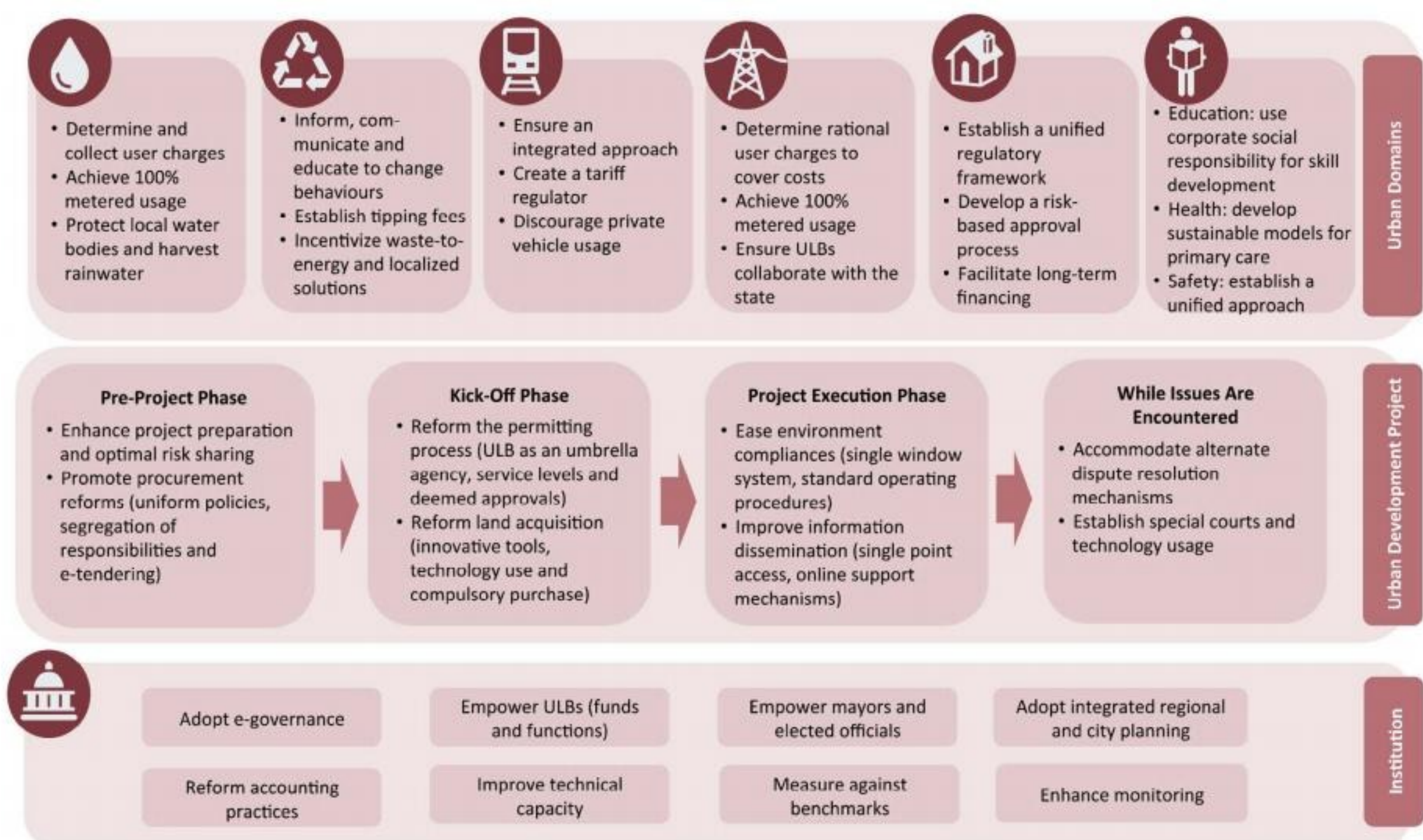


Fig 6.4: Reforms to Accelerate Urban Development
Source: World Economic Forum, Shaping the Future of Urban Development & Services

II. NEW INDIAN URBAN PROJECTS

Narendra Modi in his speech quoted, "Cities in the past were built on riverbanks. They are now built along highways. But in the future, they will be built based on availability of optical fibre networks and next-generation infrastructure."

Other than Indian smart city projects there are other initiatives which are being taken by the government to solve the urban issues facing the development challenges.



Fig 6.5: Smart city proposal facts and figures
Source: <http://secure.mygov.in/home/poll/>

In general, the new prime minister Mr. Narendra Modi and his government vigorously pushing ahead nine missions for the creation of new townships and rapid upgradation of existing ones with an equal emphasis on expansion of housing projects, urban planners are for the first time chalking out measures to contribute in a big way to ensure orderly and planned development of our cities and towns.

These nine urban sector missions are Swatch Bharat Mission(Urban), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission, The Heritage City Development and Augmentation Yojana (HRIDAY), Pradhan Mantri Awas Yojana (Housing for All-Urban), National Urban Livelihoods Mission (NULM), National Urban Health Mission (NUHM), Shyama Prasad Mukherji Rurban Mission (National Rurban Mission), Pilgrimage Rejuvenation and Spirituality Augmentation Drive (PRASAD). (Nair, 2017)

All these missions represent clear vision and intent of government for development of cities in the country. "To realize orderly development of cities for all citizens, we need to pave the way for improving quality of life of people. We are hopeful that current inequalities and inequities in cities are surmountable", Ashok Kumar Professor of Physical Planning, School of Planning and Architecture, a member of the Institute of Planners, India said. Stressing on the importance of their move, ITPI, the professional body of urban and regional

planners in India with a membership of over 5,000 planners said 40 per cent population in developing countries lives in cities, which is expected to increase to 56 percent by 2030. According to Census 2011, India has 7, 935 urban settlements house 31.16% of the country's population. The recent estimates indicate that by 2050, 50% Indians will live in urban areas and by 2030 cities and will account for 75% of its GDP.

Urban population in developing countries will continue to grow at 2.4 percent per year till 2030. According, to the United Nations by 2050, the number of people living in cities in India and China alone will grow by 696 million (India 404 million; China 292 million). Half of Asia's and Sub Saharan Africa's population will live in cities by 2030.

"In fact the 21st century is the century of the city. The city will dominate most aspects of our lives. Most innovation and wealth creation will happen in cities. City dwellers and diverse activities being carried out in cities will profoundly affect city environments. It appears that all sorts of opportunities, conflicts and challenges will be manifested in cities. Future of humankind is located in the cities. Modern city civilisation will develop or perish in cities depending on how citizens, planners, policy makers, development managers, governments, and the third sector join up and work collectively", stresses Ashok Kumar. (Nair, 2017)

Following are the overview of the prominent projects.

Redevelopment and urban renewal of 500 cities

The Government of India intends to redevelop and renew 500 cities, although details of the programme have not yet been made public.

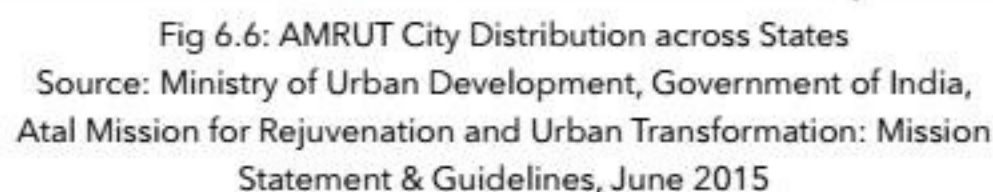
Regeneration of heritage cities

Recently, the Government of India emphasized the relevance of preserving the cultural and religious heritage of the nation, which was partly addressed by the JNNURM.

Country-specific tie-ups

A memorandum of understanding has been signed between India and Japan to turn Varanasi into a smart city with help from the city of Kyoto. The United States has expressed interest in developing three smart cities (Allahabad, Ajmer and Vishakhapatnam). India and China have also signed three Gujarat-specific pacts.

The mission aims to provide basic infrastructure like piped drinking water, sewerage/septage, storm water drains, green and open spaces and non-motorised transport in about 500 class I cities. The priority is on providing universal coverage for piped drinking water and sewerage/septage. The mission also looks to incentivize urban sector reforms to improve governance. 10 percent of funding is linked to implementation of reforms. Central government would be spending Rs 50,000 crore on the mission in 5 years and matching amount would come from the state and urban local bodies. So far total investment of Rs 44,401 crore has been approved under the mission. (Mehta & Kant, 2016)



The Housing for All mission aims to provide a house for every family living in urban area. The mission provides for housing through four streams - rehabilitation of slum dwellers with the participation of private developers using land as a resource, affordable housing through partnership with public and private sectors, promoting affordable housing for weaker section through credit linked subsidy, and provision of subsidy for beneficiary-led individual house construction or enhancement. Another flagship programme launched by the government is the Swachh Bharat Mission which aims

HRIDAY Cities

The mission statement for HRIDAY is: Preserve and revitalise soul of the heritage city to reflect the city's unique character by encouraging aesthetically appealing, accessible, informative & secured environment. To undertake strategic and planned development of heritage cities aiming at improvement in overall quality of life with specific focus on sanitation, security, tourism, heritage revitalization and livelihoods retaining the city's cultural identity. The main objective of HRIDAY is to preserve the character and soul of the heritage city and facilitate inclusive heritage linked urban development by exploring various avenues including involving private sector (Ministry of Urban Development & India 2015)



Source: Ministry of Urban Development, Guidelines for HRIDAY: Heritage City Development & Augmentation Yojana, January 2015

Industrial Corridors

Industrial Corridors are being increasingly promoted as effective instruments for achieving accelerated industrial growth by effecting integration between industry and infrastructure. It entails creating globally comparable infrastructure in a designated pathway, to provide a conducive and competitive environment for setting up businesses (Ministry of Urban Development n.d.).



Fig 6.8: Industrial Corridors

Source: Federation of Indian Chambers of Commerce and Industry, PwC, India: Surging to a smarter future, April 2015

Swachh Bharat Mission

The mission aims to make India an open defecation free country in Five Years. Under the mission, One lakh thirty four thousand crore rupees will be spent for construction of about 11 crore 11 lakh toilets in the country. Technology will be used on a large scale to convert waste into wealth in rural India in the forms of bio-fertilizer and different forms of energy (*De, L.C., Singh, D.R., SumanThapa and Gurun 2016).



Fig 6.9: Swachh Bharat Mission

Source: <http://secure.mygov.in/home/poll/>

Sector	Smart Cities	AMRUT	Other Programmes
Water	Yes	Yes	Yes (Housing for All, HRIDAY)
Waste and Sanitation	Yes	Yes	Yes (Clean India, Housing for All, HRIDAY)
Mobility	Yes	Yes	Yes (Housing for All, HRIDAY)
Energy	Yes	No	Yes (Clean India, Housing for All)
Built Environment	Yes	No	Yes (Housing for All, HRIDAY)
Social Infrastructure	Yes (education, healthcare and safety)	No	Yes (HRIDAY - Safety)

Table 6.2: Sector-Specific Opportunities from Various Urban Development Programmes

Source: Ministry of Urban Development, Government of India. Smart Cities: Mission Statement & Guidelines. 2015; Ministry of Urban Development, Government of India. Atal Mission for Rejuvenation and Urban Transformation, Mission Statement & Guidelines. 2015; Ministry of Urban Development, Government of India. Guidelines for Swachh Bharat Mission.2014; Ministry of Housing & Urban Poverty Alleviation, Government of India. Housing for All: Scheme Guidelines

III. SMART CITY STAKEHOLDERS

Residents of the city should be ideally the most important stakeholders of smart city projects. These are the people for whom the modifications are being made in the city and the citizens will be affected the most.

Secondly, the government or private organisations who are proposing the projects are the stakeholders. Government also plays a crucial role when we talk about smart economy, as the economy has a larger effect on the country.

The designers and the engineers play a vital role as they are the creators. They are innovating new techniques and implementing them under various conditions. Other stakeholders are mostly local organisations who supports the project by financing or implementation.

Role of urbanists fits appropriately in the Indian smart city proposal, as in Indian context, the term smart city is actually basic Urban development.

As per as the world economic forum states, the private sectors are the most active participators/ stakeholders for new developments in India.

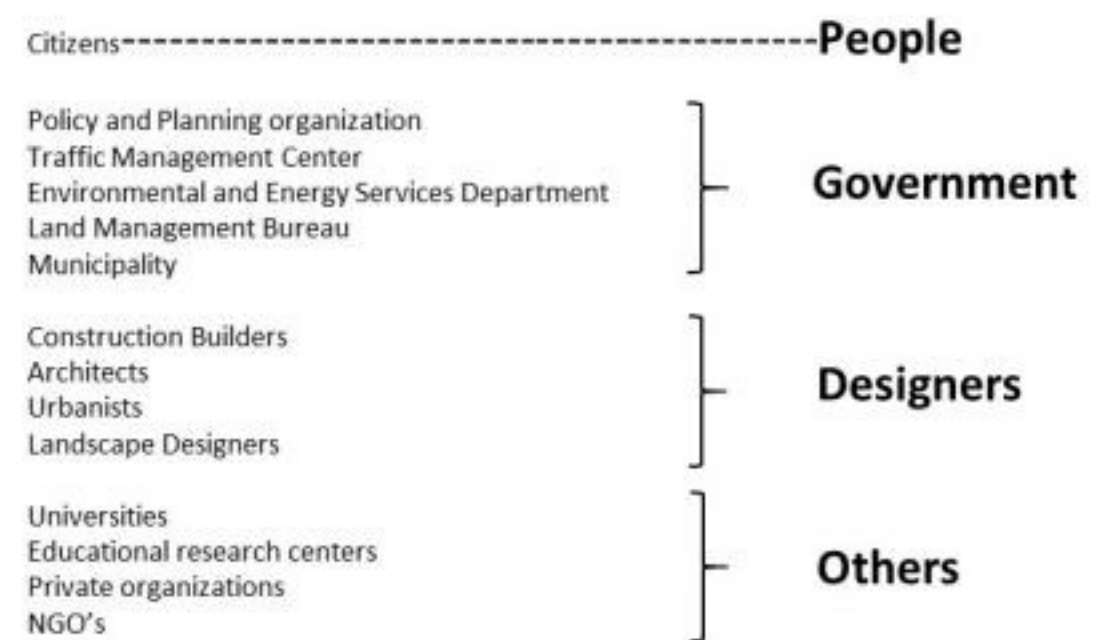


Fig 6.10: Smart city Stakeholders
Source: Drawn by author

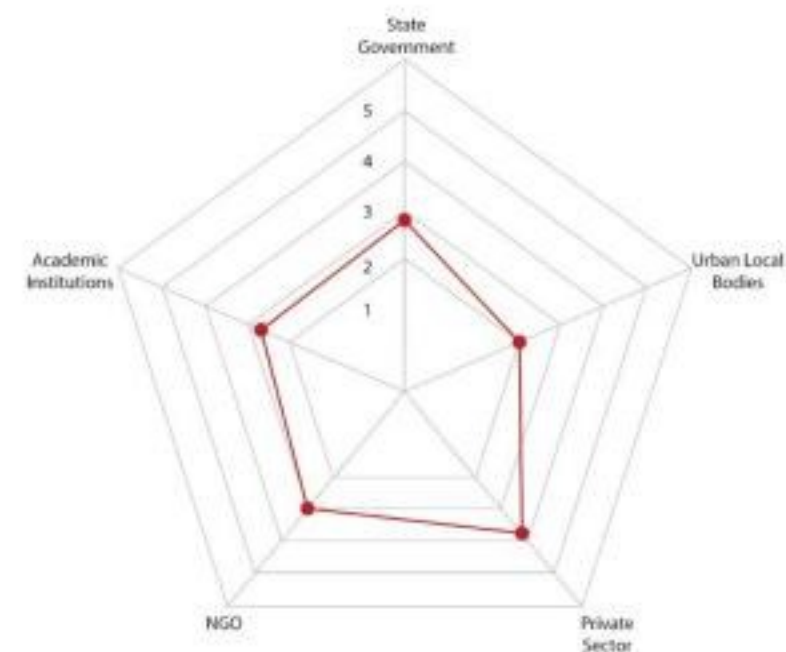


Fig 6.11: Stakeholder Readiness for Urban Transformation
Source: World Economic Forum, Shaping the Future of Urban Development & Services, India Survey on Smart Cities

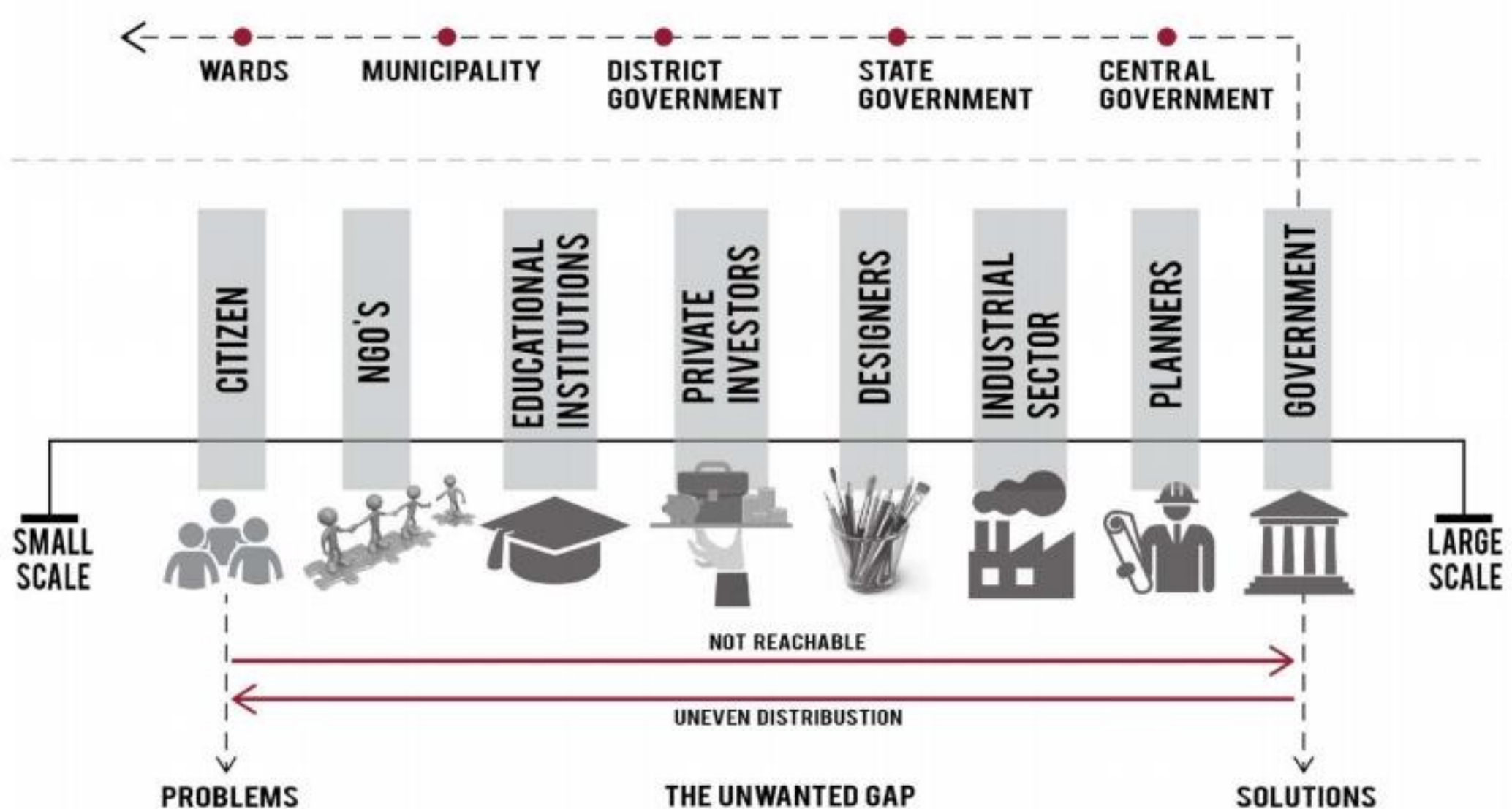


Fig 6.12: Smart city Stakeholders
Source: Drawn by author

IV. CITIZEN ENGAGEMENT STUDIES

In a report published by UK-based digital innovation charity Nesta, researchers Tom Saunders and Peter Baeck argue that the most hospitable smart cities will involve a “bottom-up” approach. This focuses on the needs and desires of the people living in them, and encourages their input when it comes to shaping a better city (Baeck 2015).

The greatest challenge smart city projects face are not technological but the challenge of approaching them with an open mind-set and embracing a participatory approach (Mulder 2014). Engaging the end-users in development processes opens previously unseen potential for including consumerist possibilities for cities and developers. In smart city context, the 4P-based urban development process has created possibilities for engaging new pro-active and positive participation methods and solutions, not only for the early stages of urban development process (planning and design), but also for construction, operation and management of local economic and social infrastructure (Majamaa 2008). Recently, discussion of PPPs’ benefits has moved from “Value-for-Money” (VFM) and cost-effectiveness to innovative development of public service structures in partnership with the private sector and general public - the end-users of the services. (Majamaa 2008)

Cities have the capability of providing something for everybody, only because and only when, they are created by everybody. - Jane Jacobs, The Death and Life of Great American Cities

In a democratic country like India, the relevance of citizen engagement is quite high. There is a lot of population which can not be let down or left out from the development process. Democracy and engagement are closely related. Barber (1984), for example, considered participation as an important component of a strong democracy and stressed that the sustainability of engagement can only be ensured in the presence of strong democratic dialogue, strong democratic decision, and strong democratic action (common work, community action, and citizen service).

Few great examples for the inclusion of citizens in the city planning decisions would be

1. In Reykjavik, Iceland, citizens can use the Better Reykjavik website to propose, debate and vote on ideas for improving the city. Each month the city council debates the most popular ideas from the website and

the city government has so far spent €1.9 million on developing more than 200 projects proposed by citizens.

2. In Paris, ‘Madame Mayor, I have an idea’ is a crowdsourcing and participatory budgeting process that lets citizens propose and vote on ideas for projects in Paris. The process will allocate 500m Euros between 2014 and 2020.

3. In Bangalore, local NGO the MOD Institute enabled residents to create a community vision for the future of the Shanthingar neighbourhood of the city by encouraging online debate. The project identified abandoned urban spaces as a major issue of concern for residents and created software which residents will be able to use to map these spaces via smartphone and SMS. (Baeck 2015)

With the new concept of Living Labs in smart city, termed by a MIT professor, Public-Private-People Partnership (PPPP) is encouraged as well. The quattro helix consisting main 4 main stakeholders (companies, researchers, public organisations and users) come together for creation, prototyping, validating and testing new technologies, services, products etc in real-life contexts. This is a way to empower citizens as active co-creators to of value, ideas & innovations that benefit the whole society.

On the one hand, the critical role that top leaders play in pushing forward smart city programs suggests that top-down approaches are most effective. On the other hand, it is people at the local or micro level whose creativity and energy are critical to creating a better life for themselves, their families and communities. The trick is to get both top and bottom to work together. (Peris-ortiz & Bennett 2017)

**PPP-based urban development processes:
Aurinkolahti and Kartanonkoski**

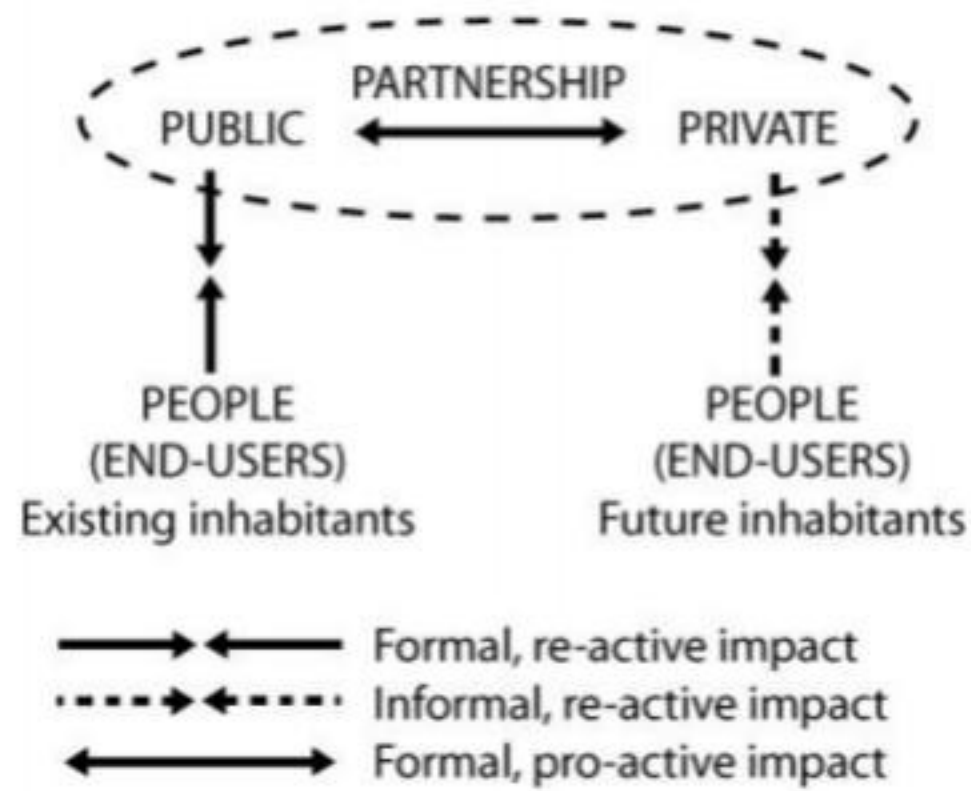


Fig 6.13: The end-users' position and status as stakeholders the in the pre-studied PPP based urban development processes
Source: The 4th p - people - in urban development based on public-private-people partnership, Wisa Majamaa

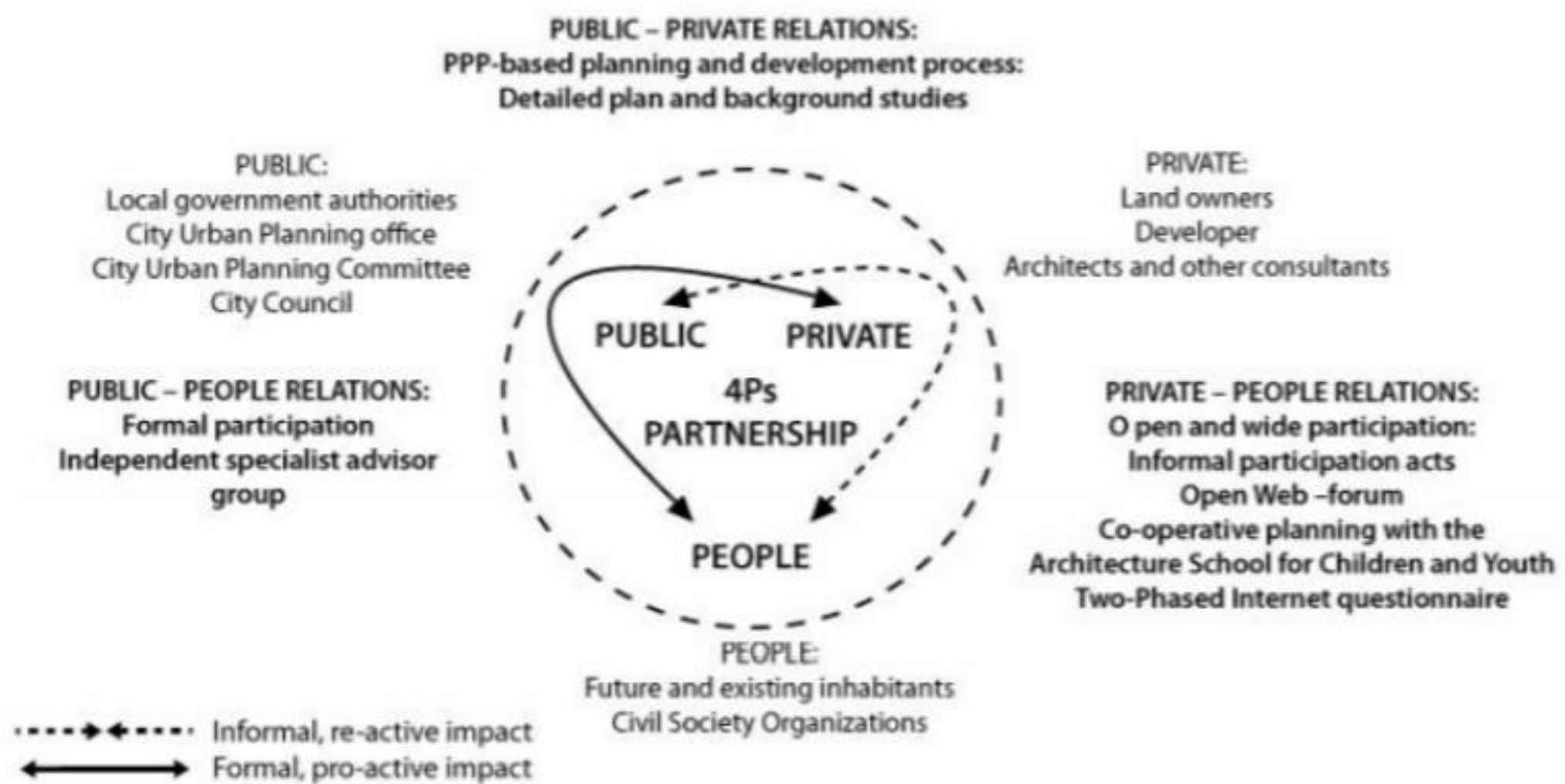


Fig 6.14: Stakeholders and participation relations in the 4P-based urban development processes for Hista and Nupuri
Source: The 4th p - people - in urban development based on public-private-people partnership, Wisa Majamaa





How can the aspect of citizen engagement in governmental policies and strategies, be included for Indian Smart Cities?

ANALYSIS

Source: https://en.wikipedia.org/wiki/Delhi#/media/File:Delhi_aerial_photo_03-2016_img1.jpg

I. DELHI AND SELECTED SITES

a) Detailed analysis of Delhi

Before we proceed with the detailed neighbourhoods, let us understand Delhi as a city and the possibilities of development. In the book "Urban Development in India", the author R.K. Bhardwaj rises a question, "Why a large proportion of the country's population chooses to migrate to and live in metropolitan complexes and work under entirely new environments?" (Bhardwaj, 1974). As named earlier, Delhi as the Endless City, proves this question right. Because of the enormous migration in search of infrastructural facilities, economic opportunities and a better lifestyle, the city is spreading the edges and newly built suburbs are being included along the periphery.

We analysed the smart city proposal with the basic issues and potentials in the previous section, here we will go through the hard facts to come up with possible smart solutions in city level.

Population: 16,788,000

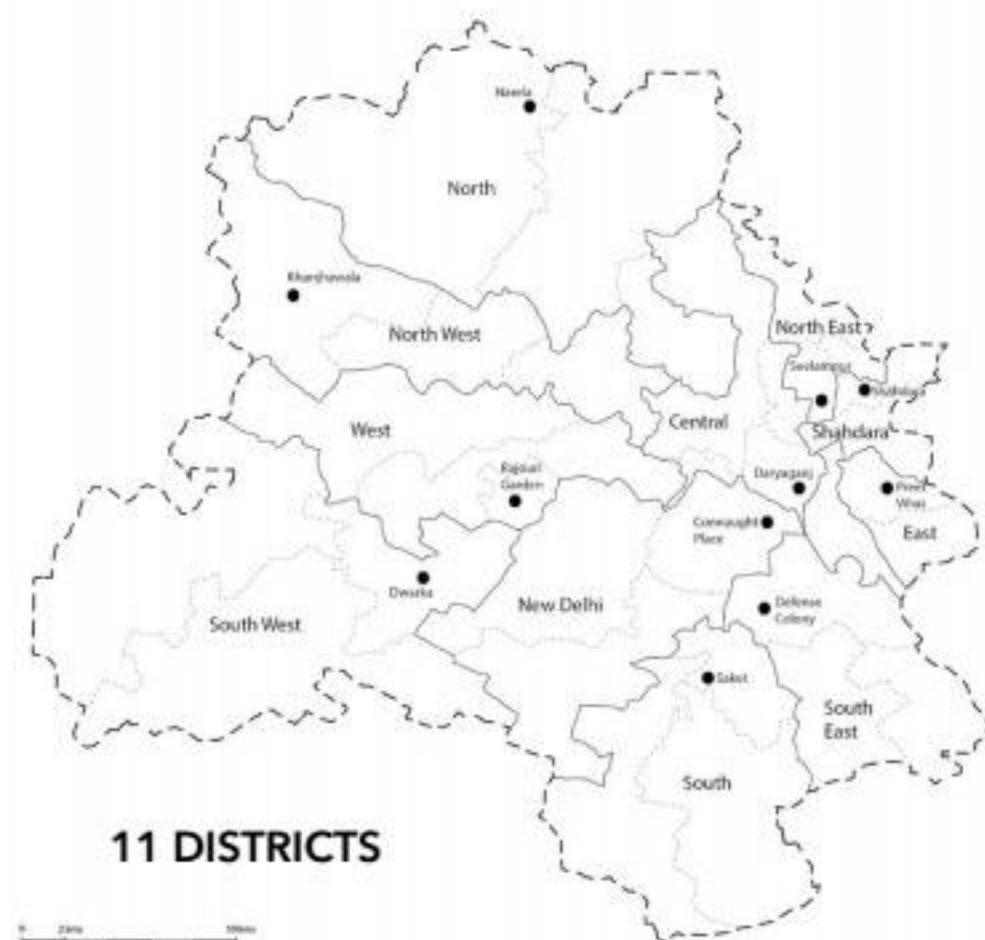
Area: 1,484.0 km²

Density: 11,312/km²(29,298/sq mi)

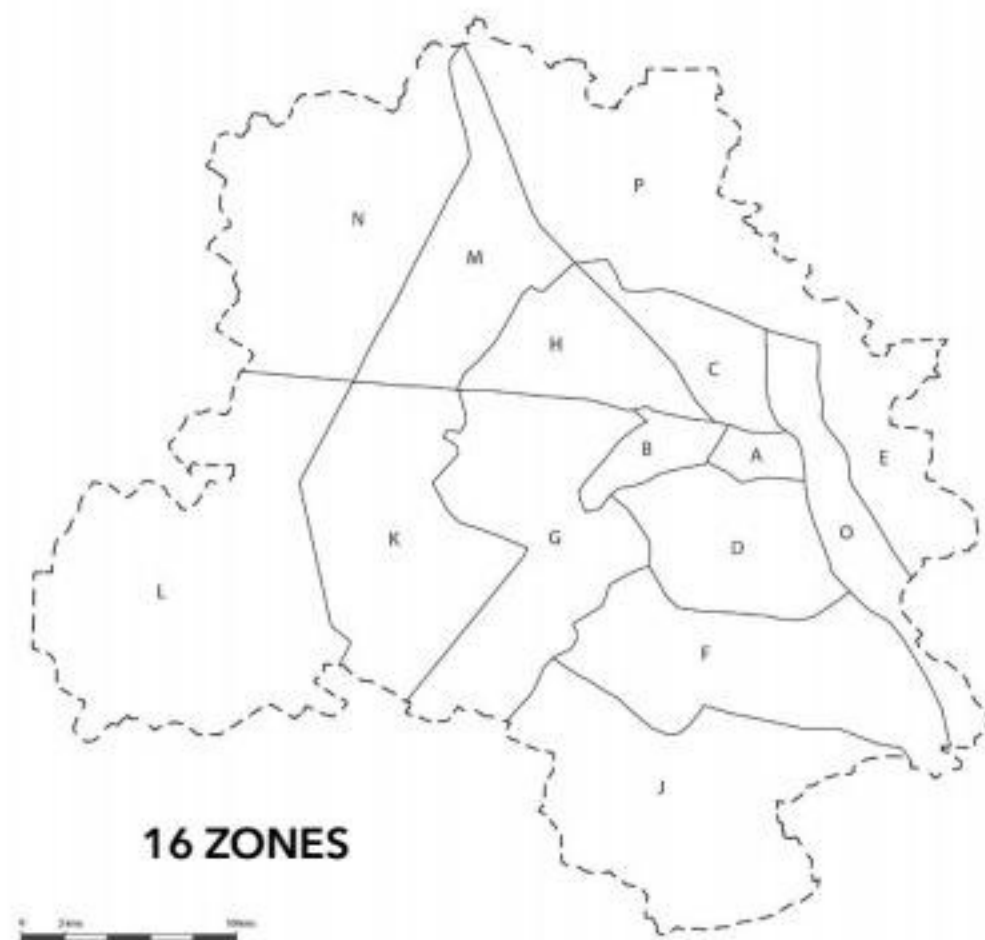
Municipality: Municipal Corporation of Delhi (MCD) + New Delhi Municipal Corporation (NDMC)

Delhi Division

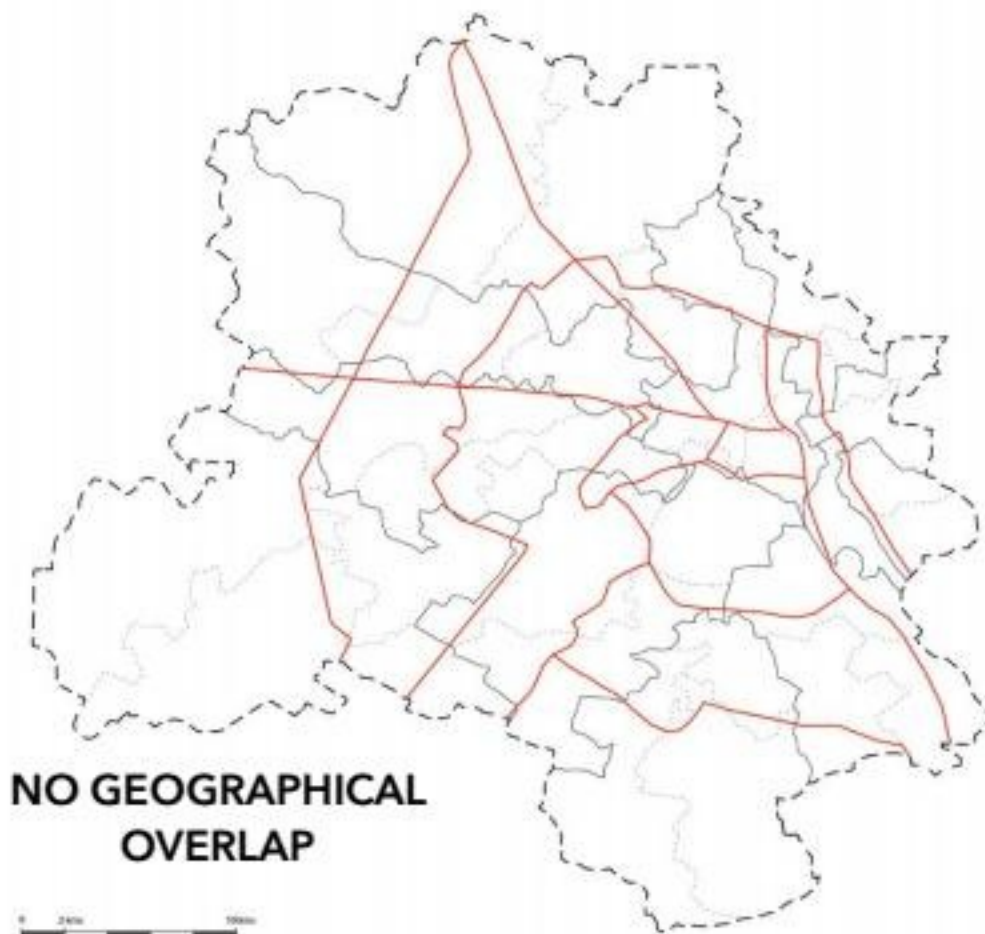
Delhi being the capital city of India is governed by both the central and the state government. They have their own city divisions which do not overlap with each other. This creates a lot of disorder in the planning system. There are already two plans, masterplan by the central government and Zonal Development Plans by the state government which is operative over the city. One of the main issues in the planning system of Delhi is the segregated development plans. Masterplan have its own proposals which are taking into account the 11 districts of Delhi. While on the other hand the Zonal development plans are based on 16 zonal divisions of Delhi which are overlapping the district borders. Now, after the introduction of Indian smart city proposal, another document is being produced which is again proposing changes or evaluating the whole city. There is a bizarre mismanagement among the data, policies and strategies of these organisations. There is no integrated solution for the city that the citizens can follow for any kind of new intervention.



11 DISTRICTS



16 ZONES



NO GEOGRAPHICAL OVERLAP

Fig 7.1: Divisions of Delhi
Source: Drawn by author

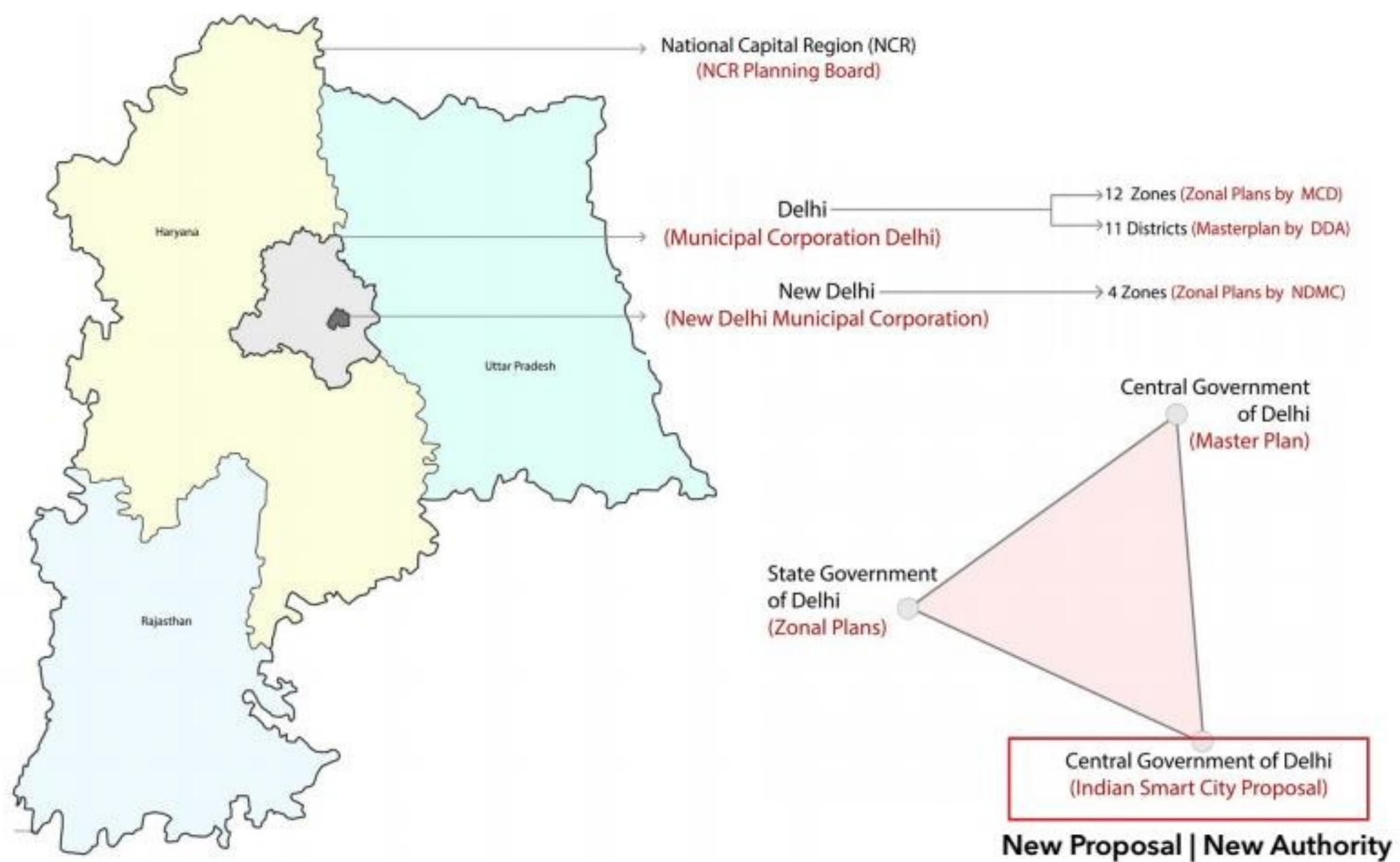


Fig 7.2: Delhi city governance
Source: Drawn by author

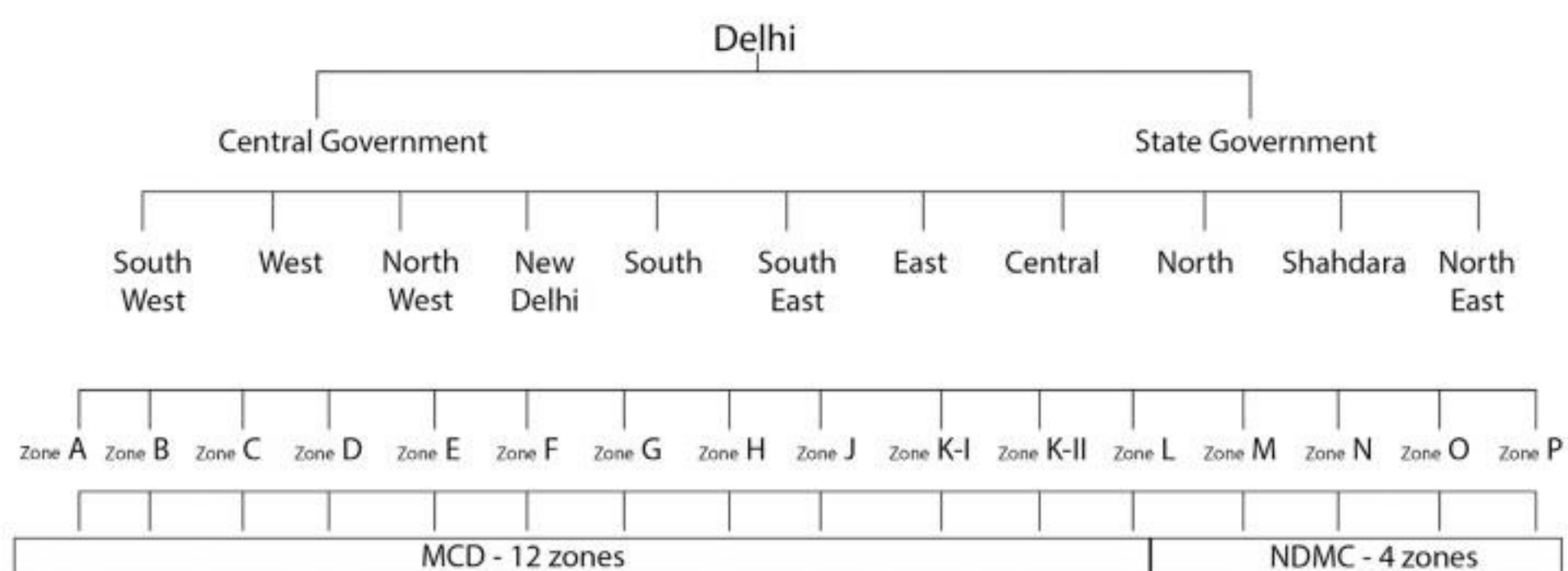


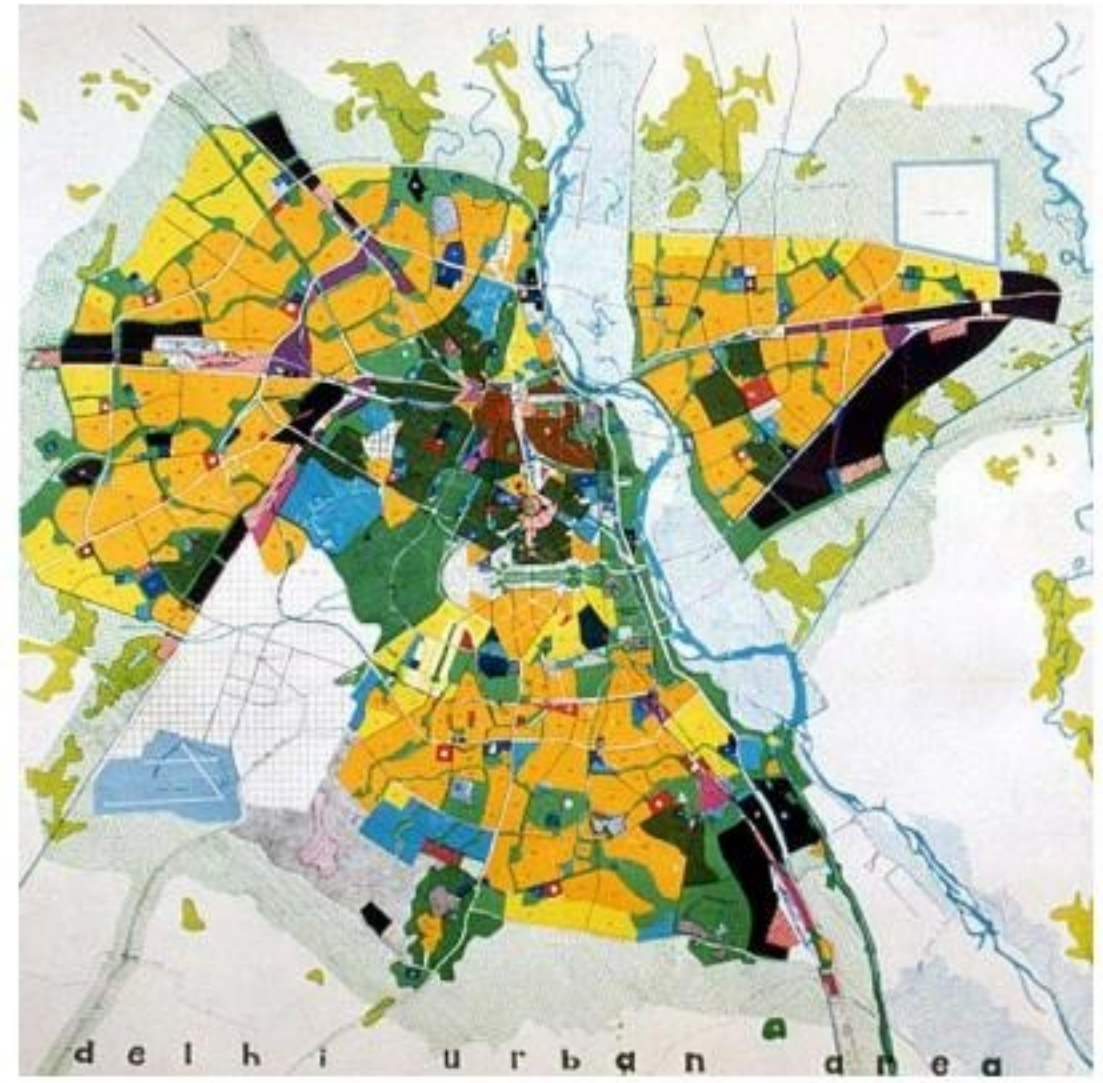
Fig 7.3: The city divisions
Source: Drawn by author

No integration of various plans and projects or authorities

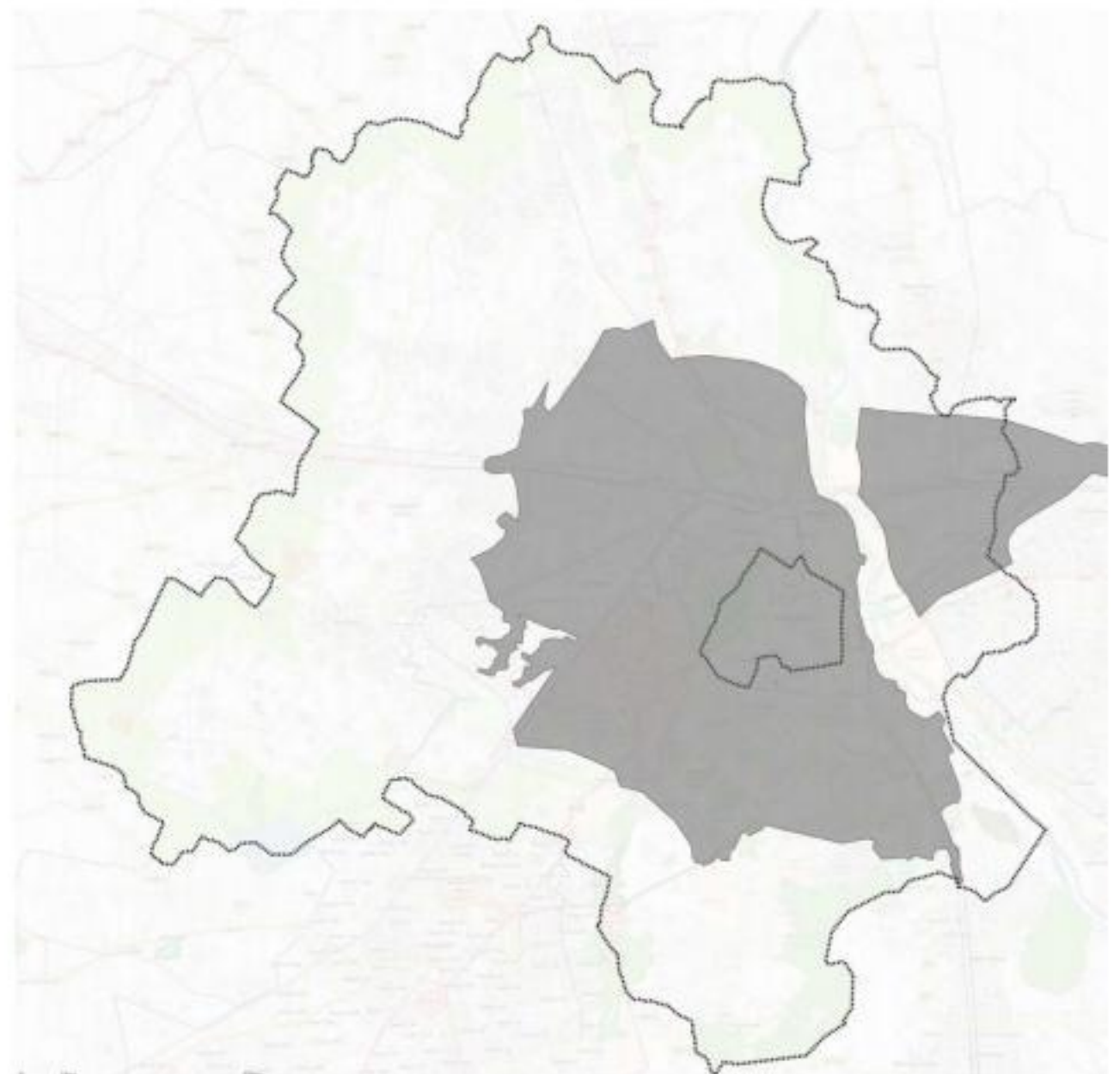
Delhi, the focus of the socio-economic and political life of India, a symbol of ancient values and aspirations and capital of the largest democracy, is assuming increasing eminence among the great cities of the world. The last three masterplan prepared by the municipality of Delhi, proves the amount of urbanization happening in Delhi. The present masterplan is for 2021, is to make Delhi a global metropolis and a world-class city, where all the people would be engaged in productive work with a better quality of life, living in a sustainable environment. This will, amongst other things, necessitate planning and action to meet the challenge of population growth and in- migration into Delhi; provision of adequate housing, particularly for the weaker sections of the society; addressing the problems of small enterprises, particularly in the unorganized informal sector; dealing with the issue of slums, up-gradation of old and dilapidated areas of the city; provision of adequate infrastructure services; conservation of the environment; preservation of Delhi's heritage and blending it with the new and complex modern patterns of development; and doing all this within a framework of sustainable development, public-private and community participation and a spirit of ownership and a sense of belonging among its citizens.

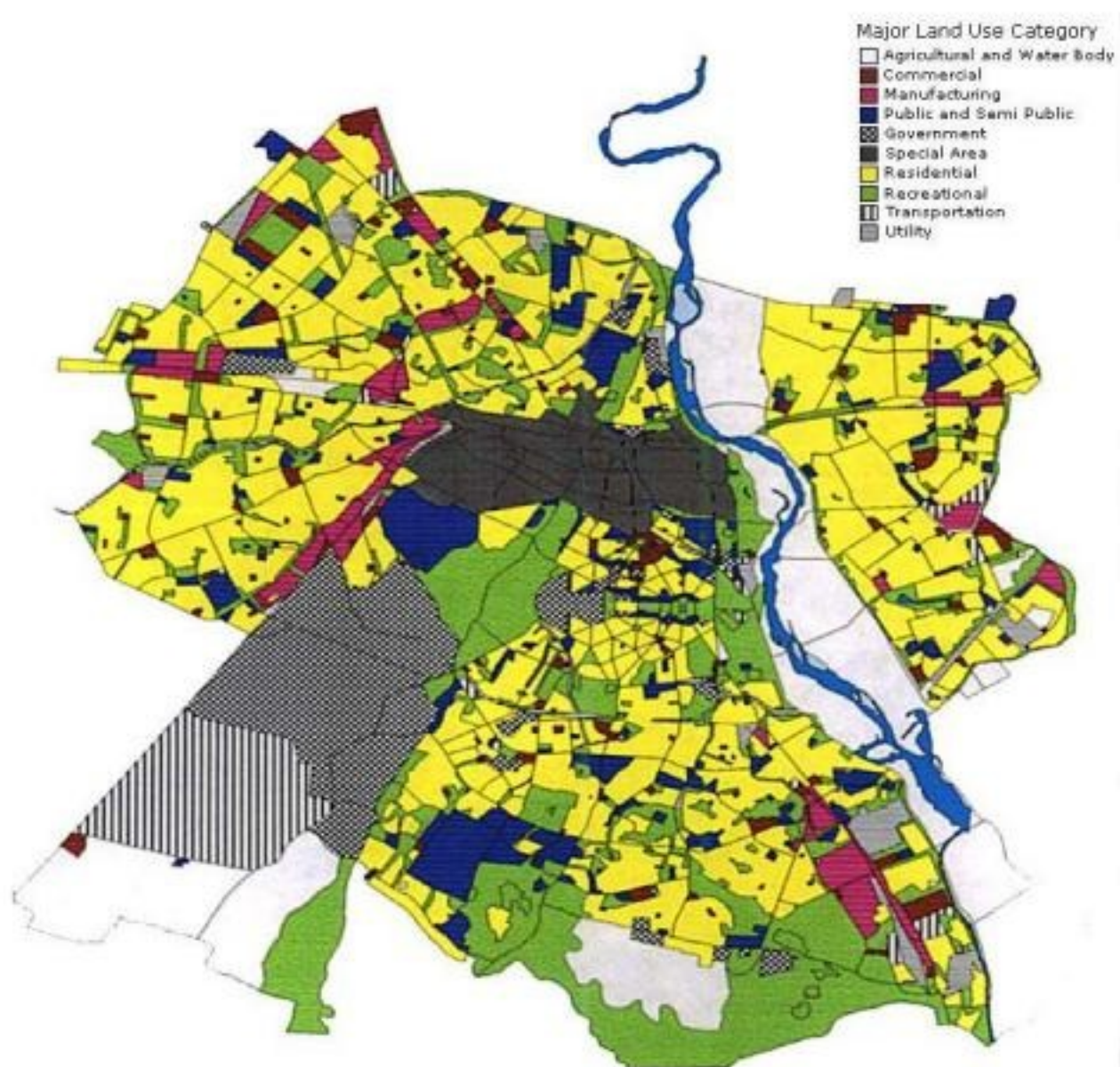
The Master Plan incorporates several innovations for the development of the National Capital. A critical reform has been envisaged in the prevailing land policy and facilitating public - private partnerships. Together with planned development of new areas, a major focus has been on incentivising the recycling of old, dilapidated areas for their rejuvenation. The Plan contemplates a mechanism for the restructuring of the city based on mass transport. The Perspective Plans of physical infrastructure prepared by the concerned service agencies should help in better coordination and augmentation of the services.

It is visible that a lot of areas are left unauthorized. Through my proposal I will try to develop 2 contrasting areas. Why should citizens experience two different treatment staying in the same city?

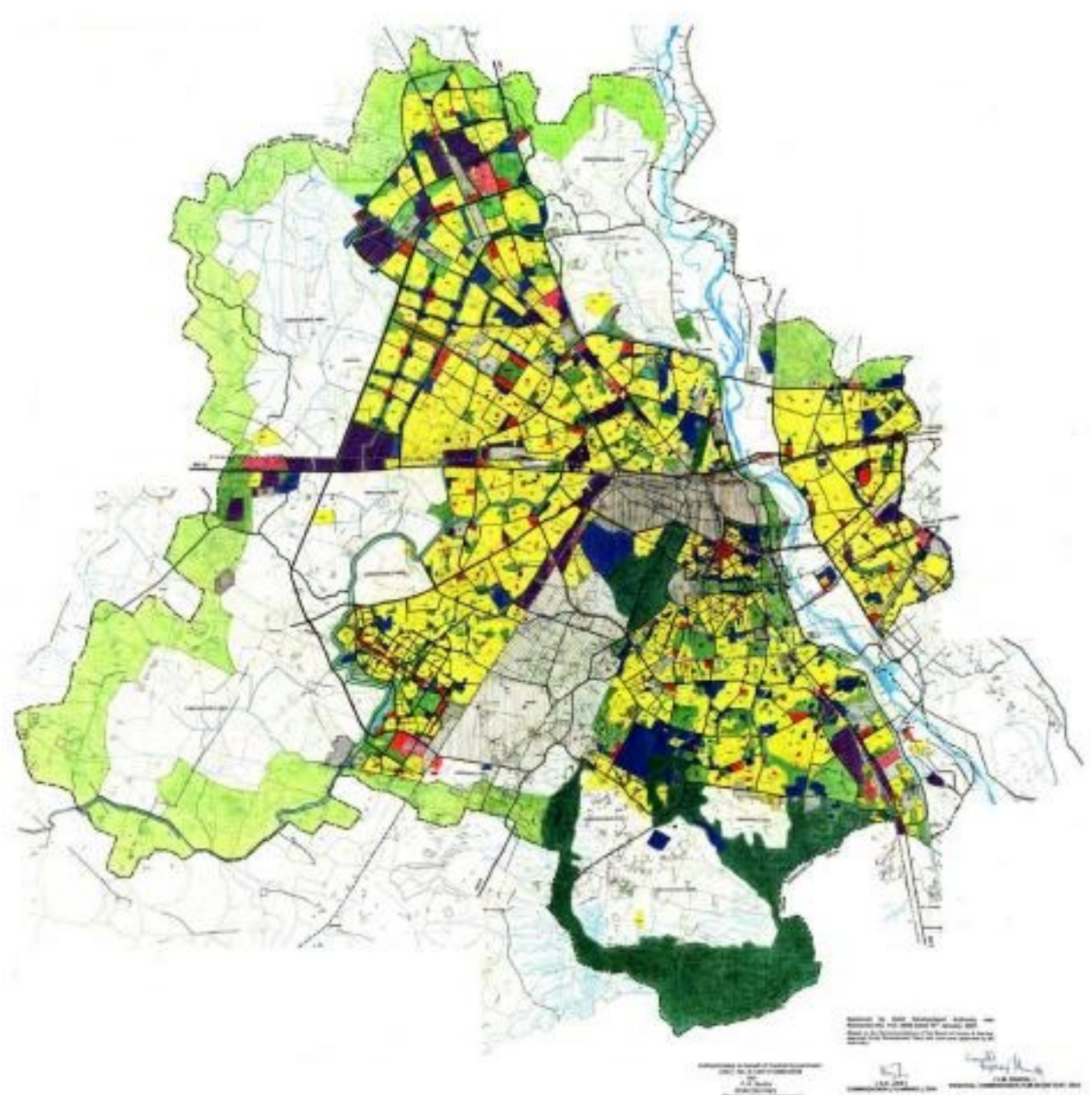


Master Plan for Delhi 1981





Master Plan for Delhi 2001



Master Plan for Delhi 2021

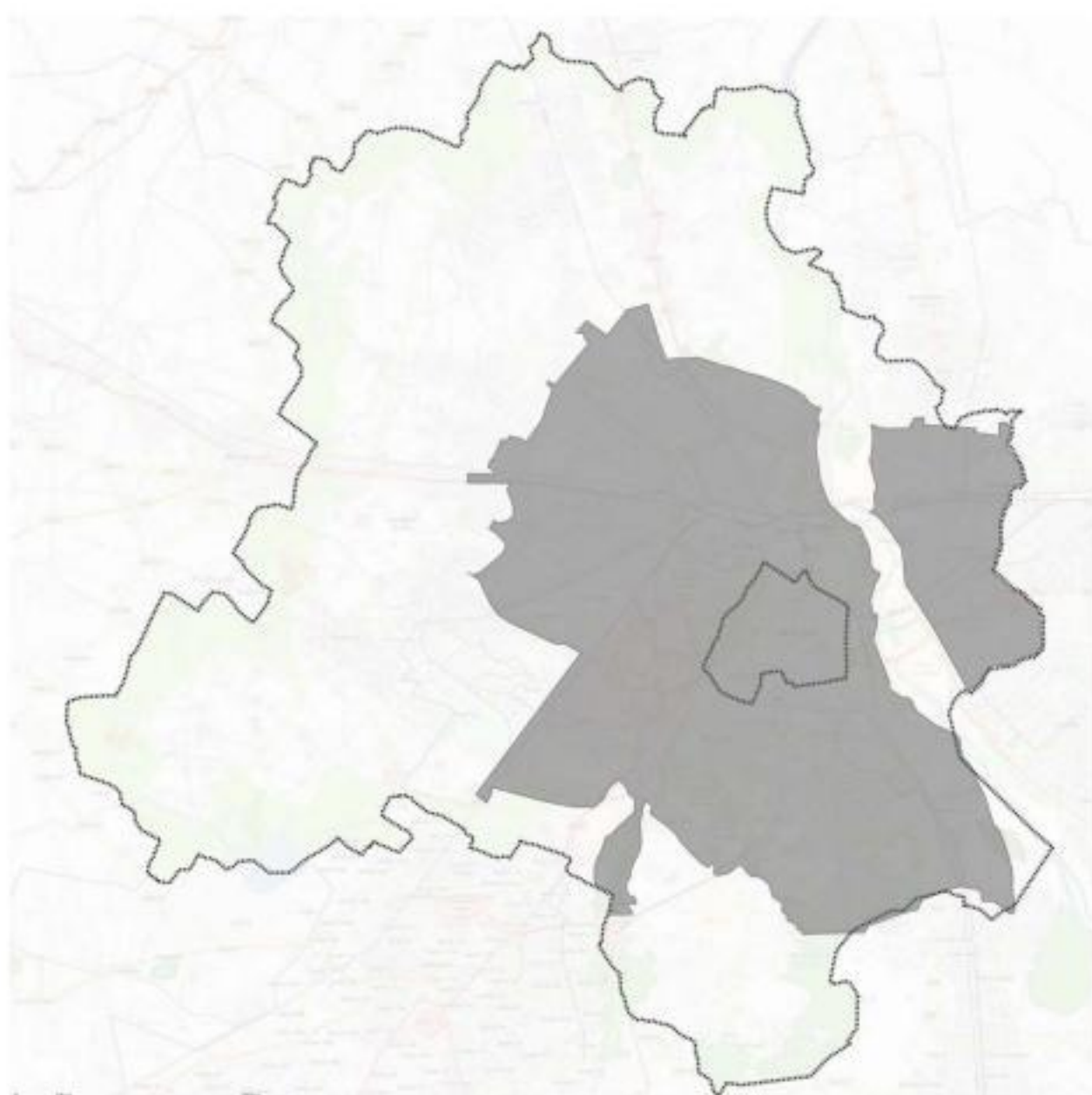


Fig 7.4: Master Plan Analysis
Source: Drawn by Author (Delhi Municipality Plans)

Master Plan for Delhi 2001- Planned zones vs unauthorised areas

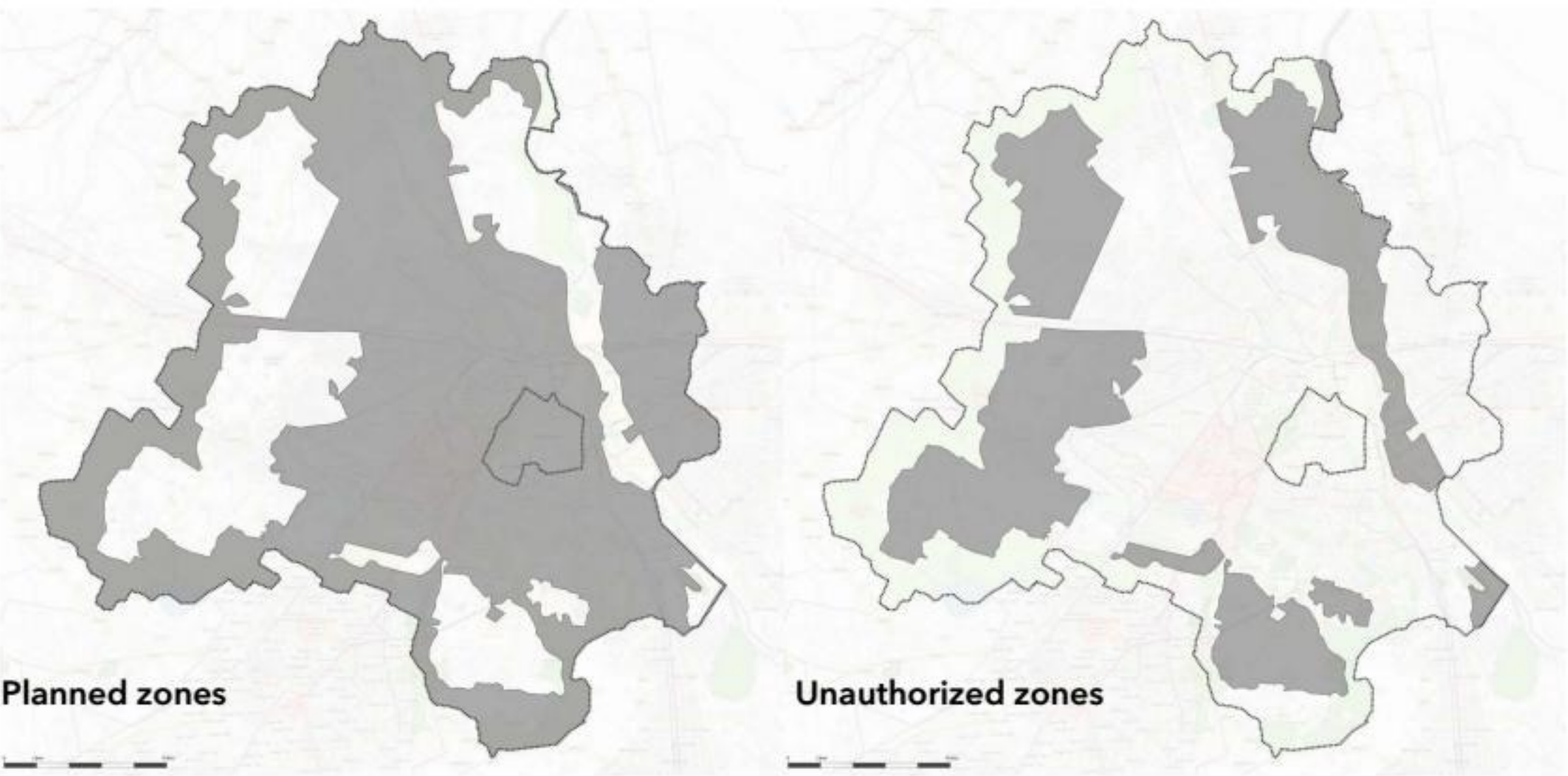


Fig 7.5: Master Plan Analysis
Source: Drawn by Author (Delhi Municipality Plans)

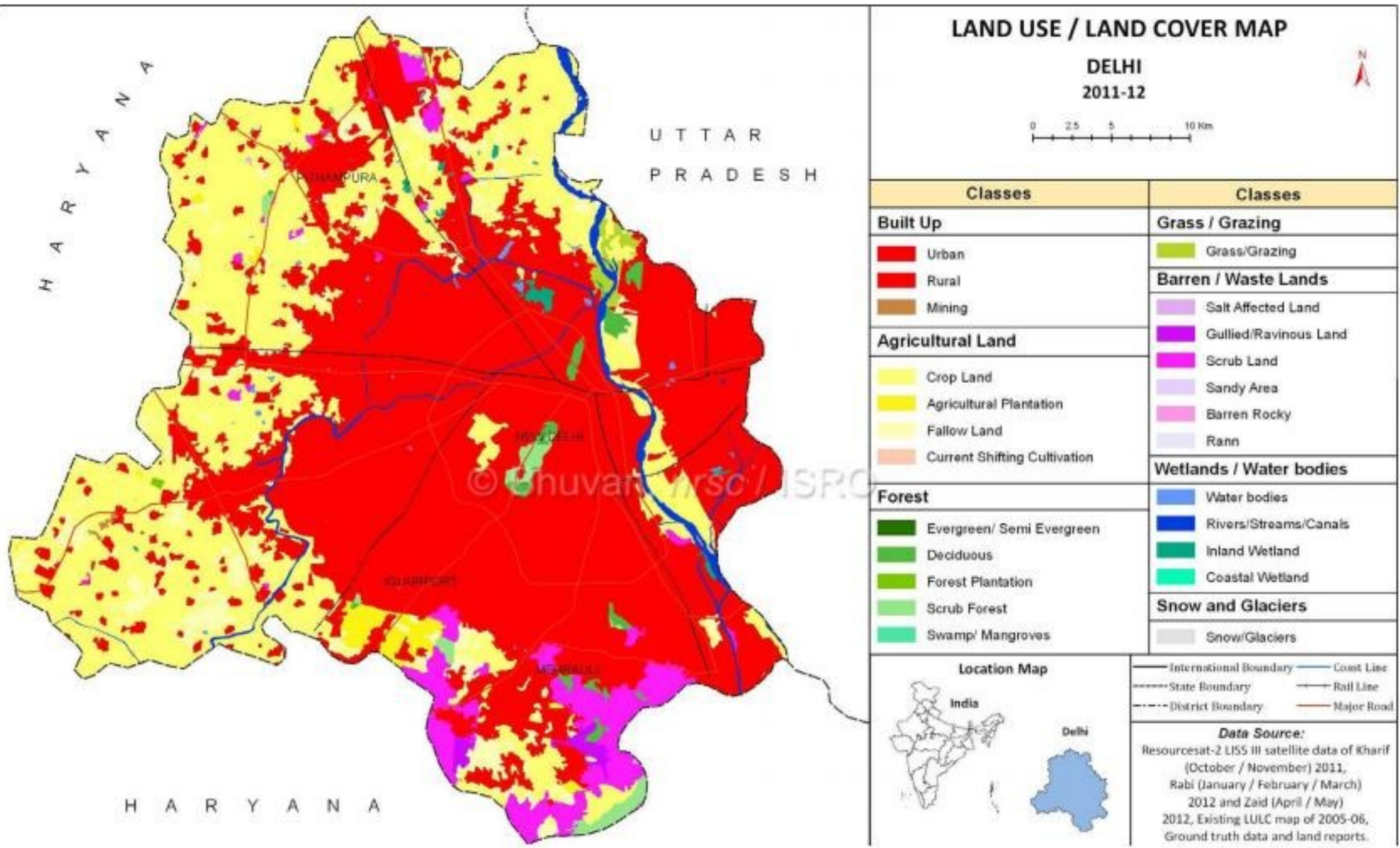


Fig 7.6: Master Plan for Delhi 2001- Urban and rural areas
Source: Delhi Municipality Landuse Report



Fig 7.7: Market crowd (A mix of urbanization and exceeding population)
Source: samaa.tv



Fig 7.8: Delhi Metro (Infrastructural additions for urbanization)
Source: India Group Today

India is remarkably growing. These are the proofs how desperately India needs to find smarter solutions.

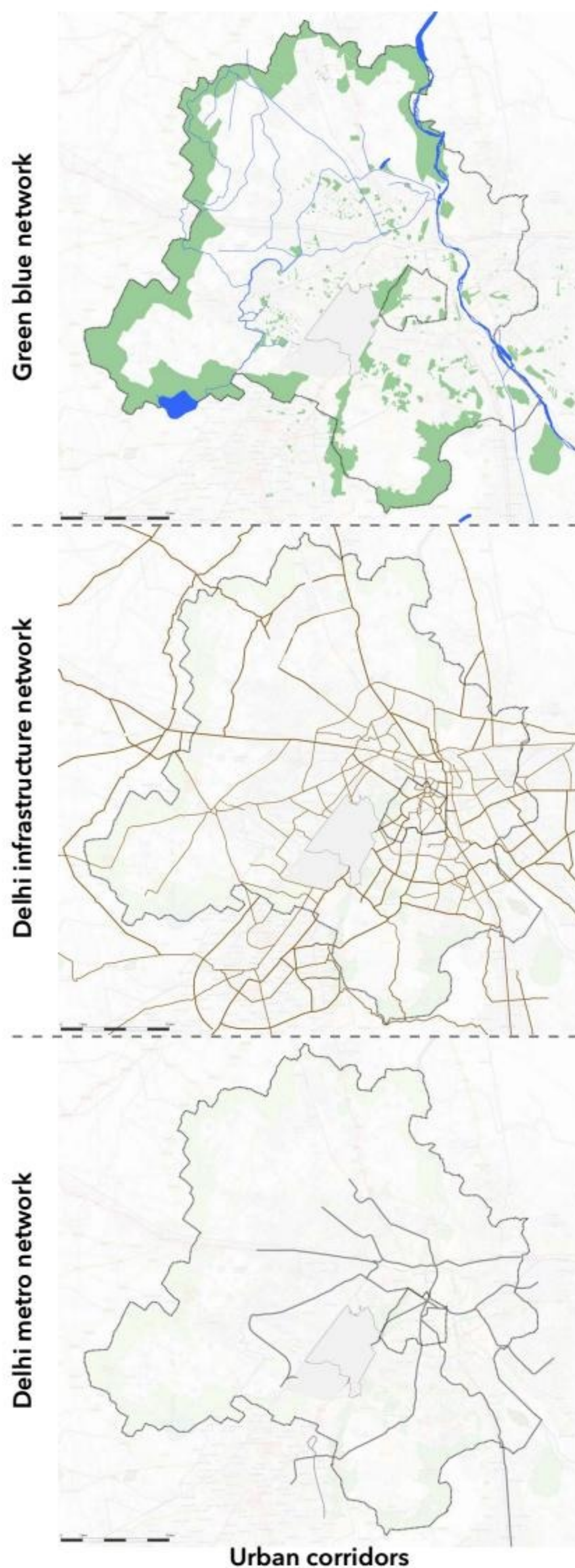
Delhi Infrastructural corridors

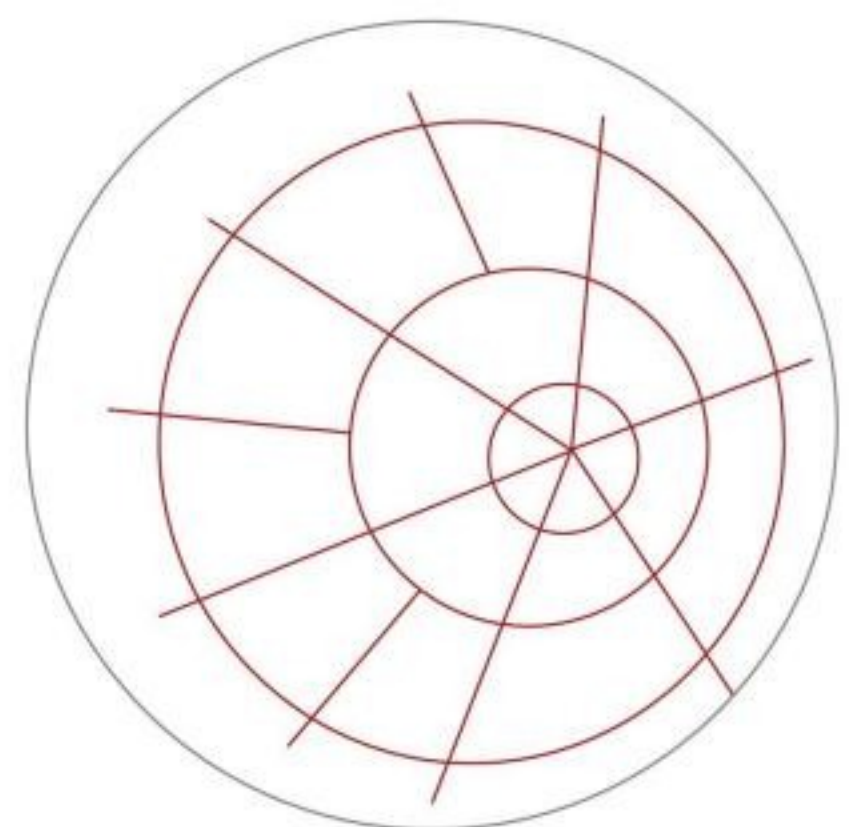
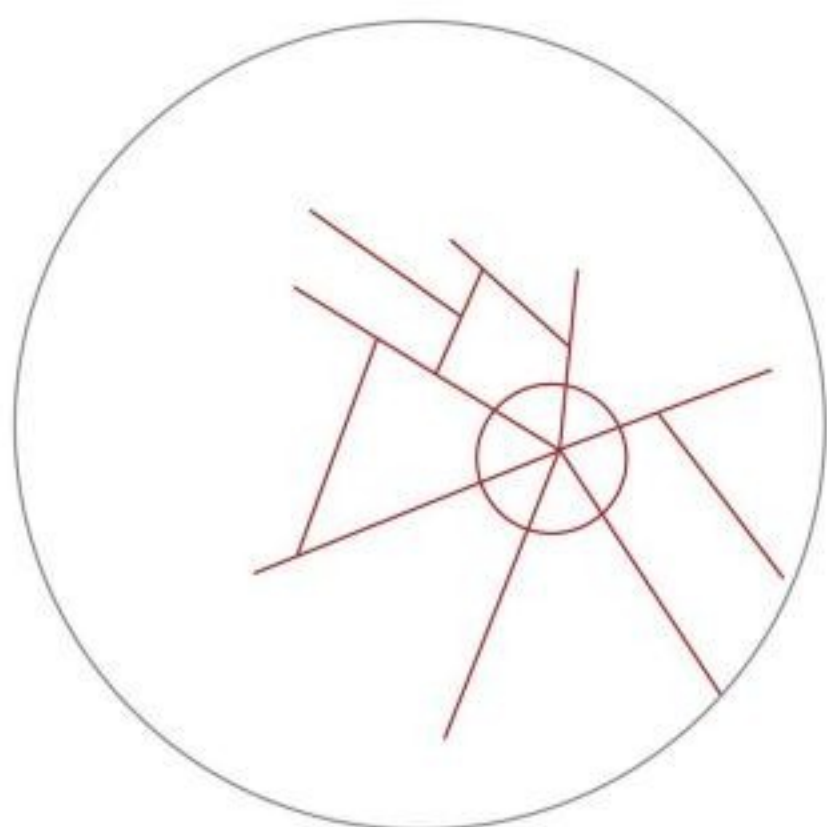
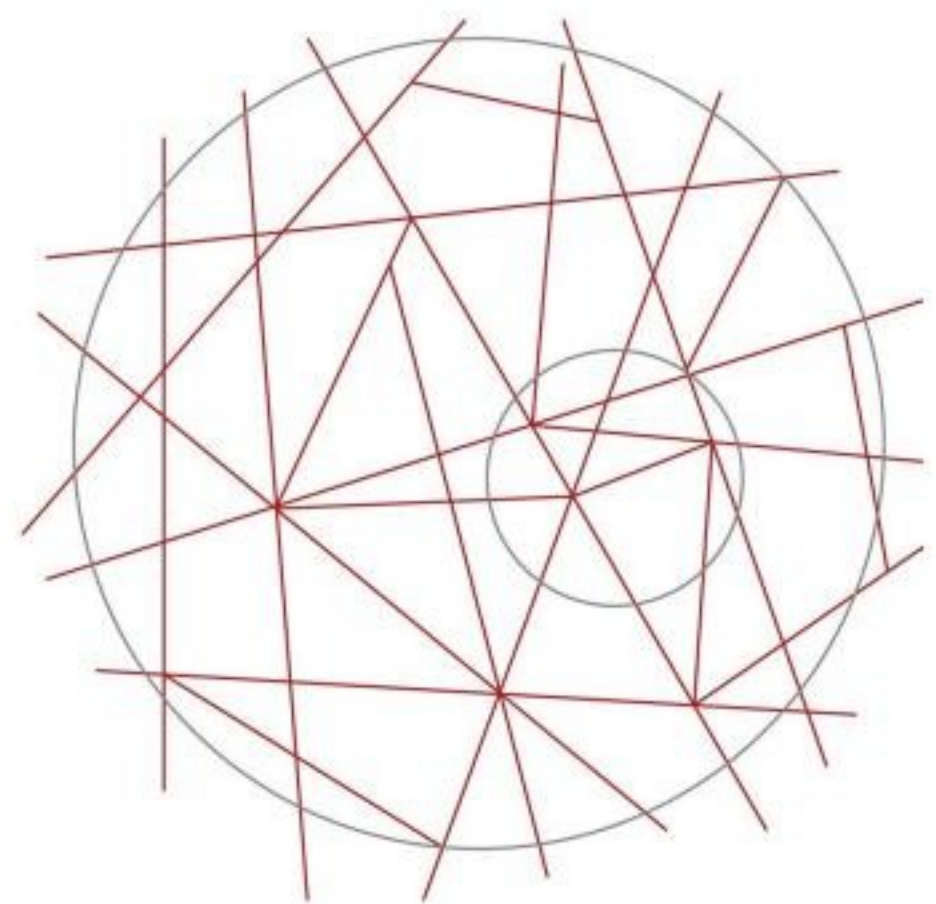
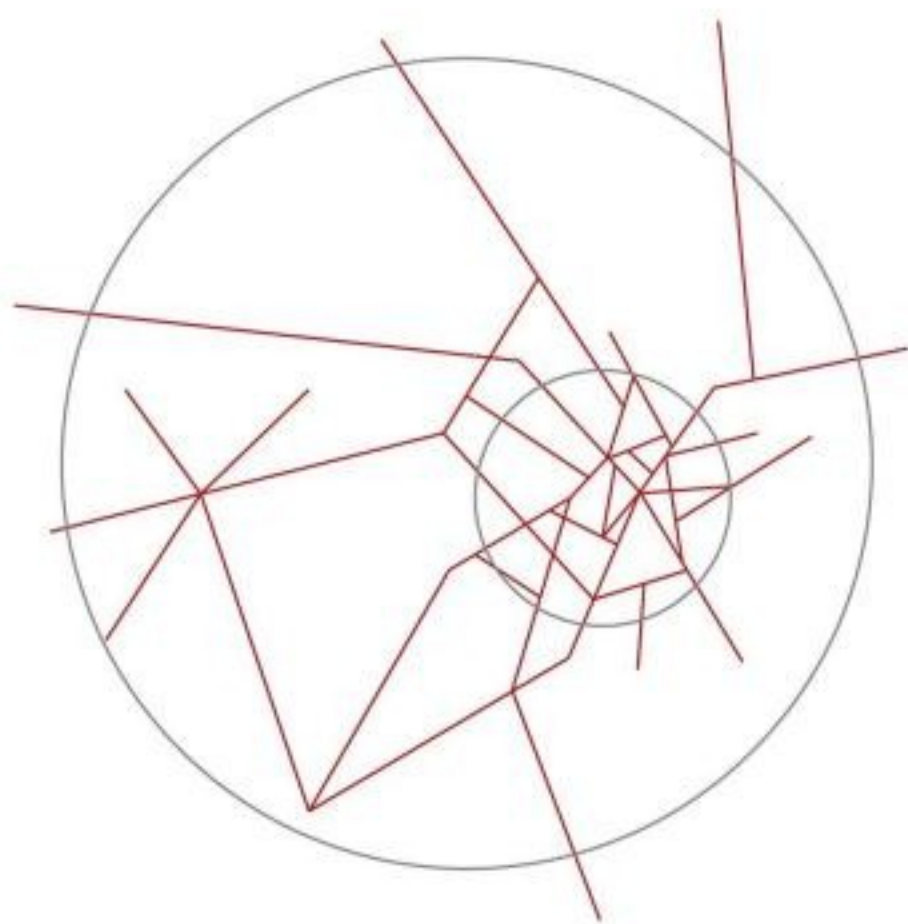
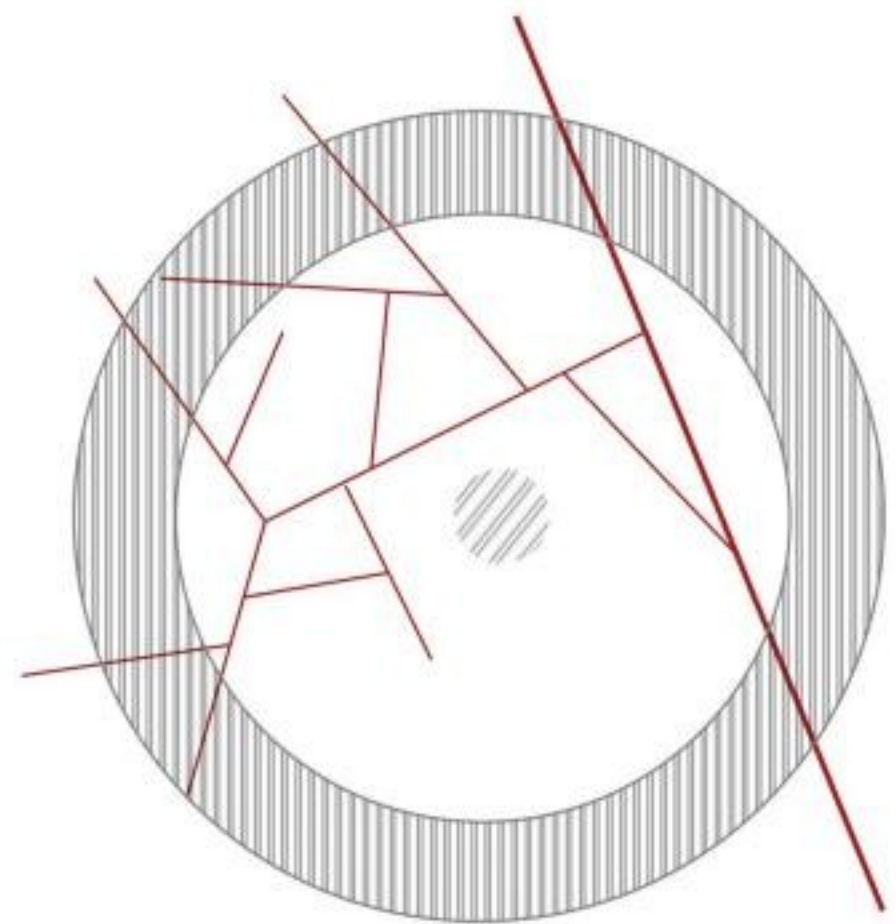
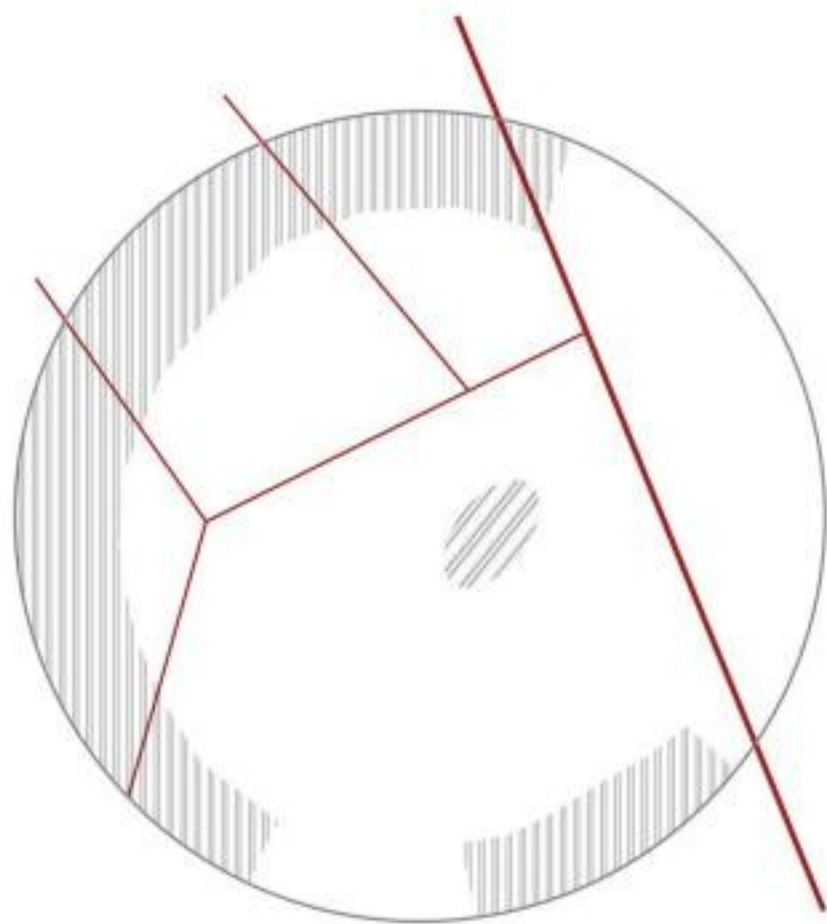
While population and human settlements are classified as urban and rural, high degree of heterogeneity and wide disparities within urban population in a city is a basic feature. City plans in India as in many other countries are essentially landuse plans—earmarking areas for residential, commercial, industrial, institutional, recreational and land for transportation. Residential land use is the anchoring feature that occupies the largest proportion of a city's land and residents and their living conditions are the focus of city plans. Residential layouts planned by the Development Authorities attempt to accommodate disparities among the city population in the planned residential areas by earmarking residential land for four categories such as high income, middle income, low income and economically weaker sections. Obviously, residential densities increase with decreasing income level, with highest densities of economically weaker sections and lowest in the case of high income group. It is also clear that the per capita costs of providing urban infrastructure (such as sewage line, water pipe, electrical connection etc.) would decrease with increasing densities. Simultaneously, the environmental conditions (congestion, crowding etc.) deteriorate with increasing densities beyond a point. Thus, there is a trade-off between urban residential density, and per capita infrastructural and environmental costs. While reasonable range in population densities associated with income are expected, this stretches in the case of Delhi for example, from less than 50 persons per hectare in some parts of the city to over 20,000 per hectare. Generally, it is the high-cost, low-density, high-income areas that have better urban services.(Ramachandran 2014)

Disconnected links in all the corridors. While the population is equally divided in the whole area. All citizens are supposed to pay equal taxes considering all the unevenness of facilities. So why there is a difference in the infrastructure distribution?

Infrastructure Corridor in Delhi	How it is presently?	How it should be?
----------------------------------	----------------------	-------------------

Fig 7.9: Infrastructure analysis of Delhi
Source: Drawn by author





Present condition

Ideal condition

The selected sites

Moving towards the smaller scale of a city from the strategy and policy making level on a city scale, I will be introducing ground level projects to include the citizens in the process of city making. To do that, I am following the three defined area based development strategies introduced by the government in the Smart city proposal. I will be implementing those strategies in a neighbourhood level and include the residents

activities to make it stronger.

For this, three different sites has been chosen in New Delhi, based on their unlike problem fields and acceptance towards technology and development. The first case is already been proposed as the NDMC area based project. So, along with the designing of three selected site, I have tried to understand the current proposal as well.

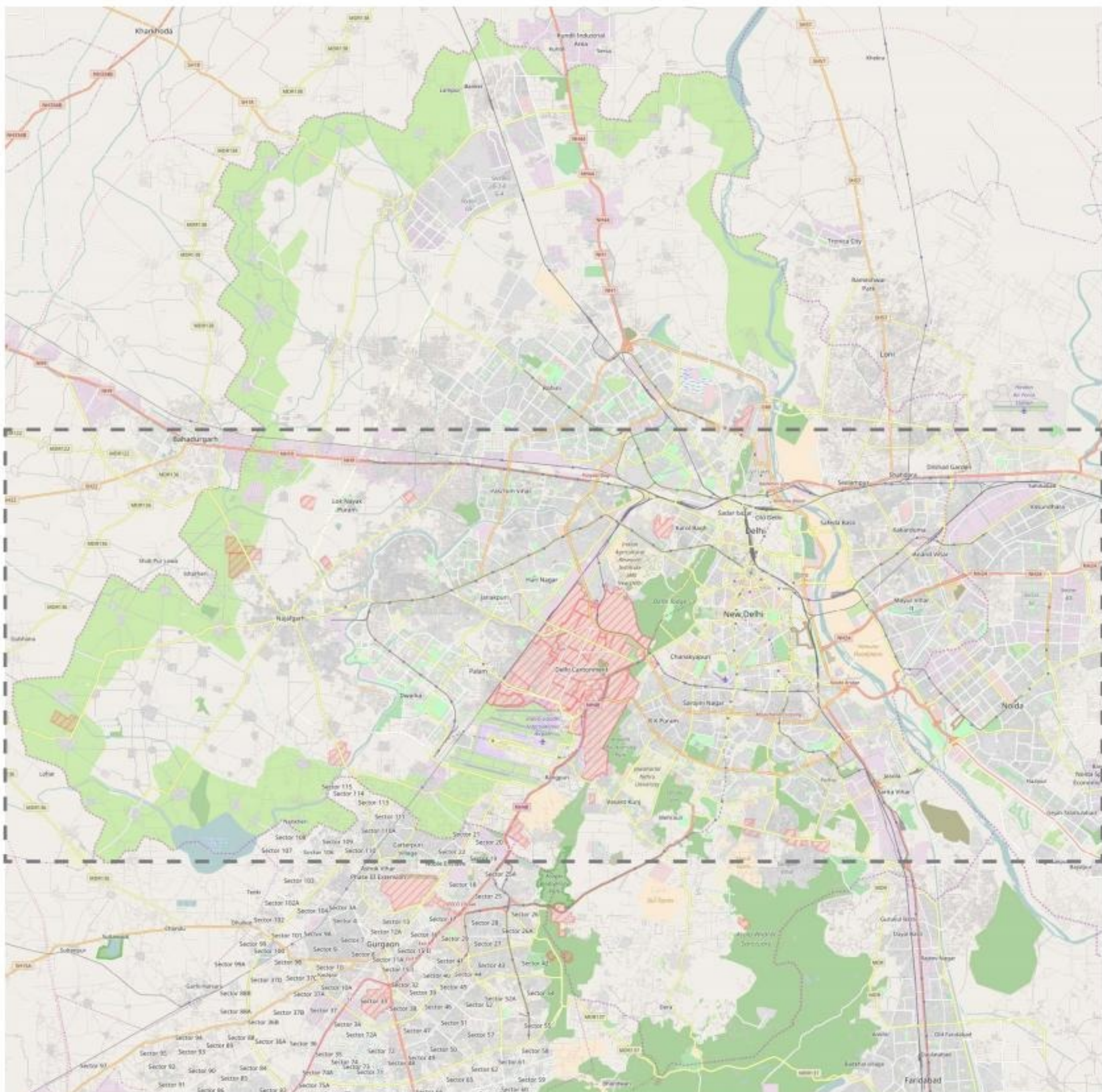


Fig 7.10: New Delhi Map for area selection

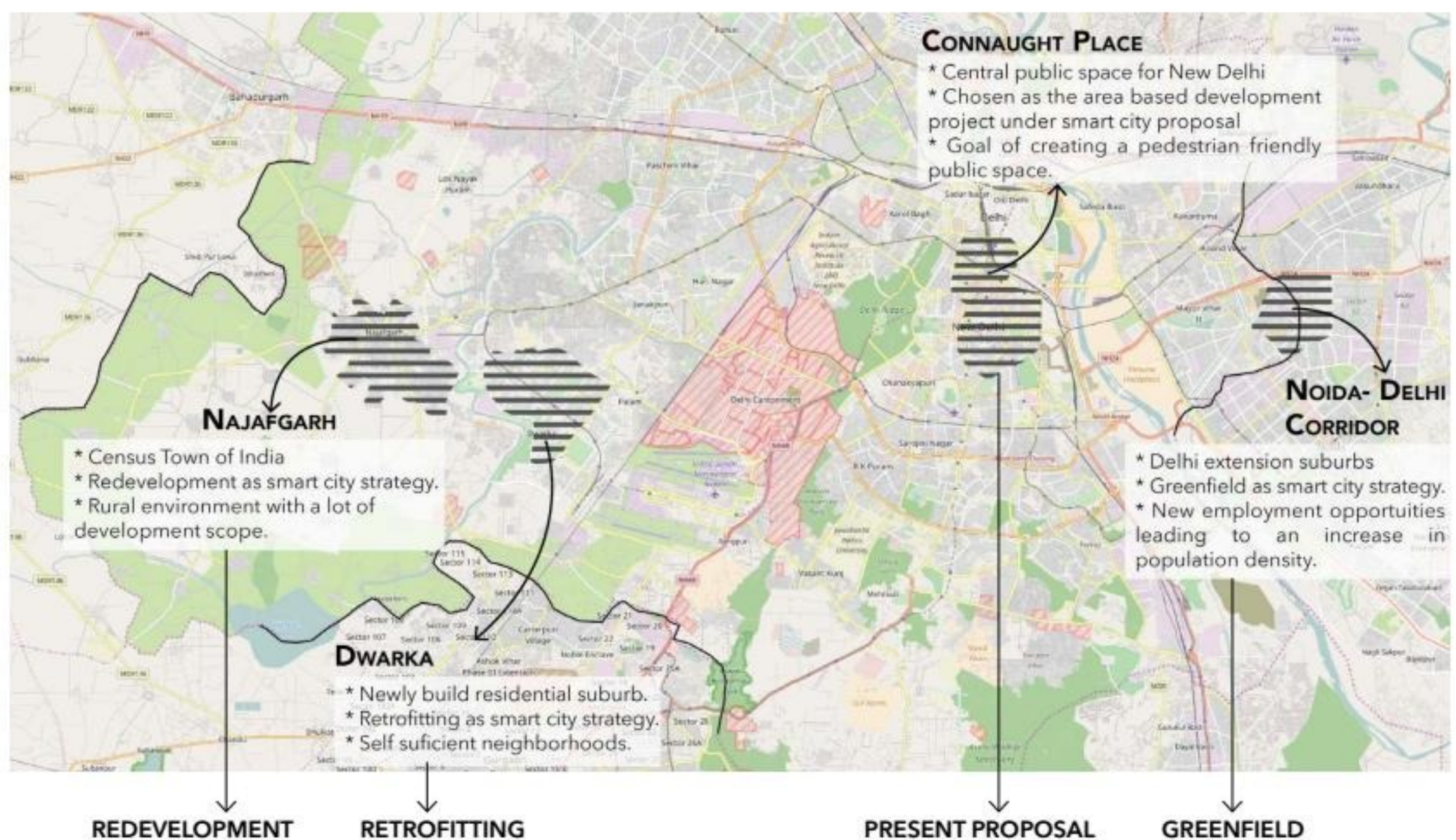
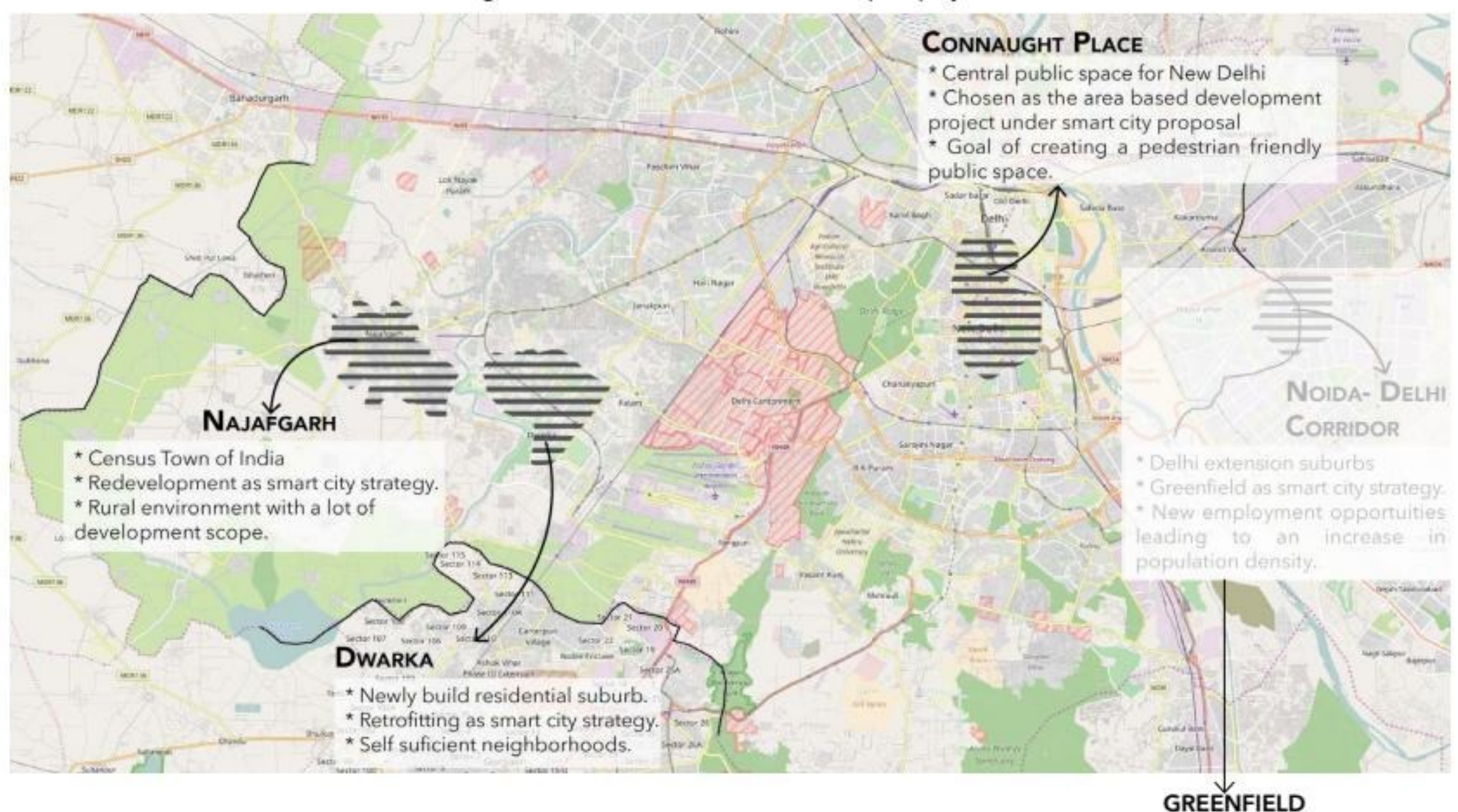
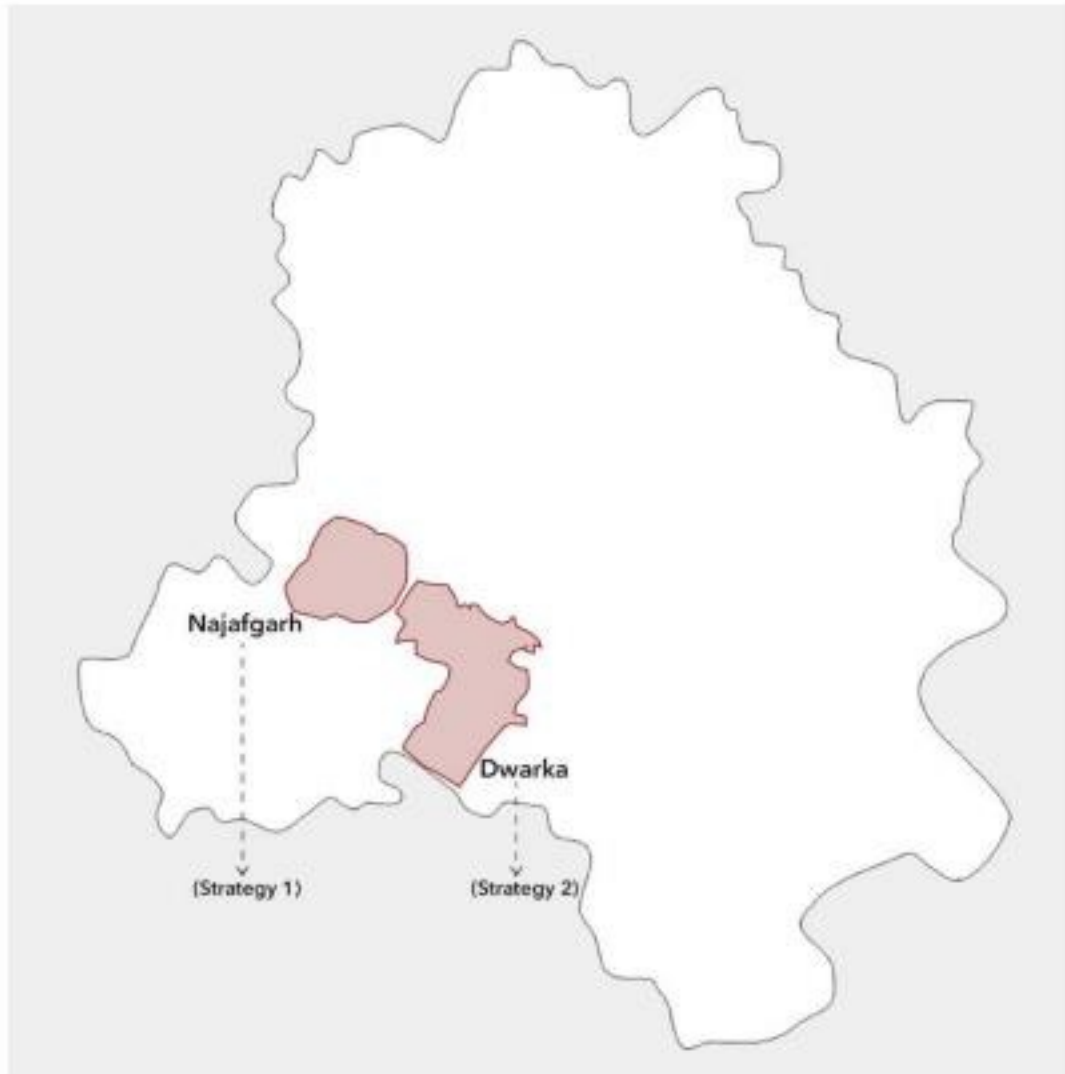


Fig 7.11: Selected areas in New Delhi for pilot projects



Limitation: Greenfield focuses purely on the sector of housing which is entirely a different sector of study and research. I will be limiting my scope to other two strategies of Indian smart city proposal due to lack of time and my personal interest.



Two neighbourhoods at a distance of one and half Kms are having different issues, portrays a lot of differences in their characters. Not just that but also the Government is treating them differently. One is a planned sub city and the other is an urban village. The sites are separated by a huge drain, which was previously a river. This became the physical barrier that separated those two sites. The second site is excluded by the citizens as well as the government as it doesn't come under authorised areas in the masterplan. We will see the issues and differences they have further.

Fig 7.12: Location of two selected sites
Source: Drawn by Author

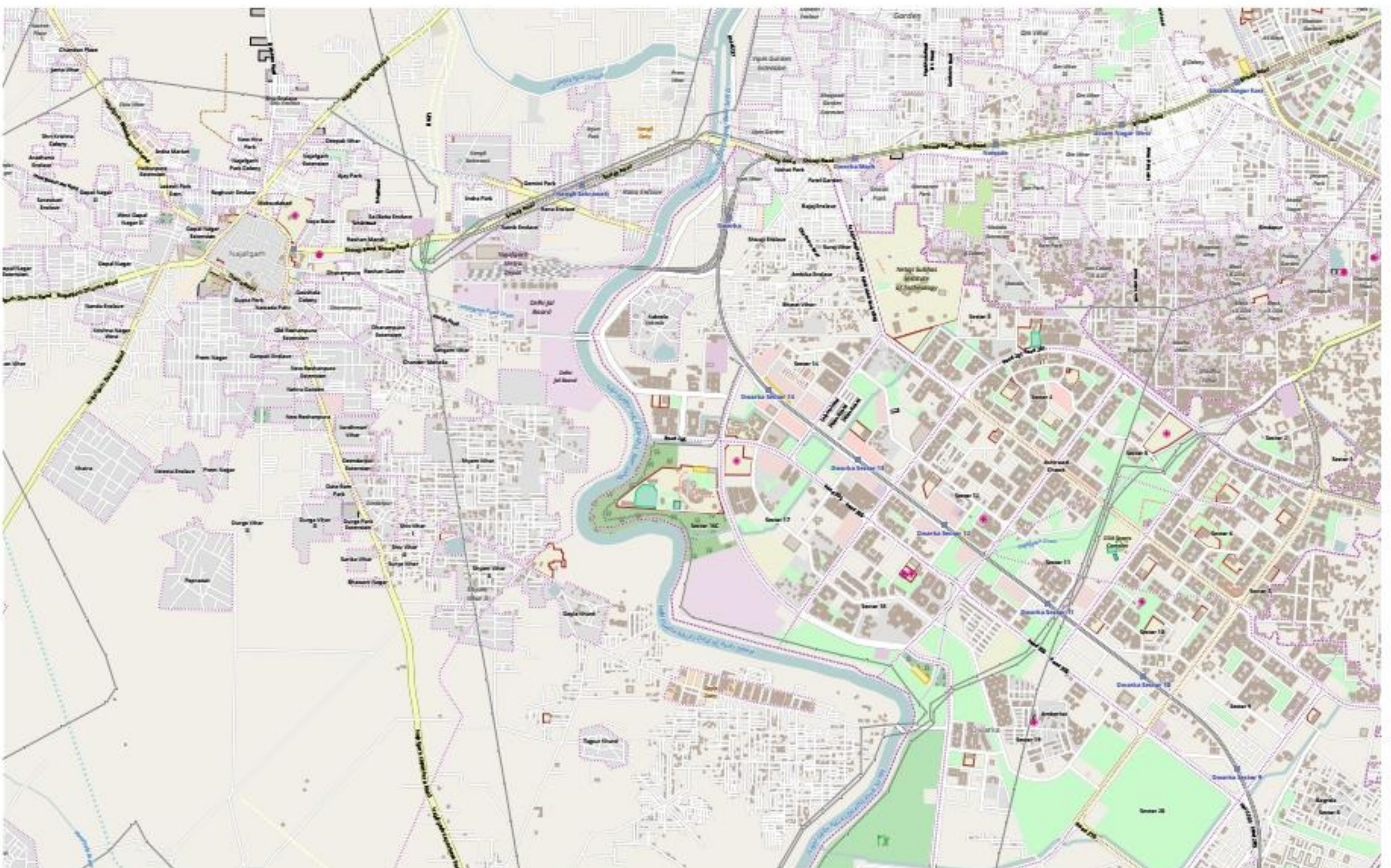
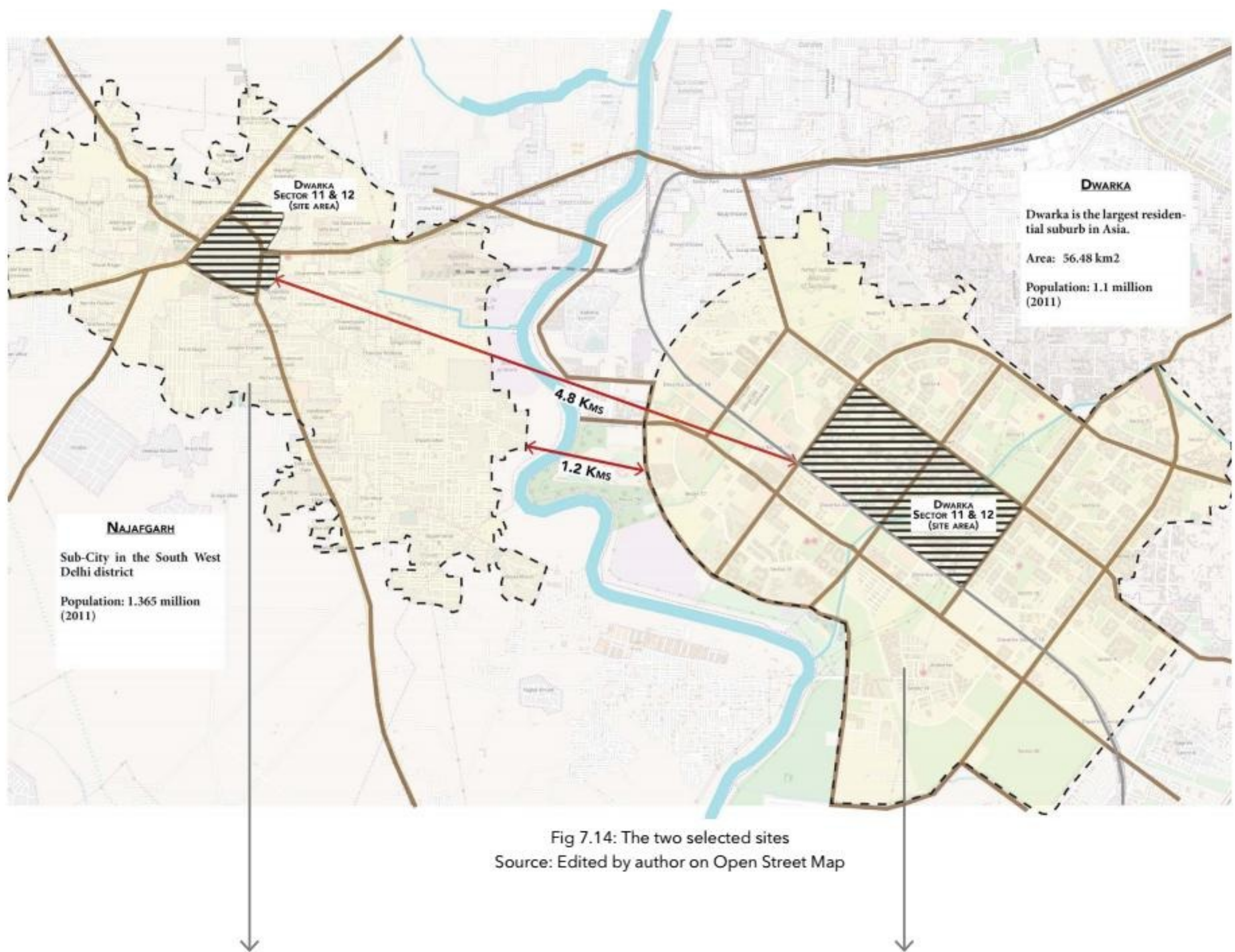


Fig 7.13: The two selected sites
Source: Open Street Map



Najafgarh



Dwarka

Fig 7.15: Site conditions and visible differences
Source: Google maps

b) Dwarka

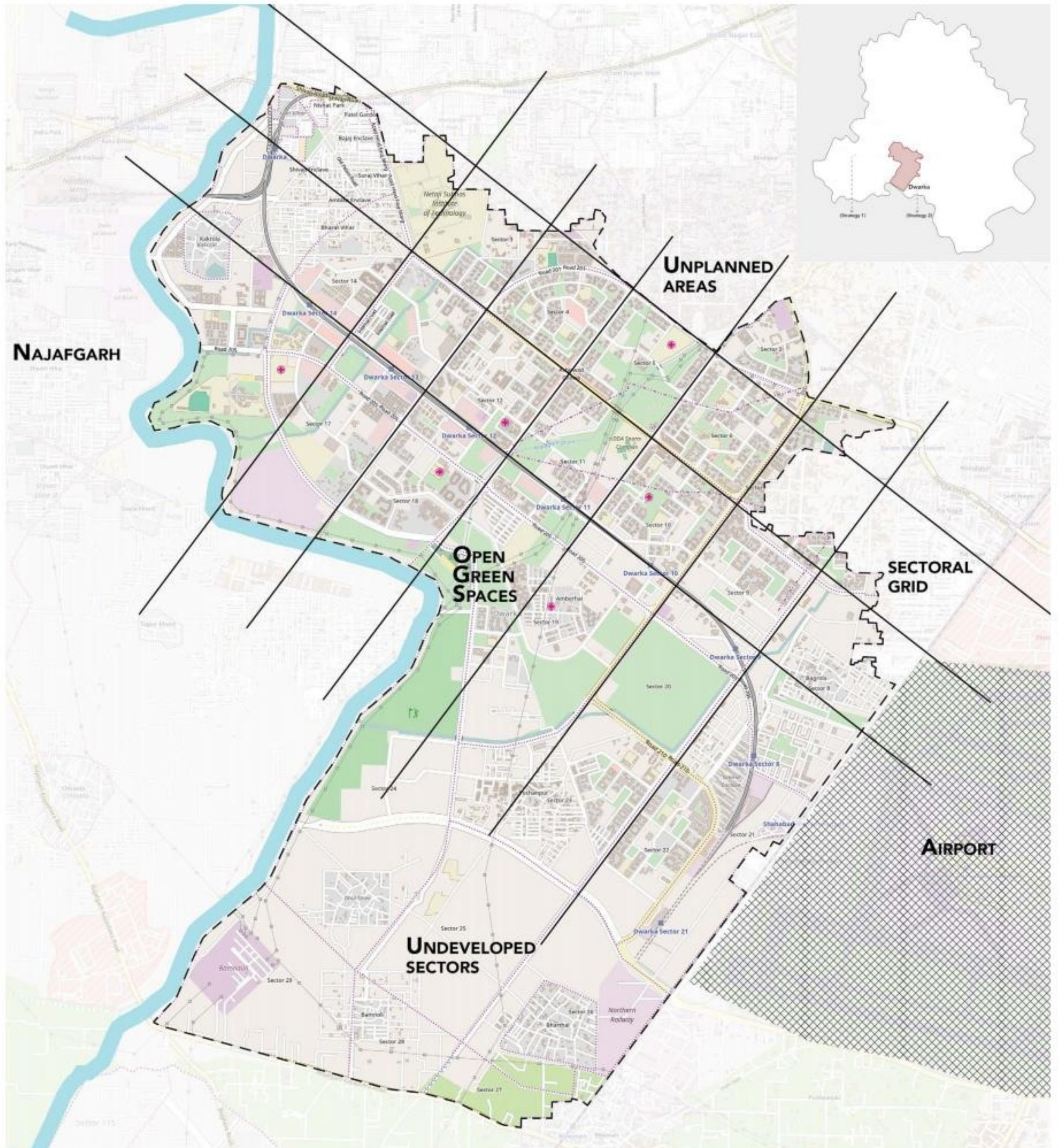


Fig 7.16: Dwarka site location
Source: Drawn by Author (Edited on Open Street Map)

The first selected site for the pilot project is a subcity that came up a decade back having a planned and organised structure. The subcity was introduced as an extension of New Delhi but gradually it became an important part of it. Geographically this can be considered as the edge of the urban limits of Delhi.

Dwarka is organised into Cooperative Group Housing Societies. It is one of the most sought-after residential areas in the city. The envisaged population as per MPD 2001 for Dwarka Sub city (Zone K (part)) was 11 lakh proposed to be accommodated. The Dwarka Sub city has an area of 5648 ha. Out of this, 1688 ha is designated as built-up and the balance 3960 ha is under planned/regulated development comprising sector 1 to 29. A multi mode transport system has been envisaged which consists of a hierarchy of road network supported with railway corridor. The development of K-II will be done in two phases i.e. implementation and development of

DDA land and redevelopment schemes for the built up area and villages. Dwarka is organised into Cooperative Group Housing Societies. It is one of the most sought-after residential areas in the city.

In this area, I will be focussing on the retrofitting strategy of the smart city proposal, which is inclusion and addition of some futuristic developments. The prominence will be on the activeness of citizen participation in the process to enrich the designing and planning aspects.

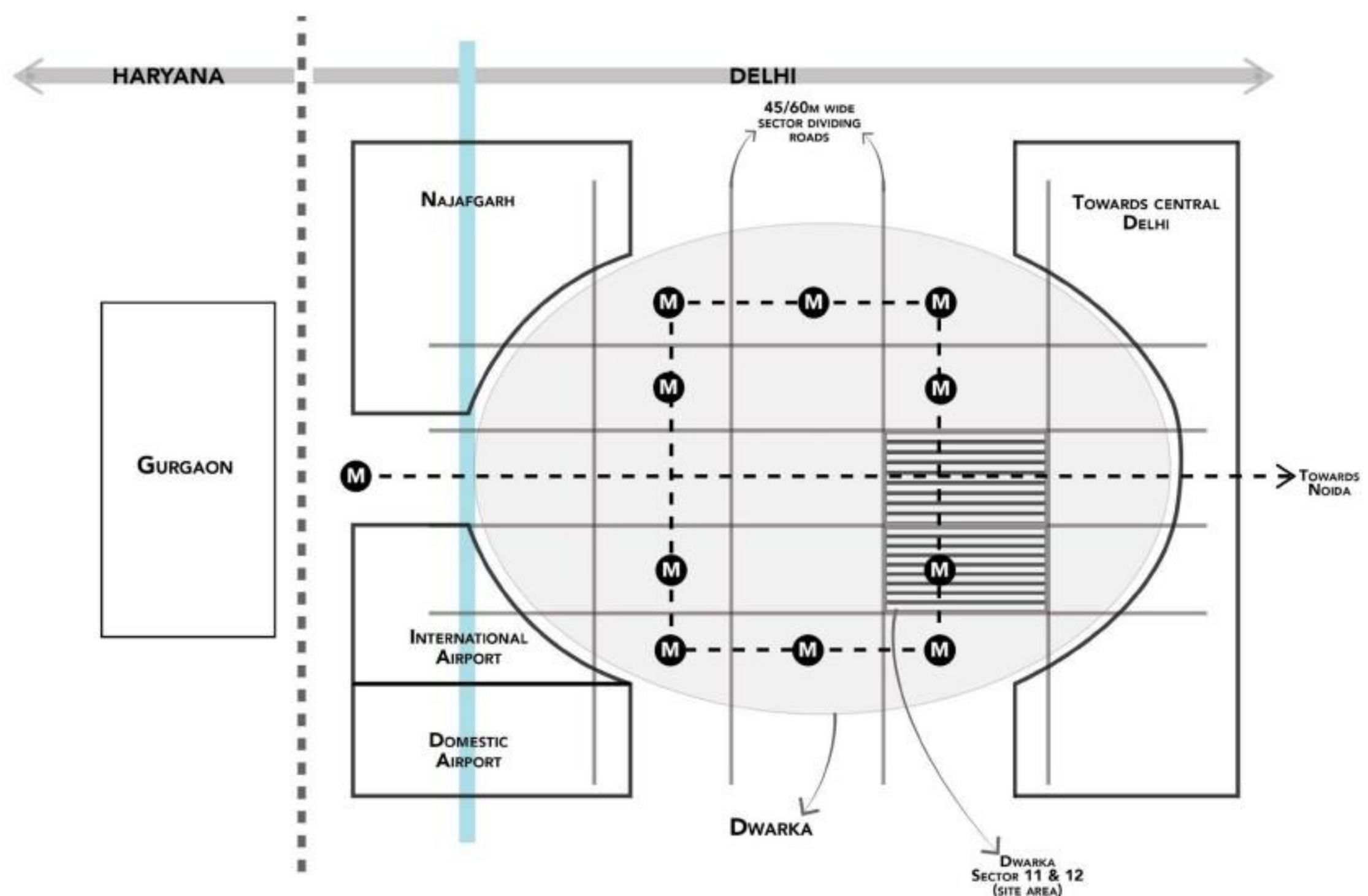


Fig 7.17: Dwarka site analysis
Source: Drawn by Author



Fig7.18: Present condition of Dwarka



Fig 7.19: Most of the parts of Dwarka are Under construction or newly built



Fig 7.20: Dwarka landuse plan by government
Source: DDA

Landuse Plan

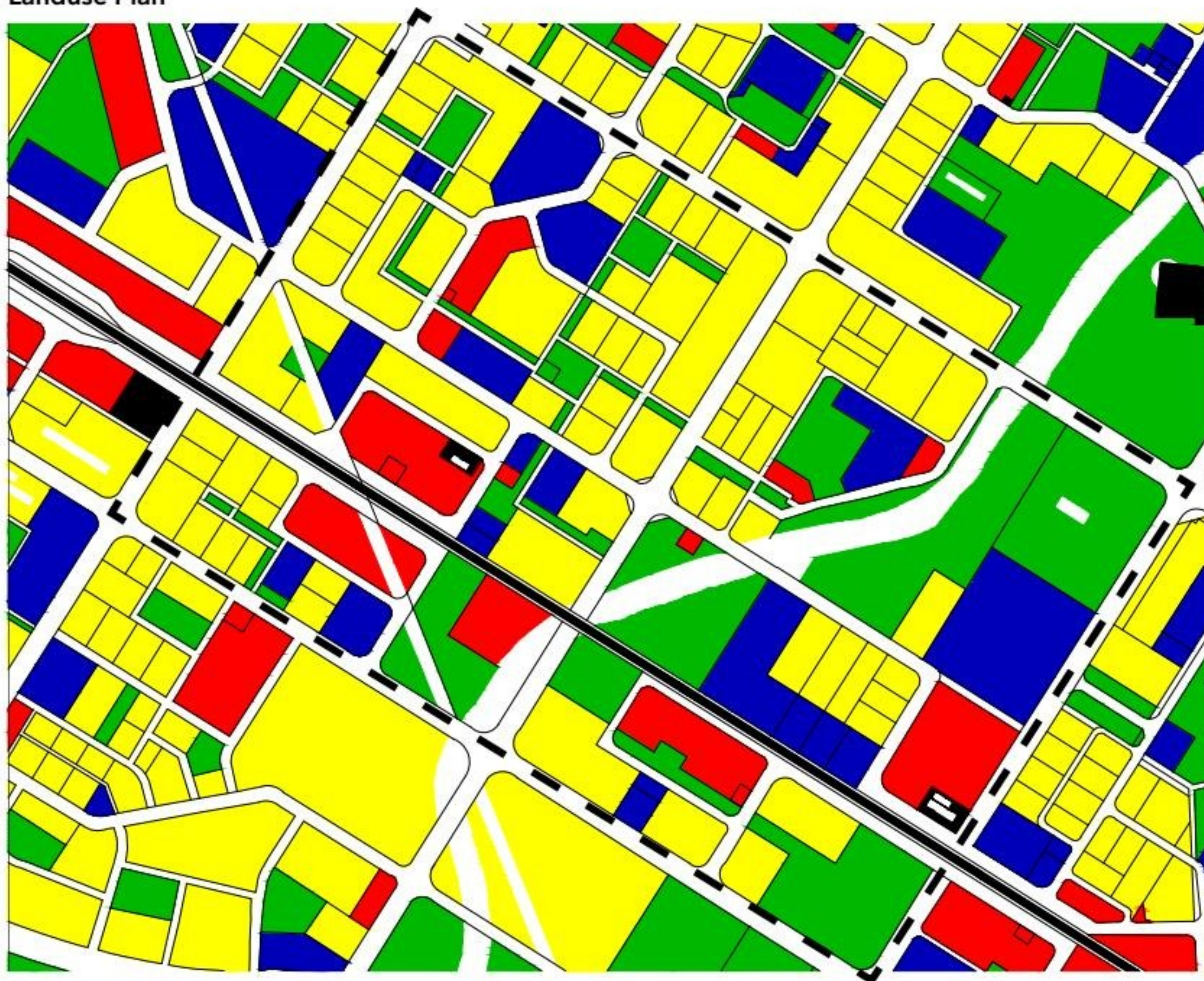


Fig 7.22: Masterplan -Dwarka Sector 11 and 12

Source: MCD



Fig 7.23: Local development plans- Dwarka Sector 11 and 12

Source: DDA

Present Landuse Map

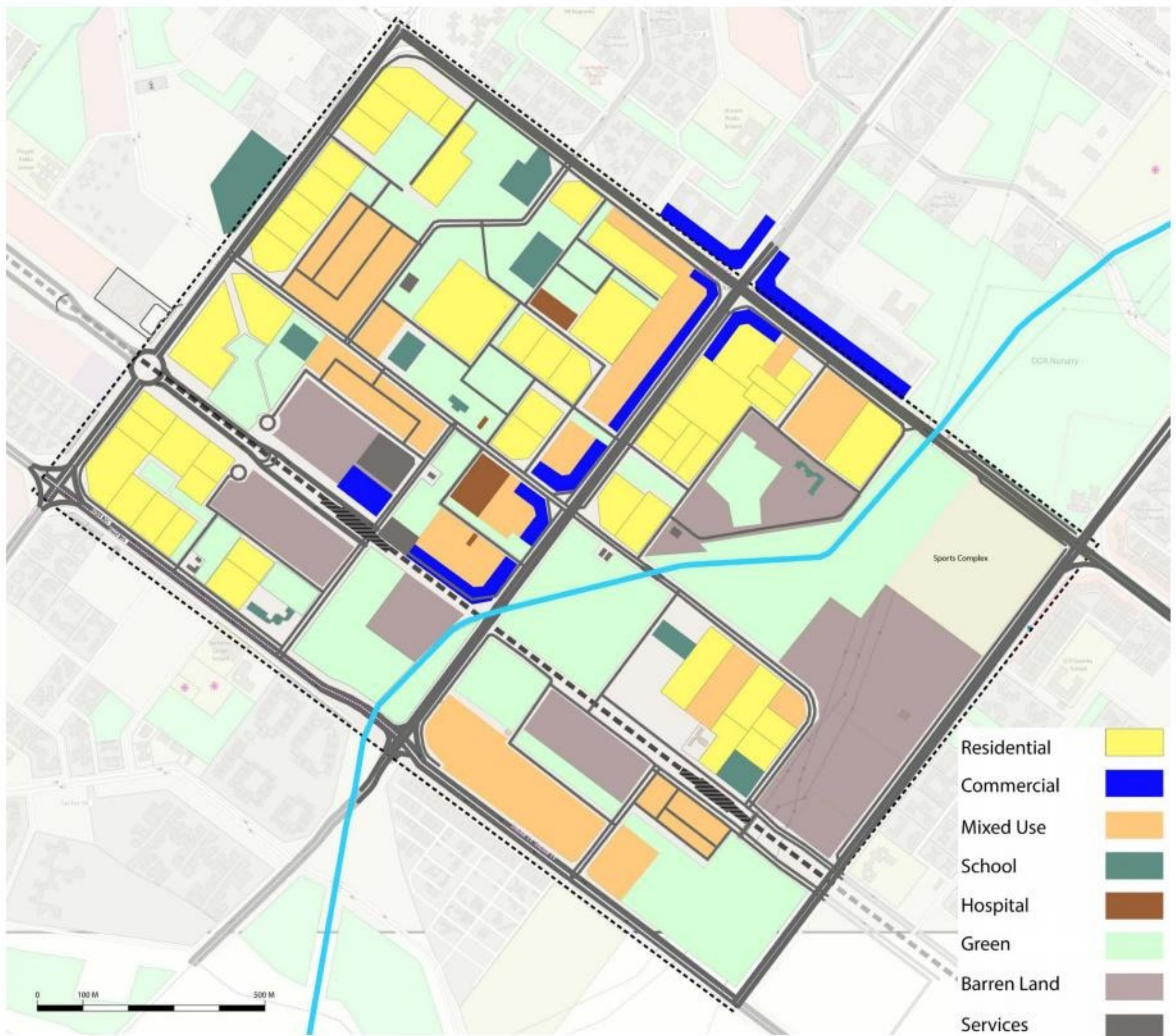


Fig 7.24: Current landuse map
Source: Edited by Author on Open Street Map

This is the real landuse map that is actually been modified illegally by the residents. This clearly shows the violations of rigid planning structure. Though Dwarka is the only planned area where mixed use is proposed by the government, but still the rigidity forces the citizens to break the rules.

From this analysis, one of the main question rises for this project that *how much rigidity and rules are actually needed or followed in the master plan and landuse plan?*

SWOT Analysis



Fig 7.25: SWOT analysis - Dwarka Sector 11 and 12
Source: Drawn by author

Strengths:

The infrastructure (road network and metro connectivity)
The grid planning
Mix of different land use

Weakness:

Location (Distance from the centre of the city)
The big drain

Opportunities:

Barren/ open Lands

Threat:

The visible separation in planning structure compared to the other parts of the city. This can also be an opportunity to grow as a demonstration project that can be followed in other parts.



The extra waste space between the road and the buildings. Can be used in a better manner.



No pedestrian movement pattern on the wider roads. Not safe while walking/ crossing the roads.



The pedestrian pathways are not being used as barren lands gives a sense of insecurity while walking nearby.



Mismanaged parking of private/ public vehicles. Illegal shops on the pedestrian pathways.



Ill maintained pedestrian pathway. Vendors using up the lanes.



A lot of spaces under the metro way is empty and not used to its potential.



Prevailing unhealthy living conditions because of the open drain. Polluting the air, water and soil nearby.



Slum development started. Construction workers who are working for the development of Dwarka staying illegally.



Left over spaces by the government.



Economic activities happening under the metro ways. This can be regulated and organised for better growth.



Cooperative housing societies are an opportunity that can influence people to engage in sustainable development.



On street parking eating up the vehicular movement space on the main roads.

Fig 7.26: Issues in Dwarka
Source: Clicked by author

c) Najafgarh

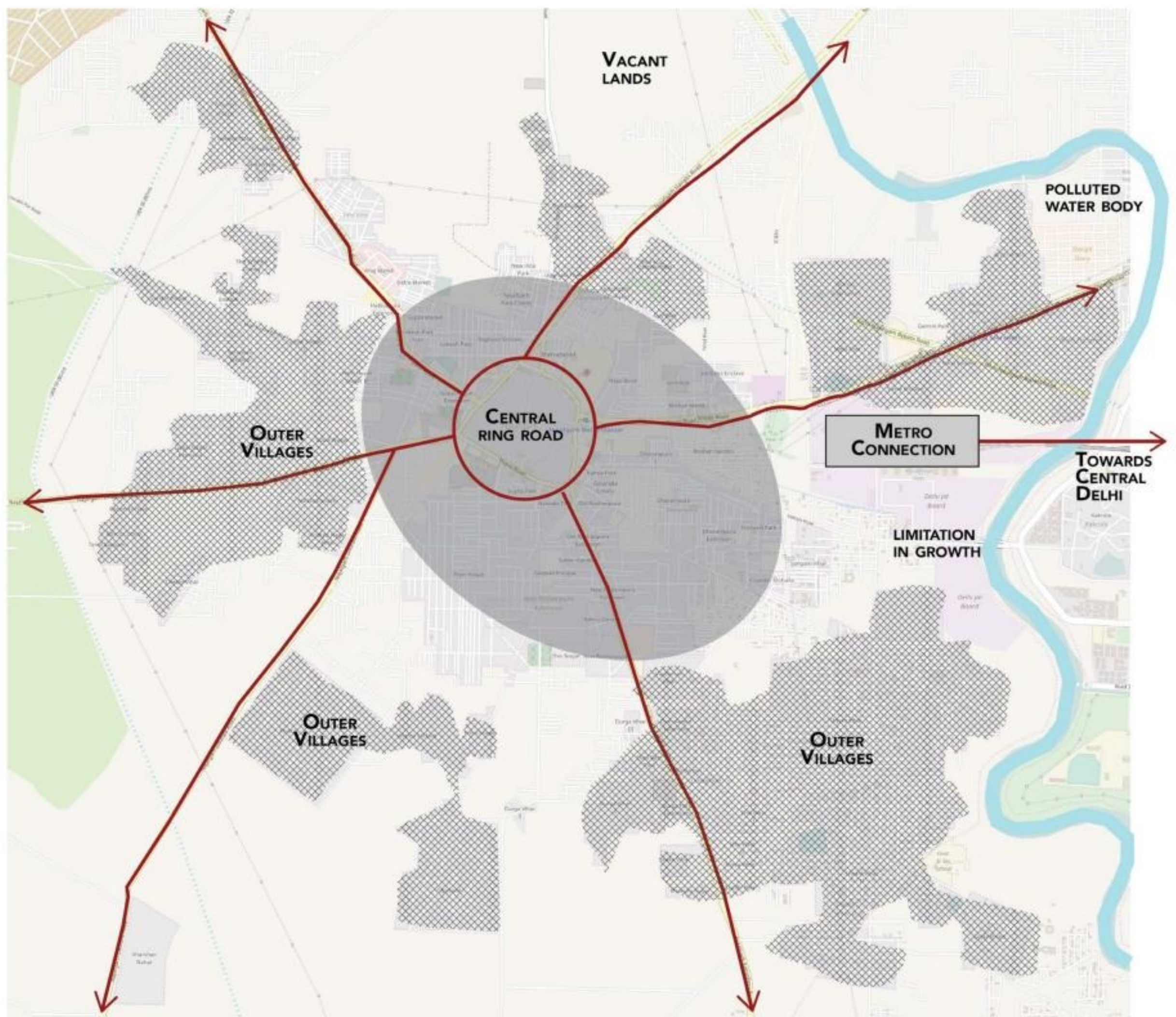


Fig 7.27: Najafgarh analysis map
Source: Drawn by author

The second site is an urban village in the vicinity of New Delhi, where a lot of new policies are being implemented under spatial and urban development proposals of the city. This area is one of the most densely placed in the city, where there are a lot of illegal landuses are residing.

Najafgarh is primarily known for being an economic and transport hub in rural Delhi. Najafgarh is surrounded by

a number of important villages of the South West Delhi district. Like all the administrative subdivisions of the Southwest District of Delhi, Najafgarh is composed of a group of villages. Najafgarh Market is well famous for different varieties of shops including textile, Hardware, Ornament, sports, sweets.

The strategy of redevelopment will be the chosen one in this case to uplift the condition of the place and

adding futuristic sustainability. The residents are not very much open about the changes, so the main issue would be including them in the design.

Najafgarh Town, built up area of villages, unauthorized colonies are existing in an area of about 2023 ha. Najafgarh Town and built up area around this town has been considered as special area for which Redevelopment Plan and Special Area Plan shall be prepared.

Master Plan for Delhi-2021 recommends preparation of redevelopment plans for Unauthorised Colonies and the villages; which shall ensure the permissibility of mixed use zoning at property or within the premise level compatible to the predominant residential areas. It must be ensured that for improvement of the physical

and social infrastructure, the minimum necessary level of services and community facilities are to be provided in all unauthorized colonies.

(i) Physical Infrastructure: Plans for provision of services shall be prepared by the concerned local bodies.

(ii) Social Infrastructure: For provision of social infrastructure, reduced space standards shall be adopted. Depending on the availability of land, facilities like community hall, dispensary etc. can be grouped together.

Along the important main movement corridor i.e. MRTS corridor, major roads, new urban development is being done/ planned recently.

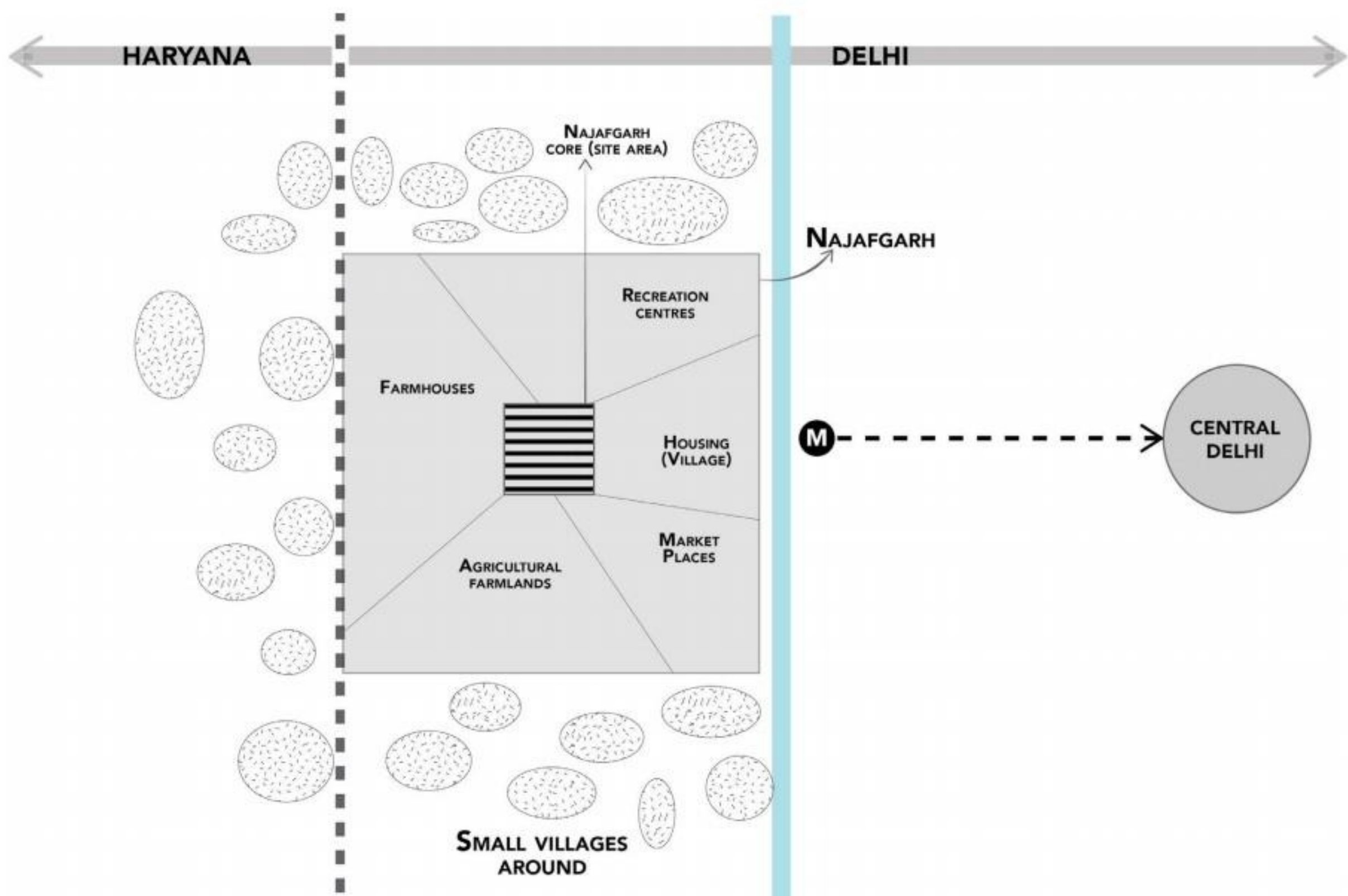


Fig 7.28: Najafgarh analysis conclusion

Najafgarh

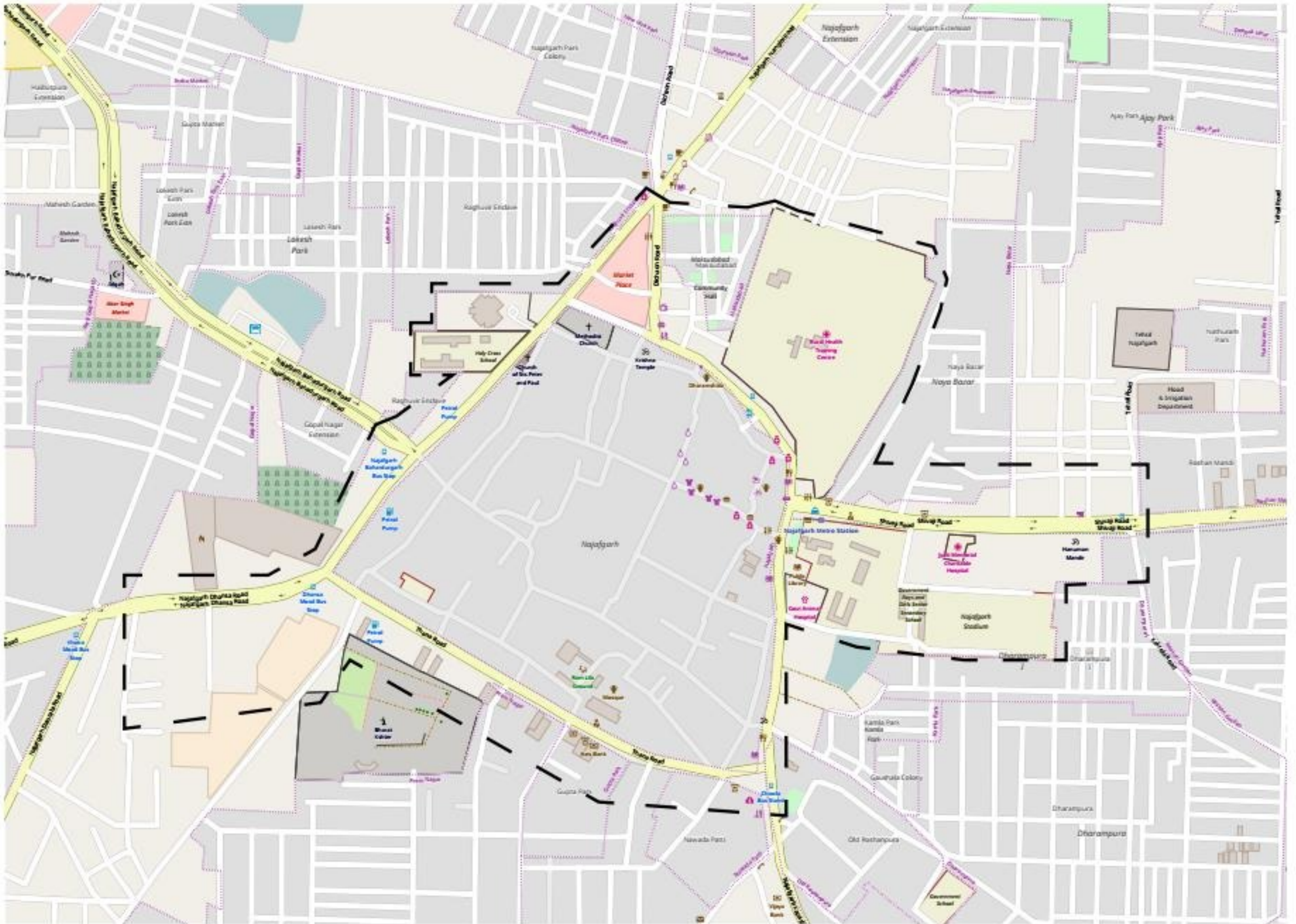


Fig 7.29: Selected site location
Source: Edited by author on Openstreet map

I selected the central market area of Najafgarh for detailed study and demonstration project. This area represent the character of the space very well. The character of the zone can be seen clearly in the images on the right.



Fig 7.30: First impression of Najafgarh
Source: Google maps (images)

SWOT analysis

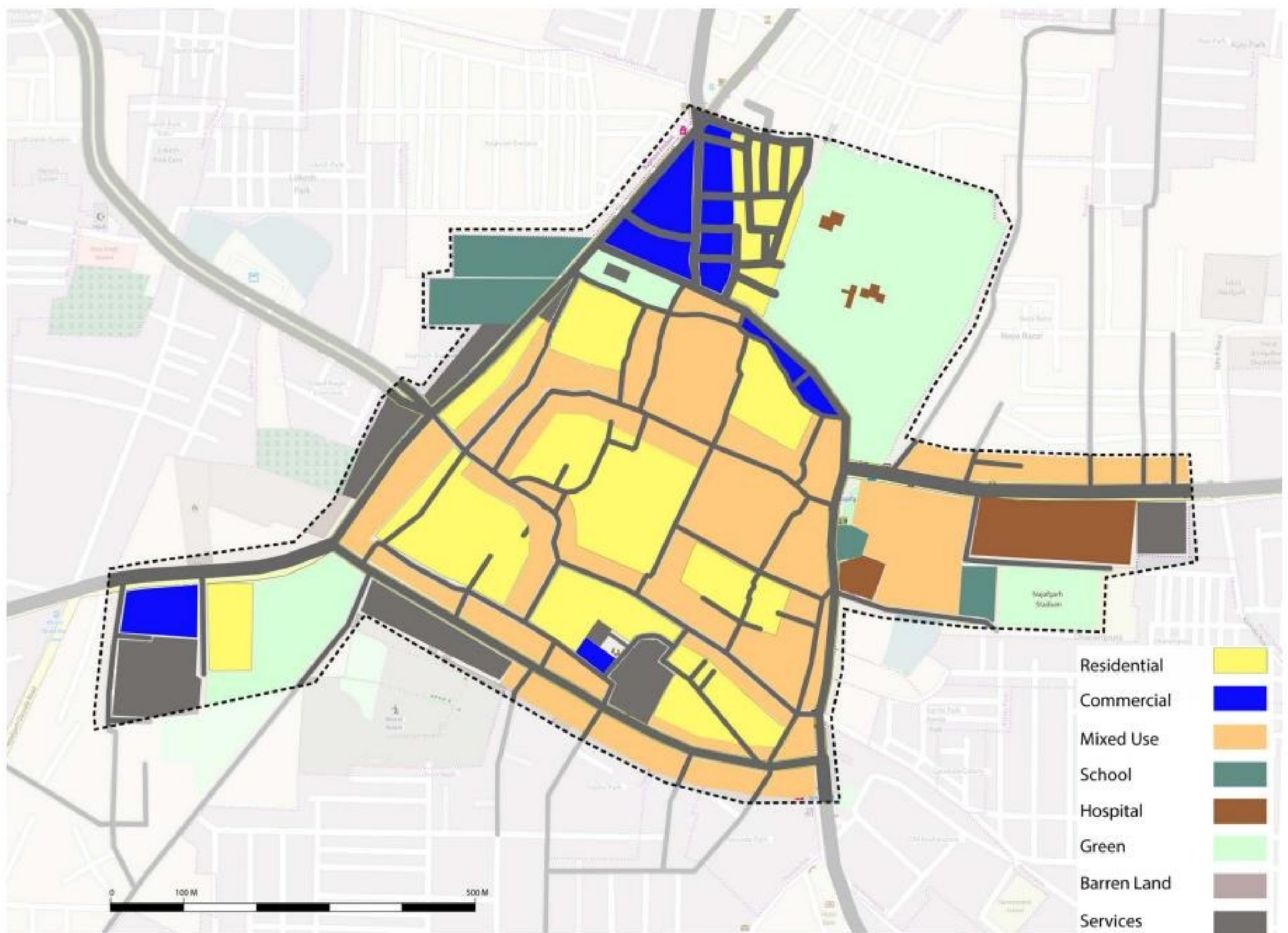


Fig 7.31: Present Landuse Plan- Najafgarh

The map above explains the unattended focus of government in this area. Citizens are not following any regulations for development. This may prove a positive point for a sustainable growth as the development will be from the scratch. Or might need more concentration.

Strengths:

Main transport corridors
Economic situations

Weakness:

Building Density
Population density

Illegal growth
Unplanned development

Opportunities:

Mixed use buildings
Possibility of growth

Threat:

Unapproachable citizens
Safety and security issues



Internal narrow streets with commercial and residential development.



On street parking of public transport.



No proper bus stops constructed for this area.



Under developed and ill maintained streets.



Open waste management system.

Fig 7.32: Issues in Najafgarh
Source: Clicked by author



Congestion due to narrow internal roads.



Shop extensions and vendors eating up vehicular road space.



Undefined junctions.



Hardware and industrial stores using road space.



Clash and congestion between the modes of transport.



Najafgarh drain creating unhealthy conditions.

Fig 7.33: Issues in Najafgarh
Source: Clicked by author

II. FROM THE INTERVIEWS

Through the questionnaires, I tried to understand perspective of Indian citizens, the professionals and the academicians related to the Indian smart city project. Noting the fact that I have stayed in India for almost 25 years, I experienced the ground level issues and have a critical approach to look at them as an urbanist, this project connects deeply at a personal level. But at the same time it was needed to know how the citizens feel about the project. Are they even aware of the facts and figures? The professionals/ officials who are working on the project had different ideas and justifications on the project issues and proposals. This questionnaire was circulated in order to get some inputs before proposing new strategies. The proposals for this project was to bridge the gaps in the present proposal in terms of strategic ground level interventions for Indian cities. I followed the process of finding an opportunity to improvise the Indian Smart Cities Mission rather than

finding issues to change it. Because the main emphasis was the inclusion of the citizens in the process to planning and development of a city, it was helpful to know their requirements and day to day problems. The questionnaire is attached in the appendix of the report (section 10.II).

Following are few strong statements from the reviewed interviews. The common issues indicated by most of the citizens were inefficient provision of basic needs and exclusion from the process of making smart city. While the professional mentioned about the probability of failure of high technological proposals by the smart city mission. Though most of the people agreed on the awareness of the new mission because of its regular mention in the news. But at the same time the details and the process or projects are not openly accessible. The citizens are criticizing without having the wholesome idea.

Rana Sarkar, Govt. employee Smart development should be inclusive of all stakeholders Sustainable on the longer run Local accessible government	Vikas Kumar, 34 years Unhealthy and unhygienic slums in the city Traffic congestion Better connectivity and efficient public transport is needed	Amit Kumar, 34 years Lack of awareness among citizens. Planning and programming should be followed with efficient and transparent implementation.
Meenakshi Singh, DDA General awareness of 100 smart cities No involvement in implementation (Only strategies and policies) Most of the elements of the proposal has been already addressed in other spatial development projects	S.K. Banerjee, 65 years Pollution is a major problem Women security issue Lack of awareness for smartness Improve quality of life Free Wifi zone, digitization is necessity	Dr. Vishakha Kawathekar General floating information about smart cities Alien concept of digitization in Indian traditional system Citizen responsible and participatory Acknowledging cultural infrastructure
R.K. Rana, 34 years (Govt.) Transport woes Power, water and Sanitation Interested in local scale participation Should be inclusive of all stakeholders	Rakesh Kumar, 28 years (MHA) Citizen safety and security Air and noise pollution Synergy between traditional approach and smart solutions should be included. Renewable Solutions	Praphul, 39 years Potable water crisis Air and noise pollution Well informed Smart city proposal through breaking news Priorities are misplaced in the fundamental objectives

III. DESIGN POSSIBILITIES

From the site analysis the scope and limitations in planning and design is clearly evident. The core objective function of the Smart City Vision should essentially be to create a policy and regulatory design that dynamically set the standards of urban living. A city that monitors and integrates conditions of all of its critical infrastructures maximizes services to its citizens. (Sarkar, 2017). According to Tom Saunders (researcher), "The goal for cities is to adopt tried and tested technologies. They should ask what issues they're facing and how they can solve them with the tools already out there." So, here I will attempt to find tailor made solutions that are needed along with the global perspective in mind. Thus, the generic possibilities for the different scales of intervention would be based on what is presently happening and what is likely to happen in reality.

2.1 Delhi (Pan city development)

The tools for the conceptual design and planning development will be smart land use planning, incentives provision, strengthening of the current framework to make it more effective; using social media to achieve transparency and participation by reaching out to more people. These recommendations together would make the process of planning more rational, transparent, participative and efficient. In other words, it would make the process of urban development Smart. Following are few points that needed to be taken care of, or the questions that arises in mind after the contextual analysis.

2.2 Dwarka (Retrofitting)

- Usage of the vacant land: (What can be the possible projects in them?)
- Temporary commercial outlets on streets: Supporting the mixed land use policy (Adaptable and flexible planning)
- Self-updating land-use register which automatically updates itself based on applications of citizens
- Smart Grid: The newly developed residential

suburb has been already planned in a grid system. Can this positive aspect be upgraded into a Smart grid system ? Can smart grid be introduced in the planned grid, along with the management of present urban infrastructure (Mohsen Fadaee Nejad,)?

- Pedestrian friendly streets are needed or encourage to be used.
- Transit Oriented Development- Transit Oriented Development is the exciting fast growing trend in creating vibrant, livable, sustainable communities. Also known as TOD, it's the creation of compact, walkable, pedestrian-oriented, mixed-use communities centered around high quality train systems. This makes it possible to live a lower-stress life without complete dependence on a car for mobility and survival. (Association, n.d.)
- Smart infrastructure management

2.3 Najafgarh (Redevelopment)

- Land Pooling Development- A more strategic planning rather than an initiative
- Pedestrian friendly streets: Detailed street sections
- Mode of transport restrictions: (Electric rickshaws, put prices/ incentives on cars on usage)
- Traffic program
- Building Quality control- Building conditions (Rights and duties of citizens)

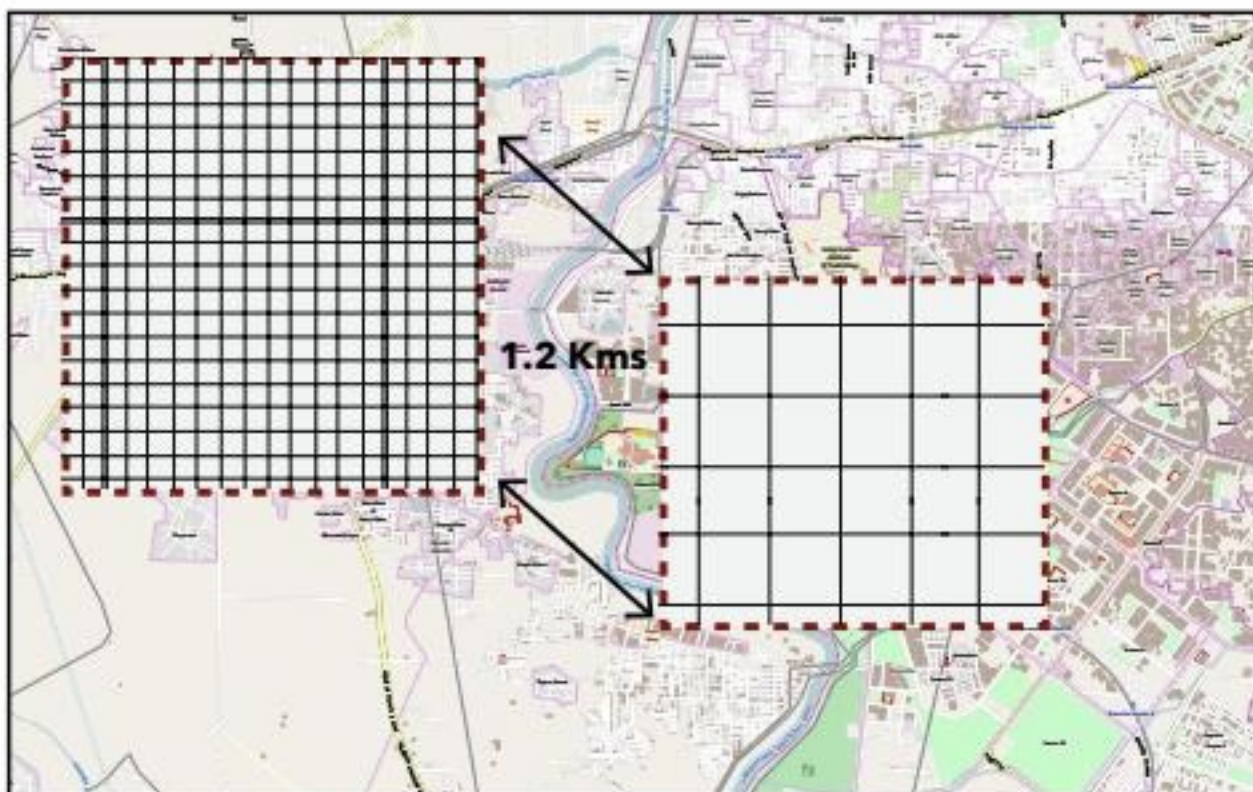
2.4 Combination of two sites (Connection of strategies)

- Ecological corridor along the Najafgarh Drain
- Najafgarh Drain cleaning treatment
- Delhi metro underway usage

IV. INFERENCES



What can be Changed and distributed evenly?
Infrastructure, Services, Management



What can NOT be Changed?
Density distribution, economic conditions

Fig 7.34: Inferences on neighborhood scale
Source: Drawn by author

A complete application of smart technologies is not imaginable in next 50 years knowing the basic issues and infrastructural standards the sites are facing currently. Both the sites have their own specific perspectives towards development according to the zonal plans developed by the DDA . The Master Plan 2021 suggests few new policies for having an integrated development strategy for the whole city, while on the other hand the ISCM proposes citizen engagement and small area based development for the city. The gaps and issues range from small issues to large gaps in the process. With the aim of fulfilling these gaps, appropriate recommendations will be advocated. I will be considering both the state government approach and the central government approach and will propose additions learning from the 25 smart cities around the world. My input as an urbanist would be how small changes in the planning process can ensure bigger impacts in the society. As earlier mentioned (in section G3), citizen engagement will be a major concentration in the final design, by incentive provision solutions to motivate the citizens for futuristic growth. Another approach would be changing the development policies (for example land use regulations) and service oriented strategies (for example electricity / water supply services) specific to both the sites. And next would be specific urban design solutions (for example street designs) for fragments of the sites.

While some observers look on India as a land of opportunity for clean energy, the truth is that it's hard to get things done there. Financial problems, massive poverty, legal issues and a stubborn bureaucracy are all big red flags on the green pathway. (Paulos, 2016)

What are the problems with existing smart plan?

Solution: more focus on fundamental planning, less focus on technology possible solutions in terms of planning and development where citizens can be involved in the system?





How can smart city technology be used to reduce unevenness in infrastructure and service distribution on a city scale? How can small-scale interventions help to deliver a smart city objective?

PROPOSALS

Source: Clicked by Author

I. INTERVENTIONS

Cities are complex, adaptive systems with their own characteristic dynamics, and if they are going to perform well from a human point of view, they need to be dealt with as such. In that light we must re-assess our current systems of planning, building and managing cities—the laws, codes, standards, models, incentives, and disincentives that effectively make up the “operating system” for urban growth. To make better cities, we need to shift to an evidence-based approach, able to draw on the best lessons of science and history about the making of good cities, from a human point of view (Mehaffy, 2014).

As Maarten Allard Hajer (Dutch political scientist and urban and regional planner) quotes *“We need smart urbanism instead of smart cities.”*

Smart urbanism can be used to find solutions for what modern 20th century urbanism has forgotten to take into account: the ‘metabolism’ of Cities - the variety of flows that connect city life to nature. What are we taking in, what are we discharging and how efficiently are we doing that?
According to Kelvin Campbell, the founder of Urban Initiatives, an internationally recognised urban design practice based in London, and now also the founder of ‘Smart Urbanism’ recommends that the basis of

the proposition is *‘Making MASSIVE SMALL Change’* - harnessing the collective power of many small ideas and actions to make a big difference.

Thus, in this project I am focusing on small changes/ interventions, that impacts a bigger audience and a larger scale. The diagnosis for this project included stages like preparation of a detailed design framework including specific goals, objectives, strategies, projects and policies. Further the implementation stage will follow with a detailed strategic plan considering the stakeholders and time phasing of the proposed projects. Establishing the goals and objectives constructed the pathway towards the strategic plan, which is defining the needed steps to achieve the end goals. The design decisions has been made depending on the formulated research questions, the evaluation of Indian Smart city proposal, the site observations and analysis, citizen’s expectations and the methods of graduation lab. Since the technology improvement is limited due to less economic resources, a lot of pressure has been put on the social component. Following diagram explains the evolution of design from the gathered data.

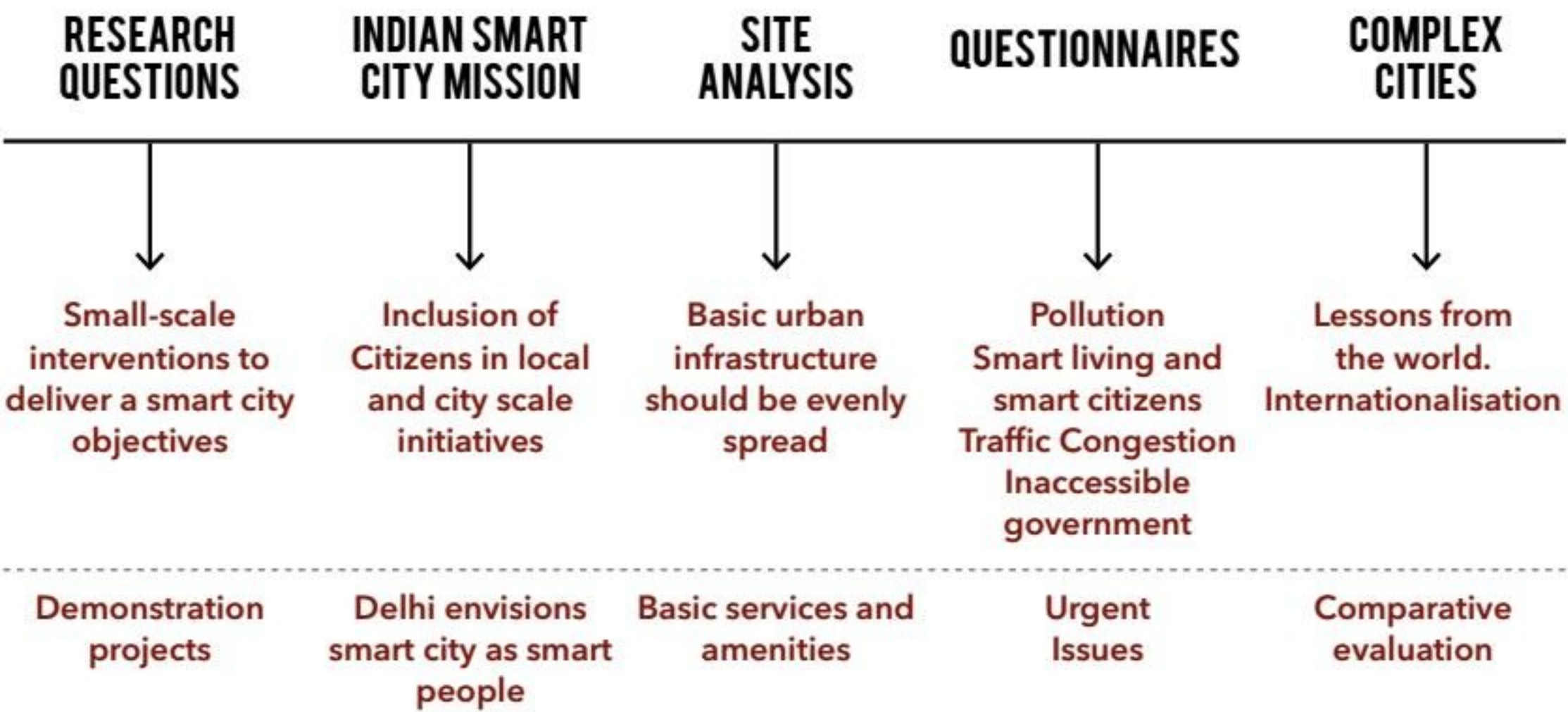


Fig 8.1: Constructing the objectives
Source: Drawn by Author

a) The Concept

About smart cities, concepts are still in their infancy, and the discussion has previously focused on the technology rather than the conceptual grounding or implementation methods (Cosgrave et al. 2013).

This research project is focusing on keywords like, citizen engagement, demonstration projects, comparative study and lessons from the world. Similar focus can be found in projects living labs around the world. The new concept of Living Labs is spreading over the world. This can be considered as one of the parts or processes of the smart city concept. The premise of the Living Lab is that the city can be used as a real-world testing ground for new ideas and technologies. The actual birth of the concept is ascribed to MIT's Prof William (Bill) Mitchell, who used it to refer to a purposebuilt lab where the routine activities and interactions of everyday home life can be observed, recorded for later analysis and experimentally manipulated, and where volunteer research participants individually live in, treating it as a temporary home (Hirvikoski et al. n.d.)

Definition of Living Lab: Living Labs refer to user-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings. In practice, living labs place the citizen at the centre of innovation and have thus shown an ability to better mould the opportunities offered by new ICT concepts and solutions to specific needs and aspirations of local contexts, cultures, and creative potentials (Hirvikoski et al. n.d.)

Approach: Living labs are both practice-driven organisations that facilitate and foster open, collaborative innovation, as well as real-life environments or arenas where both open innovation and user innovation processes, can be studied and subject to experiments, and where new solutions are developed. This unique capability enables living labs to generate concrete, tangible innovations based on user and community contributions, and at the same time to advance (academic) understanding of open and user innovation principles and processes.

Five key elements are must be present in a living lab:

- active user involvement (i.e. empowering end users to thoroughly impact the innovation process)

- real-life setting (i.e. testing and experimenting with new artefacts "in the wild")
- multi-stakeholder participation (i.e. the involvement of technology providers, service providers, relevant institutional actors, professional or residential end users)
- a multi-method approach (i.e. the combination of methods and tools originating from ethnography, psychology, sociology, strategic management, engineering)
- co-creation (i.e. iterations of design cycles with different sets of stakeholders).

According to Anna Ståhlbröst, the foundation of the ENoLL living labs was based on those **five key principles** (Ståhlbröst, 2012):

- Value: business value for their partners and societal value for the users.
- Influence: Viewing users as active, competent partners and domain experts are vital since their involvement and influence in innovation processes is essential.
- Realism: One of the cornerstones of living labs is activities should be carried out in a realistic, natural, real-life setting.
- Sustainability: Living labs is defined as an approach that meets the need of the present without compromising the ability for future generations from an economic, social and ecological perspective.
- Openness: The idea is that multiple perspectives bring power to the development process and contribute to the achievement of rapid progress.

The defined **key components** for a living lab were ICT and Infrastructure, Management, Partners and Users, Research and Approach.

To summarise, Living Labs allow a bottom-up policy coherence to be reached, starting from the needs and aspirations of local and regional stakeholders, creating a bridge between European Union and Horizon 2020, Smart Specialisation, the Urban Agenda, Cohesion Policy, and so forth (European Commission n.d.).

Thus, in this project I am trying to include the five elements, five principles and components of Living Lab. The selected sites will work as Living lab platform that will include no. of projects and policies to embrace the innovations and impact the whole city.

level	definitions	research paradigm
macro	Living Lab constellation consisting of organized stakeholders (PPP-partnership)	Open Innovation: knowledge transfers between organizations
meso	Living Lab innovation project with Living Lab methodology	Open & User Innovation: real-life experimentation, active user involvement, multi-method and multi-stakeholder
micro	individual research steps and activities, linked to the stakeholders' assets and capabilities	User Innovation: user involvement & contribution for innovation

Fig 8.2:Definitions for different scales
Source: European Network of Living Labs



Fig 8.3:Successful Living Lab projects
Source: European Network of Living Labs

b) Design Framework

The design framework explicates the detailed stages of decision making to intervene the sites and Delhi as a whole. The framework comprises of the core issues that molds the focal goals for the project. The primary goal is about the provision of even infrastructure around the city, while the secondary goal is an additive force to organize the city, citizens and the authorities well. The next stage is setting up specific objectives (8 objectives) distributed further in nine strategies that can be applied for both the contrasting neighbourhoods by implementing 15 projects/ effective solutions based on global smart city research. Most of the projects are involving the citizens for a local scale intervention, that can act as demonstration projects for the whole

city at later stages. To conceive a better urban setting, the eight recommended policies proposed for a bigger scale (city or zonal) will support the projects for successful implementation.

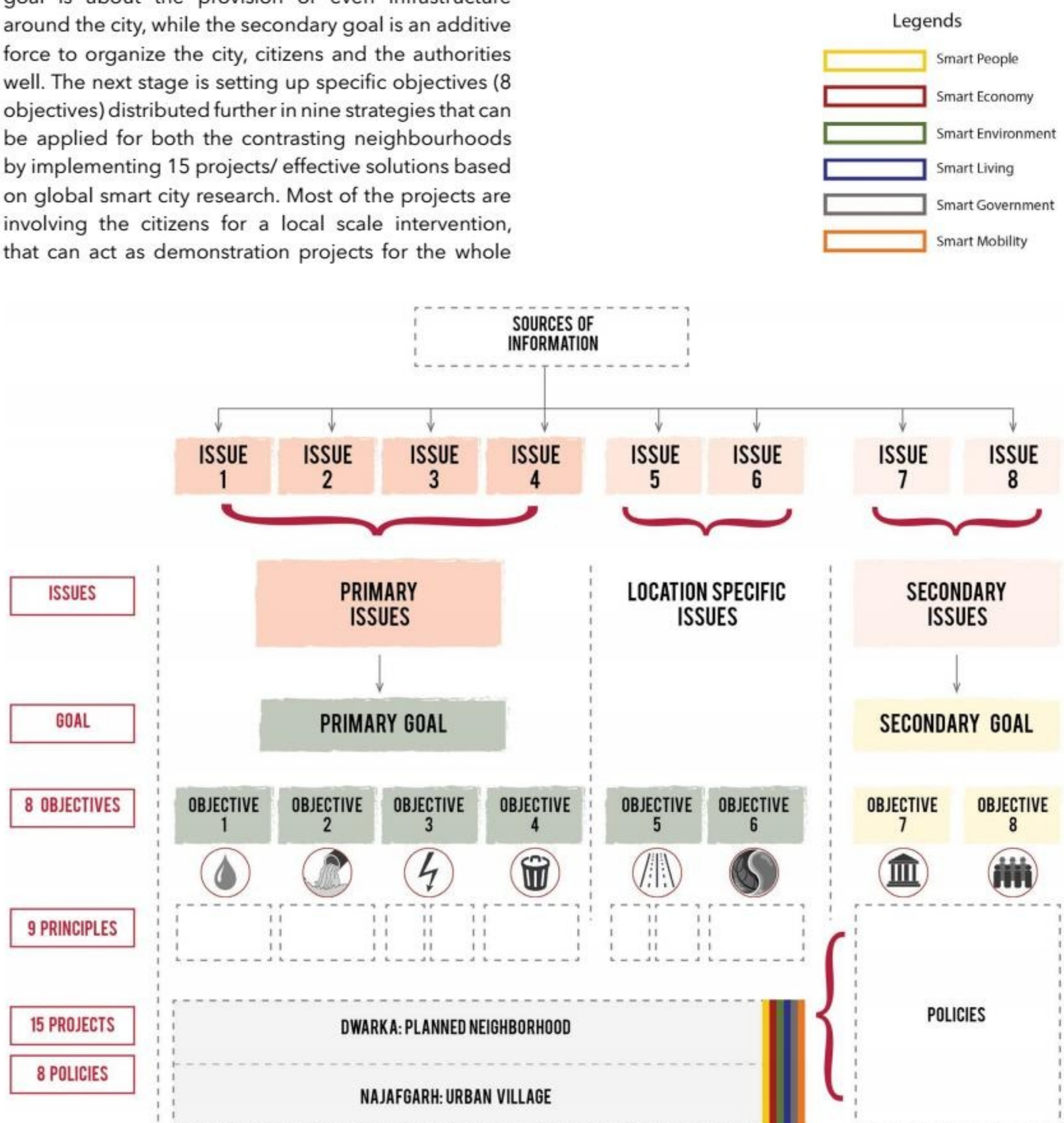


Fig 8.4: Design framework overview
Source: Drawn by Author

SOURCE

ISSUES

PROJECT GOALS

OBJECTIVES

PRINCIPLES

PROJECTS

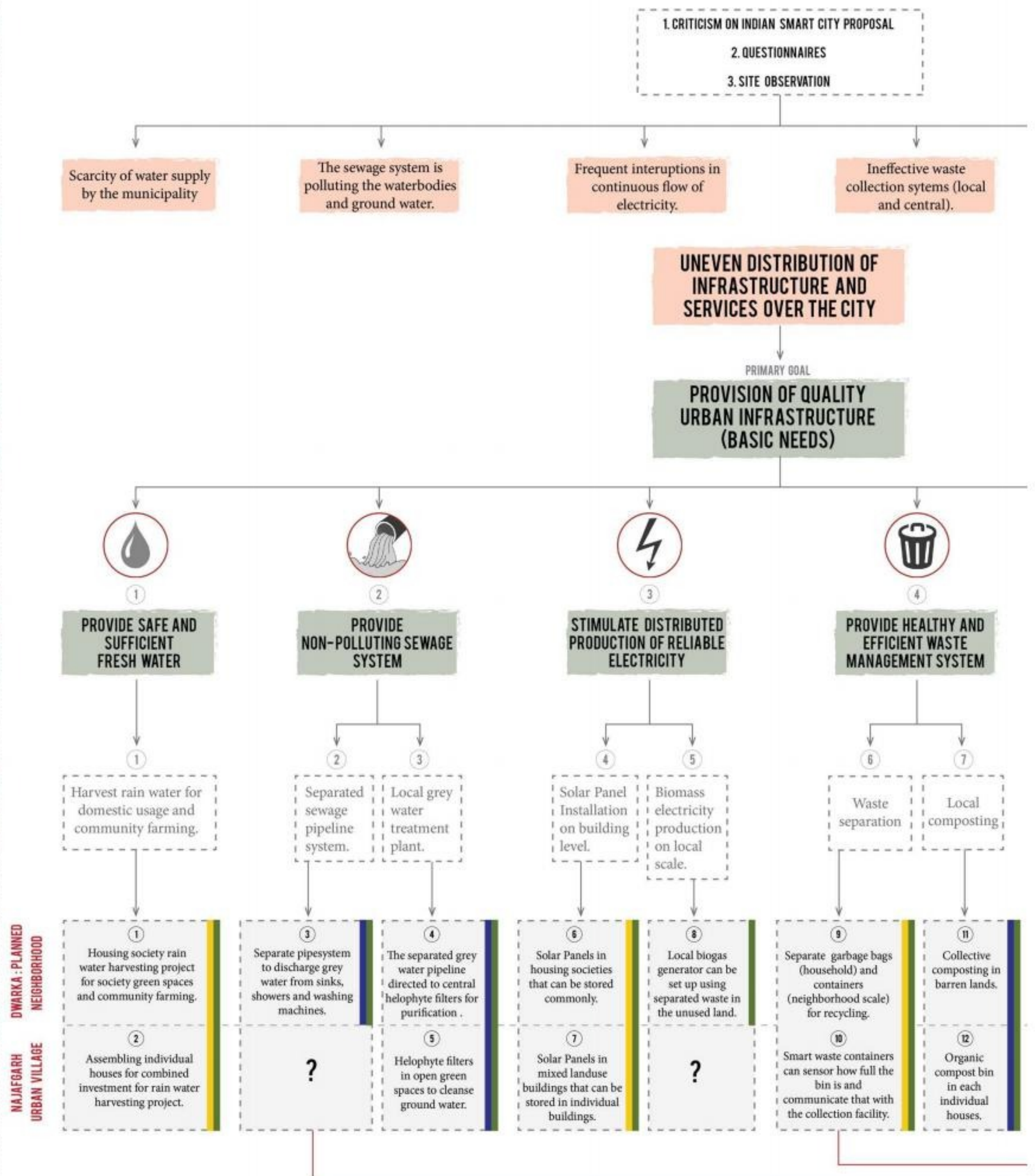
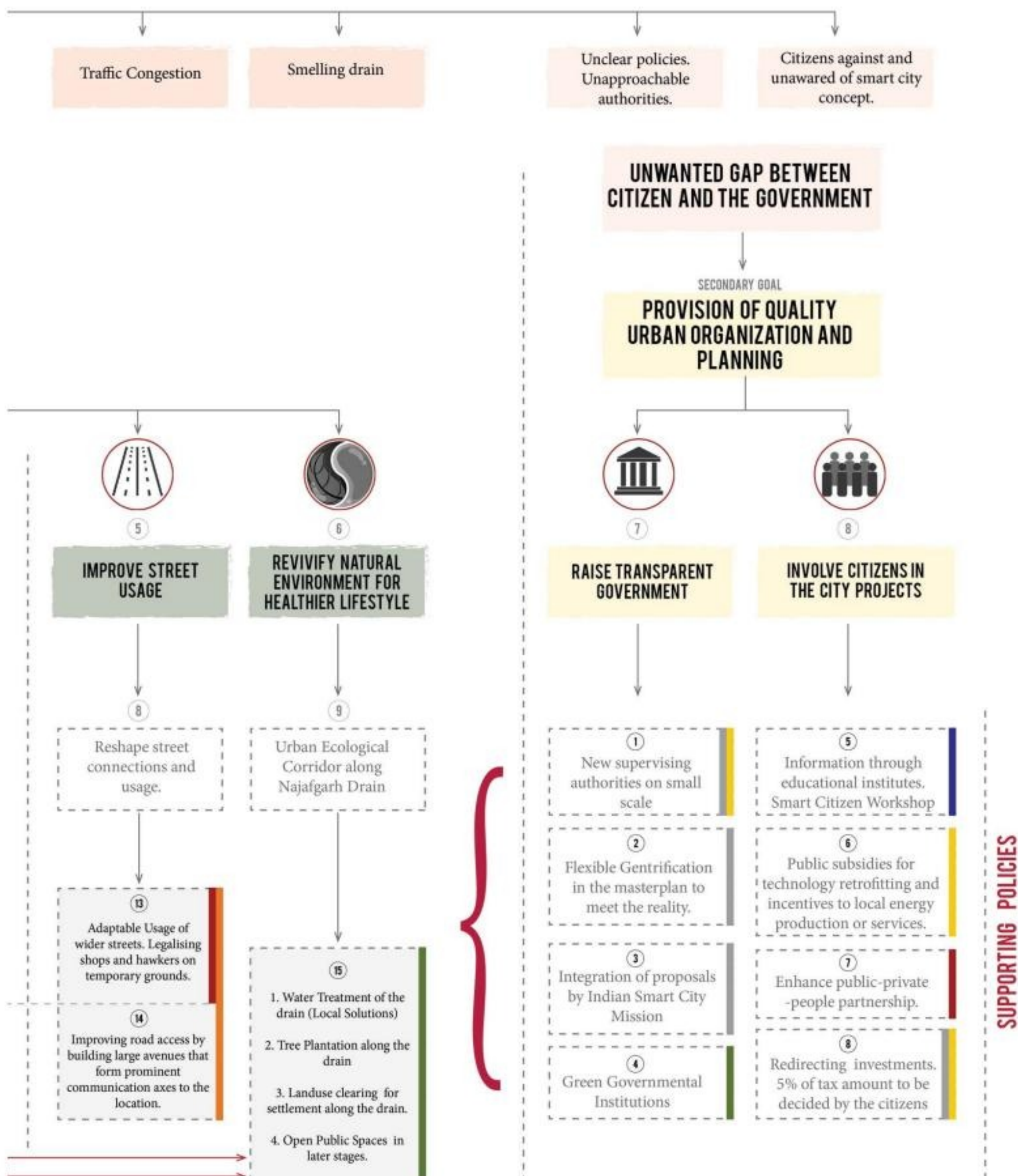


Fig 8.5: Design framework overview
Source: Drawn by Author



c) Goals

Two goals were formulated based on the issues that has been collected from the site observations, criticism of Indian smart city proposal, questionnaires collected from the professionals and citizens of Delhi.

1. Provision of quality urban infrastructure (basic needs): Urban infrastructure refers to hard infrastructure systems generally owned and operated by municipalities, such as streets, water distribution, and sewers. It may also include some of the facilities associated with soft infrastructure, such as parks, public pools, schools, hospitals and libraries. This goal focuses on increasing the social and environmental livability in an urban system. This goal is to improvise the life quality of the inhabitants, by introducing measures in the fields of the environment, housing, culture and social wellbeing. As defined, "Livability is the sum of the factors that add up to a community's quality of life—including the built and natural environments, economic prosperity, social stability and equity, educational opportunity, and cultural, entertainment and recreation possibilities." (Partners for Livable Communities, 1977). For this project and keeping in mind the context of Delhi, the components of this objective would be:

A. Condition of Built Environment- This will take care of the housing conditions and surroundings. This is relevant as we are conferring about sites which are already built and settled. So, this adding the component of maintaining the building conditions will create an attractive neighborhood to live in.

B. Provision of Basic Services- The basic facilities like water supply, electricity, waste management, sewage and sanitation are the arteries of the place. These services are to be monitored and evenly distributed among the city precinct.

C. Sustainable and Environment friendly Development: To avoid degradation of the environment, with special emphasis on the prevention of pollution, promoting renewable sources of energy and other resources. This will boost socially and environmentally aware proactive communities. Keeping in mind the economic aspects and the cultural aspects of Indian society, it is favorable to initiate small local scale solutions rather big city scale implementations. Local approaches on small scale is more likely than big scale renewable energy plants for the context. These kind of projects will also inspire the communities to work

together for an efficient system/ service.

There are four general objectives under this goal and two location specific objectives. Those will be elaborated in the next section of this chapter.

2. Provision of quality urban organization and planning:

The second goal will tackle the management of authorities to create a structured administration. This will consist of governmental policy support to communities; resources / space. Also, will encourage uniform attention to community development and rational financing of city municipal funding. Due to a larger area and unclear division of authorities and their services, it is very difficult for the citizens to approach the right authority at the right time. This objective will bring transparency in the following components:

A. Governance: A managed and clear government structure is the fundamental necessity for the capital city. The involvement of two government and other authorities make the hierarchy extremely confusing.

B. Associated Authorities: Segregated authorities make the task of the government a lot tougher than it actually is. This also hinder the appropriateness and the time limit of the projects.

A smarter city is successful if the citizens are consuming the sources in a smarter way. For this reason, the components of citizen engagement for this project would be:

A. Enable people to use smartness: In Indian context, the acceptance of smart technologies are still questionable. So, the smarter approach would be preparing the citizens to welcome the new technology for an efficient lifestyle.

B. Bottom up Planning: This component gather people to work together for a community centric program.

This objective spread out into eight policies that supports the tangible projects. Those will be elaborated in the next section of this chapter.

What is basic infrastructure?

Defined by Indian Smart City Mission

Basic infrastructure includes,

- i. Assured water & electricity supply,
- ii. Sanitation & Solid Waste Management,
- iii. Efficient urban mobility & public transport,
- iv. Affordable Housing,
- v. Robust IT connectivity,
- vi. e-governance & citizen participation,
- vii. Safety & security of citizens,
- viii. Health & Education and
- ix. Economic Activities & Livelihood Opportunities.

What is urban infrastructure?

Defined by USLegal, Inc.

The term urban infrastructure means “the underlying mechanical or technological networks for providing goods and services, such as transportation systems (including mass transit), water and sewage systems, and communication systems (including telecommunications).”

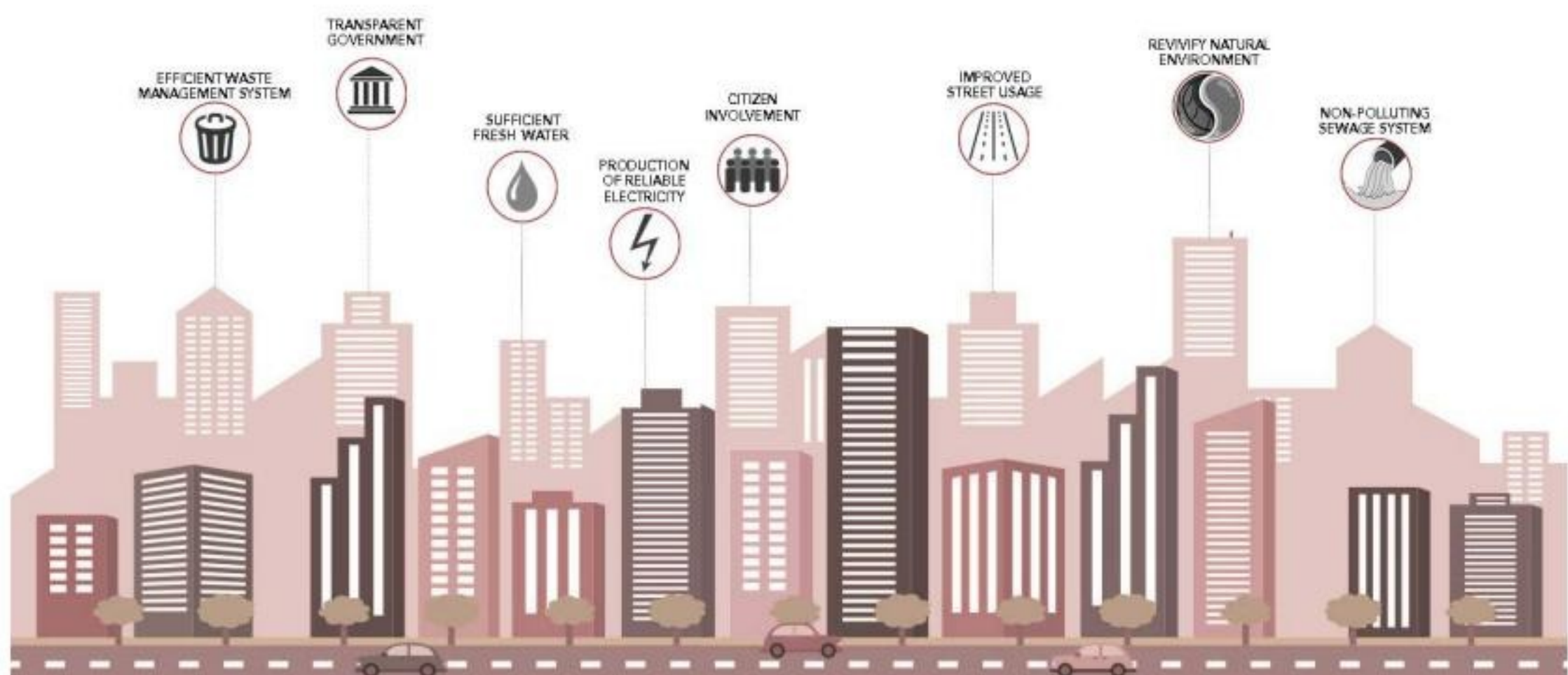


Fig 8.6: Project Vision
Source: Drawn by Author

d) Objectives

1. Provide safe and sufficient fresh water:

The scarcity of fresh water supply in Najafgarh, whereas the misuse of fresh water for gardening and extra jobs in Dwarka illustrates the need for storing and using the rain water. The strategy for this objective is to harvest rain water for domestic usage and community farming. This won't be able to fulfil the complete need of fresh water in the urban village but will provide an extra source of water. The water harvested in the urban village can be used for domestic purposes while in the planned neighborhood it can be used for green space and community farming. Also, if this drive is successful for the demonstration projects, it will reduce the pressure on the city water supply system.

2. Provide non-polluting sewage system:

The sewer network connects to the Najafgarh drain directly for both the areas. This pollutes the water bodies as well as pollutes the soil around the drain. The strategy of separated sewage pipeline system will redirect the black water for treatment and the greywater can be used after treating locally. So, this objective can be strategize based on two principles, one is the separation of sewer system and second is the local grey water treatment plant.

3. Stimulate distributed production of reliable electricity:

Households in both the neighborhoods witness power cut offs. The severity of the issue may be differ in both the sites. But due to the daily cut off of 1-2 hours, people got habituated with this inconvenience. Solar panel installation on building level can impact the citizen for a better living as well as reduce the city electricity burden as a whole. Also, at few places there is an opportunity for biomass electricity production at a local scale. The opportunity should be discussed and detailed as an effective proposal to create a difference in the system.

4. Provide healthy and efficient waste management system:

Waste management is a big issue in the city. The network and the system that is followed from waste collection from the households to the landfill is terribly inefficient. A healthy waste separation and collection system will encourage the citizen to live a healthy life. Other strategy to this objective is initiation of local

composting. This might not be operative in both the sites but selection of areas can be done on a city level to reduce total landfill.

5. Improve street usage:

The difference in the usage of streets to its potential is clearly visible in both the sites. In Najafgarh, the street are awfully congested due to badly connected junctions and the activities taking place on the street. While on the other hand, Dwarka comprises of much wider streets which are not being used to their potential. Temporary and adaptive planning structure might help to enliven the streets, that can provide safety and security to the citizens as well. Thus the strategy for this objective is to reshape street connections and boost flexible usage.

6. Revivify natural environment for healthier lifestyle:

There are very few open green public spaces in the selected project location. Moreover the only natural entity that is the Najafgarh river has been deteriorated over the years because of sewage connections. The whole stretch of the river is extremely polluted and promote unhealthy living conditions. This objective can be endorsed over the city as most of the waterbodies are in the same condition and are connected to each other. But as a pilot project this part can be proposed as an urban ecological corridor along Najafgarh Drain.

7. Raise transparent government-

Transparency in the policies by the central and state government and other authorities like Indian Smart City Mission, are required so as to bring awareness among the citizens to follow the rules and regulations. This would be beneficial for the citizens (who can approach for the right incentive/subsidy) as well as the government (who can monitor the changes over the city). There are policies under this objective that will recreate a crystal clear relation between the government and the citizens.

8. Involve citizens in the city projects: Most of the projects are citizen led projects that has been proposed in this thesis. The reason behind that is inclusion of citizens in the smarter version of city. By education and raising awareness, changes are expected in citizen's behavior. Following this strategy I will propose policies that will support the citizen led projects.

*We need **smart urbanism** instead of smart cities.*

-Maarten Allard Hajer

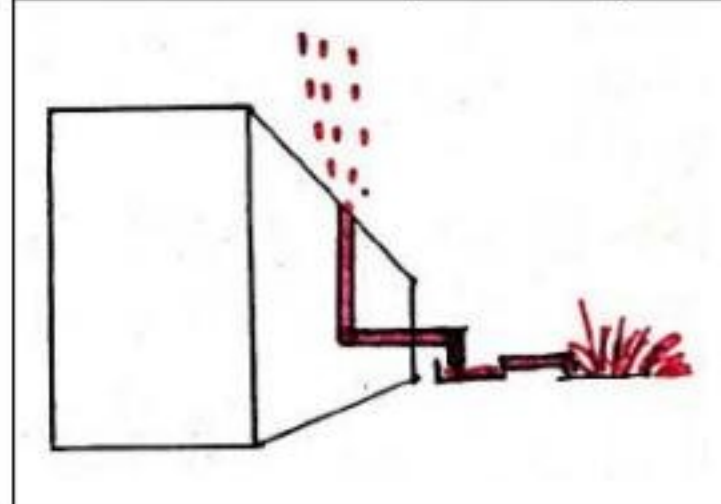
*"Making **MASSIVE SMALL** Change"*

-Kelvin Campbell

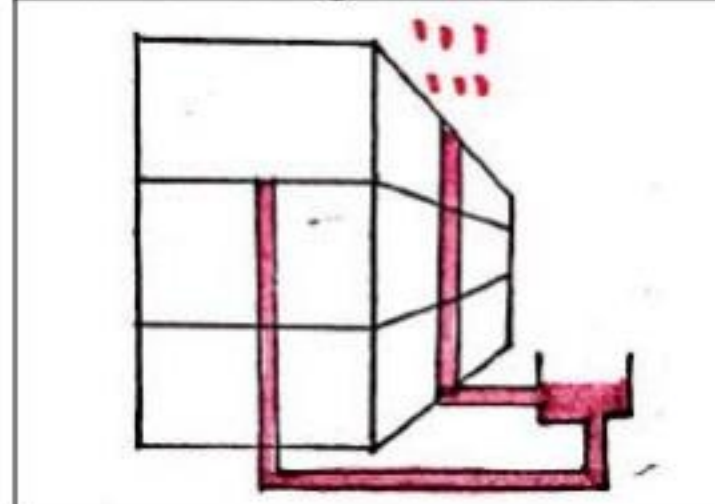
e) Living Labs (Projects)

LIVING LABS	S.No.	Project Detail	Project Name
	1	Housing society rain water harvesting project for society green spaces and community farming.	Rain water harvesting for community farming
	2	Assembling individual houses for combined investment for rain water harvesting project.	Rain water harvesting for domestic uses
	3	Separate pipesystem to discharge grey water from sinks, showers and washing machines.	Grey water separation
	4	The separated grey water pipeline directed to central helophyte filters for purification .	Central helophyte filters
	5	Helophyte filters in open green spaces to cleanse ground water.	Ground water purification
	6	Solar Panels in housing societies that can be stored commonly.	Commonly stored solar energy
	7	Solar Panels in mixed landuse buildings that can be stored in individual buildings.	Solar panel installation in mixed landuse
	8	Local biogas generator can be set up using separated waste in the unused land.	Biogas electricity generation
	9	Separate garbage bags (household) and containers (neighborhood scale) for recycling.	Garbage separation
	10	Smart waste containers can sensor how full the bin is and communicate that with the collection facility.	Smart waste containers
	11	Collective composting in barren lands.	Collective composting
	12	Organic compost bin in each individual houses.	Organic compost bin
	13	Adaptable Usage of wider streets. Legalising shops and hawkers on temporary grounds.	Adaptable street usage
	14	Improving road access by building large avenues that form prominent communication axes to the location.	Avenue connection
	15	Water Treatment of the drain (Local Solutions)	Urban ecological corridor

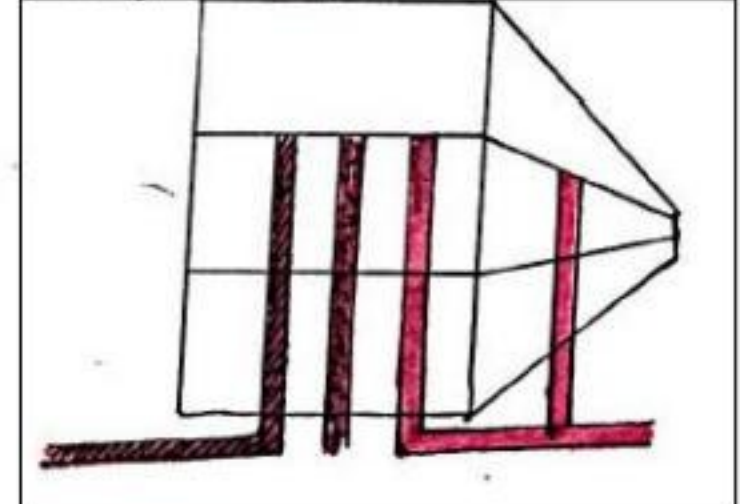
1. Rain water harvesting -common green



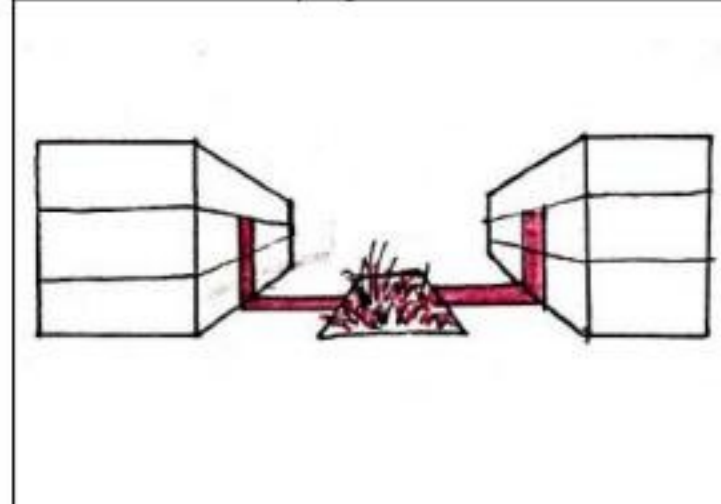
2. Rain harvesting-domestic uses



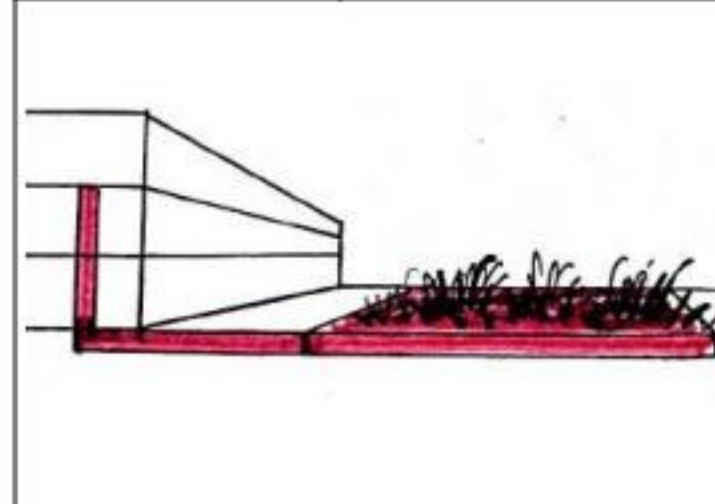
3. Grey water separation



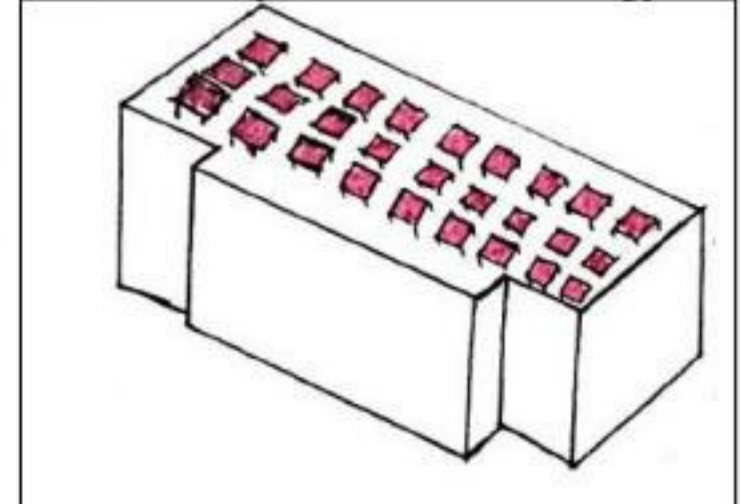
4. Central helophyte filters



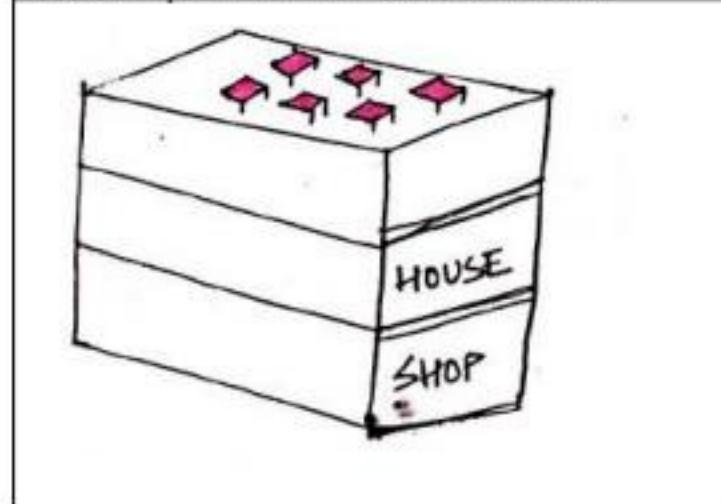
5. Ground water purification



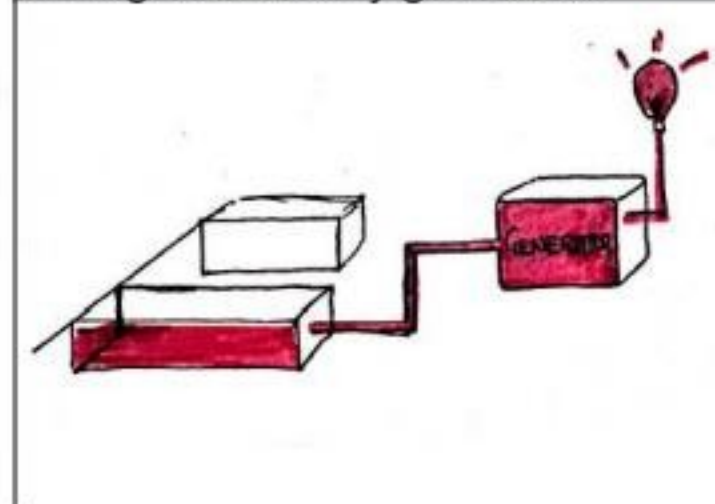
6. Commonly stored solar energy



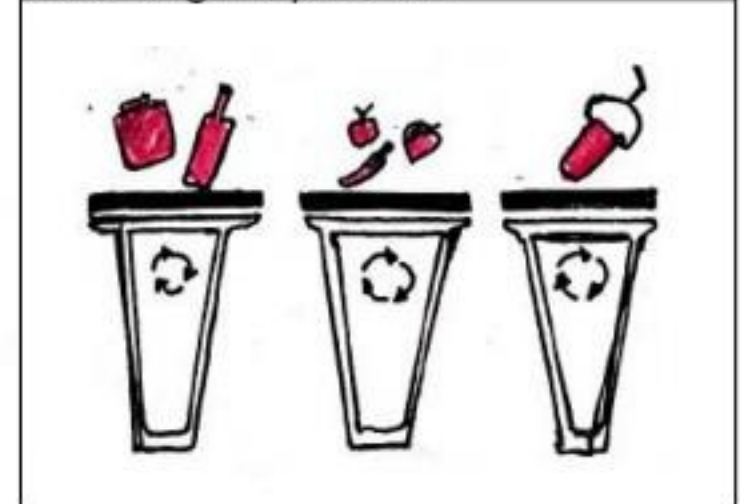
7. Solar panel in mixed landuse



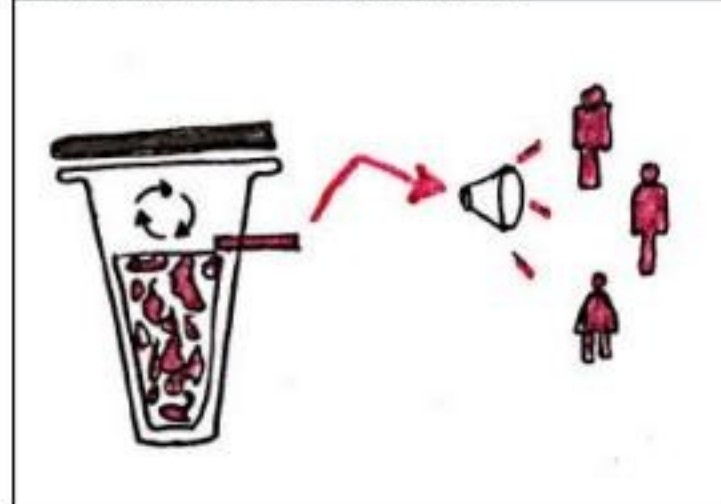
8. Biogas electricity generation



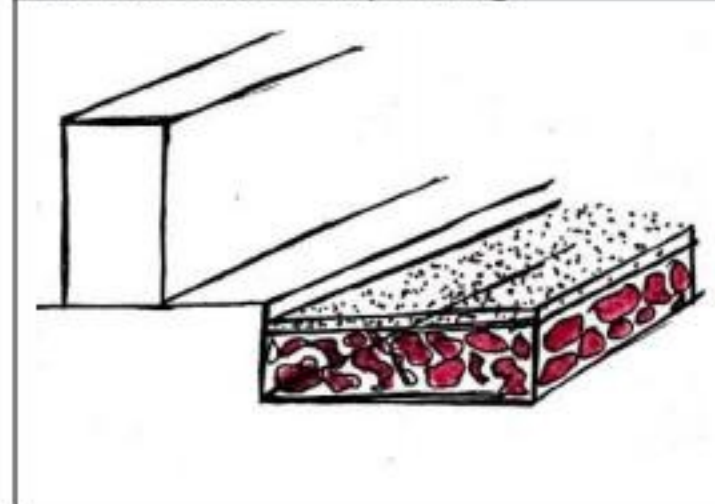
9. Garbage separation



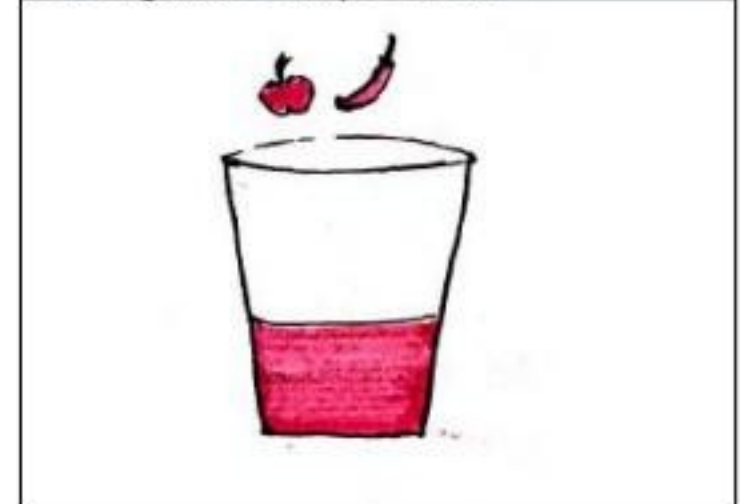
10. Smart waste containers



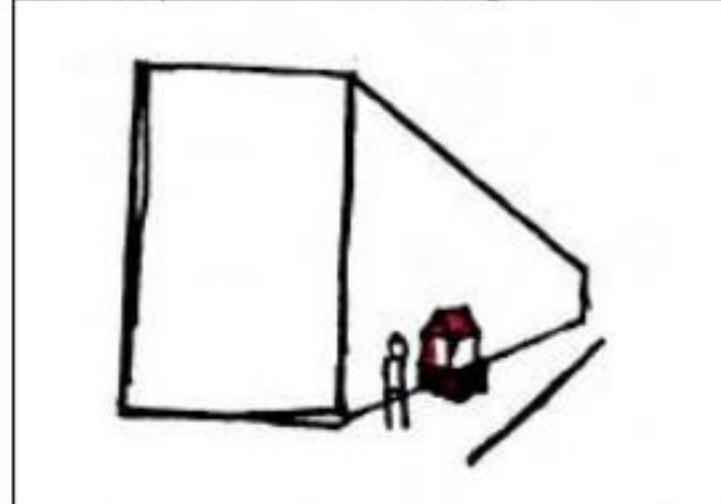
11. Collective composting



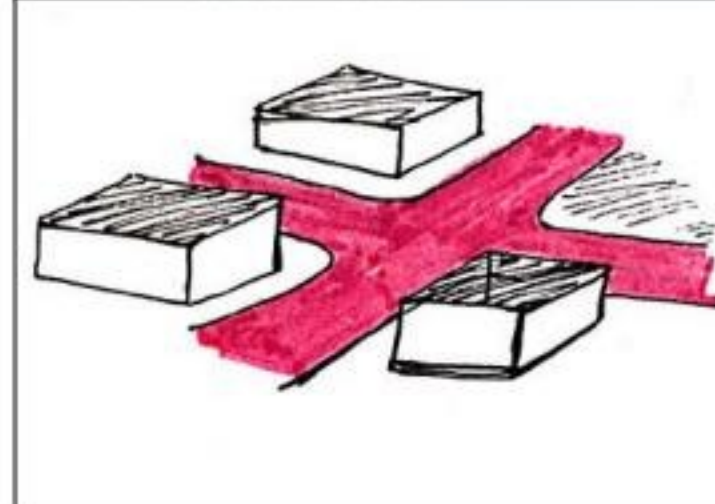
12. Organic compost bin



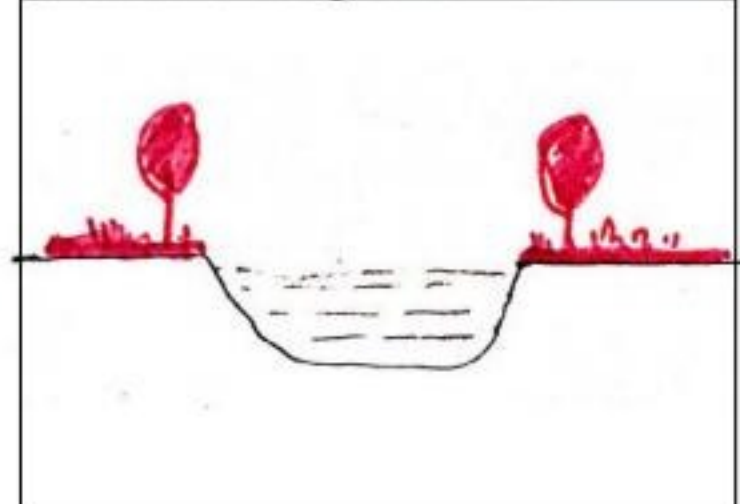
13. Adaptable street usage



14. Avenue connection



15. Urban ecological corridor



Living Lab 00
Project Title

Objective

Area: Location

i) Issue:
Describe the issue on the site (Social/ Spatial/ Political)

Site Picture

iii) Project description:
Background and explanation of the contextual solution.

Illustrations

ii) Strategy:
a) Describe the principle and requirements

Principle Illustration

Maps

b) Smart City Reference

Reference Picture

Project vision image

iv) Implementation:

a) Supporting Policies/ Projects

Related proposed projects and policies that will help implementing the project or will work as a catalyst.

b) Conditions / Scenarios for implementation

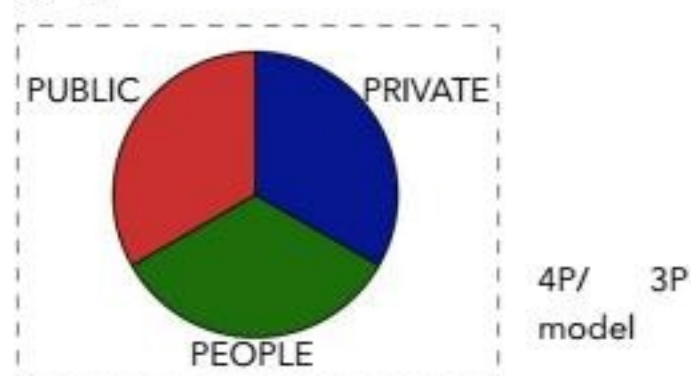
What factors might influence the project to make it a success or failure.

c) Involved Actors and Stakeholders

Who is benefiting?

Who is initiating?

Who is paying?



d) Time Phasing:

How over the years the project will come up?

v) Reflection:

Why this project and how it is conveniently possible in the Indian context?

d) Scale of Intervention:

Individual house/ community/ combined buildings etc.



Delhi



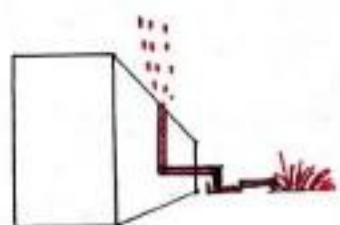
Two Sites



Dwarka Sector 11-12



Najafgarh



Living Lab #01

Rain Water Harvesting for Community Farming



Dwarka: Retrofitting

i) Issue:

Residents of private housing societies paying the water bill to maintain the open green spaces of the society space. They use the same treated water provided for domestic use by the municipality. A lot of water is being wasted that way.



Fig 8.7: Green areas in society housing

Source: <http://static.panoramio.com/photos/original/44039199.jpg>

ii) Principle:

a) The rainwater can be collected in the rooftop and can be collected through gutter pipeline and filtered in a simply constructed filter at the backyard.

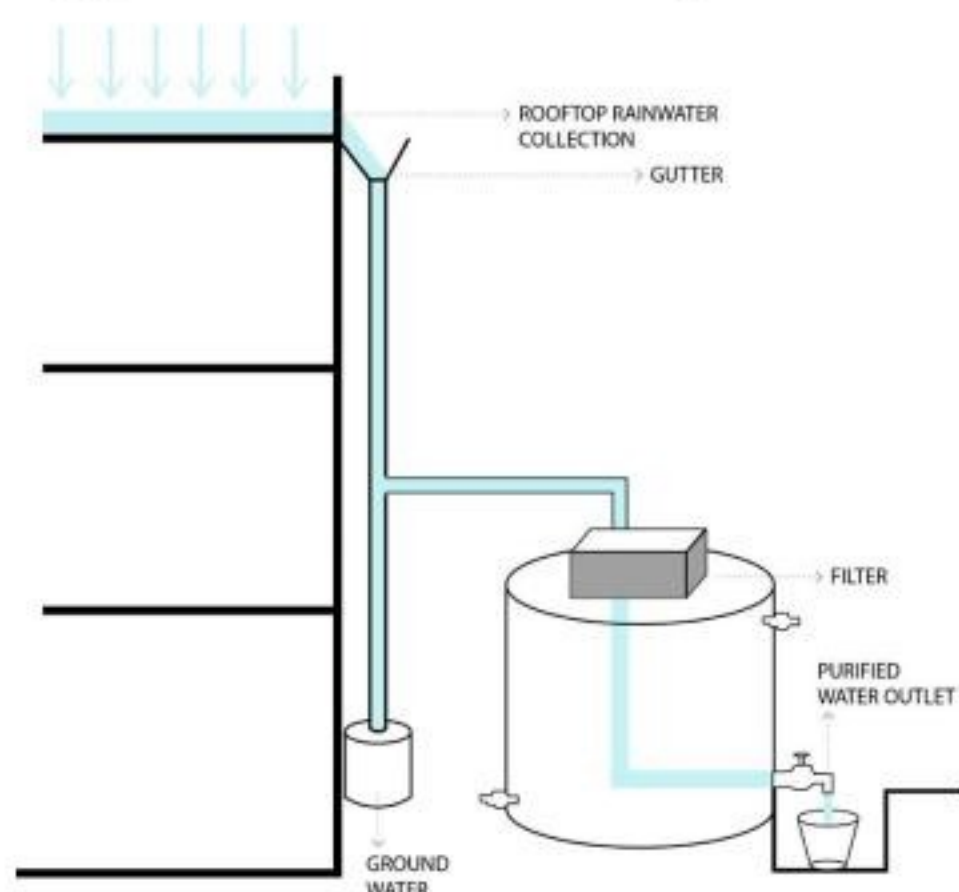


Fig 8.8: Project drawing

Source: Draw by author

The filters is constructed by brick masonry and filtered by pebbles, gravel and sand as shown in figure. Each layer should be separated by wire mesh.

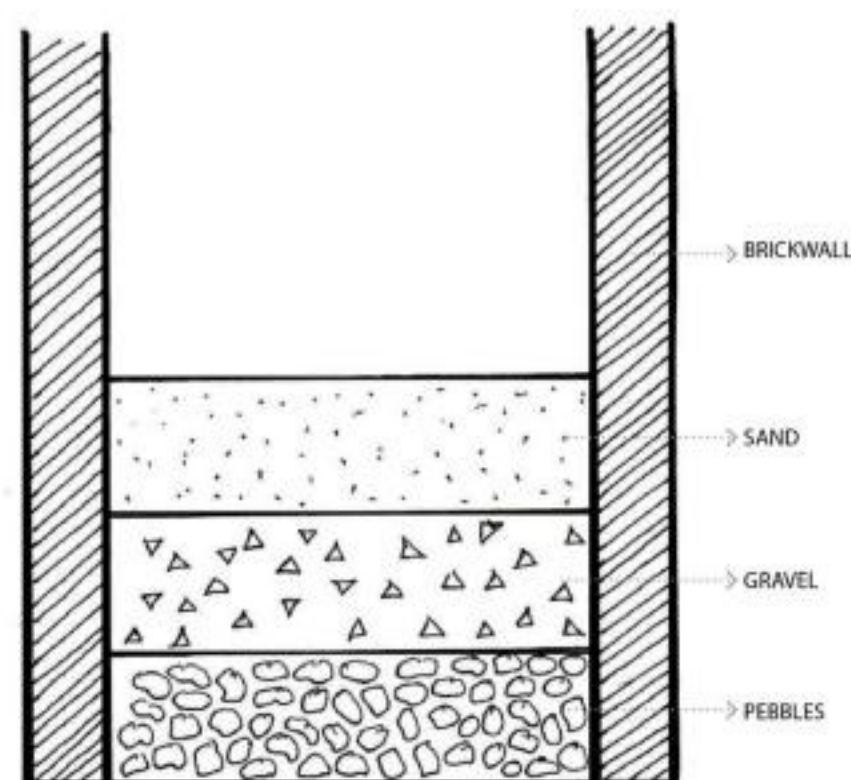


Fig 8.9: Principle of rain water harvesting

Source: Draw by author

iii) Project description:

The collected water on the rooftop can be filtered and used for maintaining the greenery and also for community farming. This way the residents will be engaged in a productive way, where they can grow their own farm vegetables in the open spaces.

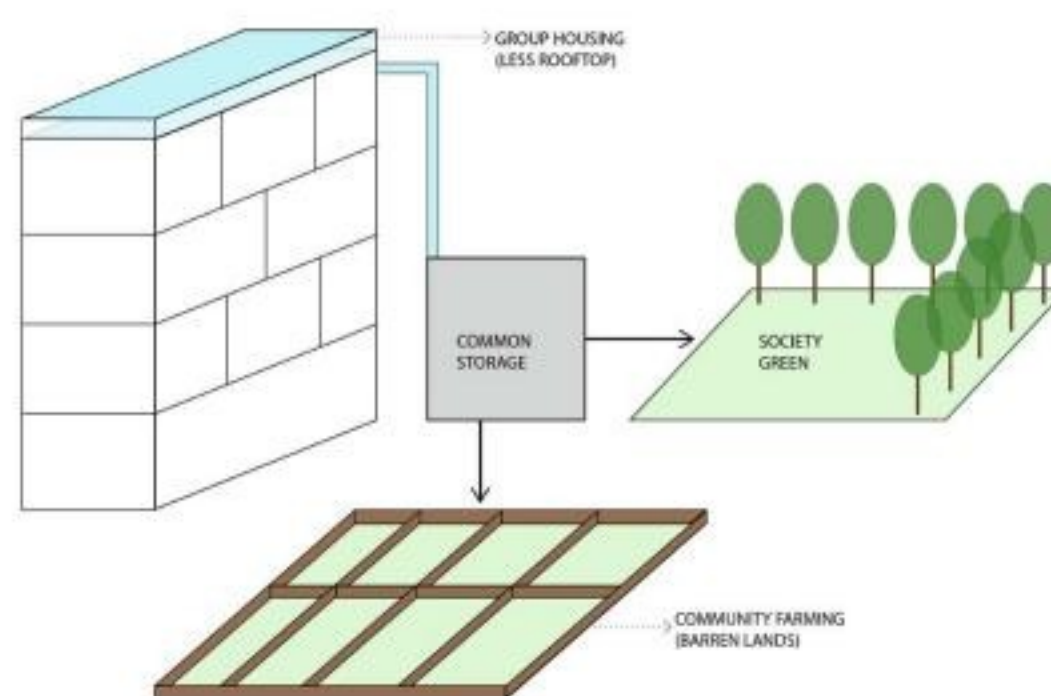


Fig 8.10: Project drawing

Source: Draw by author



Fig 8.11: Project drawing
Source: Draw by author



Fig 8.12: Project drawing
Source: Draw by author

The detailed plan shows how the private housing societies have more green space and the harvested water can be used for maintenance. While the government housing societies can use some percentage of stored water for domestic use. Individual houses can follow Project 02 details.

- Government Housing**
- Private/Cooperative Houses**
- Individual Houses**
- Buildings for rain harvesting**
- Open green spaces**

b) Smart City Reference

SMARTWATER (Smart sensor networks with energy harvesting for real time monitoring in urban water infrastructure). Six research institutes from China, the Netherlands and the United Kingdom that are experienced in smart sensor networks and communication. Projects done in Kenya and Brazil.

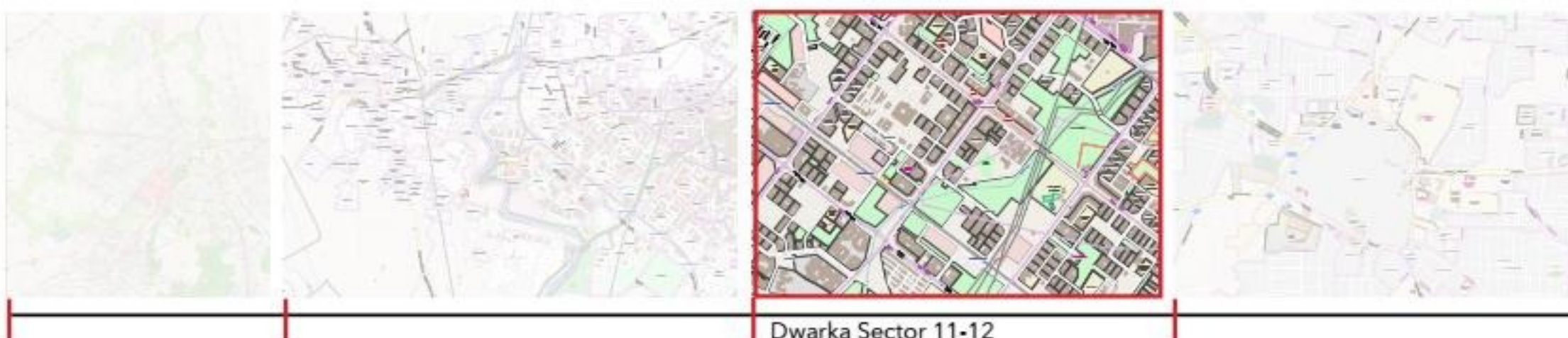


Fig 8.13: Project drawing
Source: Draw by author

iv) Implementation:

a) Supporting Policies/ Projects

1. Incentives to the households from the municipality for adapting smarter ways of resource usage.
2. Active participation of people to the new urban additions. Local scale community based initiatives for new technological projects.
3. Information through educational institutes & initiatives. Raise awareness among the citizens on social and environmental issues by the educational and health institutions for a better lifestyle.



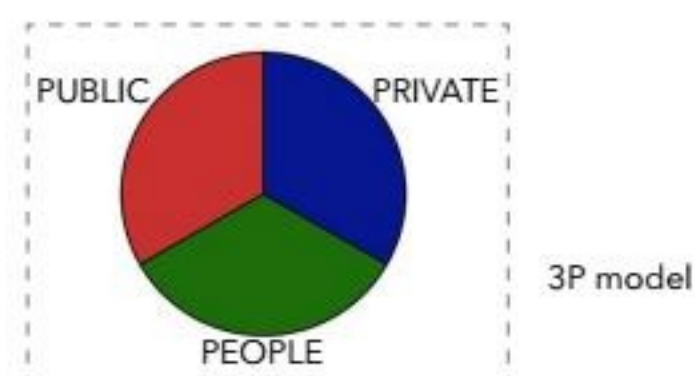
b) Conditions / Scenarios for implementation

The initiatives should be started by the housing societies to engage the residents. There would be a necessity to educate the residents about the advantages of this project. This can be done by the students from the smart educational network. The first investment would be a big amount, so the local entrepreneurs (preferably the resident of the housing society) can invest in earlier stages.

c) Involved Actors and Stakeholders

Citizens and Entrepreneurs

Incentives by the Government



e) Time Phasing:

0-2 years: Local initiatives can be started by educating the citizens about the harvesting system by the institution network

2-5 years: Pilot projects can be implemented in the second phase

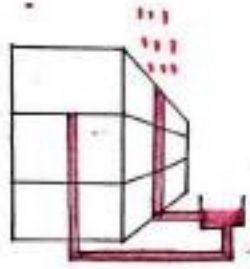
3-5 years: Evaluation and monitoring of the success by the institutions.

v) Reflection:

The incentives and subsidies will encourage citizens to use smarter approaches. The older citizens and the kids can spend their time to grow vegetables in the community garden. This initiative will bring social cohesion in a smarter way.

d) Scale of Intervention:

Each housing society comprises of 60-150 houses. This can be done in a society scale or even a building scale consisting of 20-40 houses.



Living Lab #2 Rain Water Harvesting for Individual Houses



Najafgarh: Redevelopment

i) Issue:

Scarcity of fresh water in the urban village. Informal settlements depend on community level sources for water supply. The average duration of water supply in informal settlements is one to two hours a day. Households dependent on tankers for water supply have no fixed timing or duration for supply.



Fig 8.14: Drinking water tank provided by the municipality.
Source: <http://images.indianexpress.com/2015/04/water-crisis.jpg>

ii) Strategy:

This can release a little pressure on ground water extraction, which is the primary source of water in that area.

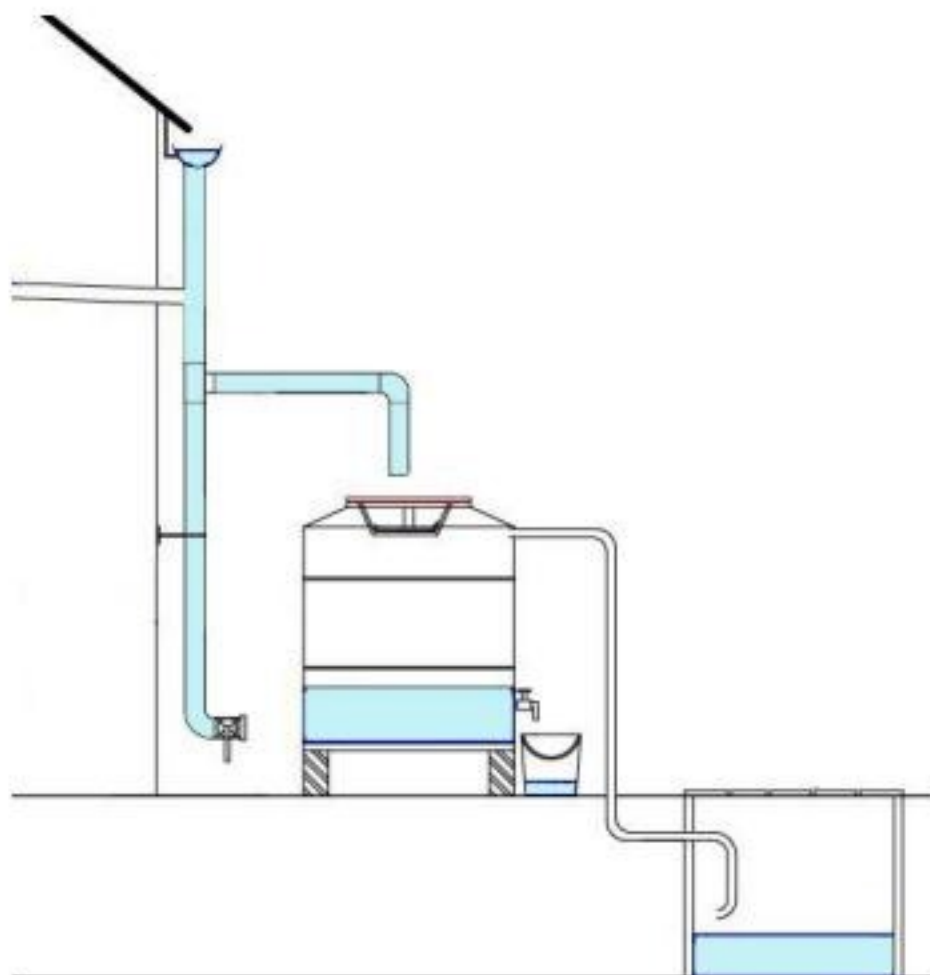


Fig 8.15: Project Illustration
Source: Drawn by Author

iii) Project description:

Assembling individual houses for combined investment for rain water harvesting project.

Most of the houses share common walls with adjacent houses and have a common shaft space for ventilation and pipelines. Such houses can be combined together and can invest for water harvesting as a common venture. The shaft can be used as water storage space and that water can be used for domestic purposes like house cleaning/ car washing/ watering plants etc.

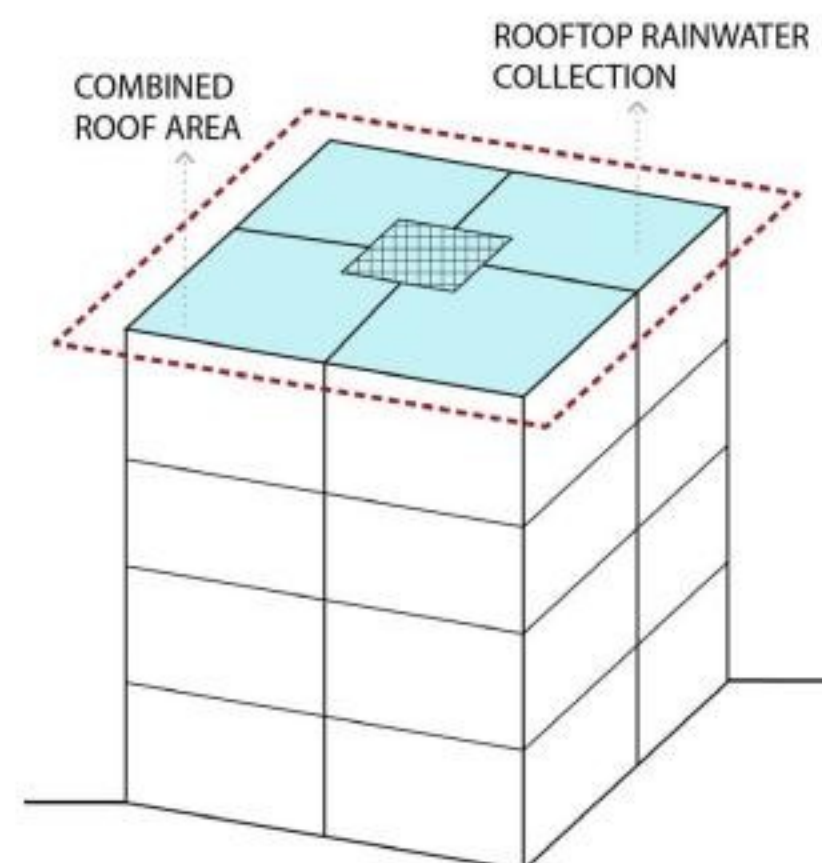
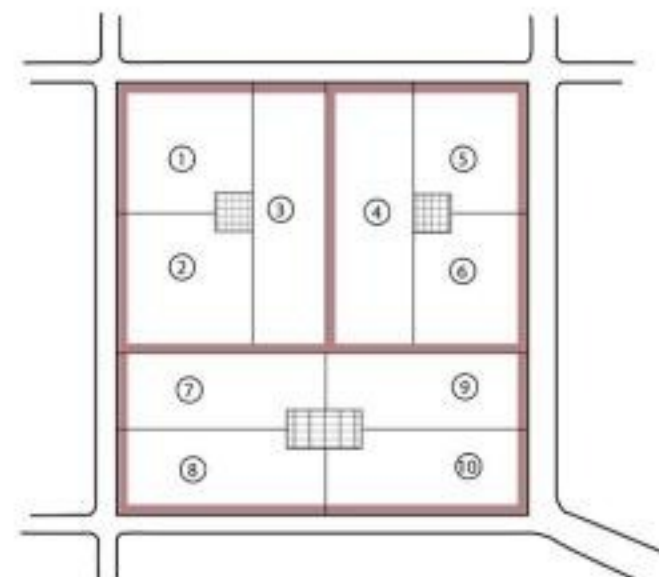
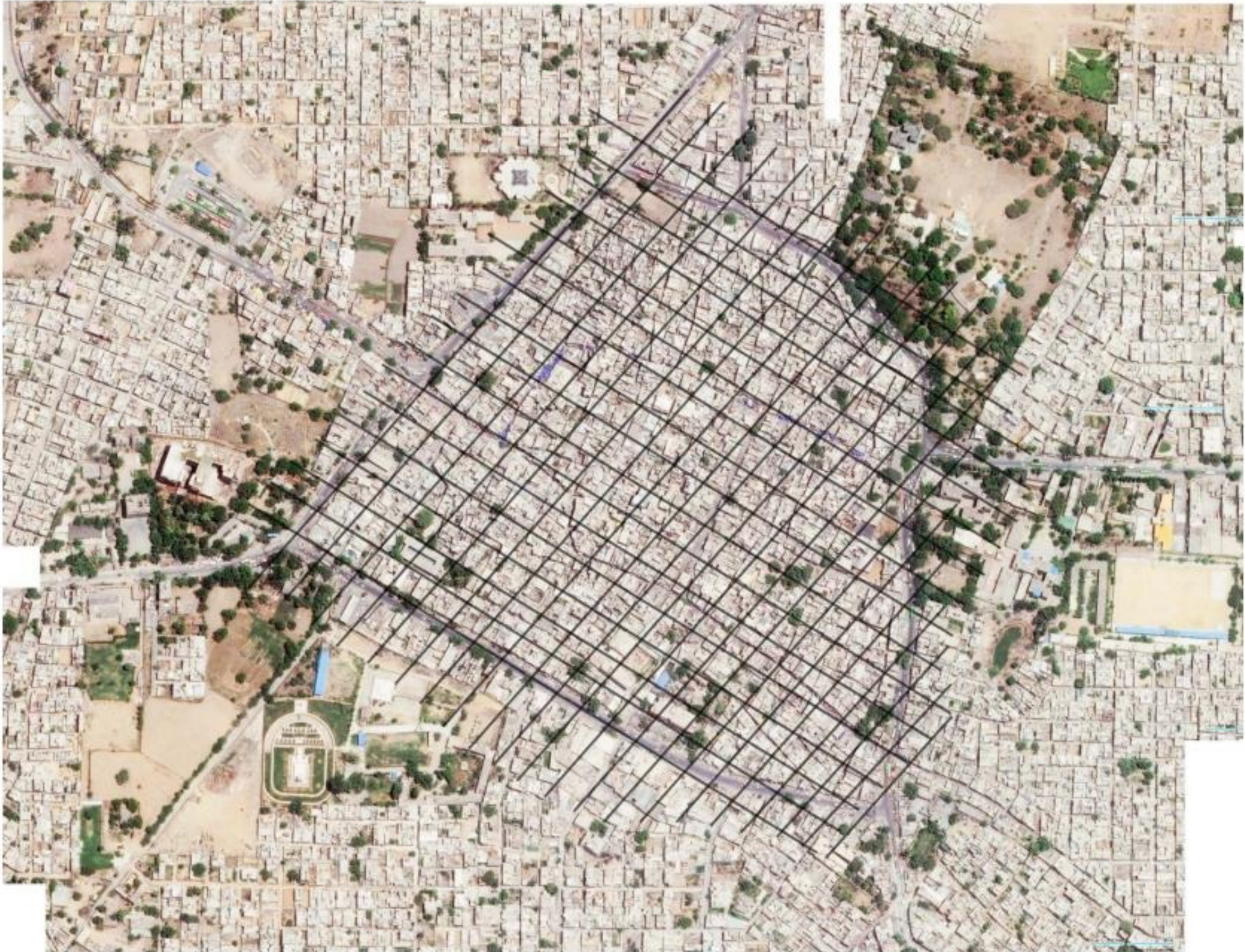


Fig 8.16: Project Illustration
Source: Drawn by Author



It is pointless to mark and combine the houses on map, as the residents will self organise themselves according to their social bonding. This map is just to give an idea how the concept will work.

Fig 8.17: Location Mapping
Source: Drawn by Author (Bing Maps)

Fig 8.18: Detailed Mapping of building assembling.
Source: Drawn by Author (Bing Maps)

iv) Implementation:

a) Supporting Policies/ Projects

Same as project (1)

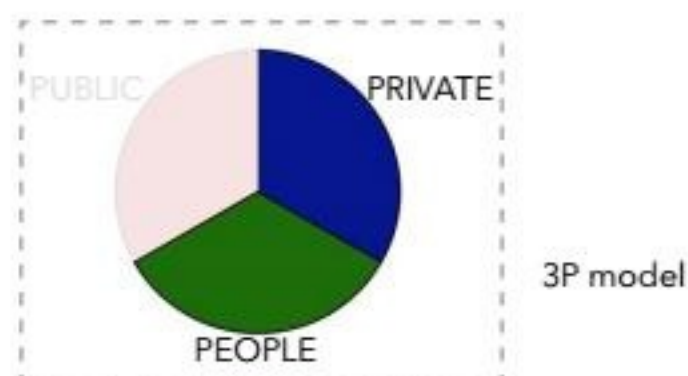
b) Conditions / Scenarios for implementation

The incentives and subsidies will encourage citizens to use smarter approaches. Later this can be set as a rule for the whole city. Individual houses in all parts of the city can follow similar strategy for harvesting water.

c) Involved Actors and Stakeholders

Citizens and Entrepreneurs

Incentives by the Government



d) Time Phasing:

1. The local initiatives can be started by educating the citizens about the harvesting system by the institution network (0-2 years)

2. Pilot projects can be implemented in the second phase (2-10 years)

3. Evaluation and monitoring of the success by the institutions. (5-10)

v) Reflection:

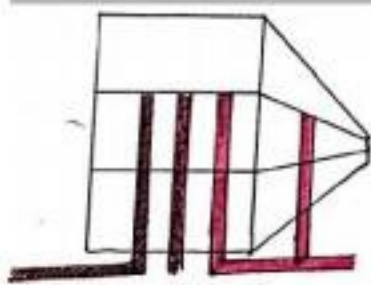
From my own perception about the area and the Indian mindset, I feel it will be a bit difficult to implement this project in a community scale in such areas. That is the reason I am proposing collaboration of 4-6 houses maximum for this project. This way the organisation will work better.

d) Scale of Intervention:

Building scale or combination of 4-8 houses.

This decision should be taken by the citizens to ensure flexibility. Otherwise the rigidity will force the citizens to break the rules.





Living Lab #03 Greywater Separation

Dwarka: Retrofitting

i) Issue:

The sewage system directly connects to the Najafgarh drain polluting to its extent. Because of lack of fresh water, if the greywater is separated, it can be treated and used for domestic purposes.



Fig 8.19: Sewer connection to the drain
Source: <http://www.geographyinthenews.org.uk/media/1638/unblocking-the-problem.jpg>

ii) Strategy:

a) The strategy is simple and smarter way to direct the sanitation system by using separate pipes for greywater and stormwater. In this simple filtration device, greywater is distributed by gravity flow into a tank containing the filter material. The filter consists of bark, a separating filter-cloth and a sand layer. The water flows continuously through the filter and directly for further use.

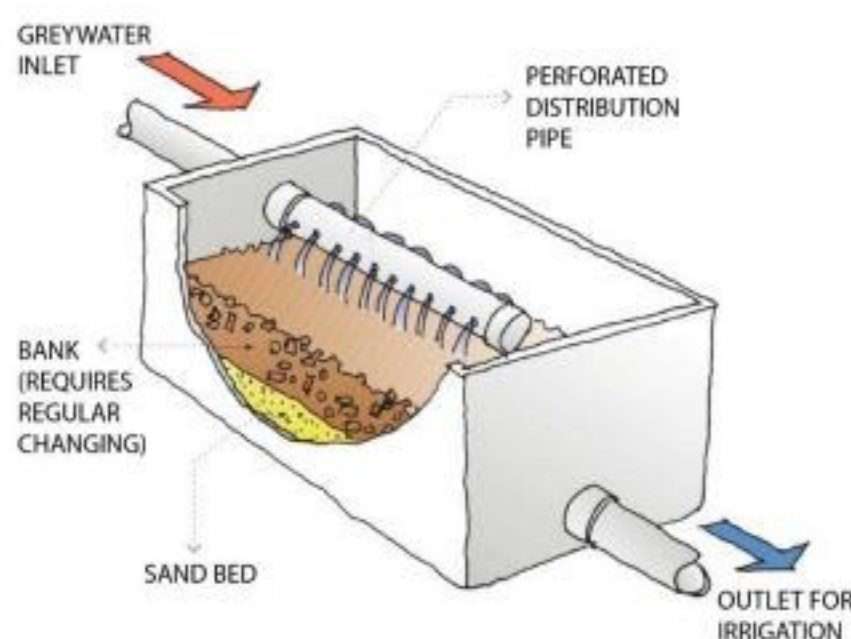


Fig 8.20: Greywater separation and Filter
Source: http://www.level.org.nz/fileadmin/downloads/Water_Use/LevelDiagram82.pdf



iii) Project description:

The project will be possible in Dwarka because of its grid planning. The pipelines can be separated and treated for domestic purpose. Following diagram shows how the strategy will work.

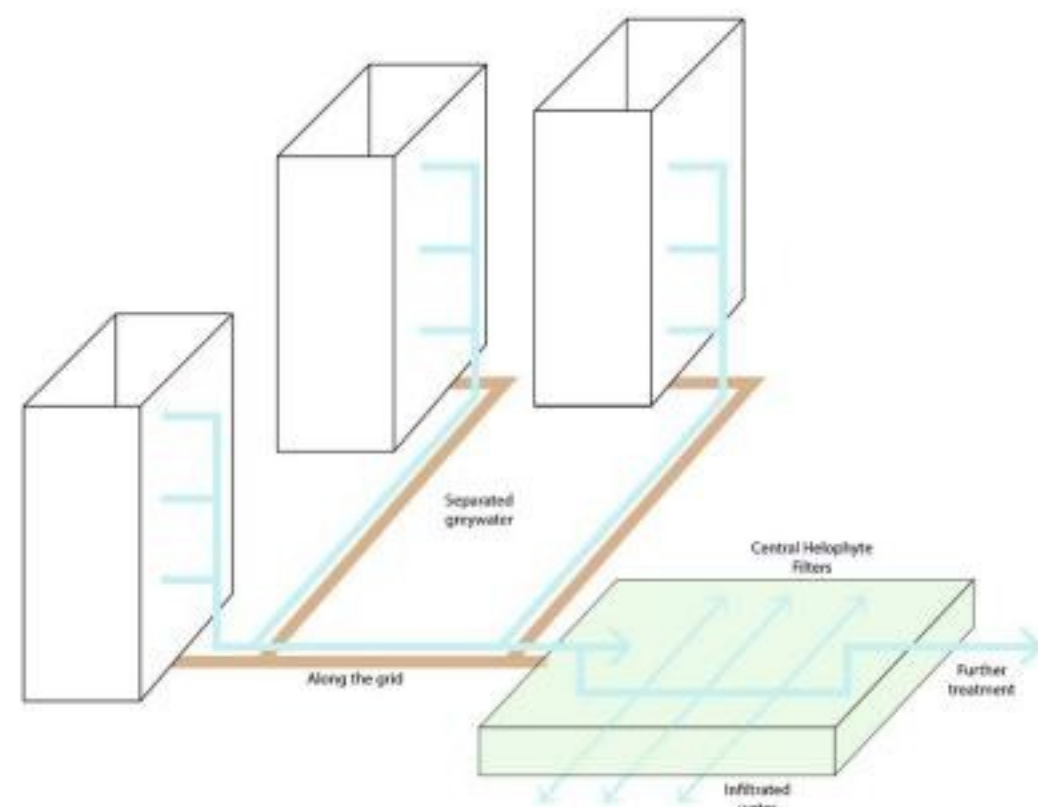


Fig 8.21: Greywater separation strategy
Source: Drawn by author

iv) Implementation:

a) Supporting Policies/ Projects
5% of tax amount to be decided by the citizens.
Enhancement of public private partnership.

b) Conditions / Scenarios for implementation
The basic infrastructure has to be initiated by the private sector or government sector. Without that the project won't progress.

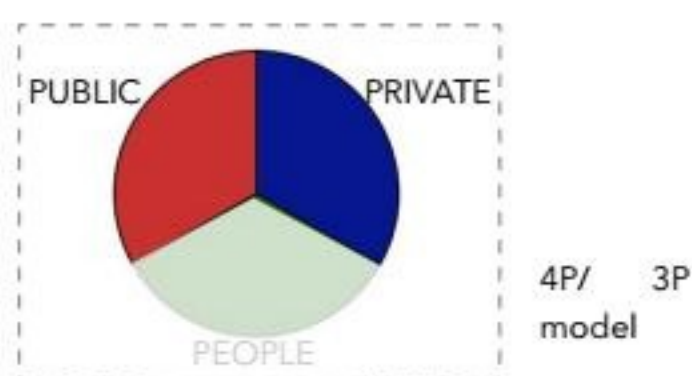
d) Time Phasing:

1. The infrastructure will take 2-3 years to set up.
2. Pilot projects can be implemented in the second phase (2-5 years)
3. Evaluation and monitoring of the success by the institutions. (3-5 years)

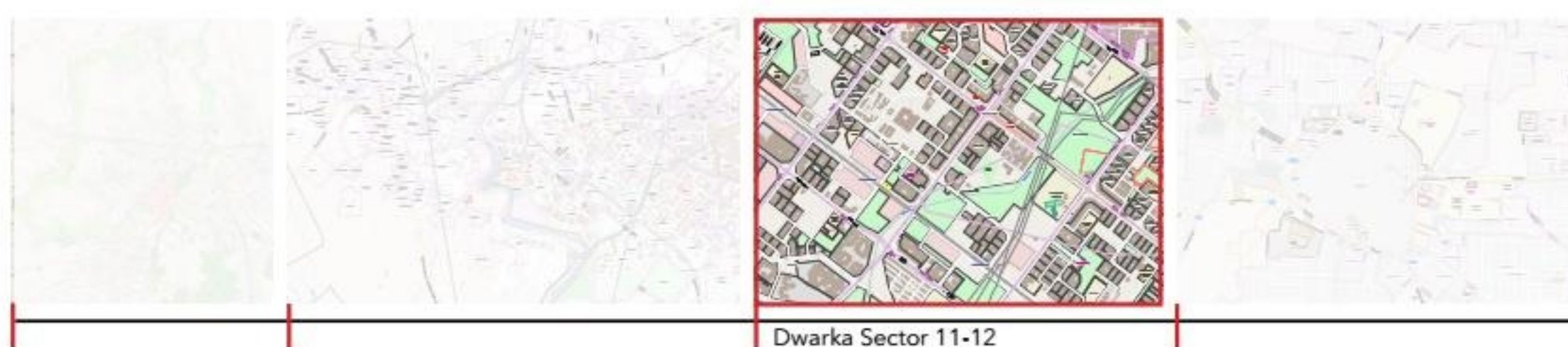
Fig 8.23: Separate pipeline for Greywater
Source: Drawn by author



c) Involved Actors and Stakeholders
Government and Private



d) Scale of Intervention:
Community or neighbourhood scale



v) Reflection:

Small water and sewage treatment plants should become part of micro-society (dwelling complex, commercial building, office, common place, park, etc) or even be available in individual homes.

Why the project is not possible in Najafgarh?

Informal settlements have different types of drainage systems. There are different actors involved in the maintenance of the drainage system in informal settlements including municipality, private sweepers and community. Despite the presence of these multiple agencies there is a high level of dissatisfaction among communities with respect to the type of drainage system and its maintenance.



Living Lab #04 Central Helophyte System



Dwarka: Retrofitting

i) Issue:

This is an opportunity rather than an issue. The barren lands can be used for as open green public spaces with this project.



Fig 8.24: Open unused land
Source: Clicked by author

ii) Strategy:

The helophyte filters are vertical flowing reed fields where grey water can be treated. These reed fields can be easily integrated in the urban fabric as they bring (green) quality. Nevertheless, there is many space needed for the filters (2 m² per inhabitant). The helophyte filters should be implemented on street or block scale to make integration possible.

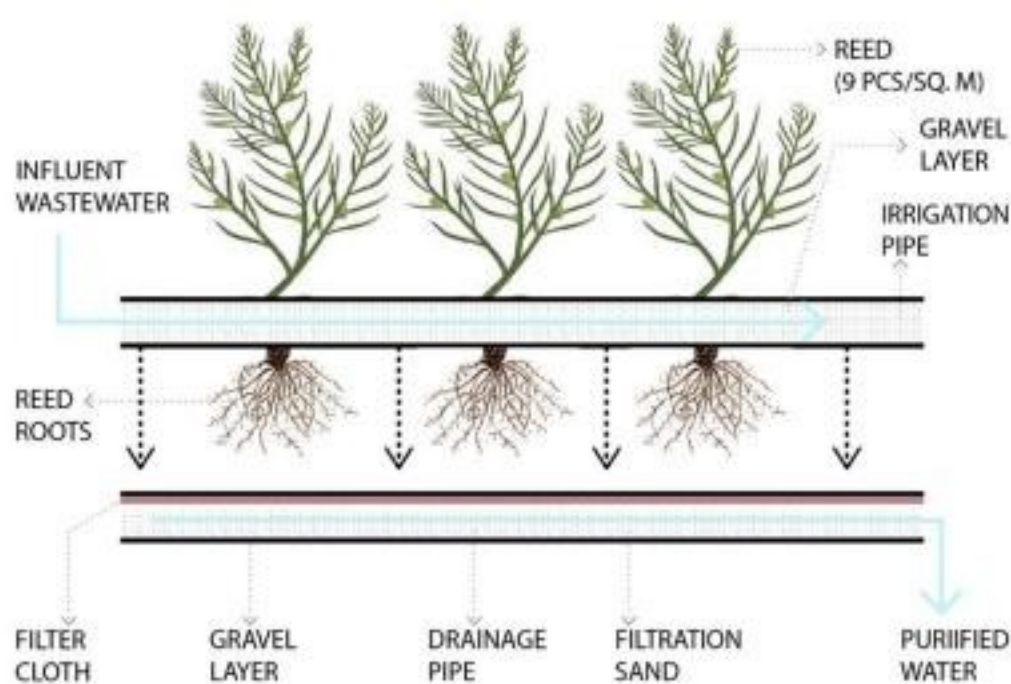


Fig 8.25: Water treatment by helophyte filters
Source: Clicked by author

iii) Project description:

The helophyte filters can be implemented along streets, in courtyards as a larger field or in existing waterways. A connection to the separate grey water system of the block or street and the surface water is necessary as well.

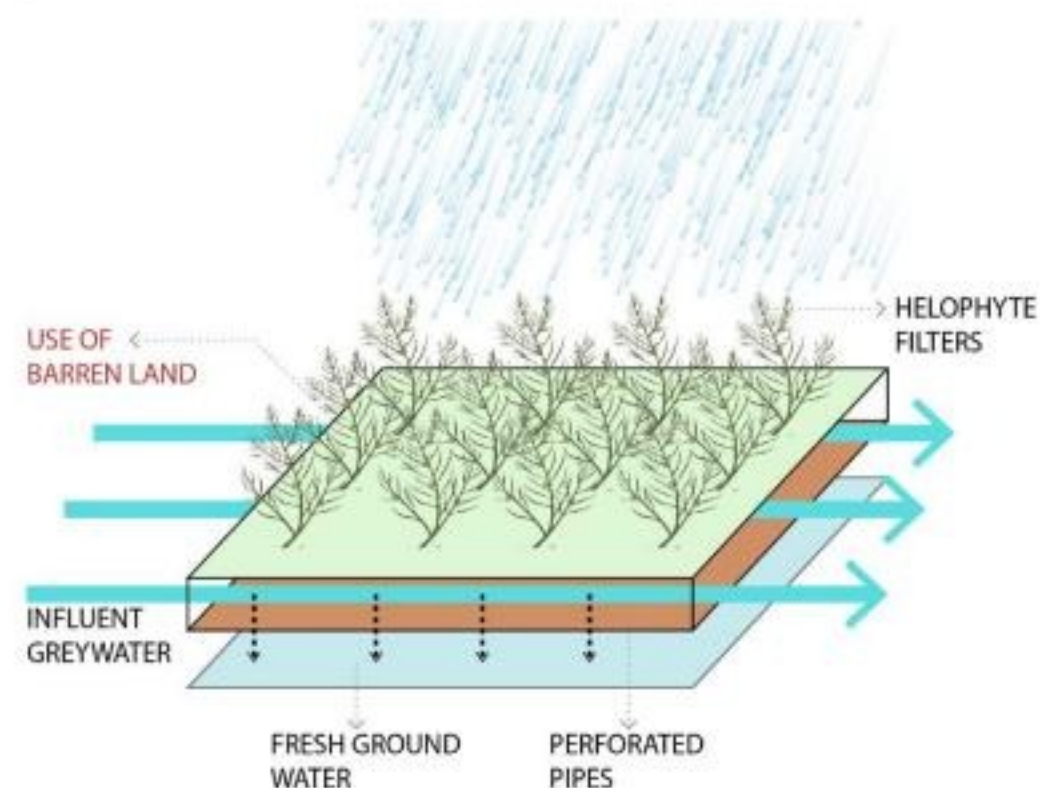


Fig 8.26: Water treatment by helophyte filters
Source: Clicked by author

iv) Implementation:

a) Supporting Policies/ Projects

1. Incentives to the households from the municipality for adapting smarter ways of resource usage.
2. Information through educational institutes & initiatives.

b) Conditions / Scenarios for implementation

This project can be successful very easily if merged with the greywater separation system.

c) Involved Actors and Stakeholders

Citizens +private

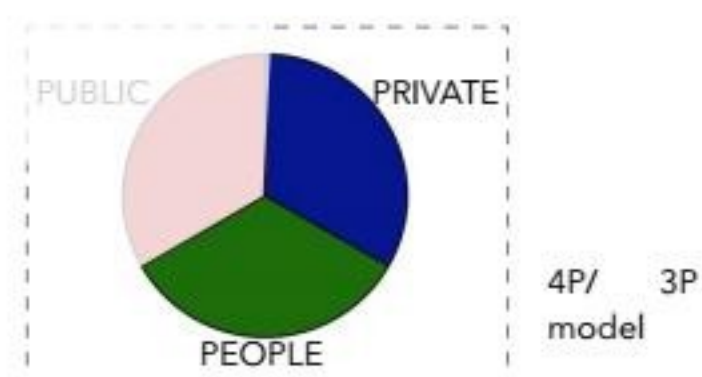




Fig 8.27: Water treatment by helophyte filters
Source: Clicked by author

d) Time Phasing:

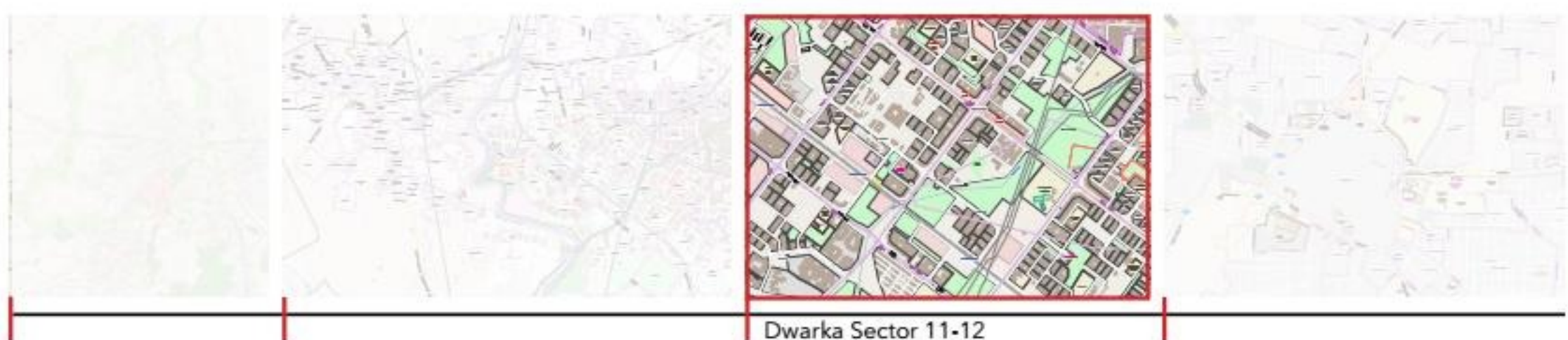
The pipeline layout has to be done first (0-3 years)
Planting of reeds can start (2-3 years)
Process of central helophyte filters (3-5 years)
Project monitoring (3-5 years)

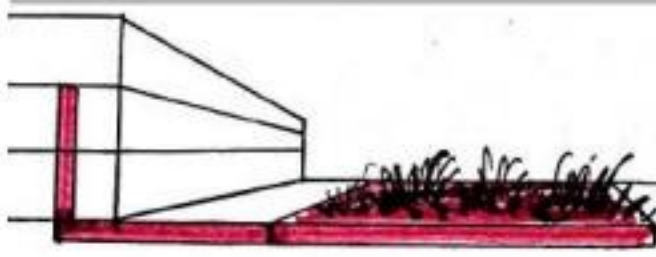
v) Reflection:

Due to the availability of a lot of open grounds, this project should be prioritised. This way the water treatment can be done for domestic purpose and a lot of pressure will reduce on the water supply system.

d) Scale of Intervention:

Community or neighborhood scale





Living Lab #05 Ground water purification



Najafgarh: Redevelopment

i) Issue:

Due to shortage of fresh water supply in this area, the residents use bore well to extract ground water. And due to the immense building density gradually the water level is decreasing. Additionally the drain passing by is creating a lot of ground water pollution, and the same water is being used by the residents.

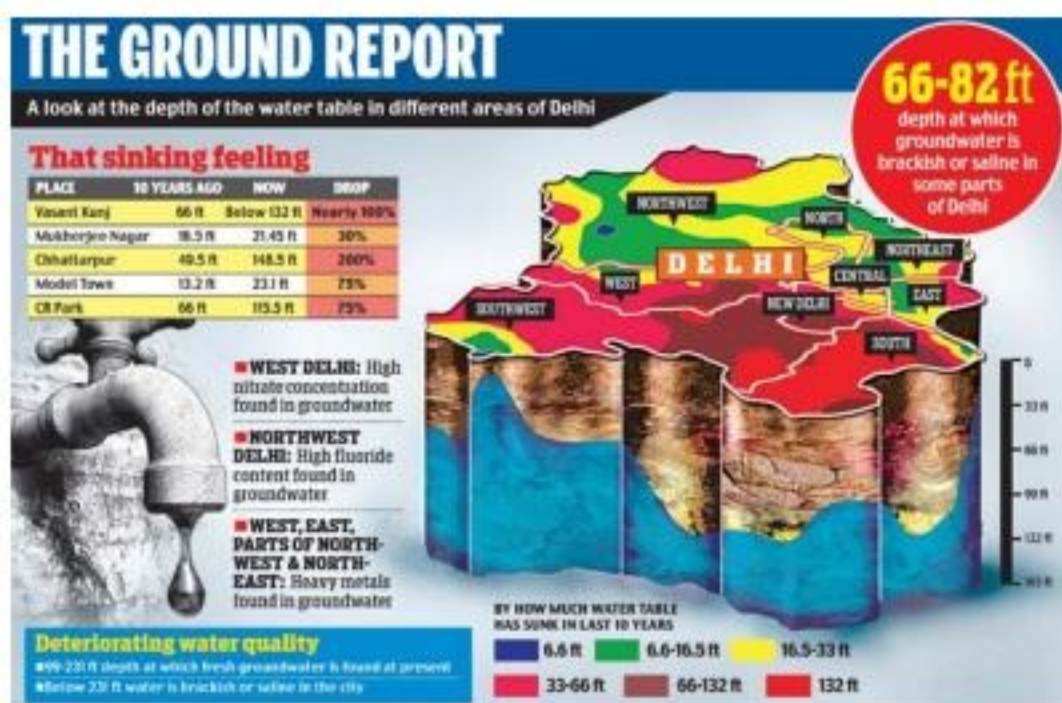


Fig 8.28: Water condition in Delhi

Source: <http://indiatoday.intoday.in/story/borewells-suck-delhi-future-dry/1/370283.html>

ii) Strategy:

a) Same principle as Project 4.

b) Smart City Reference

Orica's Botany Groundwater Cleanup Project

This is a mechanical solution, but local solutions will be used for this project in India.

Botany Groundwater Cleanup Project – 'Pump and Treat' Scheme

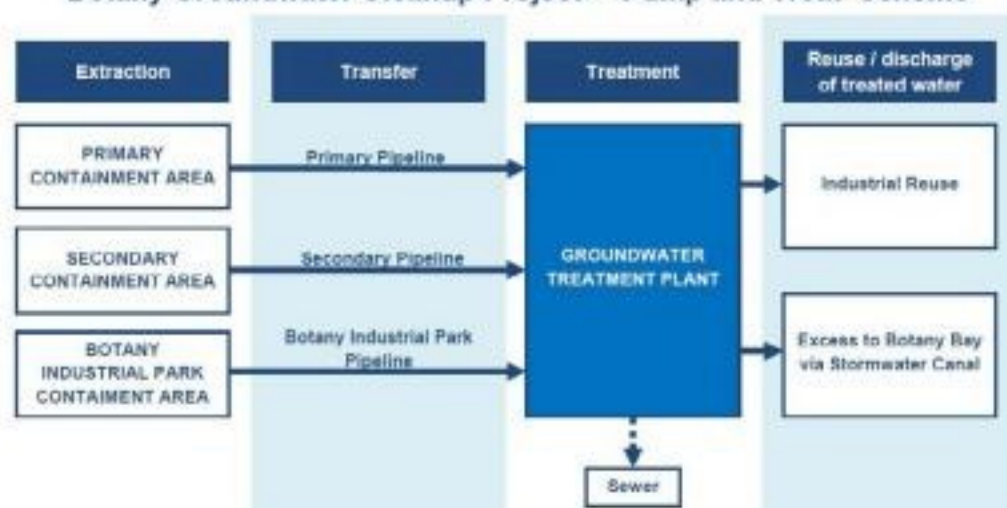


Fig 8.29: Groundwater treatment plant

Source: <http://www.orica.com>

iii) Project description:

There are very less open spaces in Najafgarh, but those spaces can be used to percolate locally filtered water to add in the ground water level.

Same as project 4

iv) Implementation:

a) Supporting Policies/ Projects

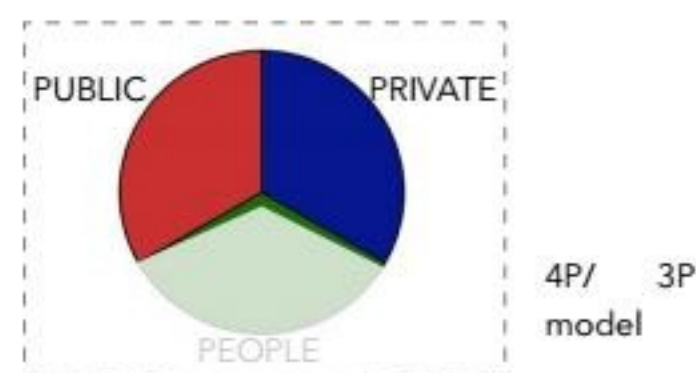
1. Private public people partnership
2. Smart Educational network to educate the citizens about the project.
- 3) Green government institution can initiate the project

b) Conditions / Scenarios for implementation

If private sector can invest money, then the project will be successful. Citizens will be interested for this project.

c) Involved Actors and Stakeholders

Private and Government as investors



d) Time Phasing:

Same as project 4

v) Reflection:

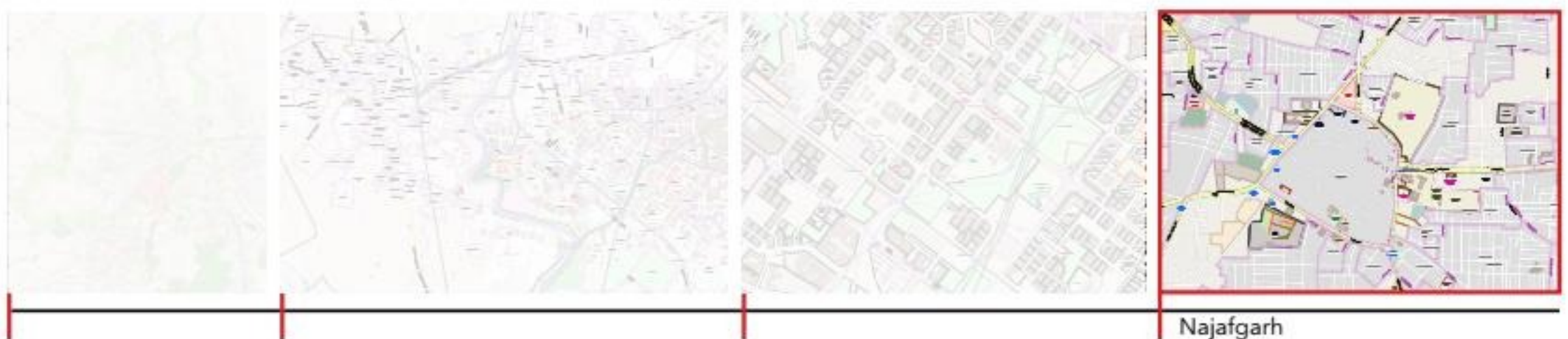
If the project become successful, then Delhi as a city will move a step ahead towards sustainability of natural resources.



Fig 8.30: Possible open spaces for ground water purification
Source: drawn by author

d) Scale of Intervention:

Individual house/ community/ combined buildings etc.



Building scale vision

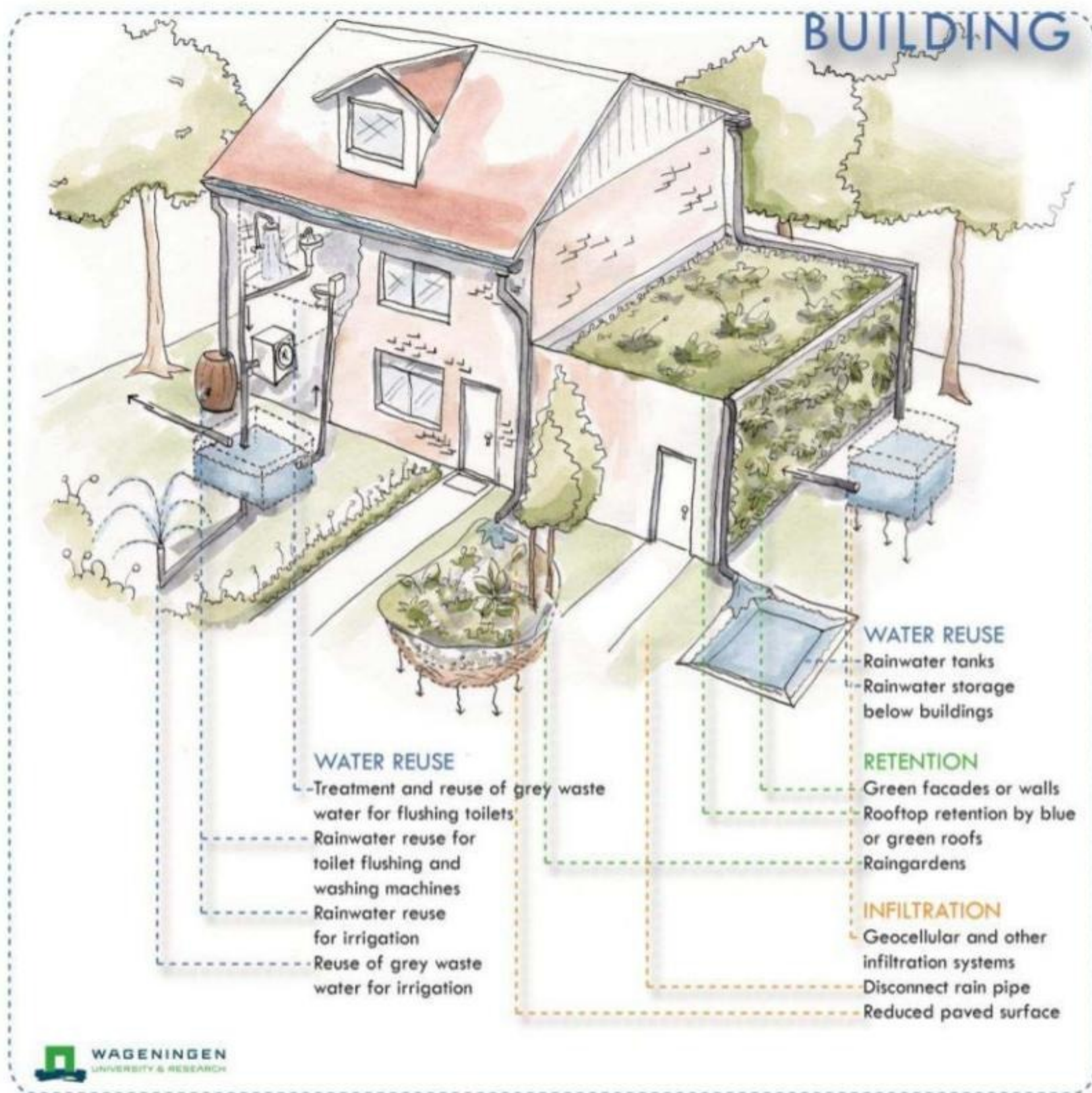


Fig 8.31: Possible Water Smart measures on building scale
Source: Towards Water Smart Cities, Wageningen Environmental Research

District scale vision

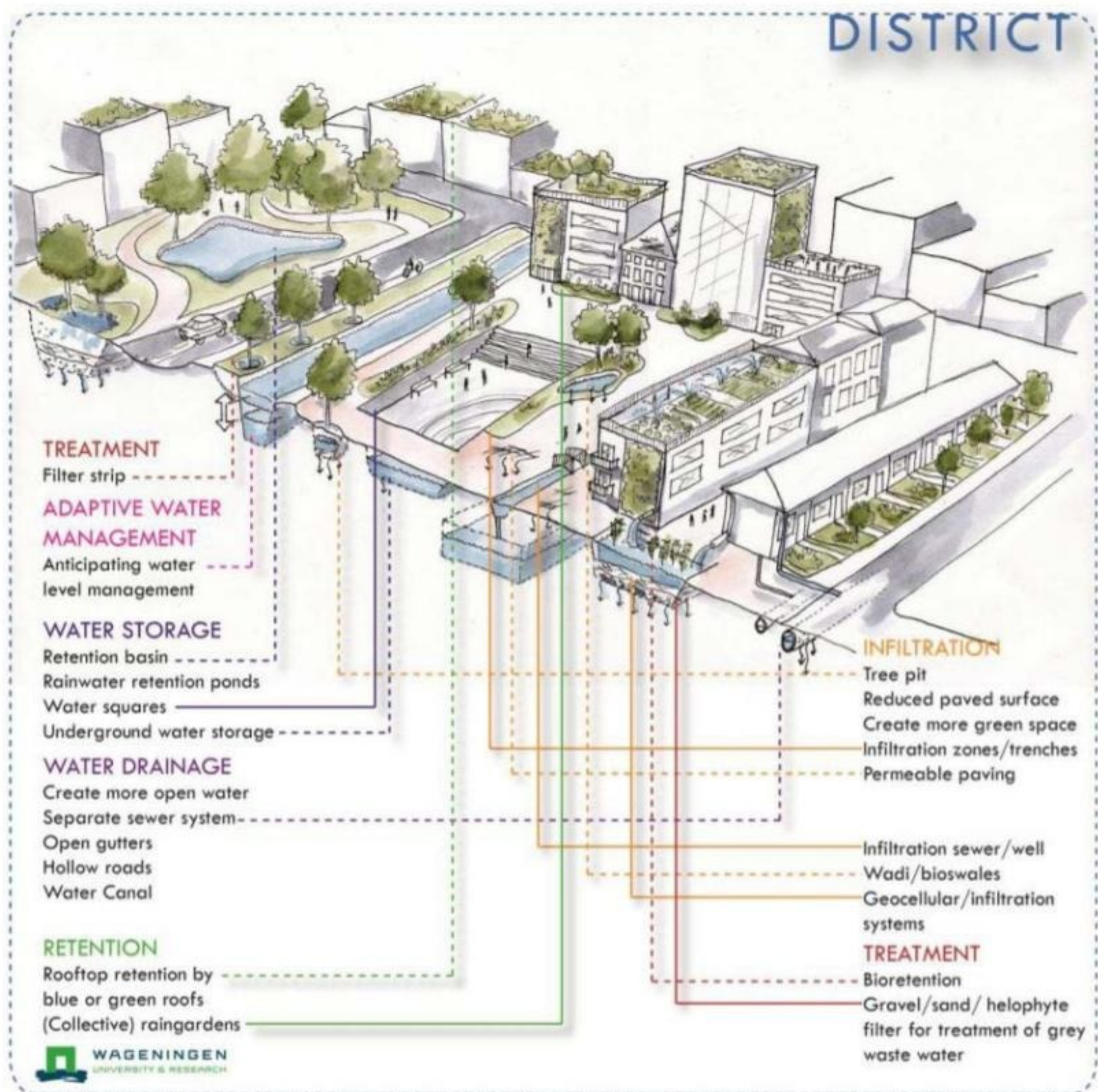
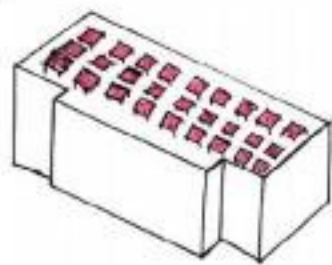


Fig 8.32: Possible Water Smart measures on district scale
Source: Towards Water Smart Cities, Wageningen Environmental Research



Living Lab #06 Commonly stored solar energy



Dwarka: Retrofitting

i) Issue:

Power cuts is a very common issue in both the sites. An alternative provision of electricity is needed.

ii) Strategy:

The principle of a traditional solar panel will work here.

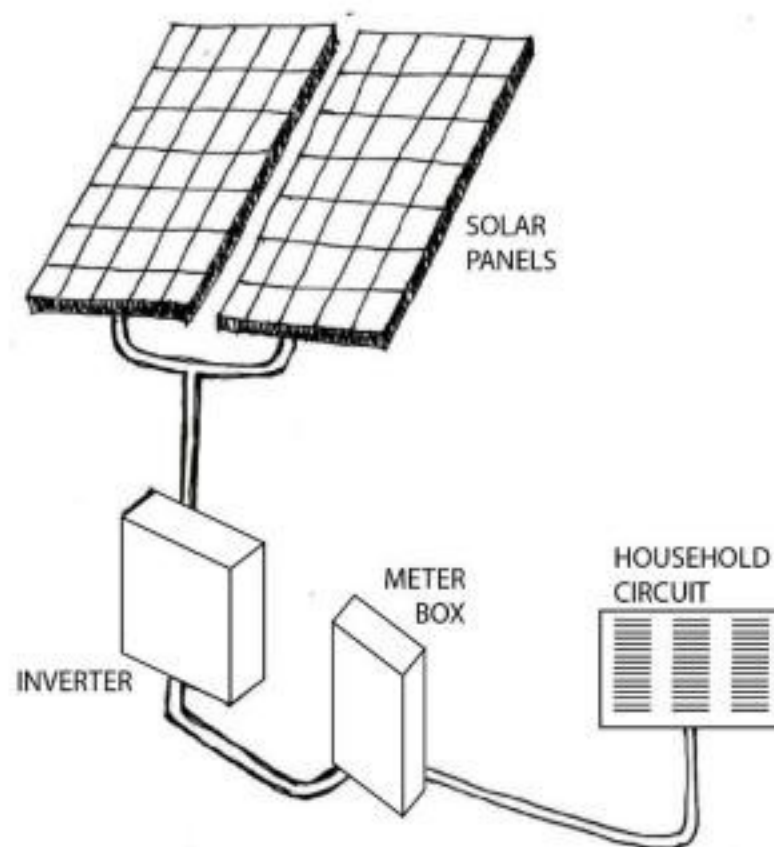


Fig 8.33: Principle of solar panels
Source: Drawn by author

b) Smart City Reference

Pythagoras Solar- Chicago

The new windows, dubbed high power density photovoltaic glass units (PVGU), are a clever hybrid technology that lays typical monocrystalline silicon solar cell horizontally between two layers of glass to form an individual tile. An internal plastic reflective prism directs angled sunlight onto the solar cells but allows diffuse daylight and horizontal light through.



Fig 8.34: Vertical Solar Panels- Chicago
Source: <http://inhabitat.com/chicagos-willis-tower-to-become-a-vertical-solar-farm/>

iii) Project description:

All the houses have battery inverters for emergency power cuts. The generated electricity from the solar panels can be stored in the inverters in each household or in each housing society.

iv) Implementation:

a) Supporting Policies/ Projects

1. Incentives to the households from the municipality for adapting smarter ways of resource usage.
2. Local scale community based initiatives for new technological projects.
3. Information through educational institutes & initiatives.

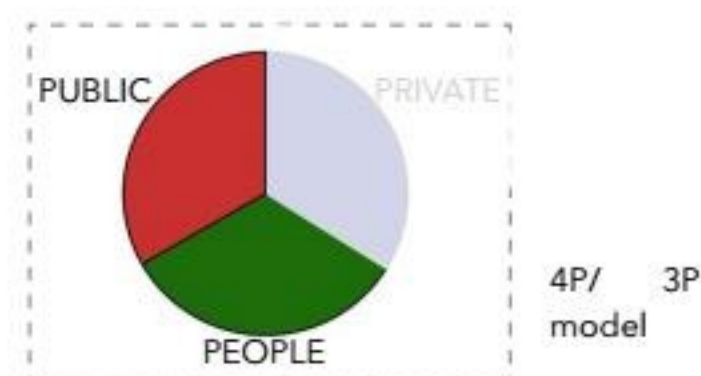
b) Conditions / Scenarios for implementation

The policy for incentives will bring a huge change in the citizens mindset. If they get a good deal out of this project, then no one will prefer power cuts in the mid of the day

c) Involved Actors and Stakeholders

Citizens initiating

Government incentivize



d) Time Phasing:

- 0-2 years: Local initiatives can be started by educating the citizens about installation of solar panels
- 2-5 years: Pilot projects can be implemented in the second phase
- 3-5 years: Evaluation and monitoring of the success by the institutions.



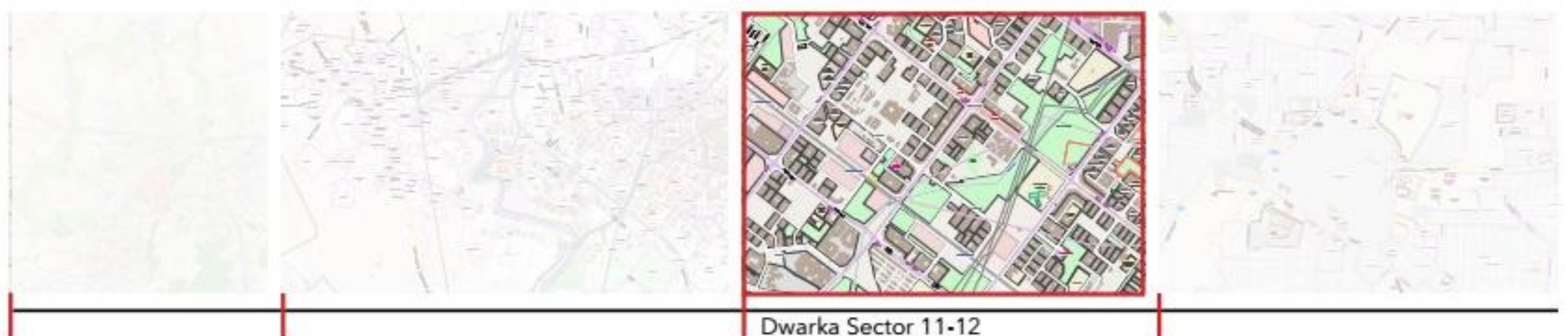
Fig 8.35: Housing societies for solar panel installation
Source: Drawn by author

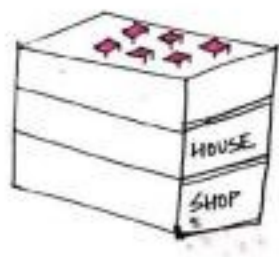
v) Reflection:

Smart meter are capable of communicating the real time energy-consumption of an electrical system in very short intervals of time to the connected utility. These should be added in each household along with installation of solar panels. This will help to monitor the usage for incentive purposes.

d) Scale of Intervention:

Individual house and combined buildings





Living Lab #07

Solar panel installation in mixed landuse



Najafgarh: Redevelopment

i) Issue:

Similar as project 6

ii) Strategy:

Similar as project 6

b) Smart City Reference

Sau Paulo (Brazil)

Smart Eco house



Fig 8.36: The traditional solar panels

Source: <https://www.smartcities.com/en/cities/sao-paulo-smart-living>

iii) Project description:

It will be difficult for an individual family to invest on such projects. But most of the houses in Najafgarh share spaces with commercial activities. This project can be introduces and regularised for mixed use landuse.

d) Scale of Intervention:

Individual house and combined buildings



Najafgarh

iv) Implementation:

a) Supporting Policies/ Projects

Same as Project 6

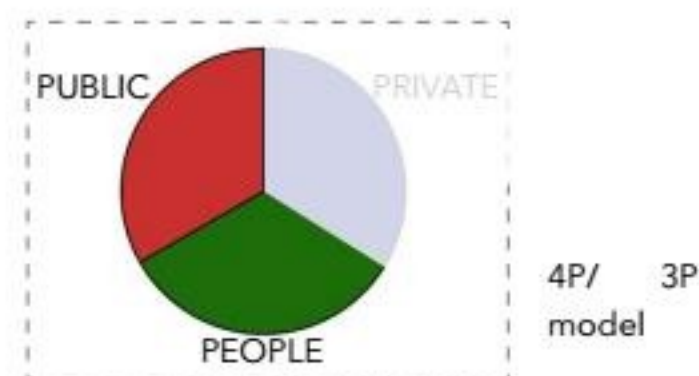
b) Conditions / Scenarios for implementation

The policy for incentives will bring a huge change in the citizens mindset. If they get a good deal out of this project, then no one will prefer power cuts in the mid of the day

c) Involved Actors and Stakeholders

Citizens initiating

Government incentivize



d) Time Phasing:

Same as project 6

d) Reflection:

A lot of economic activities get stuck in the mid of the day because of the power cuts. The shops and commercial centres will gladly invest in solar panels in collaboration with the owner / resident of the house.



Living Lab #08 Biogas electricity generation



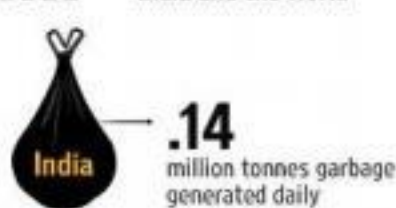
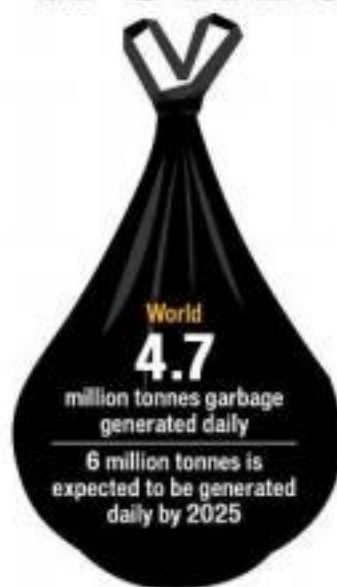
Dwarka: Retrofitting

i) Issue:

Excessive landfill happening in the outskirts of Delhi which is increasing soil, water and air pollution and using lot of space.

IT'S A DUMP

A look at the waste generated in India and the world



* ALL INDIA AND METRO FIGURES AS ON FEB 2015
*SOURCE: CENTRAL POLLUTION CONTROL BOARD OF INDIA AND CENTRE FOR SCIENCE AND ENVIRONMENT

WHAT A MESS

Of the total Municipal Solid Waste generated in India daily, only 1,17,645 TDP or 83% of what is generated is collected; Only 33,665 TDP or 29% of MSW collected is treated

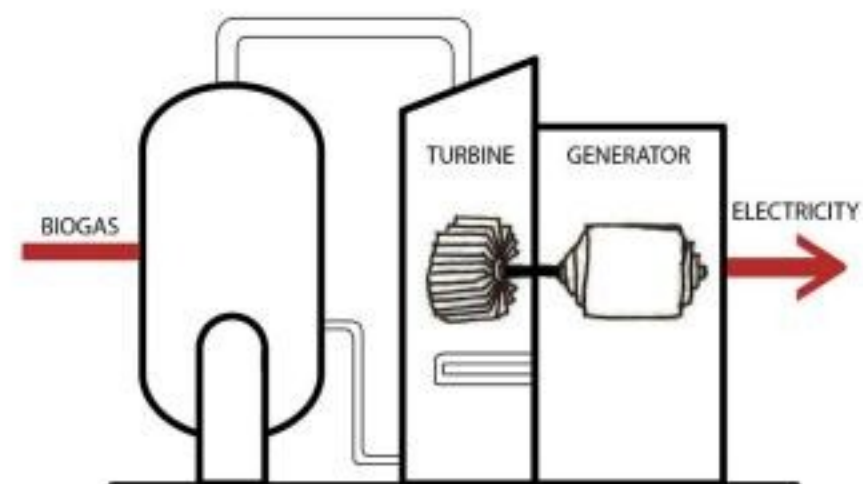


Fig 8.38: Biogas electricity generator

Source: Drawn by author

b) Smart City Reference

Marstal (Denmark), Woodland (California)

Also in India pioneer projects have been initiated.
Hyderabad, India



Fig 8.37: Landfill in Delhi

Source: <http://www.hindustantimes.com/india/india-s-cities-are-faced-with-a-severe-waste-management-crisis/story-vk1Qs9PJT8l1bPLCJKsOTP.html>

ii) Strategy:

In biogas engines no external power is required for the operation of the plant. Biomass can be converted into electric power through several methods. For a local scale anaerobic digestion would be preferable.

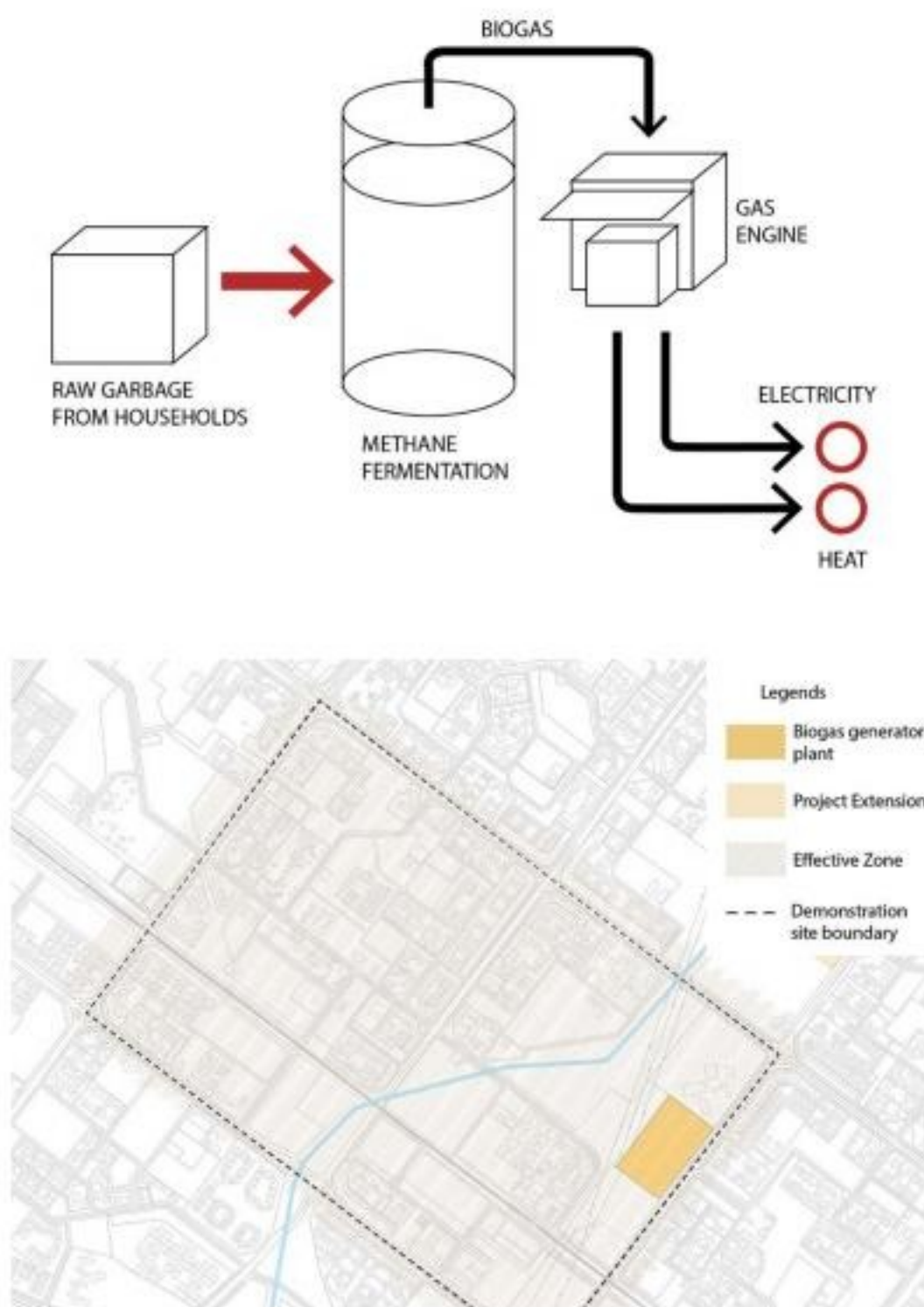


Fig 8.39: Project Vision.

Source: Drawn by Author (Picture by Author)

iii) Project description:

Smarter use of barren lands in Dwarka. This project can be merged with the waste separation (project 9) and the collective composting (project 11)



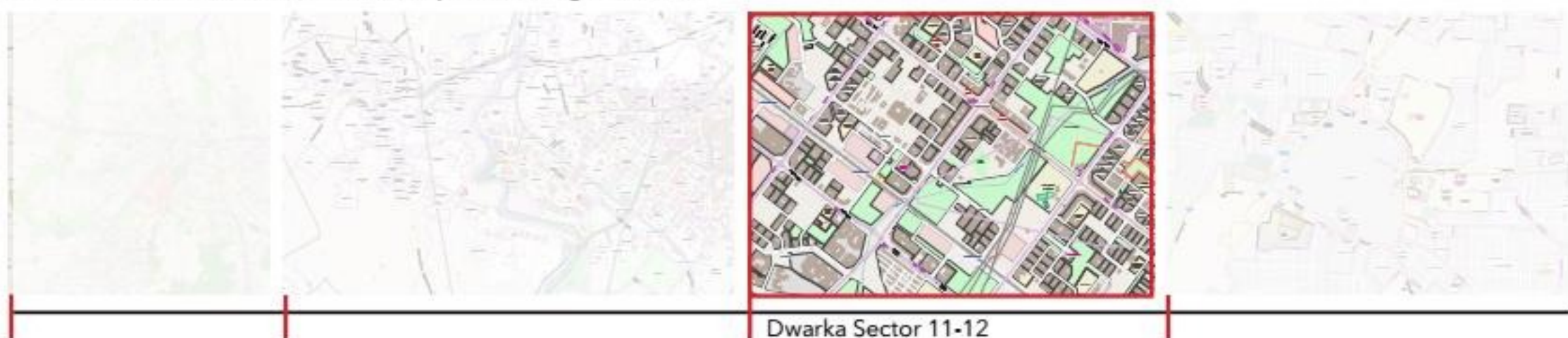
iv) Implementation:

a) Supporting Policies/ Projects

1. Green Governmental Institutes
2. Educational institute network set up pioneer projects in possible areas, with the help of local government

d) Scale of Intervention:

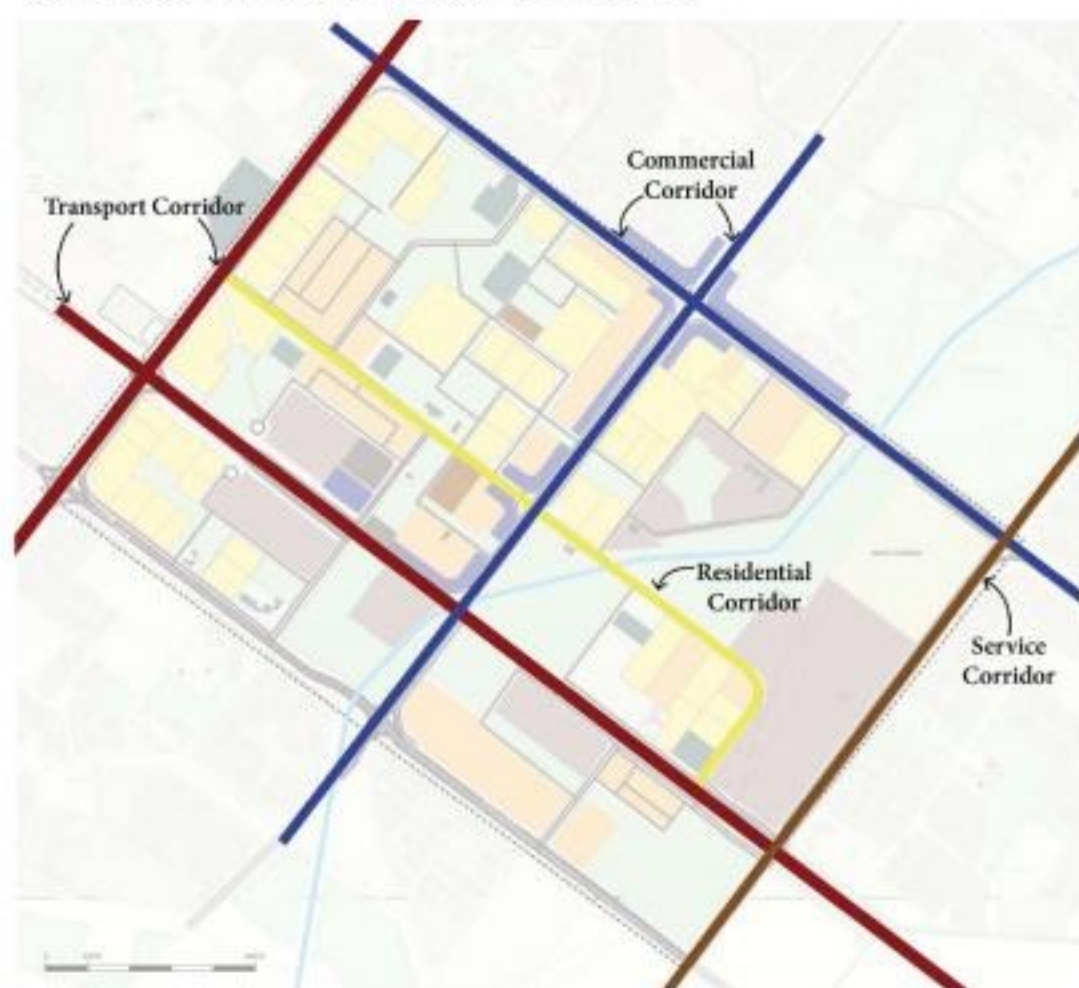
Each Dwarka sector can develop its own generator.



b) Conditions / Scenarios for implementation

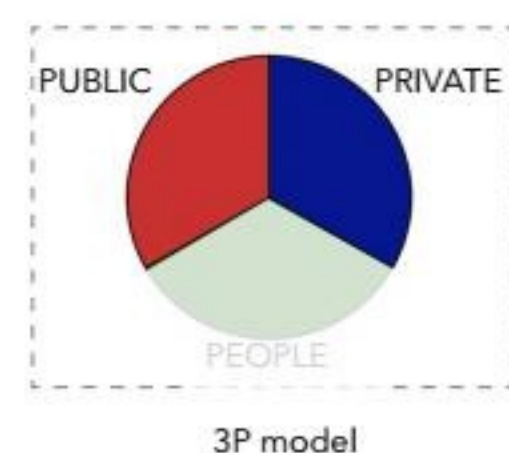
This project would be possible with an initial investment by the private sector, especially the offices/ entrepreneurs who are working in the field of renewable energy.

The project will be more conveniently done if the road typology and hierarchy is followed.



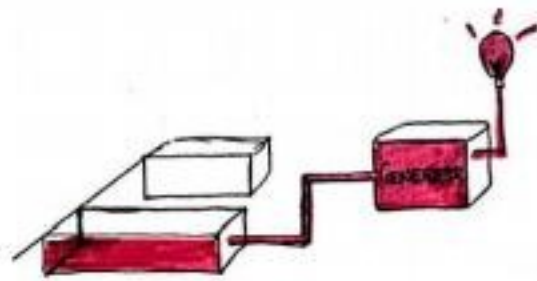
c) Involved Actors and Stakeholders

Entrepreneurs and Local government



d) Time Phasing:

- 0-2 years: Waste separation project by the citizens
- 0-2 years: Research and Biogas generator set up by the educational institutes.
- 2-5 years: Electricity generation and distribution
- 3-5 years: Evaluation and monitoring of the success by the institutions.



Living Lab #09 Waste separation



Najafgarh + Dwarka: Redevelopment and Retrofitting

i) Issue:

Collected waste being separated by ragpickers. They collect the plastic bottles etc. for recycling. But a lot of things can not be recycled because they get ruined by mixing. Thus, very less amount of recycling is possible in Delhi with the traditional system of waste collection.

DELHI

HOW IT DISPOSES OF ITS WASTE: Waste is collected at 2,500 community bins or dhalaos that serve as secondary collection centres, before being disposed off at landfills

DUMPS: Four — at Okhla, Ghazipur, Narela-Bawana and Bhalswa covering an area of 150 acres. All four are non-engineered landfills

TREATMENT OF WASTE: Experts say that at least 50% of the waste is fit for composting and another 30% can be recycled. But according to the CPCB, as of February 2015, only 4150 TDP of waste is being treated

PEEVE POINTS: 85% of the sanitation budget goes into transporting garbage. Three of four landfills are overdue for closure. The existing dhalaos will overflow by 2021. Frequent strikes by sanitation workers **MOHIT SHARMA**

8,390

Figures in tonnes per day)



Fig 8.42: Waste collection system

Source: <http://www.hindustantimes.com/india/india-s-cities-are-faced-with-a-severe-waste-management-crisis>

ii) Strategy:

If the household waste is sorted in the correct containers, it can be delivered for recycling, composting or electricity generation.

b) Smart City Reference

Waste sorting and recycling, Helsinki

Modern design popular recycling bin for public areas 4x30L This model features a very nice and modern design, very popular for both home and office use. Colored and labeled with specific recycling symbols and writings it makes very easy to separate the trash before disposal.



Fig 8.43: Helsinki waste separation system

Source: <https://www.hsy.fi/en/residents/sorting/instructions/Pages/default.aspx>

iii) Project description:

The project will not need much extra infrastructure. The citizens can locally start working on this project by separating the household waste. The Smart educational network needs to teach the citizens about the basics of waste sorting.



Fig 8.44: Possible waste collection system in India

iv) Implementation:

a) Supporting Policies/ Projects

Same as project (10)

b) Conditions / Scenarios for implementation

Same as project (10)

c) Involved Actors and Stakeholders

Same as project (10)

d) Scale of Intervention:

Households

d) Time Phasing:

Same as project (10)



Living Lab #10 Smart waste containers



Najafgarh + Dwarka: Redevelopment and Retrofitting

i) Issue:

There is an absence of an organised system of garbage collection by the municipal authorities in all the slums surveyed in the two wards. Majority of the households are indulging in dumping of garbage at a variety of locations including by-lanes, drains, nallas, open area, near toilets, and in municipal bins. The communities voiced their dissatisfaction with the low and irregular frequency of clearance of garbage by the municipal staff.



Fig 8.45: Waste Collection system (1. Najafgarh, 2. Dwarka)
Source: Clicked by author

ii) Strategy:

Smart waste containers can sensor how full the bin is and communicate that with the collection facility. The waste container places will stay clean as overfull containers are not the case anymore.

b) Smart City Reference

Clean Cube smart bins, Seoul, South Korea. Within just three months of using Ecube Labs' smart city waste management solutions, the city was able to see huge improvements in public sanitation. Since installing the Clean Cubes, waste overflow was eliminated and there was a significant reduction of litter on the streets`



Fig 8.46: 1) Waste collection principle
2) Smart City Reference (Japan)
<http://ecubelabs.com/>

iii) Project description:

Smart waste containers can sensor how full the bin is and communicate that with the collection facility. This project can be implemented irrespective of the sites and the conditions, because as the pictures confirm that be it a planned neighbourhood or an unplanned growth, the municipality provided with open garbage collection which is neither safe for the residents or the people working for the collection system. Same areas can be used to install smart containers and can be spread in a more local scale (for instance all the housing societies can have such containers).

iv) Implementation:

a) Supporting Policies/ Projects

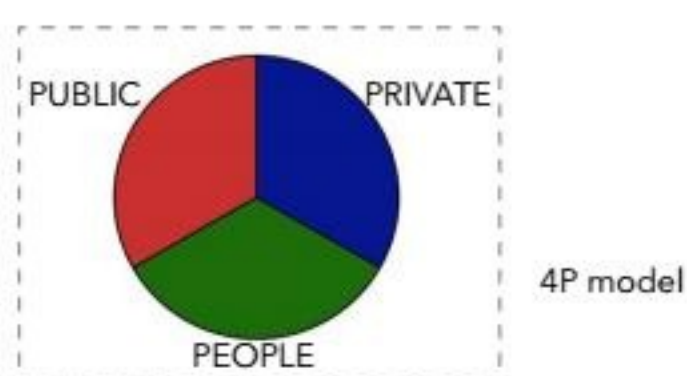
1. Waste Separation (project 9) should done executed along with this project.
2. Biomass electricity generator (project 8) would be more faster if this project can be implemented.
3. Green Governmental Institution policy can be the pioneering project.

b) Conditions / Scenarios for implementation

The government and the private companies should invest money at first to start this project. Also, the citizens need to be aware of seaparation of garbage. This would be an easy project to implement as there is no big infrastructure involved.

c) Involved Actors and Stakeholders

Citizens should act on it. Government and private investors are the stakeholders.



d) Time Phasing:

0-2 years: To place the containers on streets and garbage collection areas.

2 years: To monitor the changes (betterment) of the project by the Educational network

v) Reflection:

This can be a successful project in less amount of time and also, will initiate the local composting project and biogas generator project as well. A simplistic solution by adding these smart waste containers will bring a lot of change to make Delhi healthier.

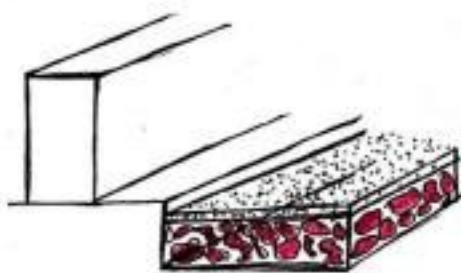


Fig 8.47: Smart waste containers
<http://ecubelabs.com/>

d) Scale of Intervention:

Street-side and community scale





Living Lab #11 Collective composting



Dwarka: Retrofitting

i) Issue:

As described in earlier project, the inefficient waste collection and management system which is creating unhealthy conditions. If the project of waste separation be successful in the area, then the barren lands can be seen as an opportunity for collective composting.



Fig 8.48: Barren and leftover lands in Dwarka

Source: <http://www.indiacityblog.com/city-special/dwarka-asias-largest-sub-city-2162/>

ii) Strategy:

The success of a composting station, its economic and environmental efficiency therefore impose that the objectives of waste treatment and of compost production are put at the same levels.

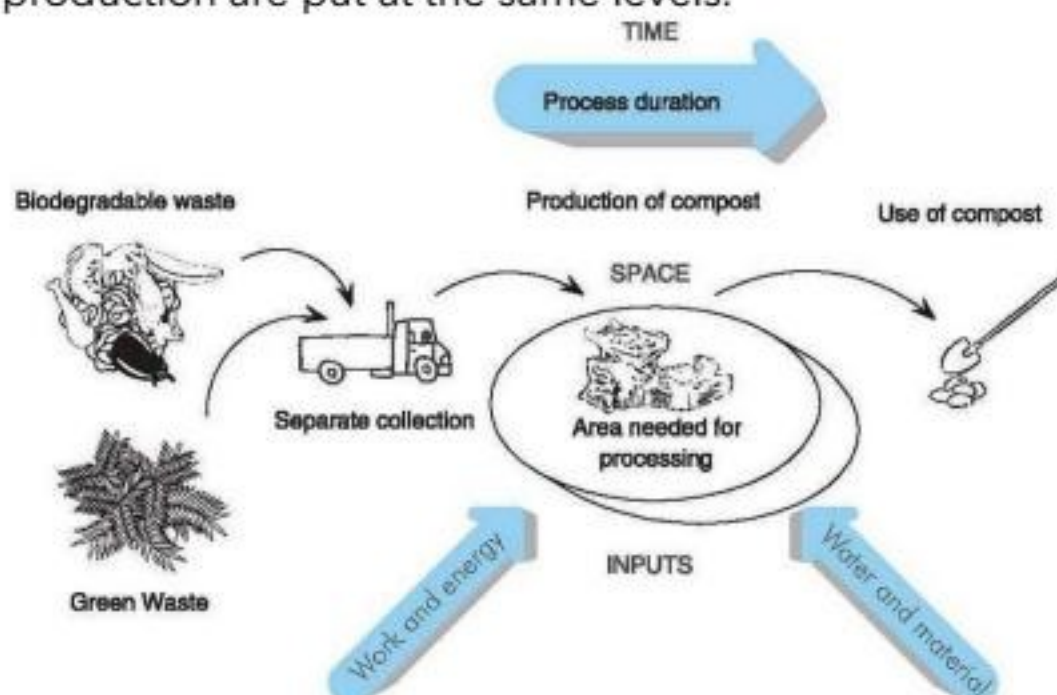


Fig 8.48: Principle of local composting

Source: <http://www.commissionoceanindien.org/archives/environment.ioonline.org/fr/solid-waste-management/composting-stations.html>

Smart city Reference

San Francisco, Ottawa, Minnesota All Collect Compost

iii) Project description:

Barren lands can be used for collective composting. This project can be merged with waste separation and collection.

iv) Implementation:

a) Supporting Policies/ Projects

Green governmental buildings should initiate such demonstrating projects

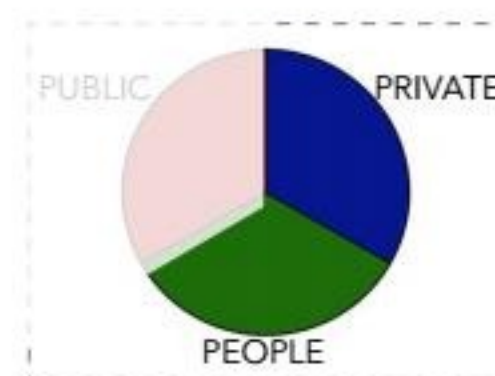
Citizens can be educated by the smart educational network.

b) Conditions / Scenarios for implementation

This project will work if other recommended waste management projects are in control. All the waste related projects should work together as provided vision image in Fig 8.51.

c) Involved Actors and Stakeholders

Citizens and private sector



d) Time Phasing:

This project will start after other projects has been initiated (2 years)

The set up of composting areas will take 2-5 years

Monitoring (3-5 years)

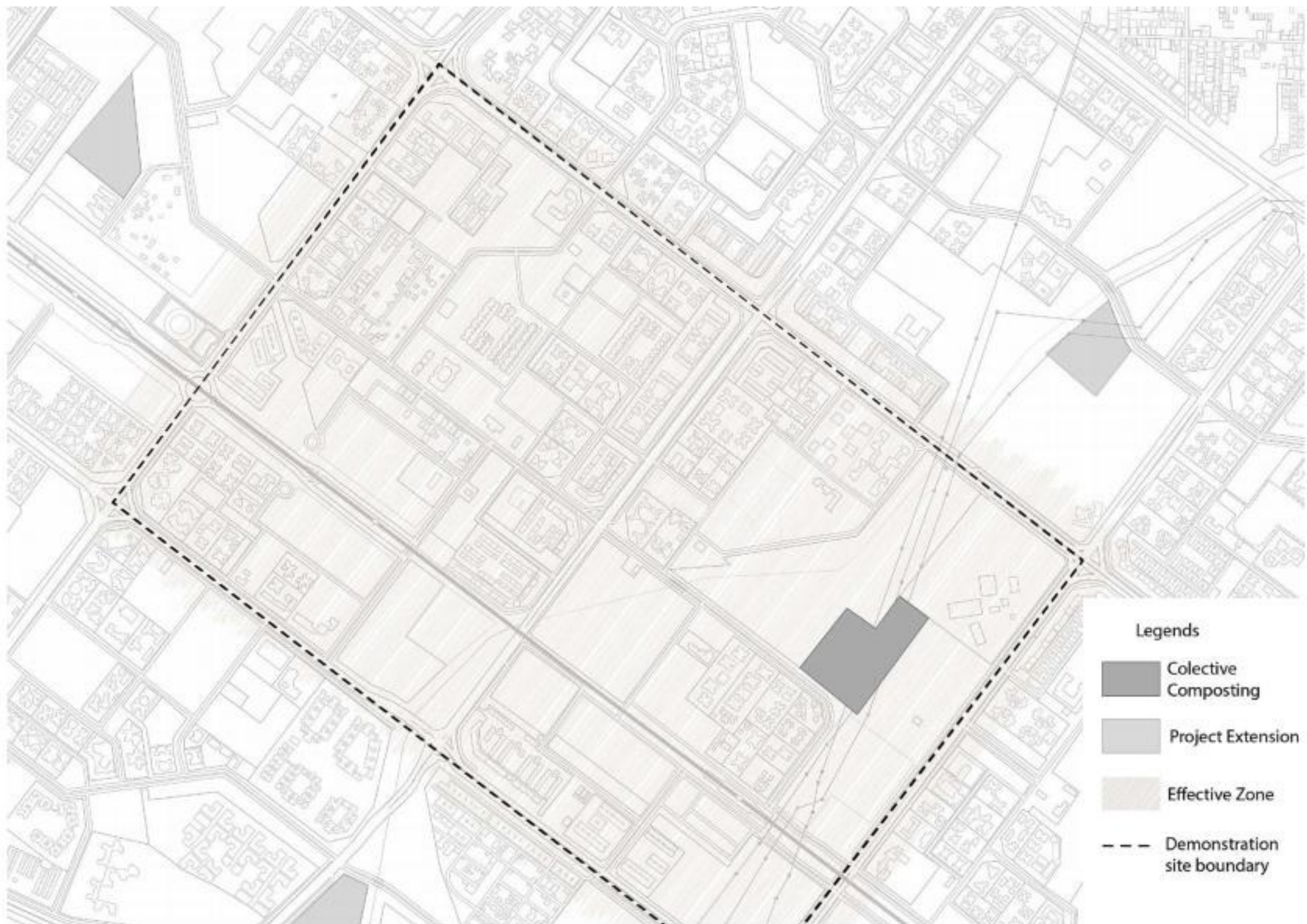
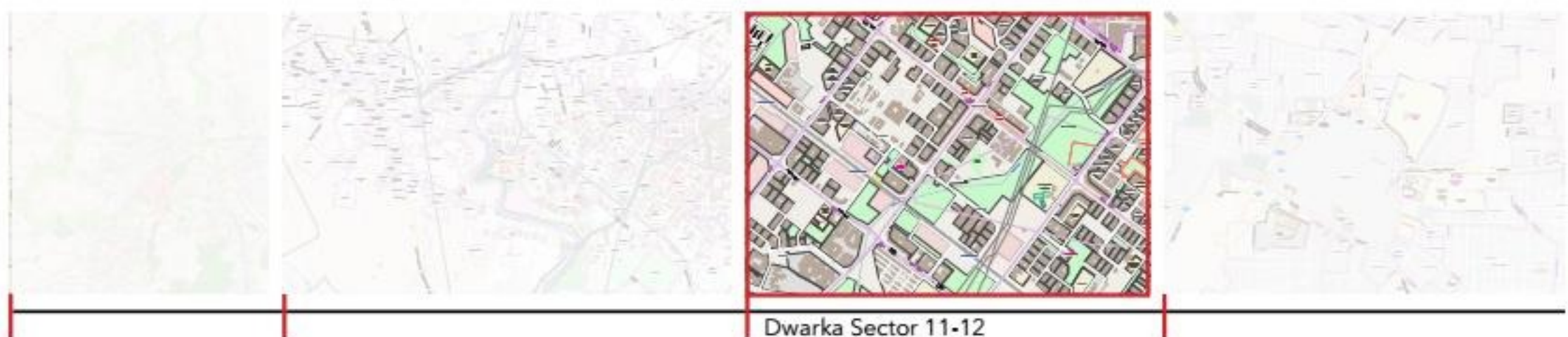


Fig 8.49: Possible location for collective composting
Source: Drawn by author

d) Scale of Intervention:

Individual house/ community/ combined buildings etc.





Living Lab #12 Organic compost bin



Najafgarh: Redevelopment

i) Issue:

Same as project 10.

ii) Strategy:

Composting is a biological process, therefore one of the basic requirements is the availability of essential nutrients that can be found in organic waste for example (Díaz, Savage, Eggerth, & Golueke, 1993).

b) Smart City Reference

New York, Boston

COMPOST BIN

- ~ loads from the top
- ~ made with thinner plastic
- ~ minimal aeration
- ~ large volume per footprint
- ~ empties from lower ports
- ~ has no bottom



Fig 8.50: Compost bin

Source: <http://learn.eartheasy.com/2012/08/compost-tumblers-vs-compost-bins-pros-cons/>

iii) Project description:

Due to insufficient common society spaces, individual houses can perform composting in their own houses.

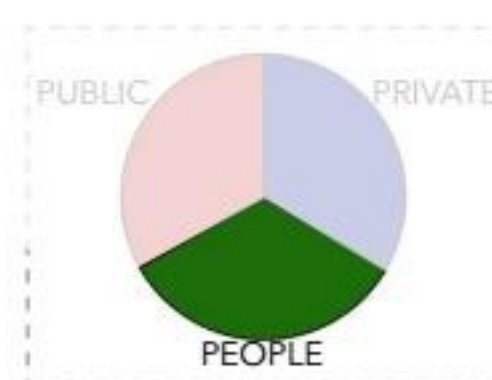
iv) Implementation:

a) Supporting Policies/ Projects

Related proposed projects and policies that will help implementing the project or will work as a catalyst.

c) Involved Actors and Stakeholders

Citizens



d) Time Phasing:

0-2 years

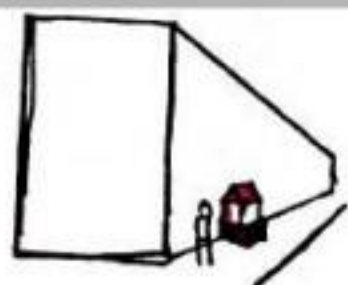
v) Reflection:

Depends on residents and families who wants to do it or not. Incentive provision will encourage them more.

d) Scale of Intervention:

Individual house/ community/ combined buildings etc.





Living Lab #13 Adaptable street usage



Dwarka: Retrofitting

i) Issue:

The wide streets are not being used to its potential in Dwarka. The streets are empty and encourage criminal activities. There are few temporary illegal shops. Economic activities can grow further in the streets.



Fig 8.52: Wide streets in Dwarka
Source: <http://www.99acres.com/NRI-Real-Estate.htm>

ii) Strategy:

a) Describe the principle and requirements

Delineated streets according to usage for flexible solutions.

Transport Corridor: Metro Stations

Commercial Corridor: All the commercial complexes along the street. Temporary commercial activities can be introduced on the streets.

Residential Corridor: Primary vehicular access to the housing societies.

Service Corridor: Waste collection, electricity office, Sports complex Nursery on the same lane.

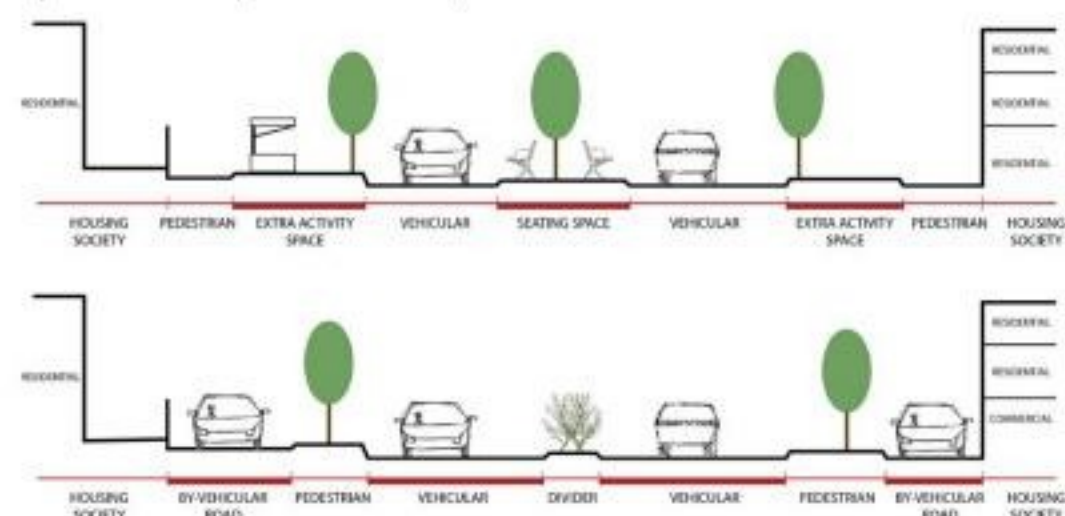


Fig 8.53: Possible flexibility in the wide streets
Source: Drawn by author

iii) Project description:

Street space, ranging from parking space to pedestrian zone to the building blocks can serve variety of functions in addition to mobility, whether based on temporary or permanent usage. The right of way can be adapted using many combination of strategies to support walkability and to achieve more diverse uses. This will encourage the economic activities in Dwarka.

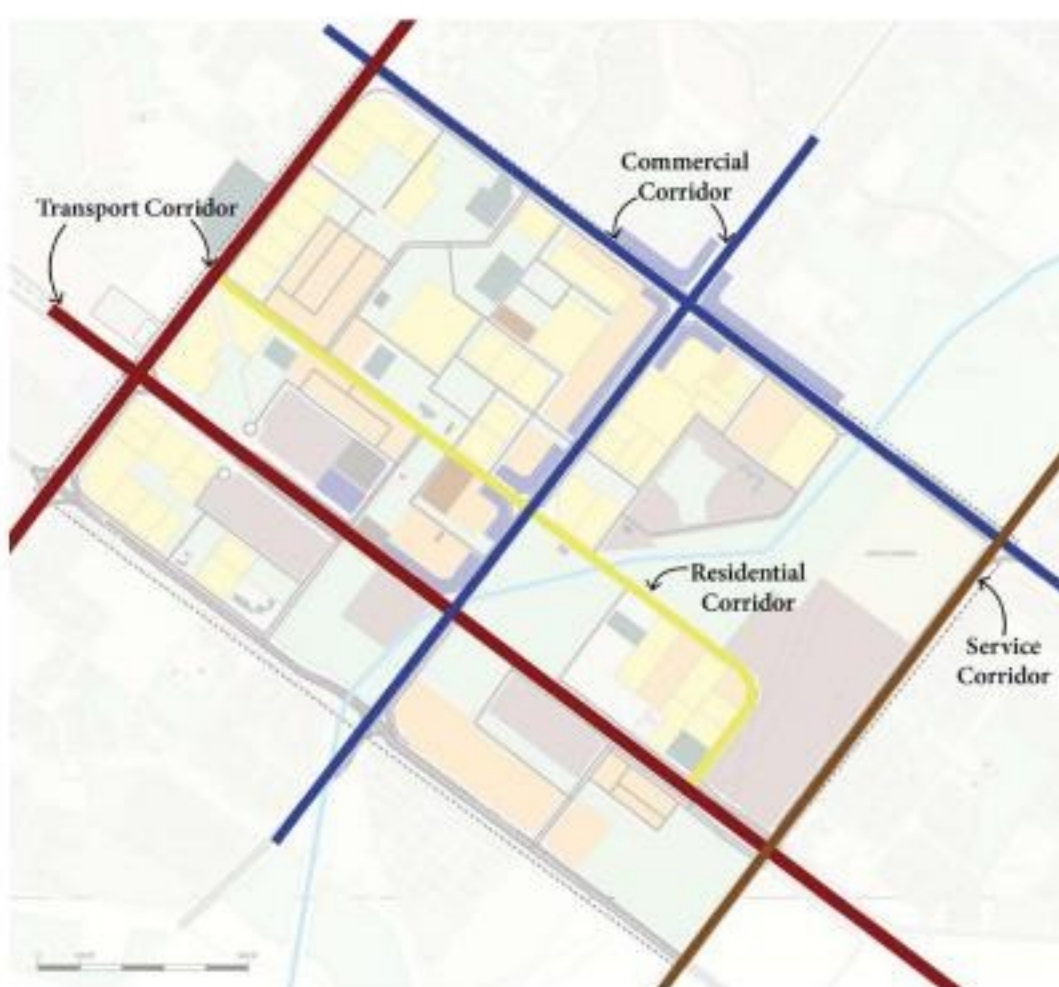


Fig 8.54: Project mapping
Source: Drawn by author

Smart City Reference

Right up your street, UK

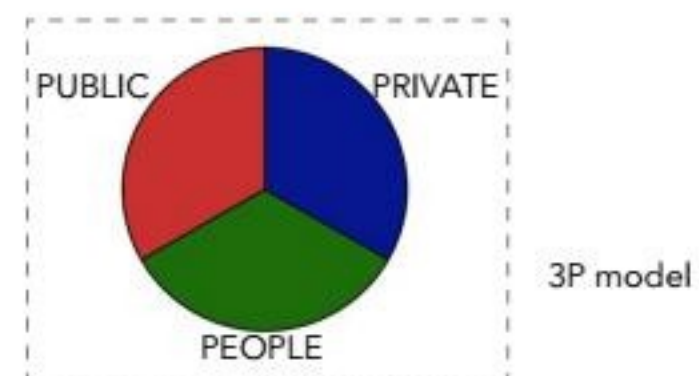


Fig 8.55: Project concept

Source: <https://www.amnesty.org.uk/resources/activity-right-your-street>

c) Involved Actors and Stakeholders

Shopkeepers and citizens will benefit from the project. The project can be taken up by the government and the entrepreneurs.



iv) Implementation:

a) Supporting Policies/ Projects

1. Flexible Gentrification in the masterplan to meet the reality.
2. Integration of proposals by Indian Smart City Mission.
3. Enhance public-private -people partnership
4. Redirecting investments. 5% of tax amount to be decided by the citizens

b) Conditions / Scenarios for implementation

Parts of streets can be used as seating areas and temporary festival spots. This way the planned neighbourhood will have more citizen engagement areas.

d) Time Phasing:

0-2 years The flexible usage of streets policy should be accepted in the beginning.

0-2 years encouraging economic activities

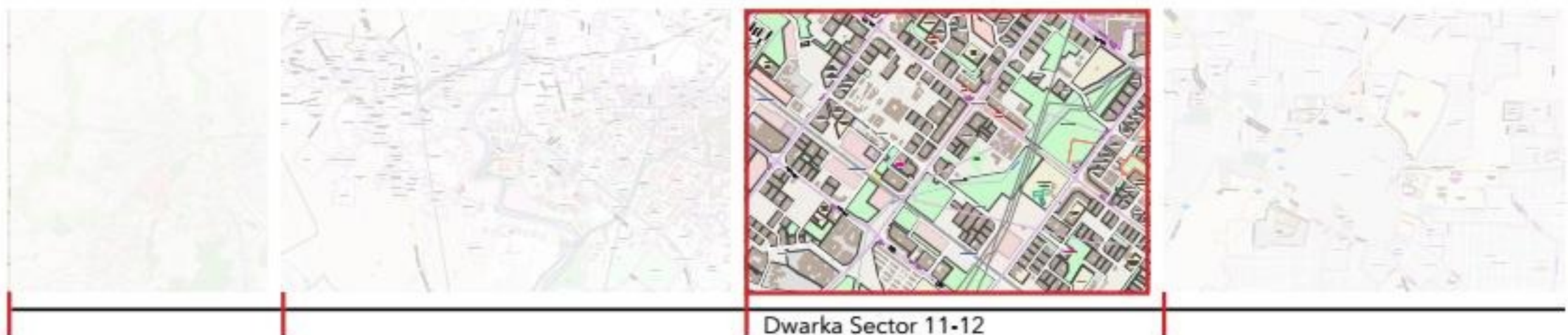
Later the activities will increase gradually with time.

d) Scale of Intervention:

Dwarka sub city scale

v) Reflection:

This project would be a pure combination of policy and local scale interventions. This will help for economic prosperity as well as demonstrate safer streets. This kind of project



Dwarka Sector 11-12



Living Lab #14 Avenue Connection



Najafgarh: Redevelopment

i) Issue:

The internal roads are occupied by parking or shop extensions. This leads to congestion on the junctions and also hampers the movement in the internal roads. Also, this kind of situation is very hazardous as there is no option for fire engine to enter those streets in case of emergency.



Fig 8.56: Congestion in streets in Najafgarh
Source: Clicked by author

ii) Strategy:

The strategy is based on simple road widening in smaller steps rather than destroying and creating a new road.

b) Smart City Reference

Strategic Roadway Widening and Connections Program, New York
Queensland, Australia



Talbragar Street Dubbo

Fig 8.57: Road widening project in Australia
Source: <http://www.transport.nsw.gov.au>

iii) Project description:

The project can be executed in stages as shown below.

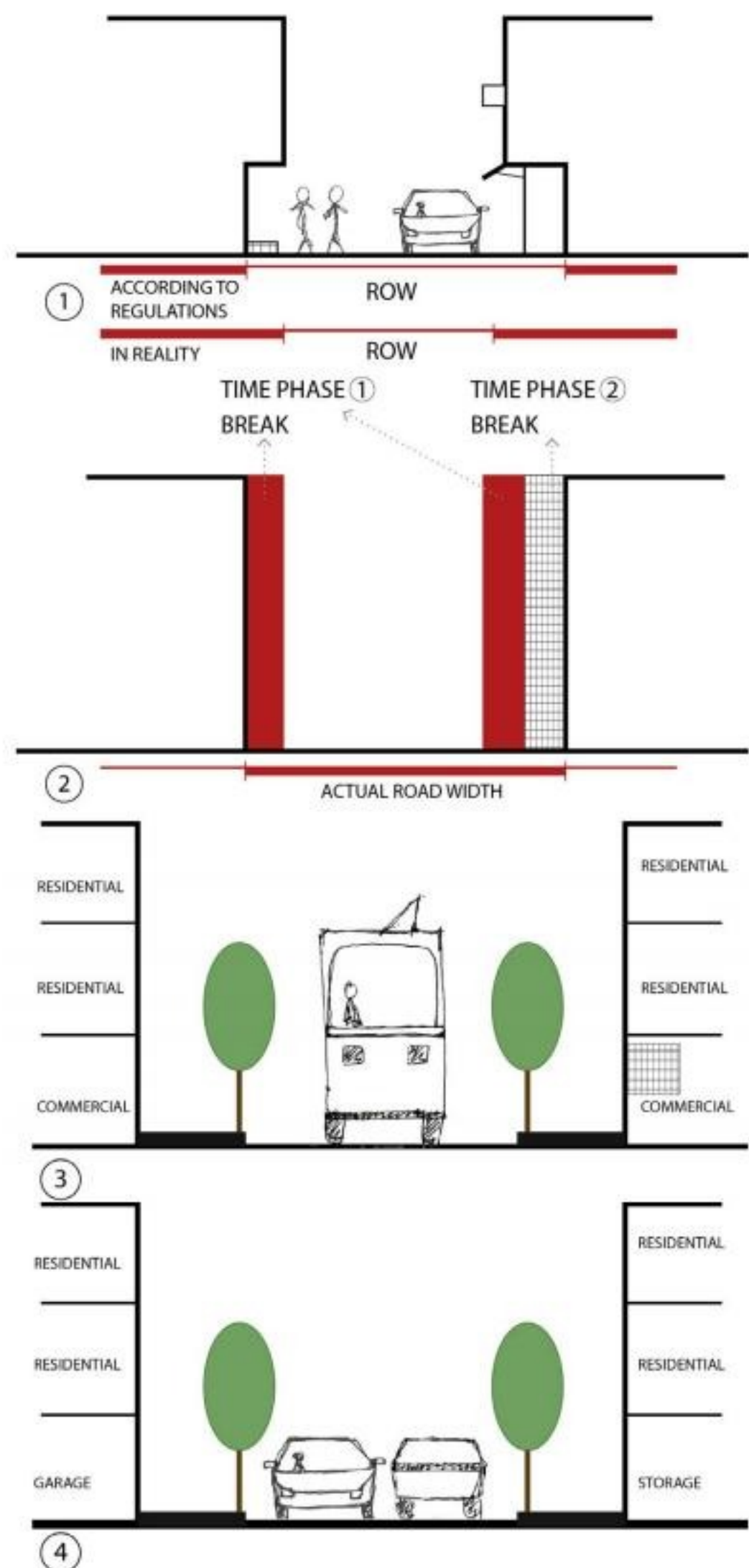
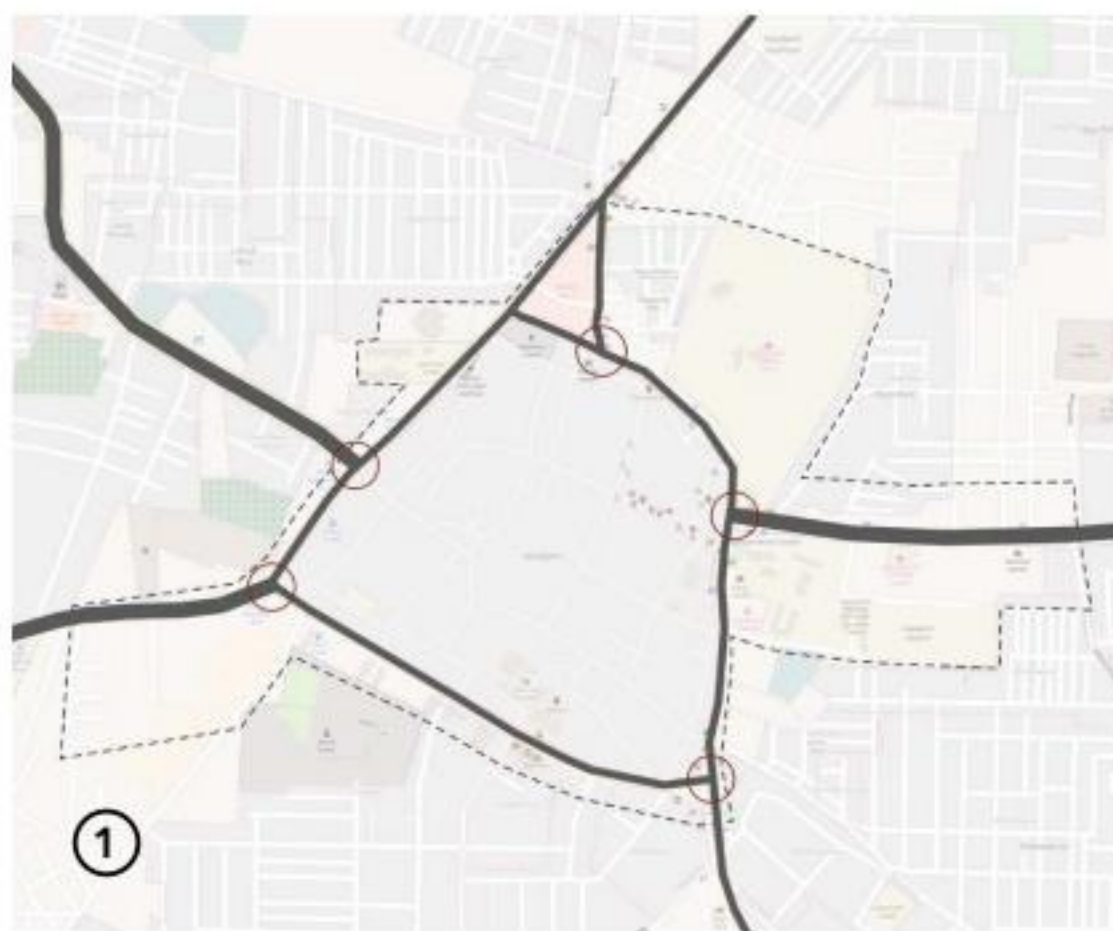


Fig 8.58: (1) Change what is needed
(2) Legalising and breaking the buildings
(3) & (4) Later stages
Source: Drawn by author



① The present condition



② First step for widening



③ Road widening by legalising building extensions



④ Future needed connection

Fig 8.59: Avenue connection phasing
Source: Drawn by author

iv) Implementation:

a) Supporting Policies/ Projects

1. Redirecting investments. 5% of tax amount to be decided by the citizens.
2. All the other projects like rain water, sewer system, waste management will perform better with this road widening project.

b) Conditions / Scenarios for implementation

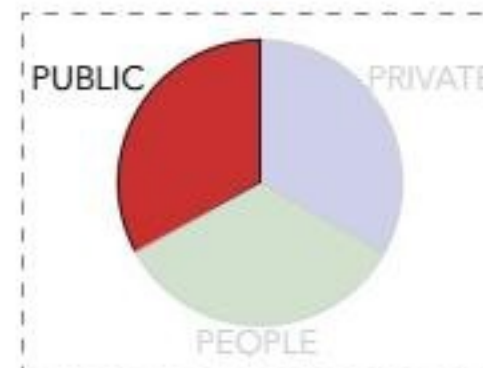
This project would be going against the citizens in the first phase by legalising and breaking the extensions. But on a longer run this would be helpful for them. This should be totally a governmental project.

d) Scale of Intervention:

Individual house/ community/ combined buildings etc.

c) Involved Actors and Stakeholders

Beneficial to citizens, local government to put money.

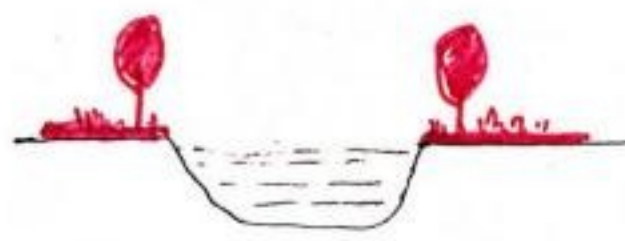


d) Time Phasing:

0-2 years- realigning the actual street and breaking temporary construction.

2.-3 years- refining and widening of street with designed junctions





Living Lab #15 Urban Ecological Corridor



Najafgarh + Dwarka: Redevelopment and Retrofitting

i) Issue:

The Delhi Jal Board is in charge all the piped sewage infrastructure in the city, but the drains themselves fall under the jurisdiction of the Irrigation and Flood Control department, despite the fact that they essentially function as open sewers. The sewerage system is connected to the drain, polluting it more day by day. Because of the drain the settlements nearby are suffering with unhealthy environment.



Fig 8.60: The Najafgarh drain and adjoining settlements
Source: https://readtiger.com/img/wkp/en/Delhi_aerial_photo_03-2016_img2.jpg

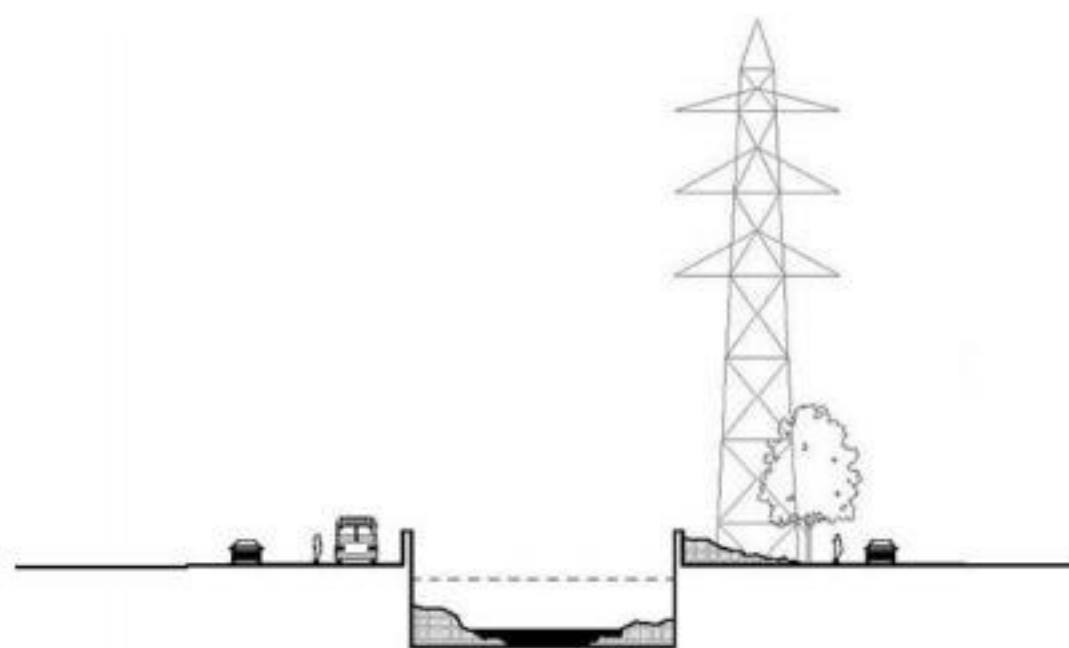


Fig 8.61: Section of Najafgarh drain
Source: Drawn by author

ii) Strategy:

Phytoremediation is the direct use of living green plants for in situ, or in place, removal, degradation, or containment of contaminants in soils, sludges, sediments, surface water and groundwater.

Phytoremediation is:

- A low cost, solar energy driven cleanup technique.
- Most useful at sites with shallow, low levels of contamination.
- Useful for treating a wide variety of environmental contaminants.
- Effective with, or in some cases, in place of mechanical cleanup methods.



Fig 8.62: The concept of phytoremediation

b) Smart City Reference

The sustainable waterfront, Auckland, New Zealand

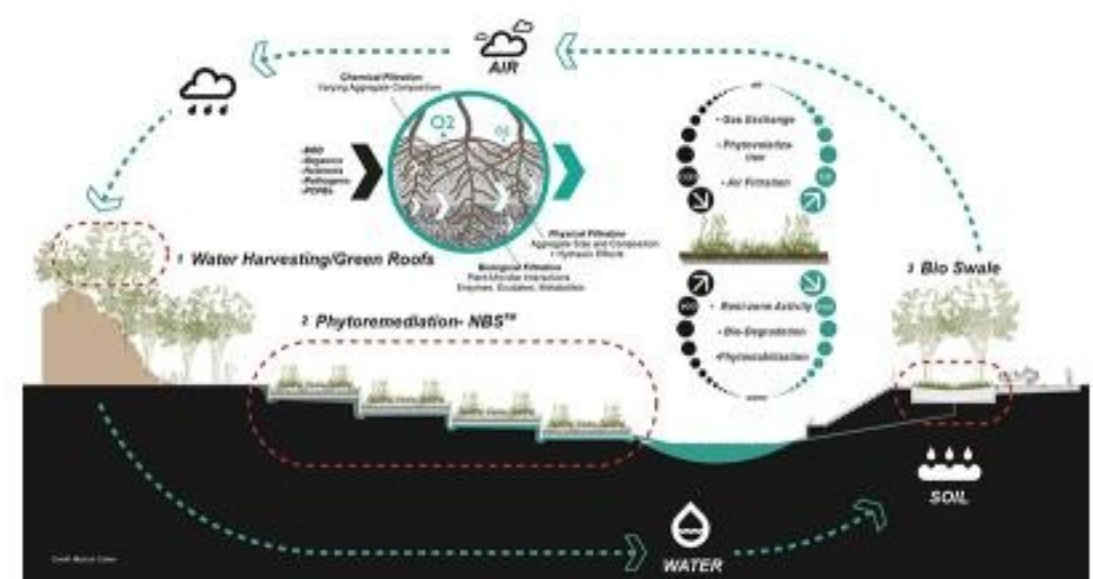


Fig 8.63: Water and soil phytoremediation in Auckland

iii) Project description:

Traditional and conventional methods of sewers and central sewage treatment are challenged with many factors such as availability of land, fund allocation and other socio-political issues. In this juncture, there is a need for complete rethinking on smarter ways of water and sewage management.

The project can be carried on in 4 phases:

1. Water Treatment of the drain (Local Solutions)
2. Tree Plantation along the drain
3. Landuse clearing for settlement along the drain.
4. Open Public Spaces in later stages.

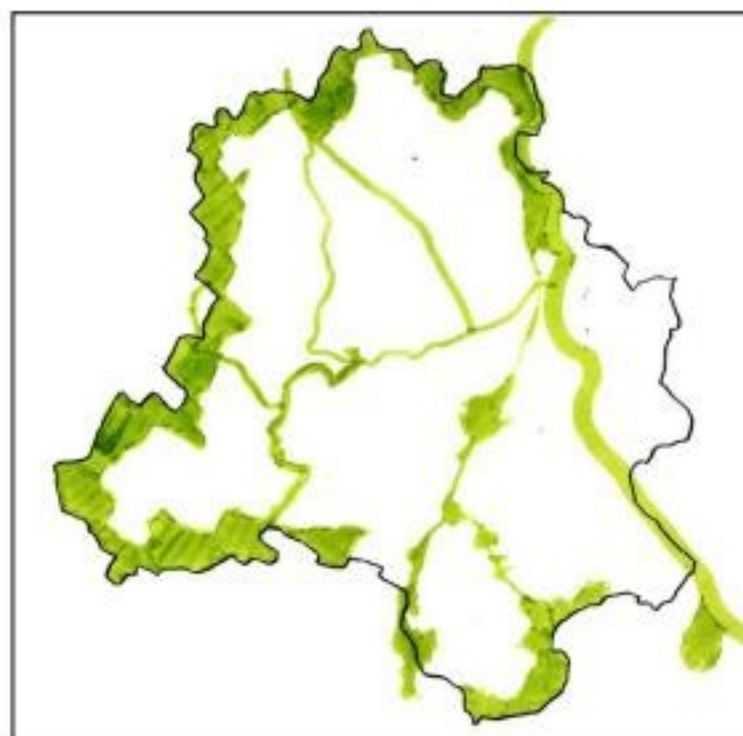
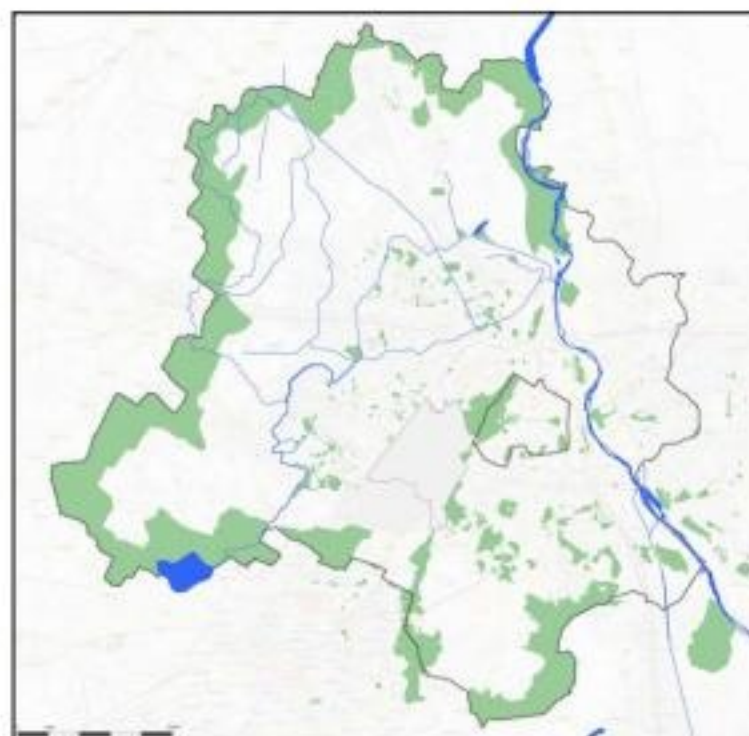


Fig 8.64: The project concept
 Fig 8.65: Urban ecological corridor
 Fig 8.66: Current Delhi condition
 Fig 8.67: Further proposal
 Source: Drawn by author

iv) Implementation:

a) Supporting Policies/ Projects

1. The grey water separation project should be started to reduce the pressure on the drain.
2. New supervising authorities on small scale
3. Enhance public-private -people partnership.

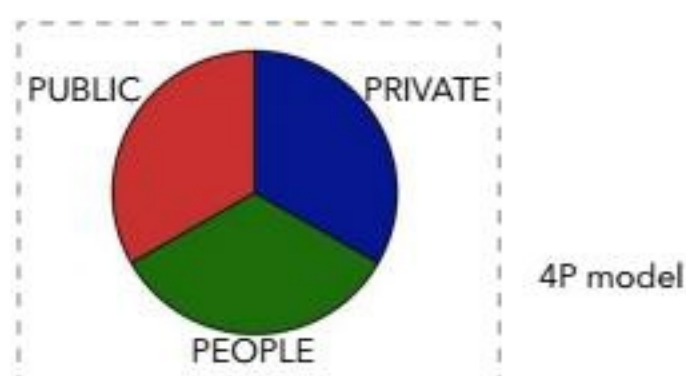
b) Conditions / Scenarios for implementation

This project needs a lot of efforts from the local authorities to engage the citizens and work collectively. All the stakeholders have to come together for such a big project. Though there is no mechanical treatment being done, but the scale of the project is quite huge. Thus, the investors, the educational network and the government have to work together with the help of citizens.

c) Involved Actors and Stakeholders

Government + Private +People

Private companies , Smart educational network, local and city level government authorities, citizens



d) Time Phasing:

0-10 years- Phytoremediation process and local treatment

0-10 years- Tree plantation and growth

10-15 years- Relocation of landuse and buildings

15-20 years- Public space and riverfront project.

e) Scale of Intervention:

Both Najafgarh and Dwarka will have an impact of this project. In later stages such projects can work out on a city scale.



v) Reflection:

Compared to the city green blue corridor, this is a small scale project. If this project succeeds then such interventions can be carried on other parts of the city for better green blue corridor connection and open public spaces.

Vision Image



Fig 8.68: Project vision
Source: Drawn by author



Fig 8.69: Green blue connections on a city scale
Source: Towards Water Smart Cities, Wageningen Environmental Research

f) Supporting Policies

POLICIES	1	New supervising authorities on small scale	Local smart authority
	2	Flexible Gentrification in the masterplan to meet the reality.	Flexible landuse
	3	Integration of proposals by Indian Smart City Mission	Authority integration
	4	Governmental Institutions encouraging renewable resource production	Green Governmental Institutions
	5	Information through educational institutes. Smart Citizen Workshop	Educational network to monitor smartness
	6	Public subsidies for technology retrofitting and incentives to local energy production or services.	Incentive approach
	7	Enhance public-private -people partnership.	4P model
	8	Redirecting investments. 5% of tax amount to be decided by the citizens	Redirecting investments.

Policy #01

Local smart authority



i) Issue:

The government authorities are not approachable and accessible by the citizens. Due to overlapping of central government and state government (described in chapter 7), there are a lot confusion on the rules and policies. This encourages the citizens to ignore the rules. Also, this increases corruption in the system.

ii) Policy description:

Every district will have their headquarters with various private organisations joining together. This will provide transparency in the system and easily approachable authorities for the citizens.

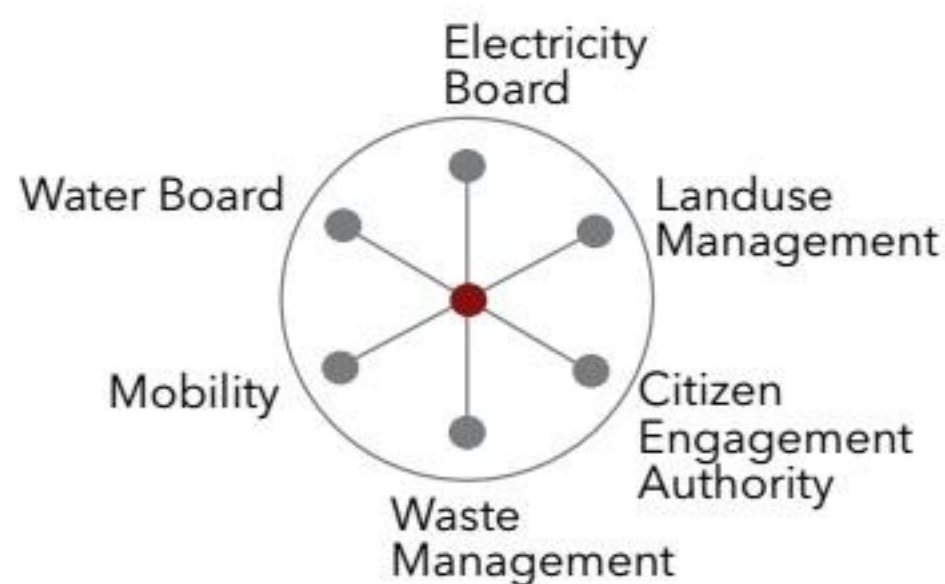


Fig 8.70: Project Concept
Source: Drawn by author

iii) Policy Implementation:

The smart city project can help to combine the work and document of all the related authorities to come together on a local scale.

b) Involved Actors and Stakeholders

Beneficial to the citizens and policy should be implemented by the government.

v) Reflection:

The policy must be regulated on the city scale and all at once. There would be needed employments for combination of documents and interaction of authorities.



Fig 8.71: Districts of Delhi
Source: Drawn by author

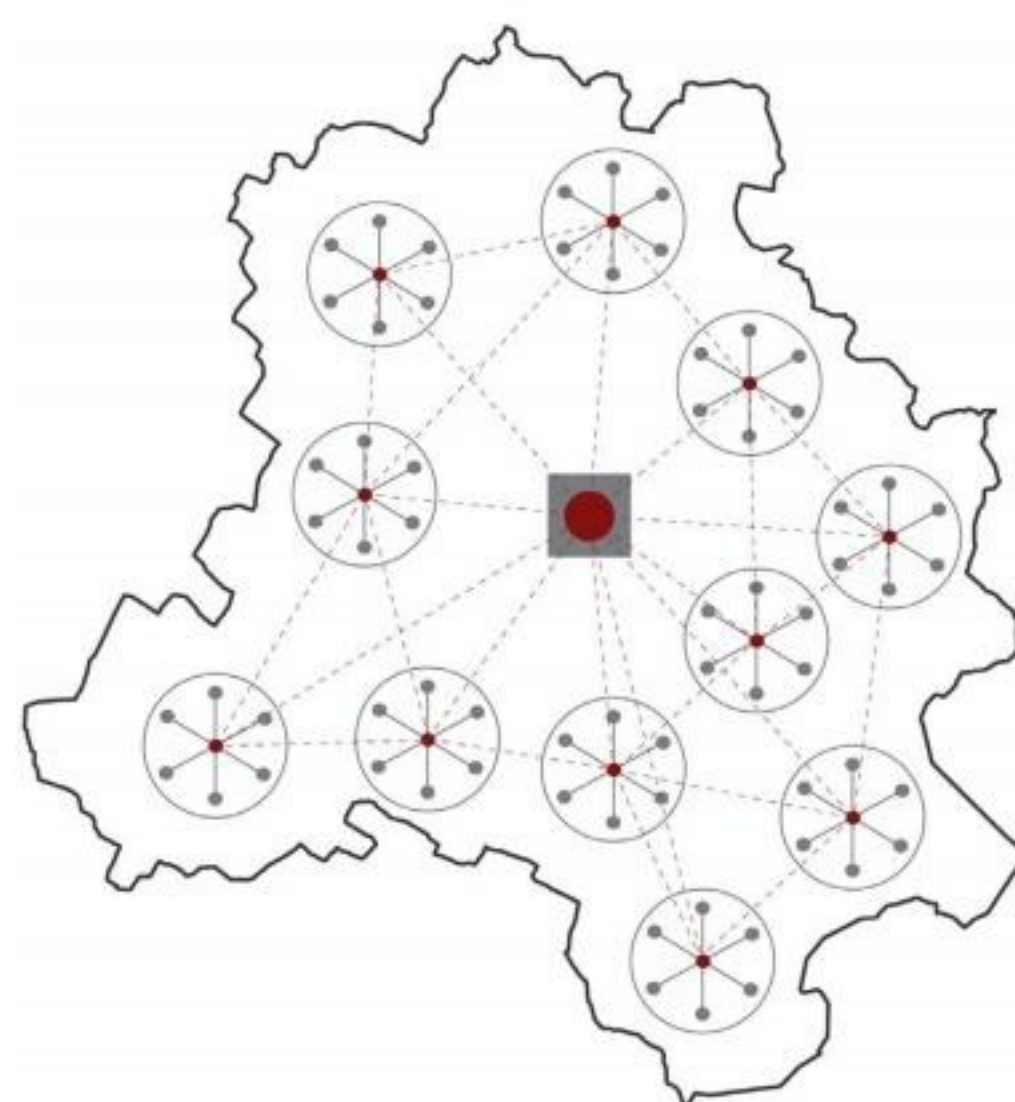


Fig 8.72: Local authority in each district
Source: Drawn by author

Policy #02

Flexible landuse



i) Issue:

The landuse plans produced by the government is not being followed by the citizens. The citizens are expecting more flexibility in the planning system.



Fig 8.73: What is flexibility in landuse?

Source: Drawn by author

ii) Policy description:

As shown in fig 8.0, the actual landuse structure is very rigid. Thus it would be easier for the government to manage as well as better for the citizens to have less rules but to be followed strictly. Below shown is the proposal with proposed flexible landuse rules.

iii) Policy Implementation:

This should be politically implemented which will have a huge spatial impact.

iv) Involved Actors and Stakeholders

Government

v) Reflection:

Documentation work about the land ownership and prices to be done before implementation of this policy. But this project will help to reduce the illegible activities in the city and also reduce the unevenness and divisions

The breakdown of the rigid landuse can be done by following these rules.

S.No.	Landuse	Not to be clubbed with
1	Residential	Industrial, Cremation Ground, Brick-Kiln
2	Public Semi Public	Education, Medical Centres, Community Centres, Industries
3	Recreation	Public/ Semi Public
4	Agriculture	Industries that create soil pollution
5	Heritage and Conservation sites	Industries

Table No. 2: Classification of Land Uses

Main Code	Sub Gr.Code	Main Groups	Sub Groups	Graphic Symbol	Colour Symbol
100		RESIDENTIAL			Yellow
	110		Primary Residential Zone		
	120		Mixed Residential Zone		
	130		Unplanned/Informal Residential Zone		
200		COMMERCIAL			Blue
	210		Retail Shopping Zone		
	220		General Business and Commercial District/ Centres		
	230		Wholesale, Godowns, ware- houses/ Regulated markets		
300		INDUSTRIAL			Violet
	310		Service Industry		
	320		Light Industry		
	330		Extensive Industry		
	340		Heavy Industry		
	350		Obnoxious/ hazardous Industry		
400		TRANSPORT AND COMMUNICATION			Black
	410		Roads		
	420		Railways		
	430		Airport		
	440		Seaport & Dockyards		
	450		Bus Depots/Truck Terminals/Freight complexes		
	460		Transmission & Communications(Telephone Exchange, TV Station, Broadcasting Station, etc.)		
500		PUBLIC AND SEMI PUBLIC			Red
	510		Govt/Semi Govt/ Public Offices		
	520		Govt Land(Use undetermined)		
	530		Education & Research		
	540		Medical & Health		
	550		Social Cultural and Religious		
	560		Utilities and Services		
	570		Cremation and Burial grounds		
600		RECREATION			Green
	610		Playground/Stadium/Sports Complex		
	620		Parks & Gardens-Public Open Space		
	630		Special recreational zone- restricted open spaces		
	640		Multi-open space (Maidan)		
700		AGRICULTURE LAND			Light green
	710		Agriculture		
	720		Forests		
	730		Poultry and Dairy Farm		
	740		Rural Settlements		
	750		Brick kiln & Extractive Areas		
	760		Water Bodies		
800		SPECIAL AREAS			No colour
	810		Old Built up (Core) Areas		
	820		Heritage & Conservation Areas		
	830		Scenic Value Areas		
	840		Other Uses		
900		VACANT LAND			No colour
	910		Built but un-occupied		
	920		Vacant under construction		
	930		Vacant developed but unbuilt		

Table 8.1: Present landuse policy

Table 8.2: Proposed landuse policy
Source: Drawn by author

Policy #03 Authority integration



i) Issue:

All the authorities work on their separate documents and maps for the same city. Difficult for citizens to have a coordinated map or policy brief for the city.

ii) Policy description:

Smart Planning as the coordination and management of Masterplan and Zonal Development Plans. Other new/ upcoming projects to be merged with the Smart city plan.

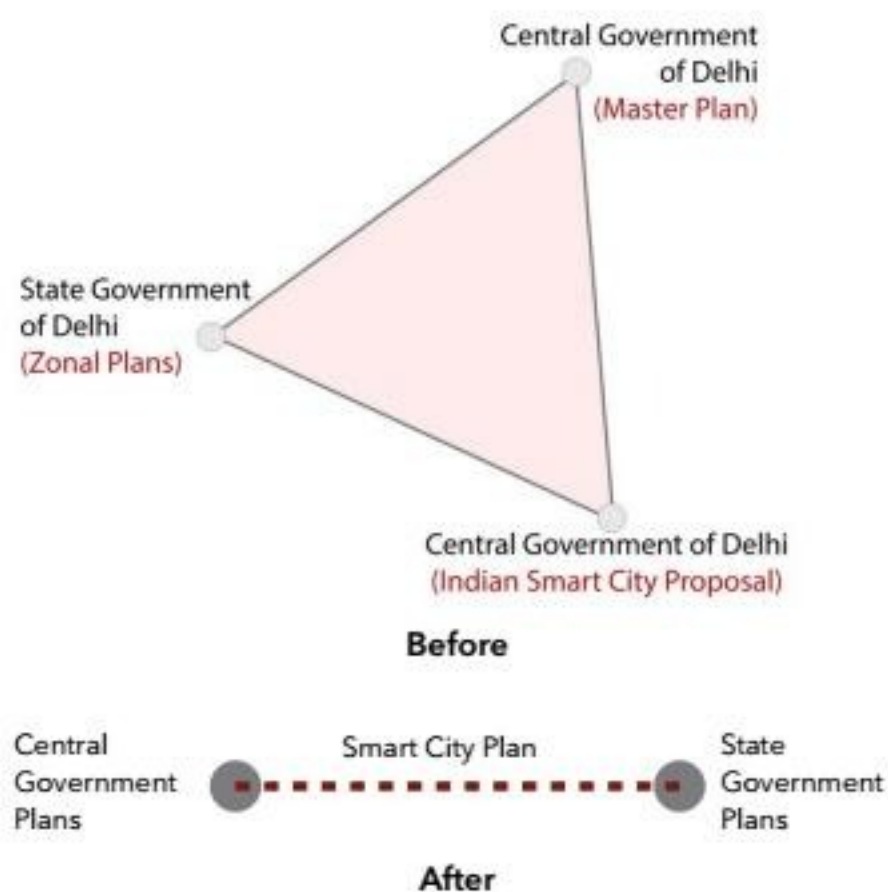


Fig 8.74: Authority integration
Source: Drawn by author

iii) Policy Implementation:

The policy can be implemented with the smart city proposal. This can be the pan city development to integrate all the authorities at one place.

iv) Involved Actors and Stakeholders

Smart city Authority, DDA, NDMC, MCD

v) Reflection:

This policy can be integrated with policy (1) to have more strong foundation.

Policy #04 Green Government Institutions



i) Issue:

There are many governmental offices and educational institute present in the selected sites. In general, the governmental institutions holds a lot of empty open spaces which are not maintained properly or even if maintained, can be used for betterment.

ii) Policy description:

These governmental institutions can demonstrate small scale smart (sustainable) projects as discussed above. The government can take this opportunity to create new projects to inspire the citizens. This way the officials can spread the effect of local interventions in their own neighbourhoods.

iii) Policy Implementation:

The policy can be implemented in the city scale for all the governmental offices. This way the patchwork will get a backing to begin with.

iv) Involved Actors and Stakeholders

Government and Private
Private sector to help implementing

v) Reflection:

This employees of the offices/ institutions can come up together one in a while to implement such project. Some incentives like awards for good implementation can be done by the government to appreciate and encourage the work.

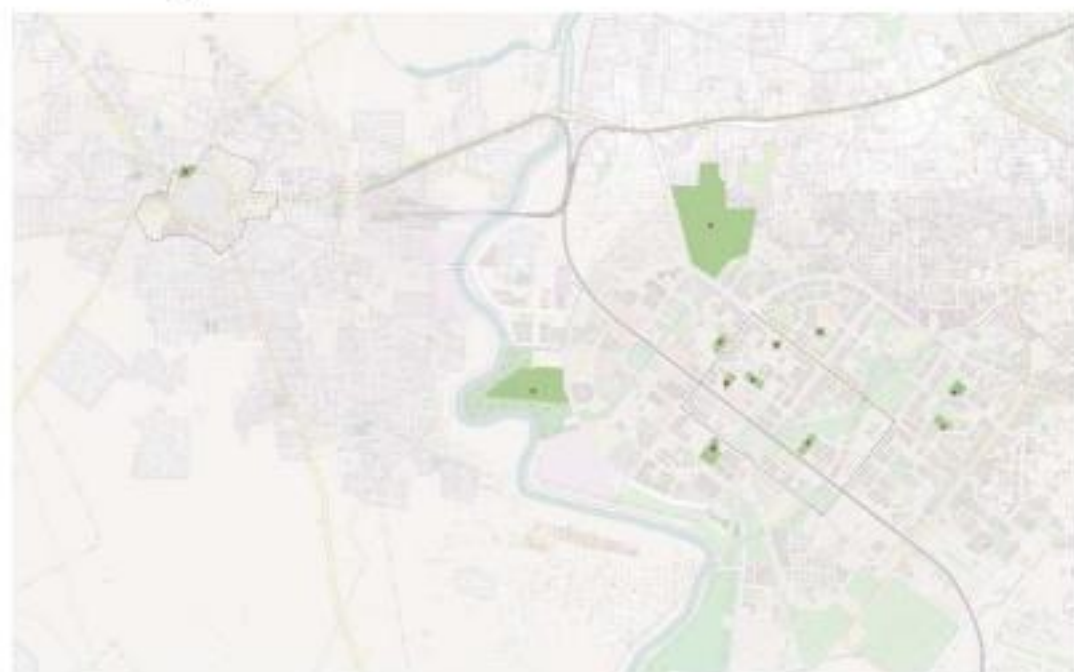


Fig 8.75: Possible green institutions in selected sites
Source: Drawn by author

Policy #05

Smart Educational Network



i) Issue:

The layout of all the educational institutions in the neighbourhoods can be used as an opportunity resource in the smart city growth.

ii) Policy description:

The education institutes can create a network together to implement local scale smart initiatives and to educate the citizens about smartness.

The students would be the most efficient resource to use to spread the smart initiatives to each households. Further small workshops can be conducted by this network for citizens.

iii) Policy Implementation:

This policy can start as an organisation but the spread will be spatial. Also encouraging more citizens to follow the smart league.

iv) Involved Actors and Stakeholders

Beneficial to citizens

Conducted by students from government and private educational institutes.

v) Reflection:

This project won't need any extra infrastructure and have the potential to connect all the living labs (projects) in the whole city. This will also support the expansion and phasing of smart patchwork.



Fig 8.77: Policy concept on two site scale
Source: Drawn by author

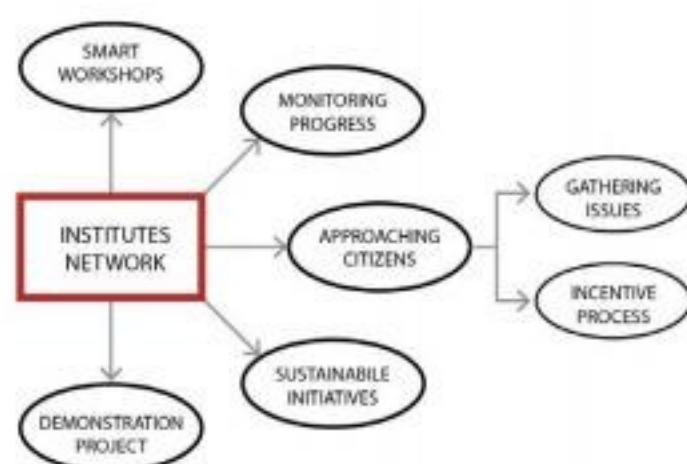


Fig 8.76: Smart educational network
Source: Drawn by author

Policy #06

Incentive approach



i) Issue:

The citizens will not be very enthusiastic for sustainable projects if they have to put in their money. They would require some financial support or incentives to

ii) Policy description:

The policy is to regulate some incentive from the government towards the citizens to initiate the self organised growth.

iii) Policy Implementation:

The implementation will not need a lot of effort. This is just enactment of a law/ regulation and to spread the voice of incentives to the citizens.

iv) Involved Actors and Stakeholders

The government will be the main actor and the citizens will be benefited the most.

v) Reflection:

This policy will not have any direct spatial implication but indirectly amplify the listed projects.

Policy #07

4P model



i) Issue:

India is following the PPP model (Public Private partnership), which excludes the citizens from many stages of development.

ii) Policy description:

As discussed in section 6.IV (Chapter 6), Wisa Majama explains the relevance of 4P model (People private public partnership) which will include the citizens in decision making processes for the city development.

iii) Policy Implementation:

The implementation of this policy might take sometime as a lot of stakeholders are connected and will have a say on this. But a strict rule can be set up by the government at first , gradually all the stakeholders will realise the importance of this policy in terms of city growth.

iv) Involved Actors and Stakeholders

Government, private and people, all the stakeholder will have equal effect on this policy

v) Reflection:

This policy will lead to a more transparent relationship among the government and citizens. Also the citizens will be relying more on the private sectors.

Policy #08

Redirecting investments



i) Issue:

The citizens pay taxes regularly to the government for provision of services and infrastructure. The government uses that money in long term projects or larger infrastructures. But the issues that are location specific keeps on piling up.

ii) Policy description:

This policy will give an opportunity to the citizens to propose new local developments and ask for some amount from the government. Some percentages of the collected tax should be redirected directly towards citizens urgent needs. 5% of tax amount to be decided by the citizens.

iii) Policy Implementation:

This would be a governmental decision, so enactment of the policies might take some time. This will take place if all the authorities and municipalities agrees for the same.

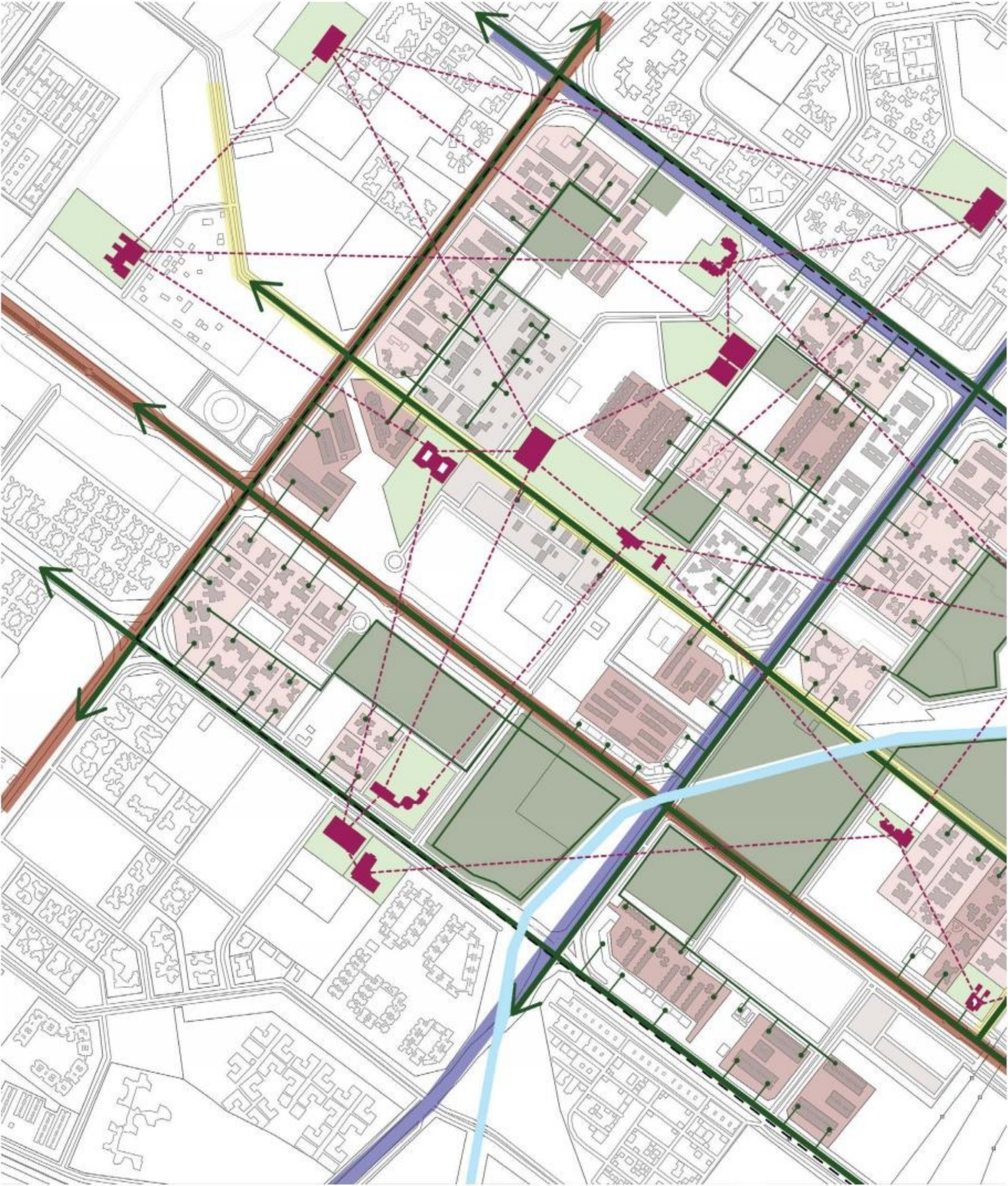
iv) Involved Actors and Stakeholders

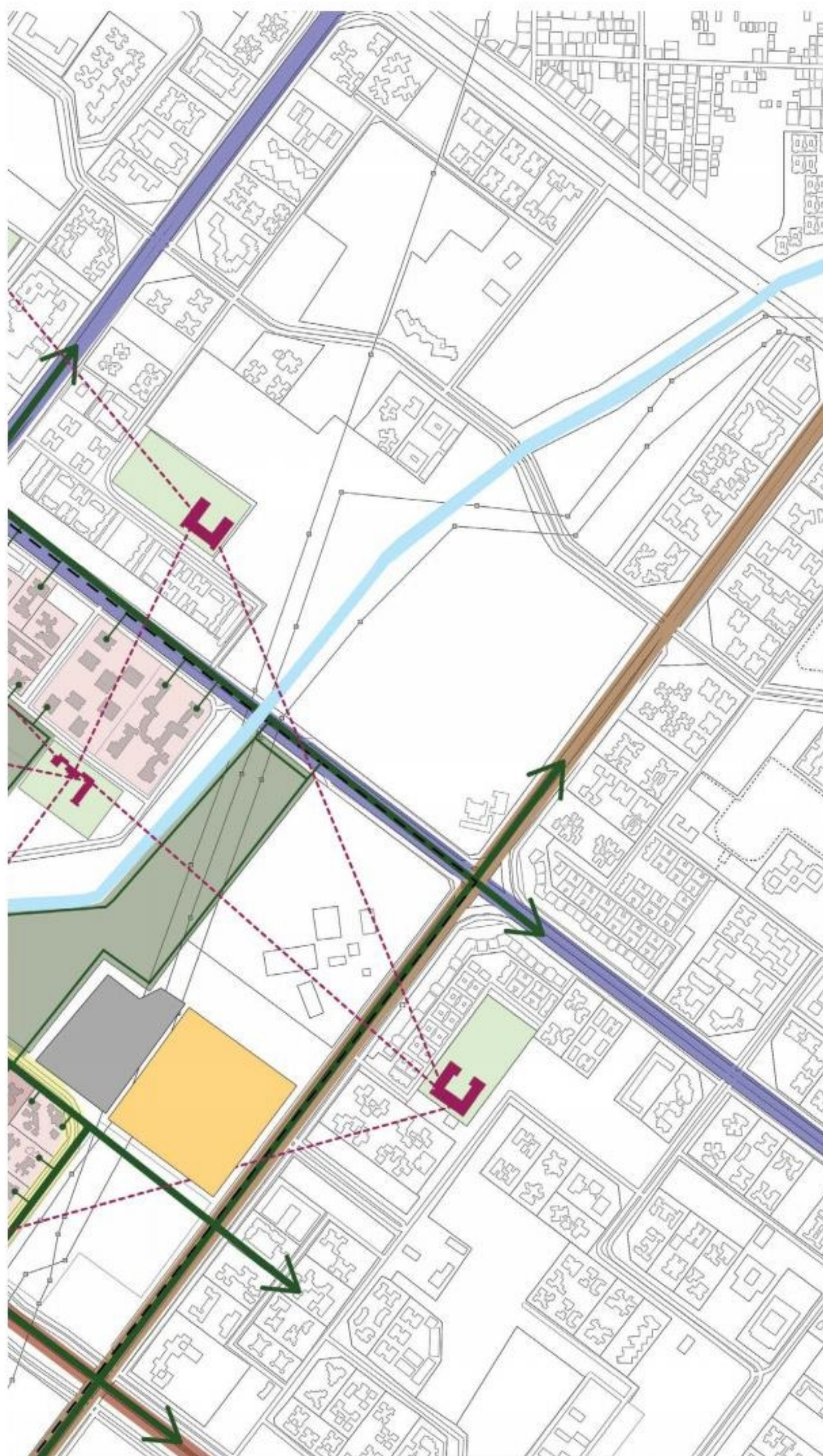
Government

v) Reflection:

The effect of this policy can be visible in early stages, when couple of projects proposed by the citizens starts implementing. The citizens will feel more connected to the city and overall liveability will increase.

The Living Lab Platform 1





This drawing explains how all the living labs can spatially fit in one living lab platform.



Fig 8.78: Living lab platform 1
Source: Drawn by author

II. STRATEGIC PLAN

Spatial planning is all about putting things on the map: existing spaces and places, as well as spaces and places to come. Yet how much of mapping for spatial planning actually engages the supposed beneficiaries of planning? (Ian Babelon 2017).

This is the section of the report where I will discuss the implementation process and possibility of further extension. The evaluation of the project will be an important part in this section. The first step is to put all the projects together at a demonstration site to make sure that all the projects can work together without creating a chaotic situation. The projects should be flexible enough to inspire people to initiate.

Strategic planning takes into account the internal and external influences that can amplify the projects. The

demonstration site can be successfully implemented if the following steps fall right into place:

1. The living labs (projects) initiated properly
2. The policies are regulated by the government
3. Effective collaboration among the stakeholders
4. The stakeholders/ financiers putting money on time
5. The citizens are enthusiastic about the change
6. The steps of time phasing being followed
7. Each stage of design and implementation are completed in defined time
8. Monitoring and evaluation is clear

A strategic plan across areas, that can be implemented in stages, will result in an holistic solution in the long term.

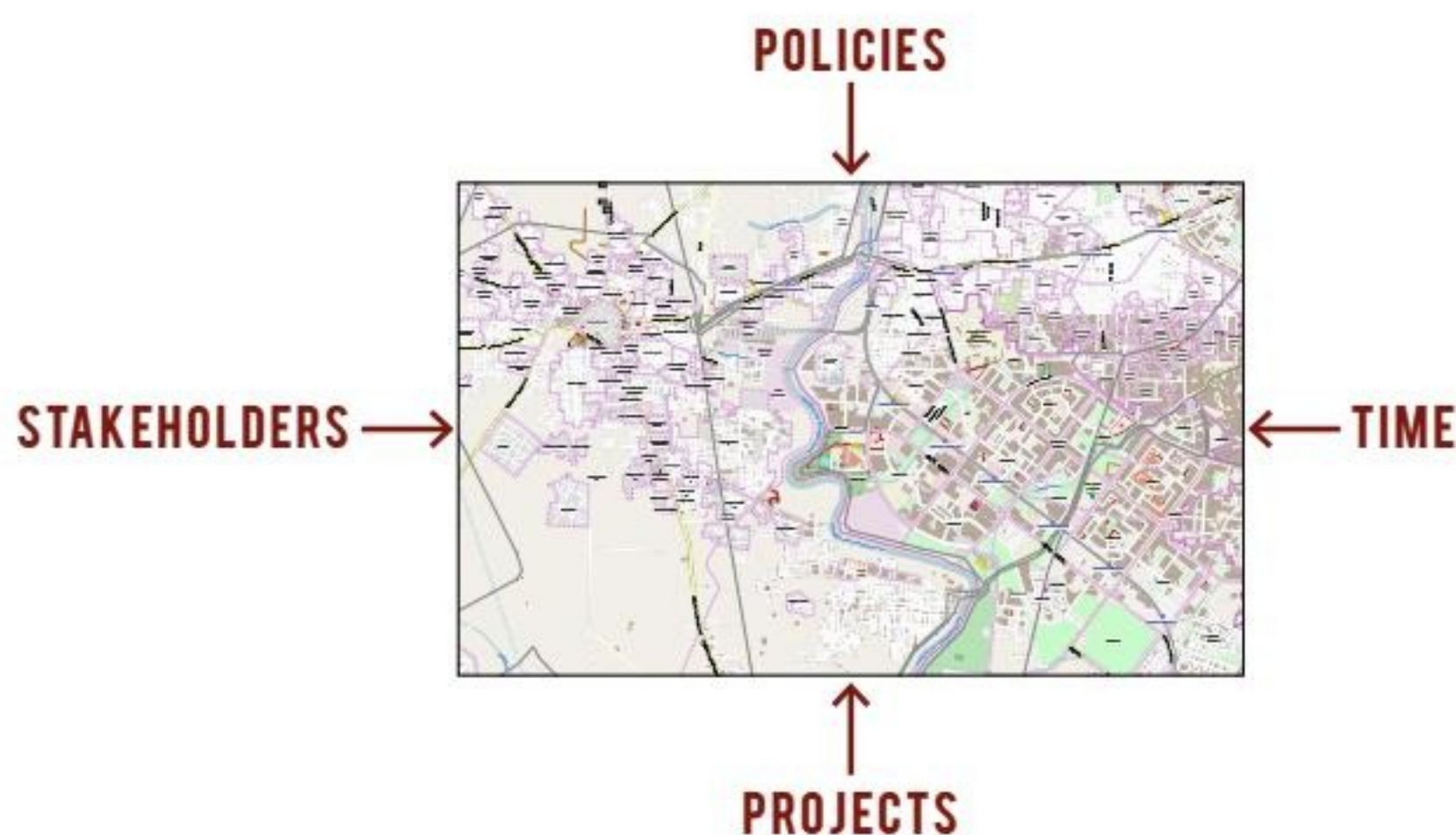


Fig 8.79: External influences of strategic plan
Source: Drawn by author

a) Design and Implementation Model

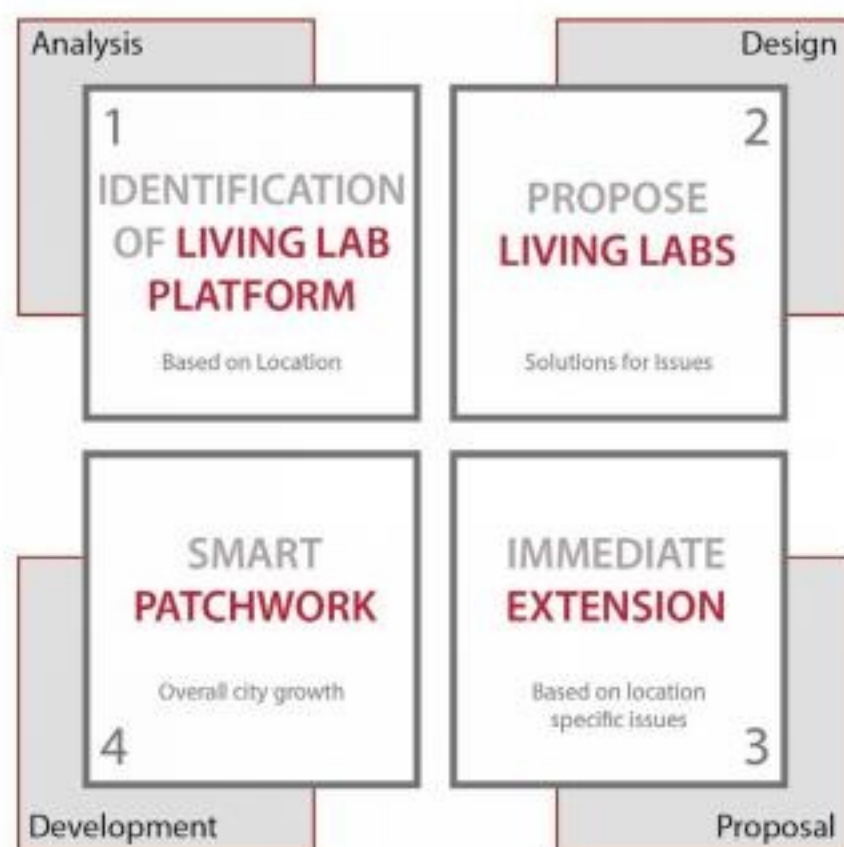


Fig 8.80: Design Model
Source: Drawn by author

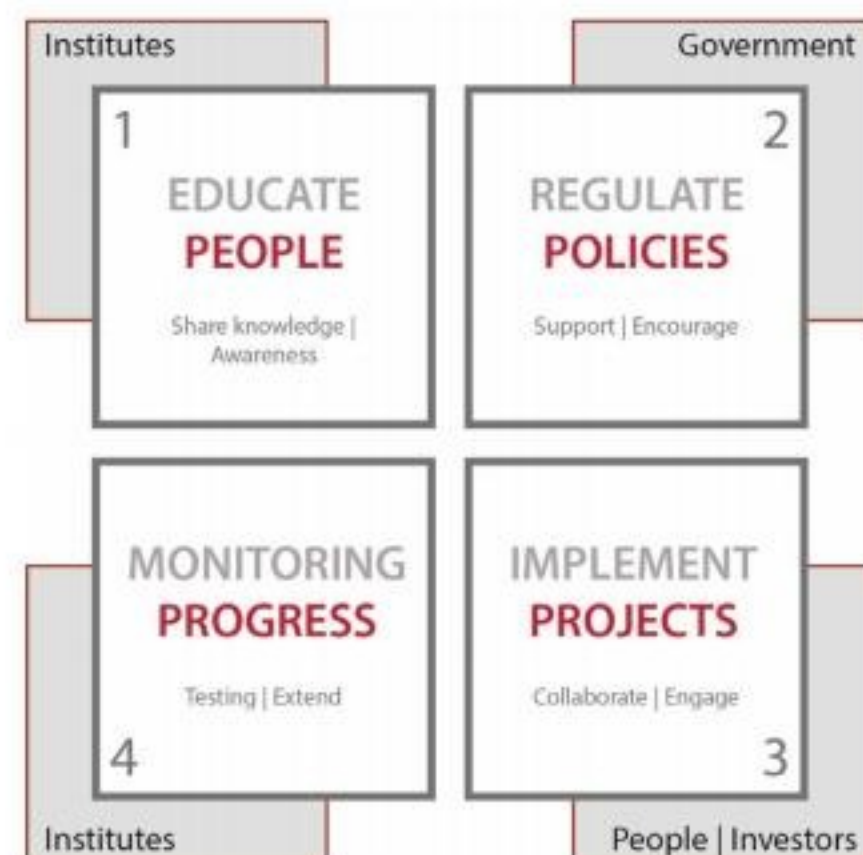


Fig 8.81: Implementation Model
Source: Drawn by author

The design model is a 4 step model, where the process starts from finding the issues of an area and delineating the living lab platform, and ends with city scale extension as smart patchwork. This model can be followed in any Indian metropolitan cities, if the objectives of the smart city are similar. The 4 steps include 4 detailed process like analysis, design, proposal and implementation.

The implementation model is a 4P model, where inclusion of stakeholders and their scope of work has been explained. Beginning of the implementation will be by educating the people, then regulating the policies by the government, implementing the projects by the collaborating all the stakeholders. The last step would be testing the living labs and monitoring the progress for further extension.

The model won't work separately if it is not schemed in a process. The following process explains the relations between the model and the process will strengthen the growth.

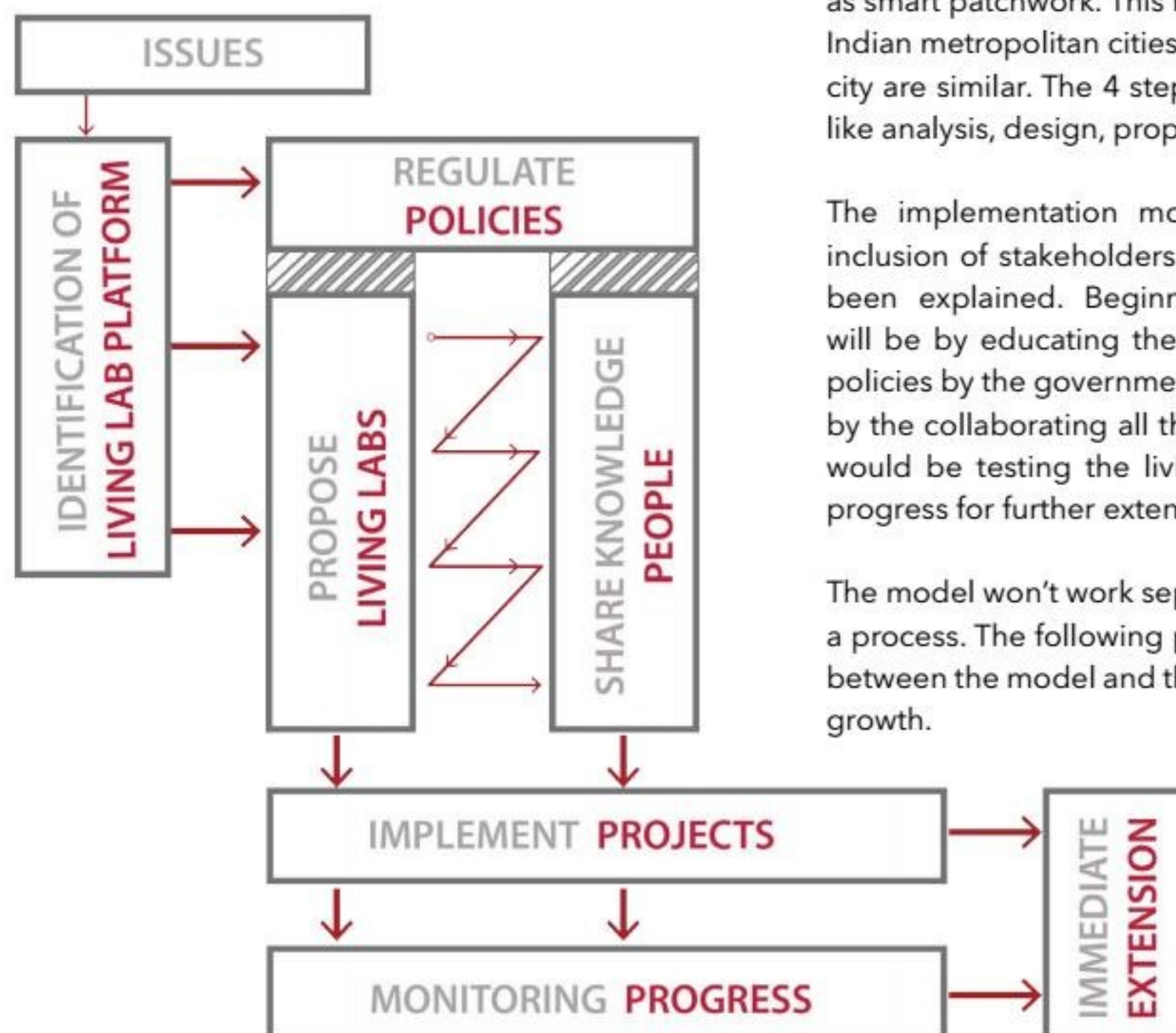
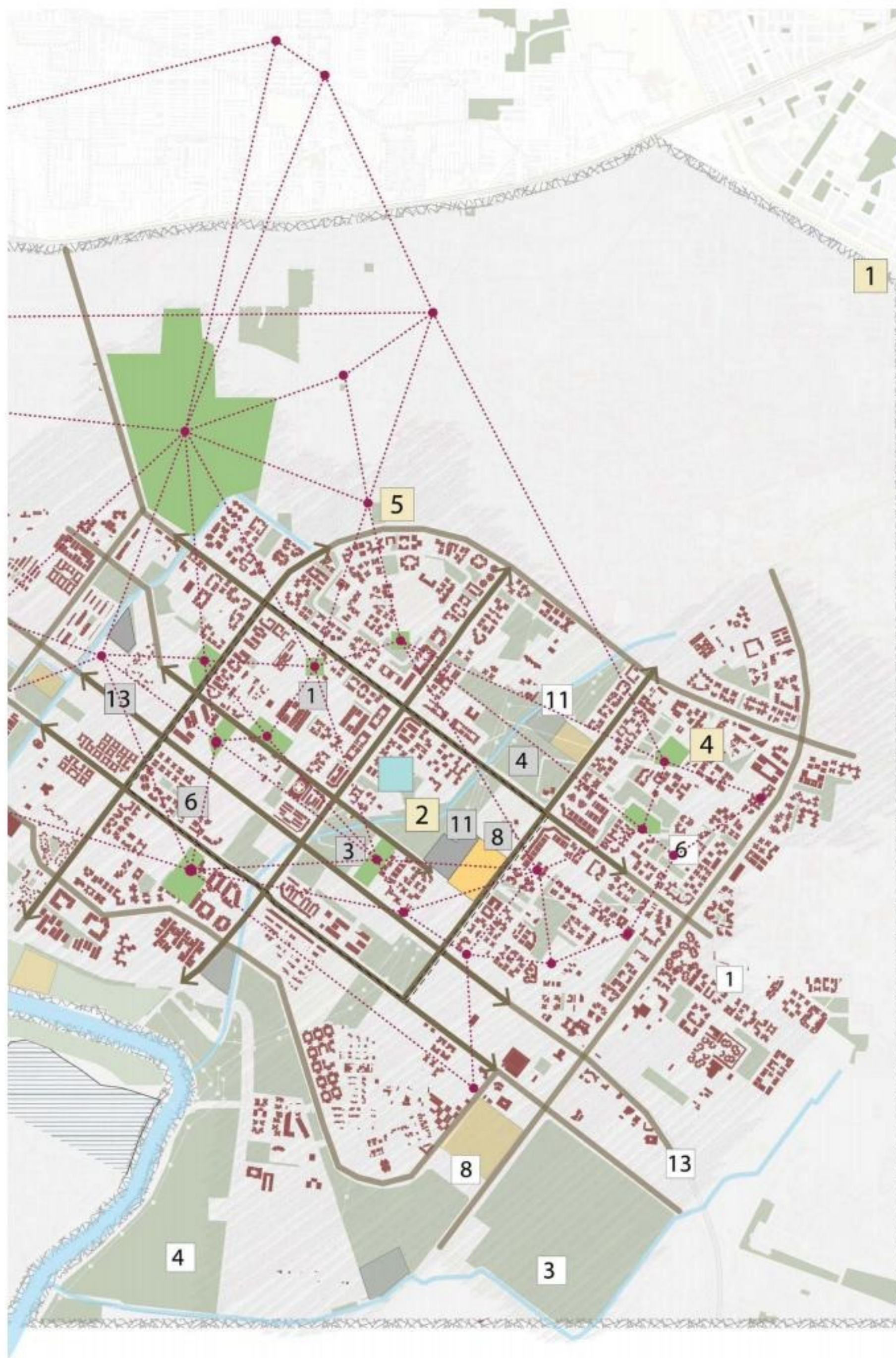


Fig 8.82: Process of design and implementation
Source: Drawn by author

b) The demonstration projects



Fig 8.83: The proposal
Source: Drawn by author



Legends		
	Demonstration project boundary	
	Possible extension	
	Project Number	
	Extended Project	
	Policy Number	
	1	Rain water harvesting for community farming
	2	Rain water harvesting for domestic usage
	3	Grey water separation
	4	Central Helophyte filters
	5	Ground water purification
	6	Commonly stored solar energy
	7	Solar panel installation in mixed landuse
	8	Biogas electricity generator
	9	Garbage separation
	10	Smart waste containers
	11	Collective Composting
	12	Organic Compost Bin
	13	Adaptable Street Usage
	14	Avenue connection
	15	Urban ecological corridor
	1	Local smart authority
	2	Authority integration
	4	Green Governmental Institutions
	5	Educational network

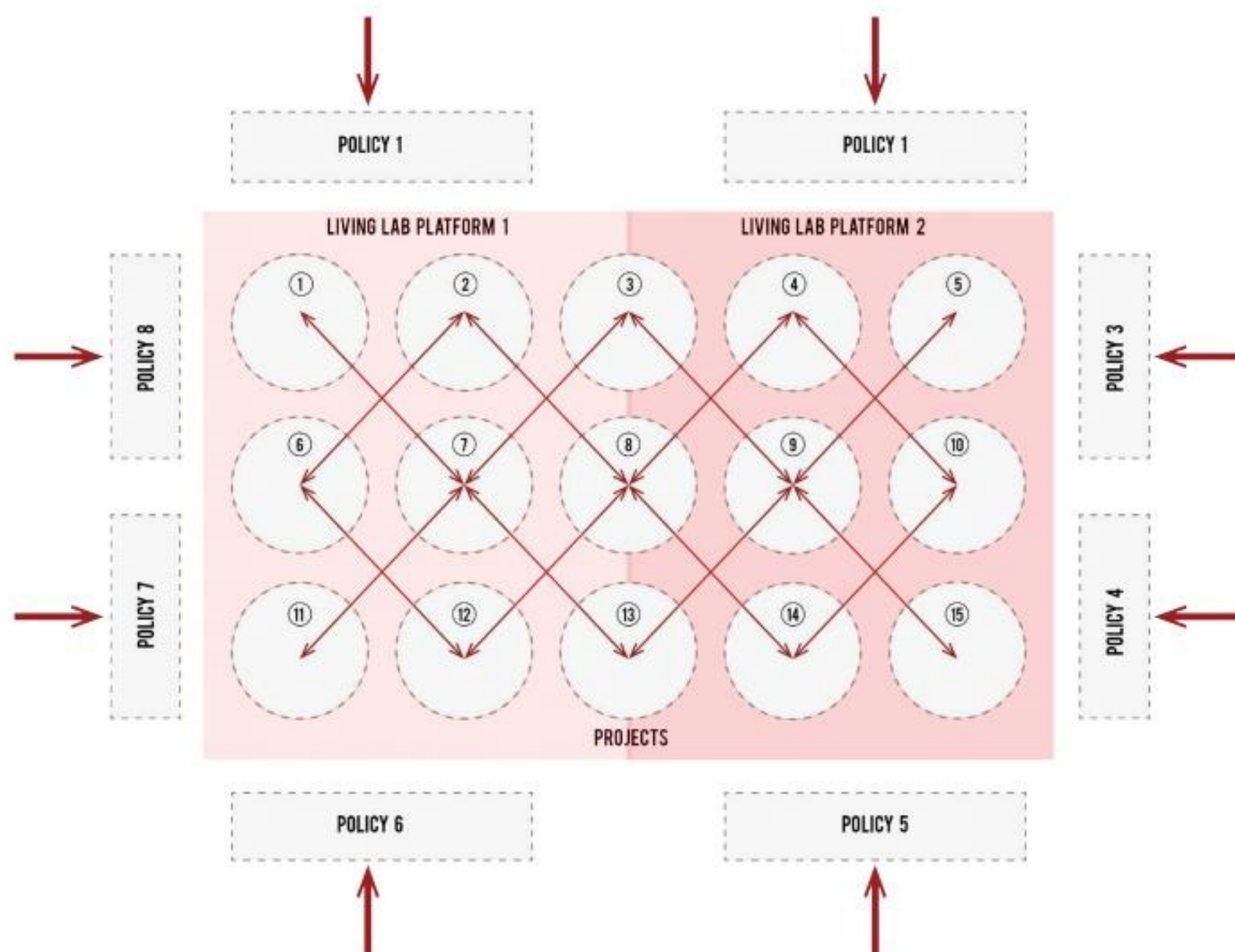


Fig 8.84: Combination of all living labs
Source: Drawn by author

In this project, I have introduced 15 living labs for 2 living lab platforms. The first living lab platform consists of 9 living labs (projects) and the second living lab platform consists of 6 living labs. While one project is situated in between the two sites to promote connections between those two areas. Thus, this demonstration projects displays how two different patches can built at the same time to reduce differences between them. As mentioned earlier, the sites has been selected based on their differences in living conditions. But still two concepts of retrofitting and redevelopment can work together to combine the growth.

Similarly, other patches can be detected and living lab platforms can be initiated in all parts of the city. Areas that have resemblance with these demonstrated living lab platforms can be extended with similar projects. But areas containing other location specific issues can come up with new living labs and policies to support themselves. With introduction of new patches, the growth and impact on the city would be more visible.

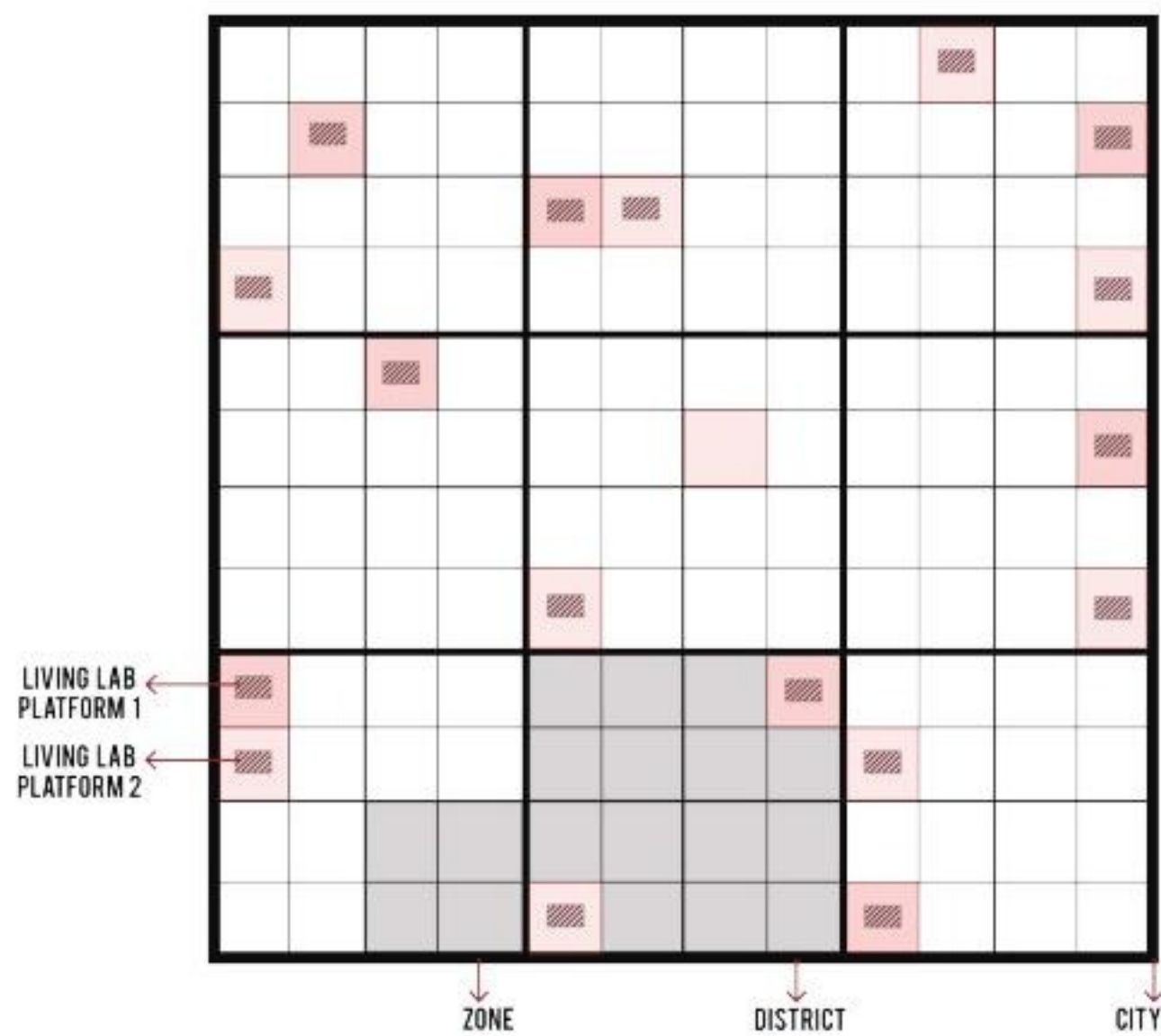
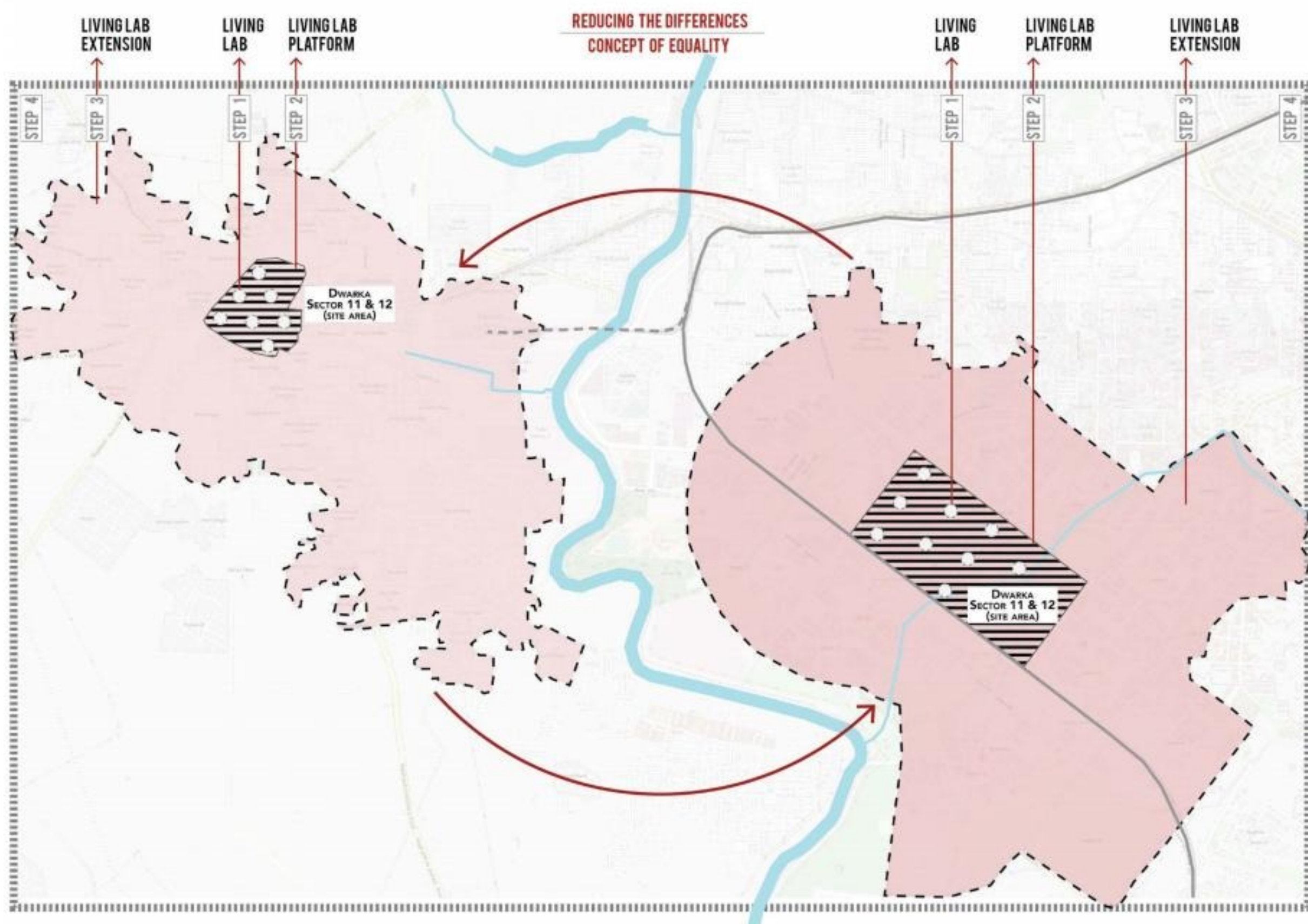


Fig 8.85: Living labs and living lab platforms
Source: Drawn by author

Fig 8.86: Concept of patchwork smartness
Source: Drawn by author

c) Stakeholders analysis and Scale of Impact

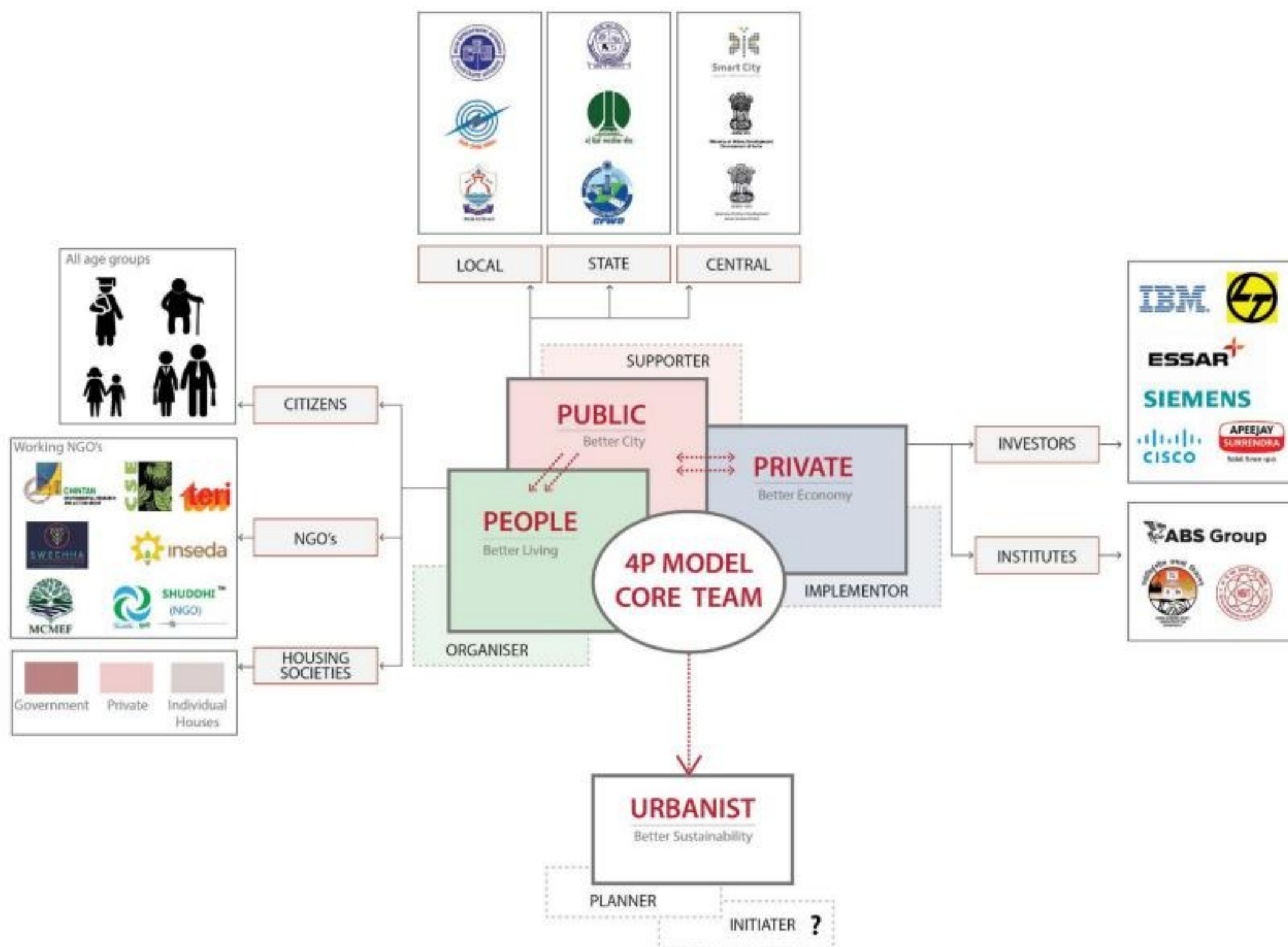


Fig 8.87: Primary stakeholders
Source: Drawn by author

The project is mainly about retrofitting new changes rather than creating some new infrastructure. Successful retrofitting requires good partnership working between a range of stakeholders. When stakeholders understand what each others needs are within an area, and their planned expenditure, then there is the opportunity to align goals. Working together at a variety of scales (building scale, neighborhood scale, zonal scale and city scale) to deliver an efficient implementation of the proposals.

This typically can only be achieved when there is a clear multi stakeholder strategy to maximise the opportunity of expansion and impact. The 4P model discussed in chapter 6 is purely relevant for this demonstration project. The core team of stakeholders (picture on left) establish the relation among them and their responsibilities. It is better to have a distinct structure to allocate the jobs of each stakeholders. The table below shows which stakeholders is accountable, responsible, consulted and informed at which stage.

RESPONSIBILITY									
POLICY-MAKING	INFORMED	INFORMED	INFORMED	INFORMED	INFORMED	CONSULTED INFORMED	CONSULTED INFORMED	ACCOUNTABLE RESPONSIBLE	
PLANNING	INFORMED CONSULTED	CONSULTED	INFORMED	INFORMED	CONSULTED	ACCOUNTABLE RESPONSIBLE	CONSULTED INFORMED	CONSULTED INFORMED	
DESIGN	CONSULTED	INFORMED	CONSULTED	CONSULTED	INFORMED	CONSULTED	INFORMED	INFORMED	
IMPLEMENTATION	ACCOUNTABLE	RESPONSIBLE	ACCOUNTABLE RESPONSIBLE	ACCOUNTABLE	RESPONSIBLE	CONSULTED	CONSULTED	CONSULTED	
OPERATION AND MAINTENANCE	RESPONSIBLE	ACCOUNTABLE	RESPONSIBLE	ACCOUNTABLE	ACCOUNTABLE RESPONSIBLE	ACCOUNTABLE	ACCOUNTABLE CONSULTED	INFORMED	
MONITORING	INFORMED	RESPONSIBLE	INFORMED	ACCOUNTABLE RESPONSIBLE	INFORMED	ACCOUNTABLE	INFORMED	INFORMED	
	CITIZENS	NGO'S	CO OP HOUSING	INSTITUTES	PRIVATE INVESTORS	LOCAL GOVT.	STATE GOVT.	CENTRAL GOVT.	STAKEHOLDERS

Fig 8.88: Responsibility of stakeholders
Source: Drawn by author

Expected impact of the project

The project's long-term impacts will be as follows: -

- The concept of smart solutions for sustainable development will be extended to immediate extensions and further into zonal and city scales. That would include proposing of the other new living labs based on the location priorities.
- Though the projects are done in collaboration of various stakeholders, but the interventions are mostly to self-organize resources. The citizens will learn and be motivated to bring some change in the city.
- Will decrease vulnerability of cities, having a cutting-edge technologies and quick-win initiatives.
- Will be easy to implement.
- Will be introduced to make the most efficient use of the resources.

- All the projects have the provocation to generate employment.
- Cooperation will be improved between the public and private sectors in research and the implementation of the most innovative solutions to sustainable urban environments.
- Wellbeing of the city inhabitants will be enhanced and the environmental quality of cities improved. Possible establishment of new industries and fields of business in the developing transition countries will lead to economy boost, creation of working places and increase of wellbeing of inhabitants.
- Develop network of experts and city administrations across the regions.
- Develop network of institutions at regional, national and local level.

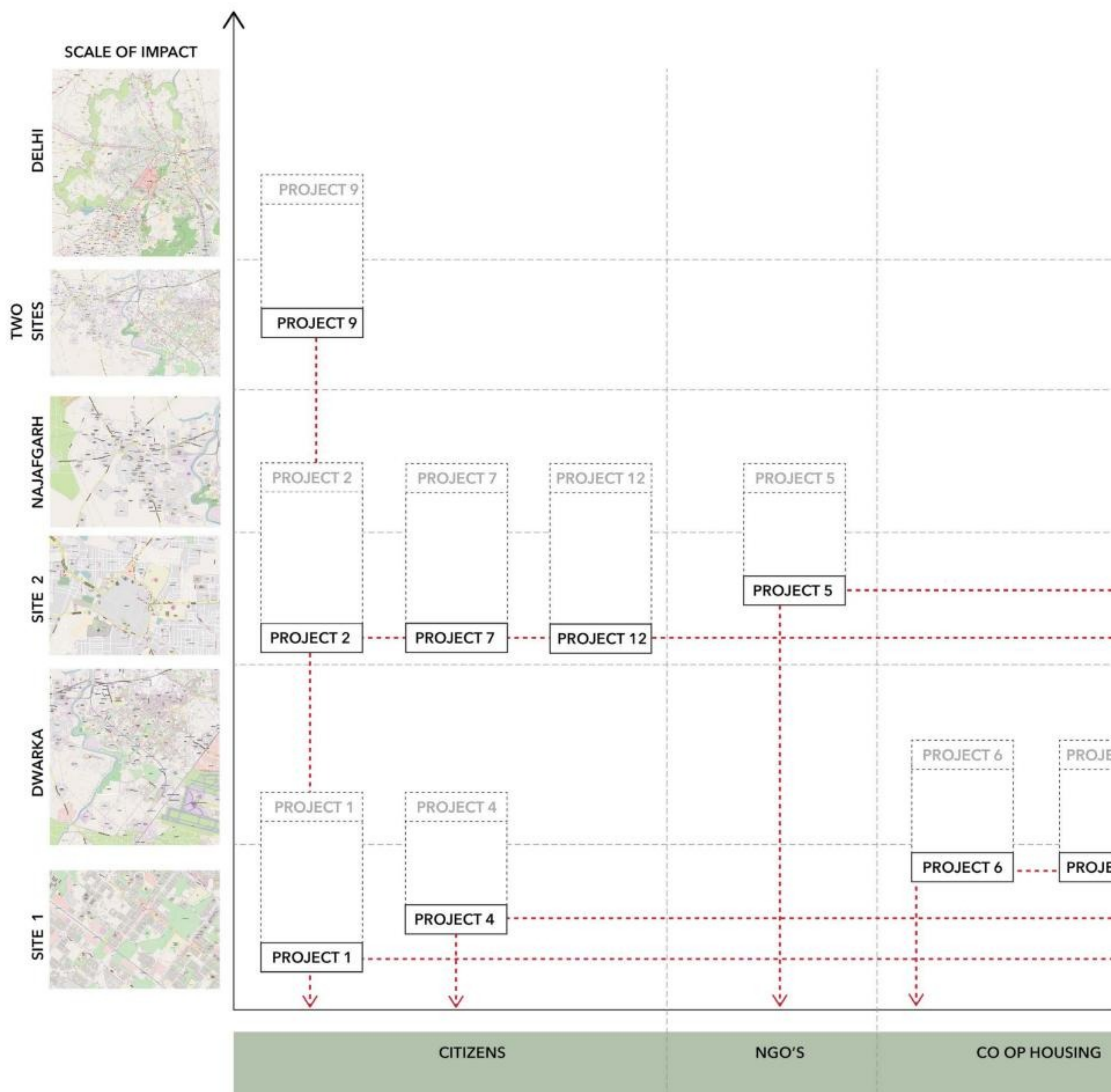
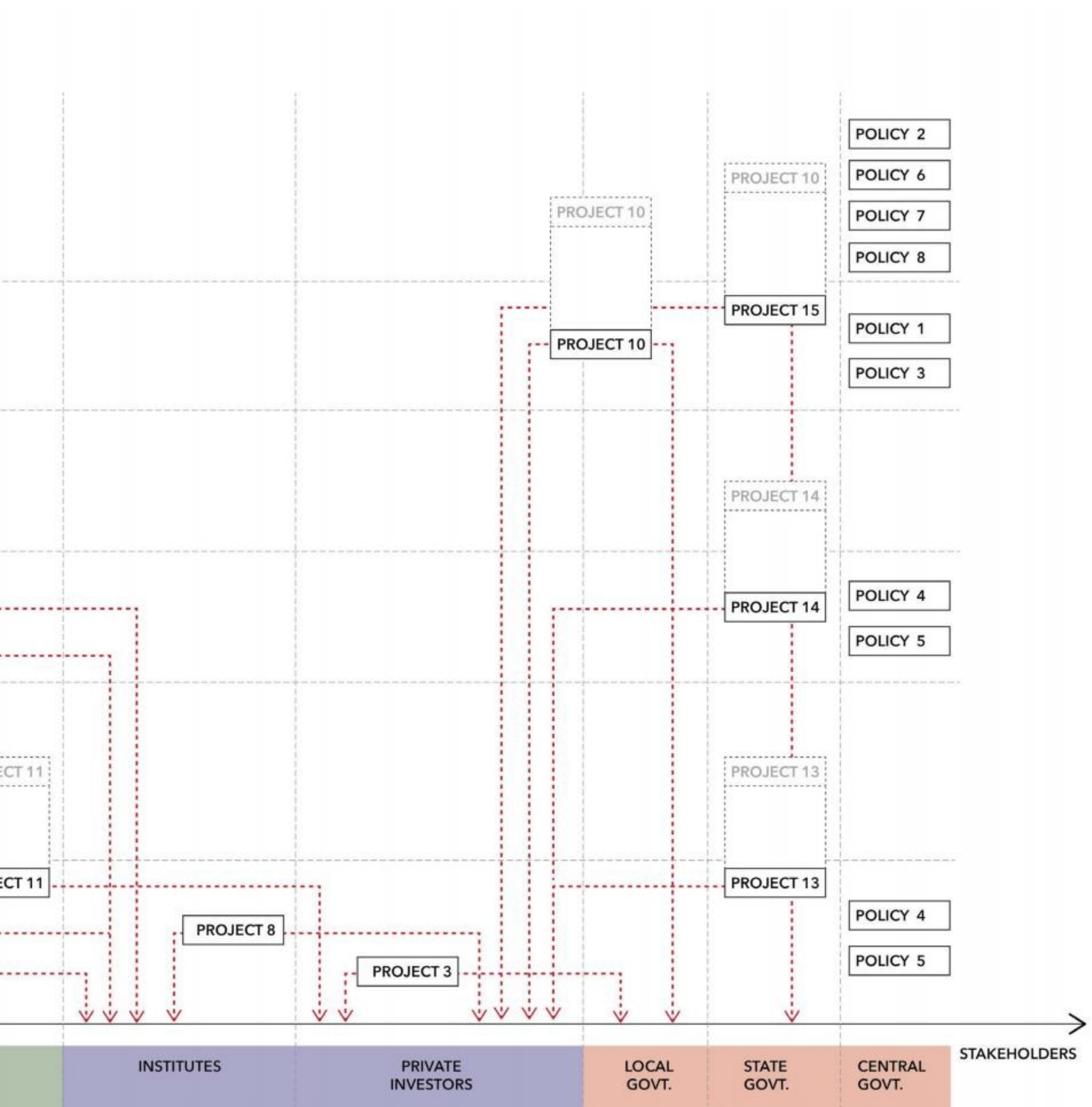


Fig 8.89: Scale of Impact
Source: Drawn by author



d) Phasing of the project

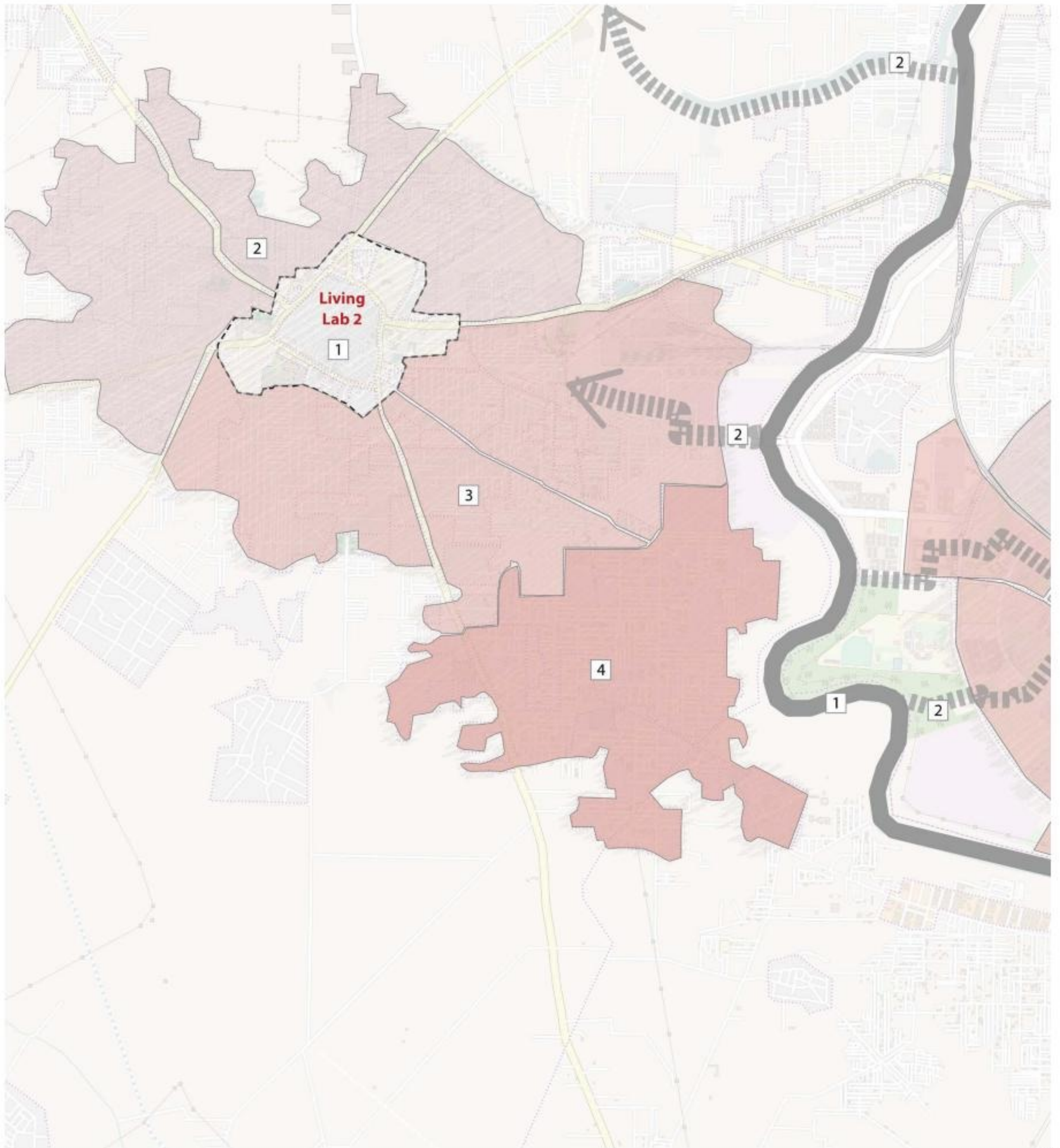
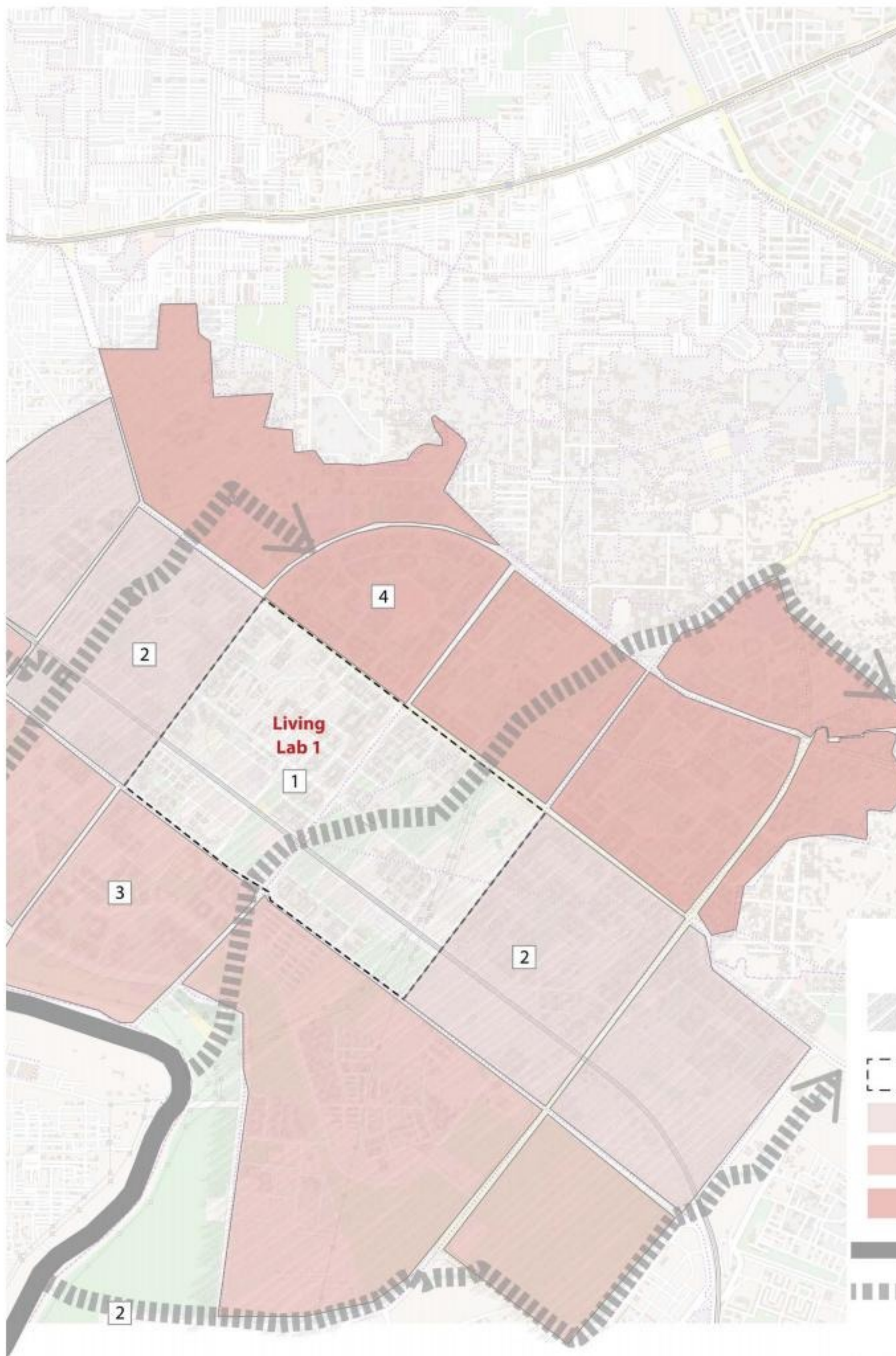



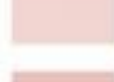





Fig 8.90: Phasing of projects
Source: Drawn by author



Legends

-  Extended Site Boundary
-  Phase 1 → Demonstration Projects
-  Phase 2
-  Phase 3 } Extension of Living Labs (Site 1 & 2)
-  Phase 4
-  Phase 1 → Demonstration Projects
-  Phase 2 → Extension (Combined Site)

Phasing process:

Phase 1: This is the living lab platform extent.

Phase 2: This area is selected based on the demonstration site edges. The adjoining limits has been added in phase 2.

Phase 3: In the third phase the area nearby the drain will be constructed so that Project 15 can be initiated.

Phase 4: The outer edges towards the centre of the city and edges of the city to merge with other living lab platforms.

Note: The phases may or may not be followed strictly depending on the project phasings and stakeholders availability/ consent).

For further extension at the city scale, the stages are:

Step 1: Living lab platform (Similar as phase 1)

Step 2: Immediate extension of living lab platform

Step 3: The living lab platform extension and adjacent living lab platforms get merged to reduce the social conflicts and uneven services.

Step 4: Zonal development and merging of living lab platform (extensions) patches to form similar conditions.

Step 5: The combination and connection between developed zones and living lab platforms (patchwork development) throughout the city.

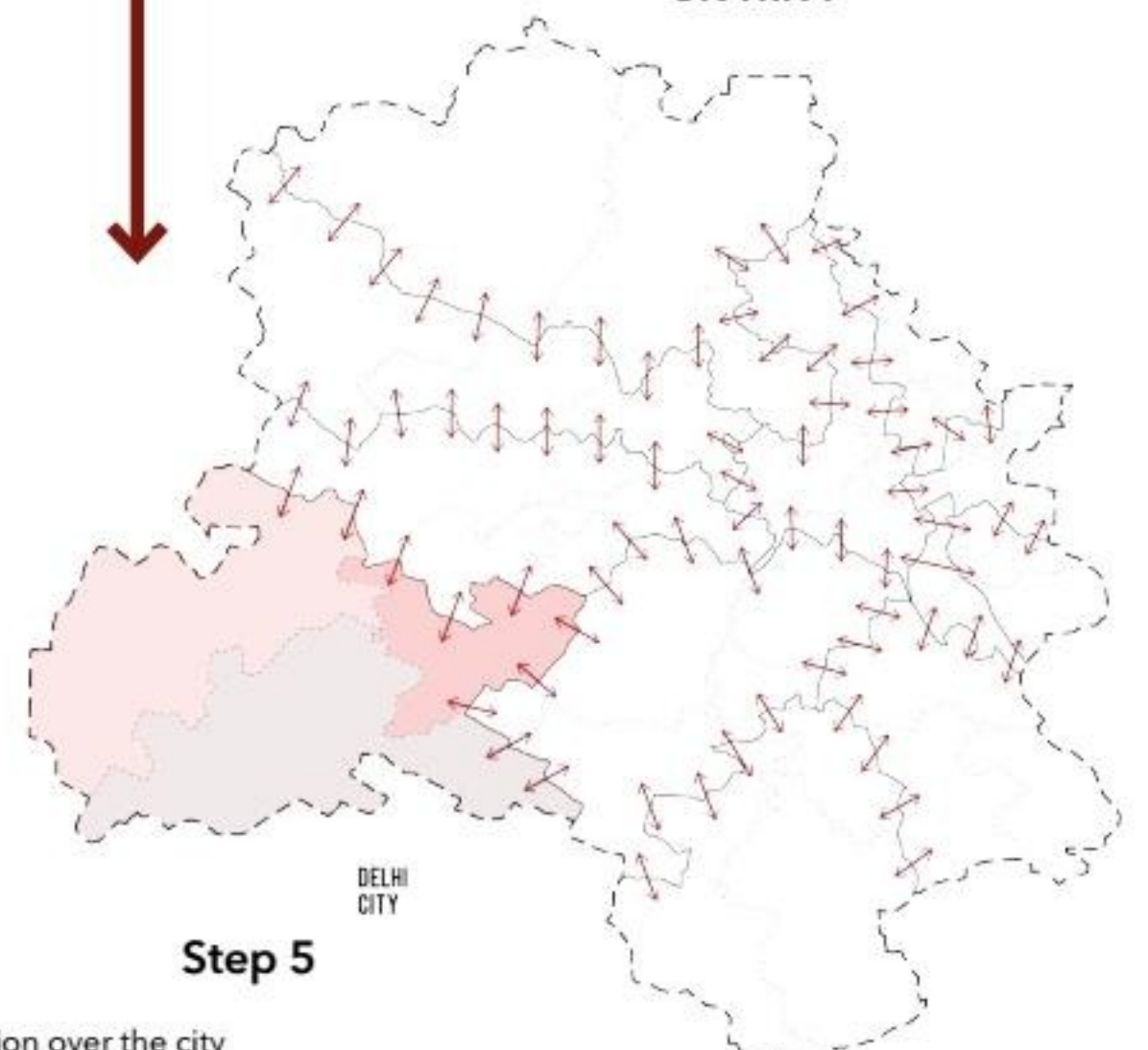
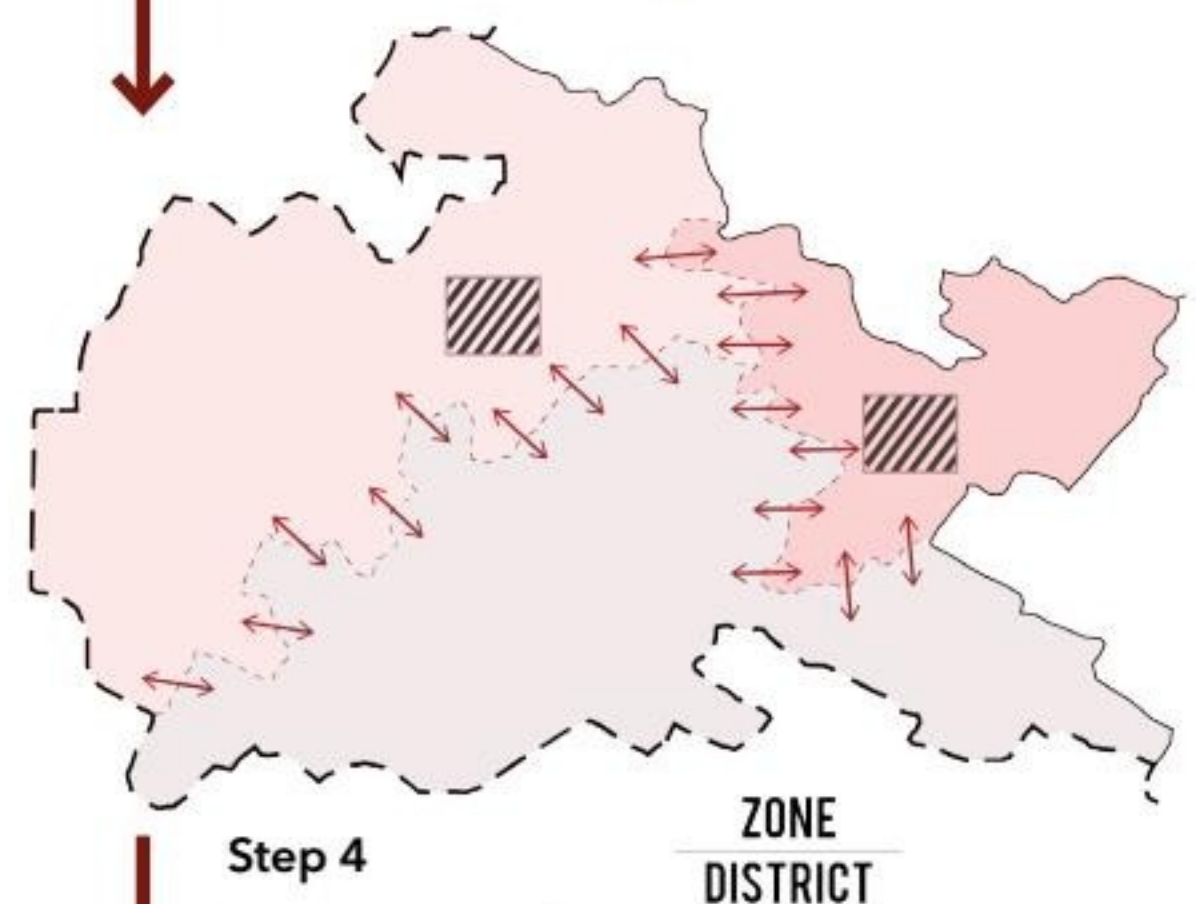
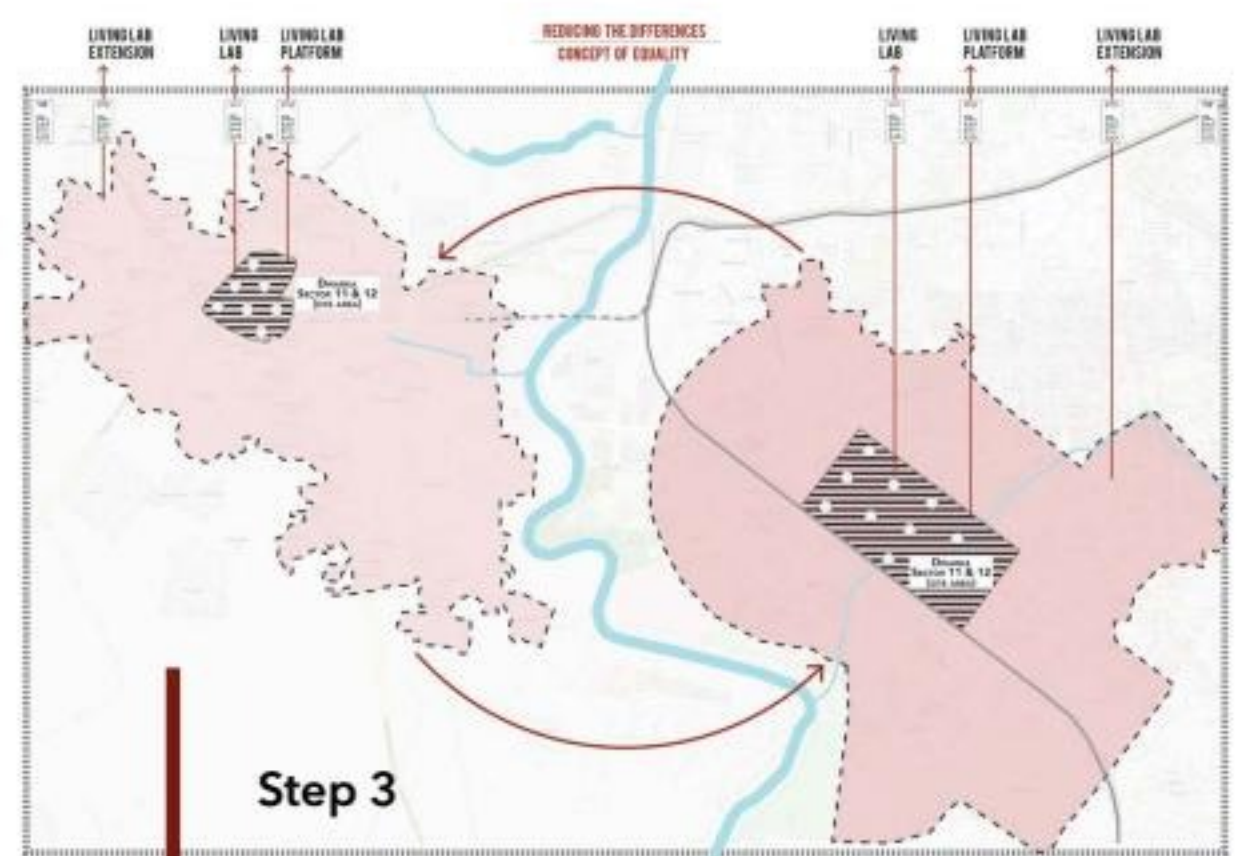
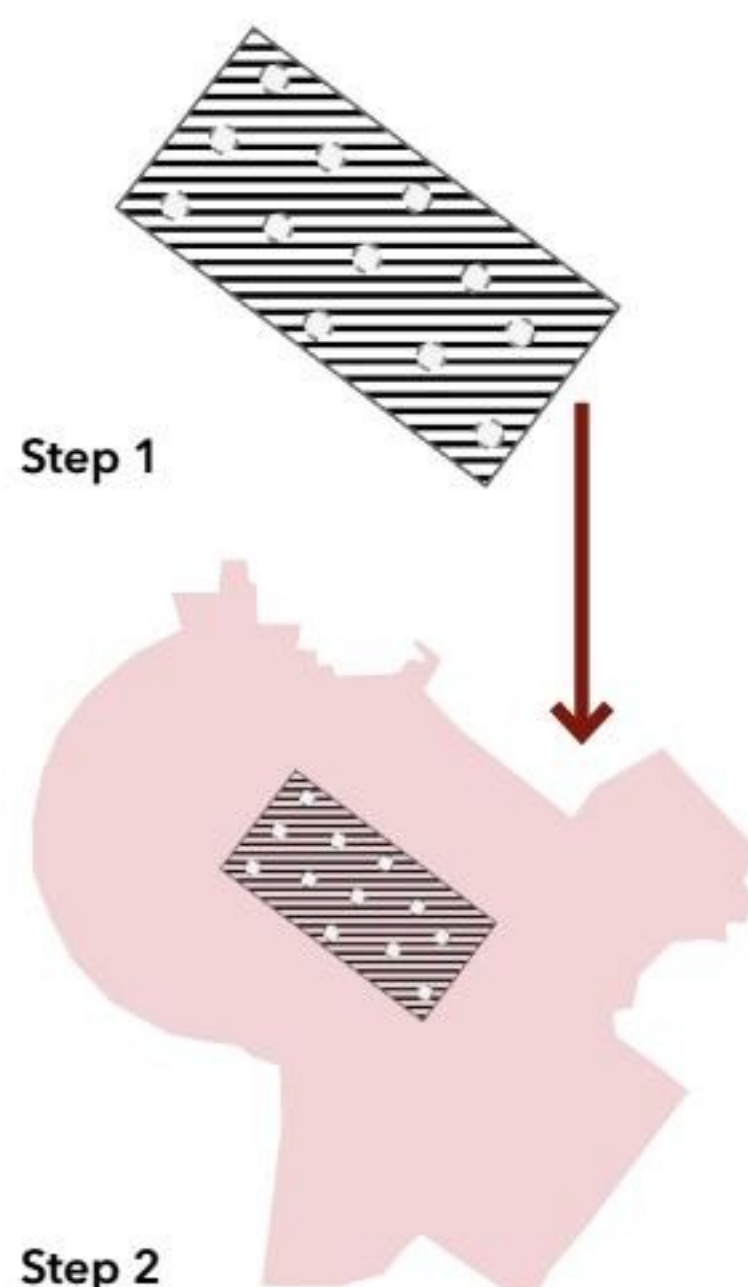


Fig 8.91: Further extension over the city
Source: Drawn by author

III. EVALUATION OF THE PROPOSAL

		Indian Smart City Proposal	My proposal
CONCEPT	THEORY	Smarter solutions for smart city branding	Smarter approach to implement the needed solutions
	ISSUES	Focus on city scale problems	Neighborhood (location) specific issues
DESIGN	OBJECTIVES	For national scale Issue oriented at a	City
	PRINCIPLES	Technological smartness	Sustainable and Affordable smart
	SOLUTIONS	City scale design	Neighborhood scale design
IMPLEMENTATION	INTERVENTIONS	Top down planning	Self organised (Bottom up + Top down)
	TIME	30 years (Output time)	5 years (Output and monitoring)
	MONEY	A lot of investment (Government + International)	Contribution of various stakeholders
	STAKEHOLDERS	3P Model	4P Model
	QUALITY	Even throughout the city	Uneven (growth in patches)
	MONITORING	Difficult to monitor	Easier for quality check
	SCALE OF INTERVENTION	City	Patches (Neighborhood)
	SCALE OF IMPACT	City	Neighborhood ↓ City

1. Objectives- This project objectives are more appropriate than the present governmental proposal as they are based on location specific and generic city issues to provide tailor made solutions.

2. Strategy and its extents- The strategies applied for this project are already proven principles which is accepted over the world. The international lessons are applied in the sites for smart urbanism.

3. Definitional Appropriateness- A precise definition has been formulated for Indian smart cities in this project. (Refer Chapter 5 and chapter 9)

4. Citizen Inclusion: Most of the living labs proposed in this research project are not just including the citizens but motivating them to self-organise themselves for a smarter growth.

5. Financing of the project: The 4P model of stakeholders will work , not only in terms of decision making, implementing but financing as well. But in initial stages, the government should incentivize the citizens to boost their confidence.

6. Project monitoring: A separate network of educational institutes will be responsible to monitor all the projects in frequent intervals (every 2 years). The changes for betterment of interventions can be justified using the quality check.

7. Impact of proposal on the City: The whole city can be impacted if such demonstration projects are initiated in all the parts of the city. The upgradation in each phasing stages will confirm a bigger impact on the city.

8. Impact on the Citizens: The most important impact on the citizens through this project would be making them smarter. This process will create smart citizens along with smart city.

Table 8.3 : Comparison of Suitable approach
Source: Drawn by author

9

SELF SUSTAINANCE
=
SMART!



CONCLUSION

I. CONCLUSIONS

Thus, concluding this project I would say smart cities should not be seen as technically advanced urban space but as space intelligently managed with optimal resource used with least resource footprints. By having such localized solutions smart cities can overcome many problems that municipalities face in providing the common services such as water supply, sewers and central sewage treatment plants. In the beginning of the research a lot of questions were in my mind, as well as lots of questions were asked by the researchers regarding smart India. How smart cities in India are possible? Where it is not possible? What scenarios can make it possible? How much can be extended on a general level for other cities? With this general note I would like to conclude this project with few specific statements after the detailed research that I am completing.

1) Smart cities in India are possible and should be developed.

A lot of criticism is gained for the Indian smart city proposal by the researchers and citizens. The answer to their questions would be; Yes, this is the right time for India to become smart, only right approaches are needed. Smart city is not only ICT and internet of things, there is a much deeper meaning to it. Any process/ project that is helping the city to manage its resources (physical/ natural/ human) in a more suitable manner, then that is smartness. For India, the definition of smart city should be Smart designing and planning in terms

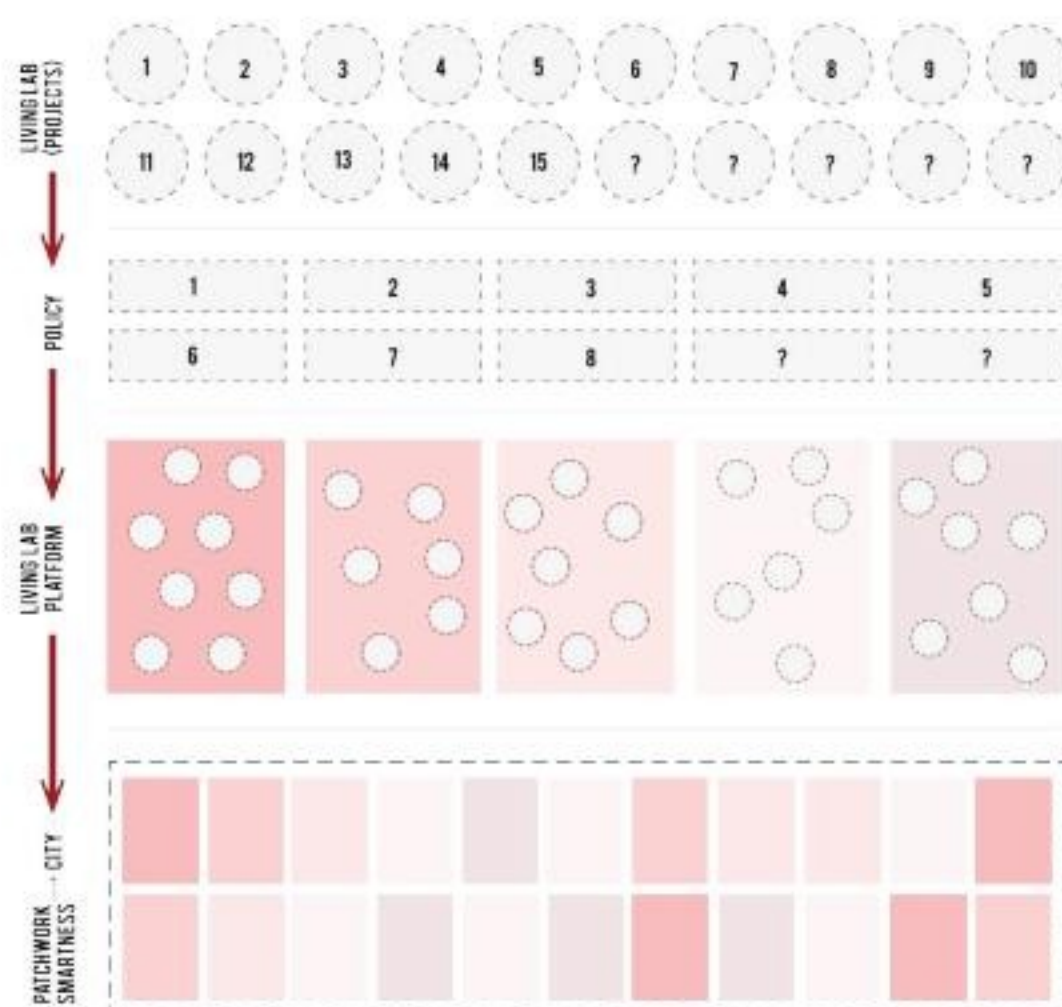


Fig 9.1 : The concept and growth of living labs
Source: Drawn by author

of distribution of resources to reduce the unevenness of infrastructural services. And the smartest way to reach this goal would be inclusion of citizens in the process of making the city smarter. The users should be able to access the city in a smarter way otherwise there is no point to include technology in not-so-urban areas.

2) Smart patchwork can be one of the successful theories for development.

The steps of development (shown in previous section) will originate the concept of smartness from a really small scale, but will have the progress in a larger city scale. The concept termed here is smart patchwork. Smart insertions in an area of almost 1500 Kms that Delhi owns is not very much achievable in one go. But small neighborhoods can be sprouted in a smarter way and then combine and expanded. The concept of smart patchwork is amalgamation of living lab platforms together to create a smart city.

3) Smart Urbanism concept is more useful than smart city concept in India.

Smart Urbanism requires cities to commit themselves with integrated, sustainable and participative urban growth. The way worldwide cities evolve will guide the future of society not only in the urban development field, but also in their economic, ecological and civic engagement aspects (Madrid n.d.). Nowadays, the main challenges we face require that cities renew their strategies to achieve better living conditions in urban

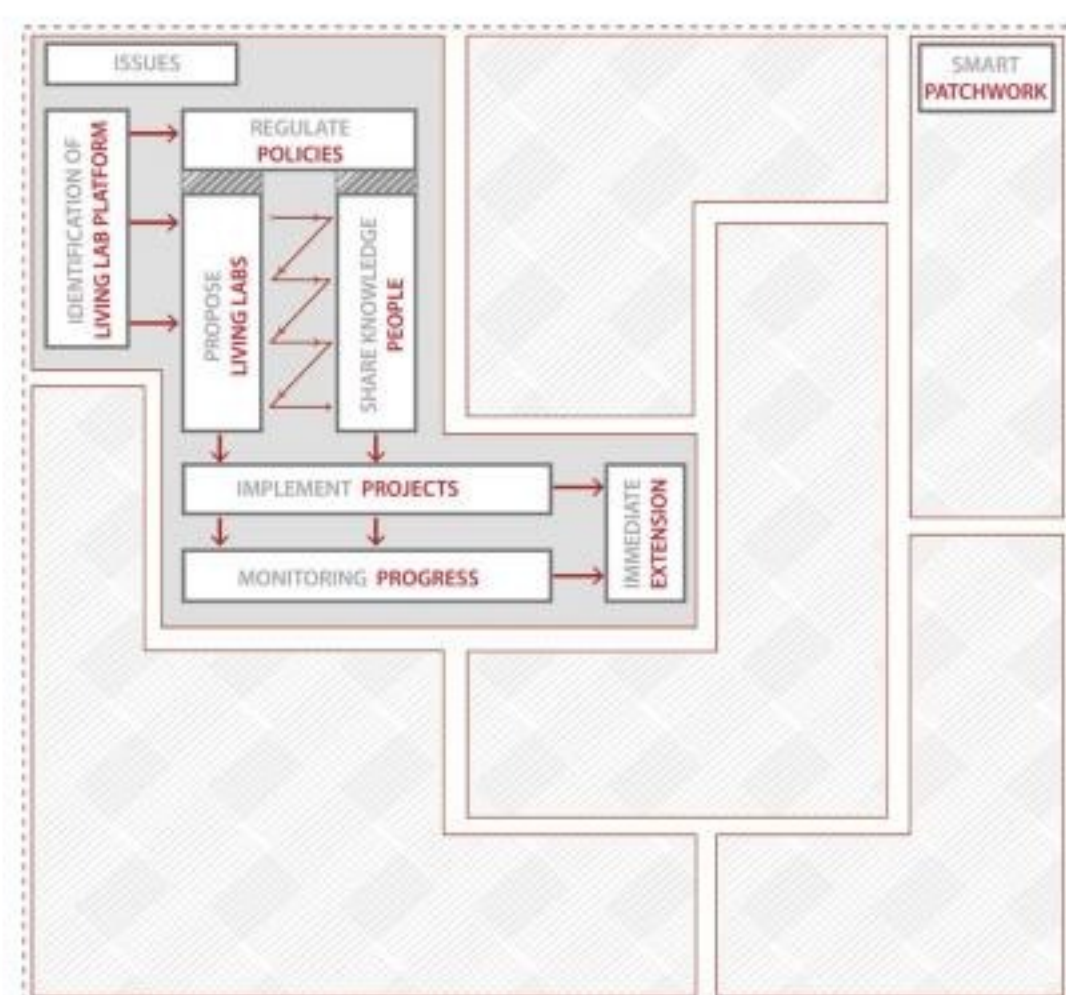


Fig 9.2: The process of growth of smart patchwork
Source: Drawn by author

areas, so that they can offer their citizens equitable and inclusive places to develop their daily life. Smart growth (also called New Urbanism) refers to various policies and planning practices that create more compact and multimodal communities, in contrast to sprawl, which results in more dispersed and automobile-dependent development. Smart city planning will also focus on big city infrastructure which will revolve around mobility and ICT.

4) Act on small areas, rather planning the whole city.

Projects that stimulate the use of existing infrastructure, rather recommending further concretization in the city. These projects will be environmental friendly and will also help centralization and break the endless sprawl of the city. In most of the cases the larger concretization happens for big city infrastructural projects. In my research I tried to use the existing infrastructure and retrofit the smart solutions in them.

5) Tailor made approach, not just on a city scale

The concept of living lab platform is introduced in this research to validate the point that the world is talking about tailor made definitions and projects for each cities. But the area of European cities (for example the area of Amsterdam is 219 Km²) cannot be compared to Indian city areas (for example Delhi is 1475 Km²). Thus,

in Indian context, the tailor made solutions are needed for smaller chunks of area rather than a city scale. The objectives and principles can remain same, which can act as a toolbox. While the projects can differ from place to place based on the specific locational needs.

6) Only bottom up or only top down will not make sense

As a pilot initiative, it was appropriate to follow a combination of bottom-up approach and top down approach. Similar approaches (4P model) should be responsible for interventions to improve urban governance processes impacting environmental and city services in Delhi. There is a lot of population in Delhi, and it is not ethically correct to separate the citizens while decision making or city developing. The increasing of urban population worldwide will threaten urban planners and governors with phenomena such as the new urban management system that Megacities will need, inclusive development patterns that guarantee the integration of citizens in the urban life.

All the conclusions are based on a new urban structure demonstrated in the selected neighbourhoods. This concluded to a coherent project storyline of six elements.

	Smart (Urbanism) Growth	Sprawl
Density	Higher-density, clustered activities.	Lower-density, dispersed activities.
Growth pattern	Infill (brownfield) development.	Urban periphery (greenfield) development.
Land use mix	Mixed.	Single use, segregated
Scale	Human scale. Smaller blocks and roads. Attention to detail, since people experience the community as pedestrians.	Large scale. Larger blocks and wide roads. Less detail, since people experience the landscape at a distance, as motorists.
Public services (shops, schools, parks)	Local, distributed, smaller. Accommodates walking access.	Regional, consolidated, larger. Requires automobile access.
Transport	Multi-modal transportation and land use patterns that support walking, cycling and public transit.	Automobile-oriented transportation and land use patterns, poorly suited for walking, cycling and transit.
Connectivity	Highly connected roads, sidewalks and paths, allowing more direct travel by motorized and nonmotorized modes.	Hierarchical road network with many unconnected roads and walkways, and barriers to nonmotorized travel.
Street design	Streets designed to accommodate a variety of activities. Traffic calming.	Streets designed to maximize motor vehicle traffic volume and speed.
Planning process	Planned and coordinated between jurisdictions and stakeholders.	Unplanned, with little coordination between jurisdictions and stakeholders.
Public space	Emphasis on the public realm (streetscaping, public parks, public facilities).	Emphasis on the private realm (yards, shopping malls, gated communities, private clubs).

Table 9.1: Necessity of smart urbanism (compares major differences between two land use patterns)(Litman 2015)

Source: Evaluating criticism of smart growth, Victoria transport policy institute

II. RECOMMENDATIONS

At the conclusion of this project, there are few recommendations that I would recommend for Indian cities regarding future developments necessary to advance the topic of this research. These recommendations are determined after the analysis, study and probable design scenarios that has been discussed in previous chapters. Following are the two main concerns which will ensure efficient spatial development if the objectives and the policies can be strengthened.

1) Strong commitments towards basic services:

Indian constitution guarantees six fundamental rights (i) right to equality, (ii) right to freedom, (iii) right against exploitation, (iv) right to freedom of religion, (v) cultural and educational rights, and vi) right to constitutional remedies. The right to equality explains five aspects of equal opportunities, where the basic services are not mentioned anywhere. From the site analysis and studying the conditions of Delhi, it is highly visible that the infrastructure and service provision have two faces, one is where they portray Delhi as the capital city by providing world class services, while second is services in left over areas in the city. It is the duty of

the government body to treat all the citizens in equal manner. Thus, I recommend to enact a law "Equality to basic services and infrastructure" where provision of even infrastructure layout over the city is encouraged.

2) Focus on smart Indian dimensions

The six universal smart key dimensions that we studied in Chapter 3 does not fit correctly in the Indian scenario. Not only Indian cities should have their own smart city definition but also they should focus of their specific smart dimensions based on the urgencies of India. The following table shows the six different needed focus for Indian cities. These dimensions are not just a listing of objectives but also a scheme that shows the relations among each other. None of the aspects can be prioritized over each other as they connect with each other in various stages.

There can be many more recommendations for creation of smart India. These two are primarily the additional practicalities that is concluded after designing and planning the demonstration projects which will situate the statements of development proposed in previous chapter.

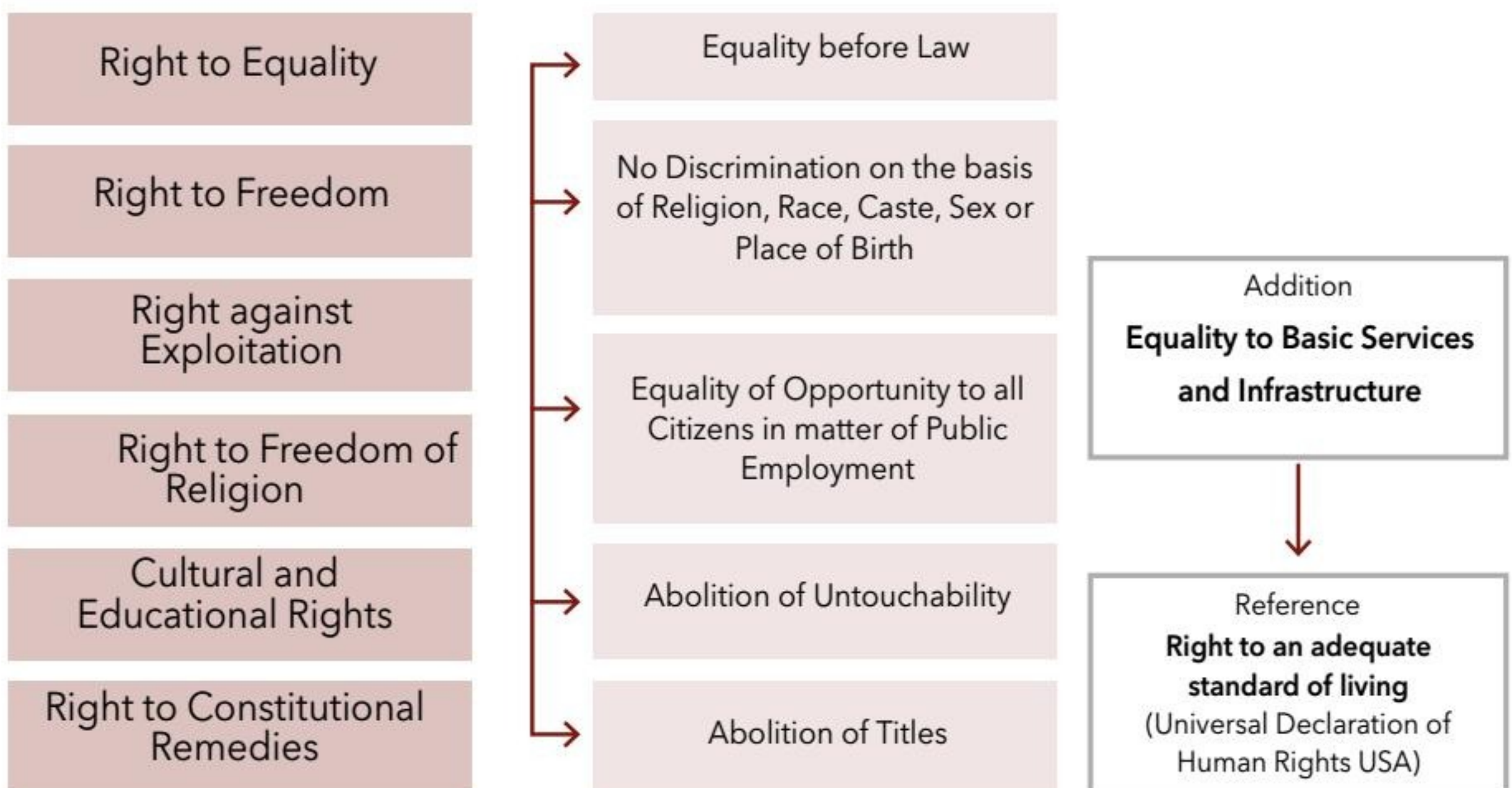


Fig 9.3: Indian smart city dimensions and relations
Source: Drawn by author

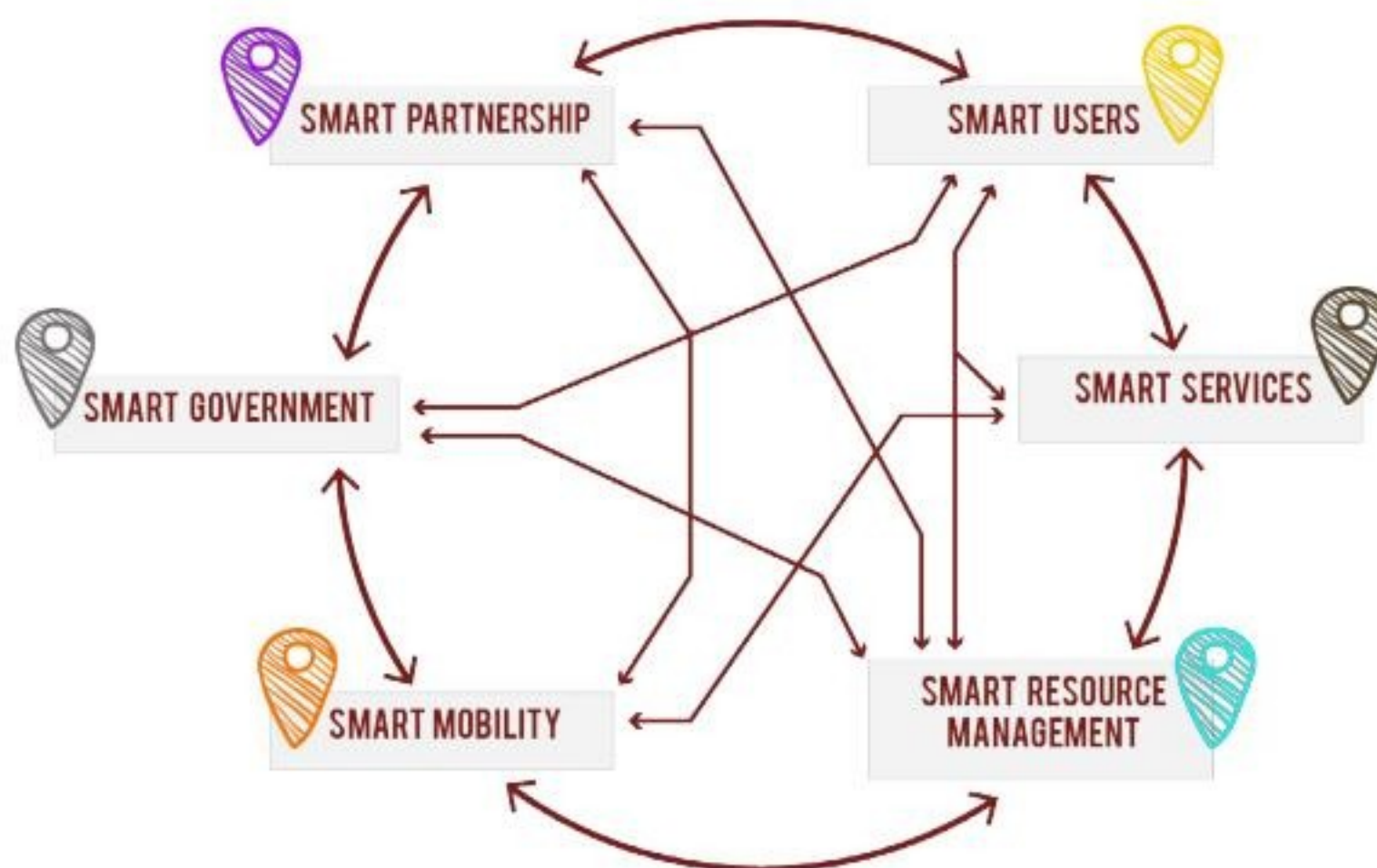
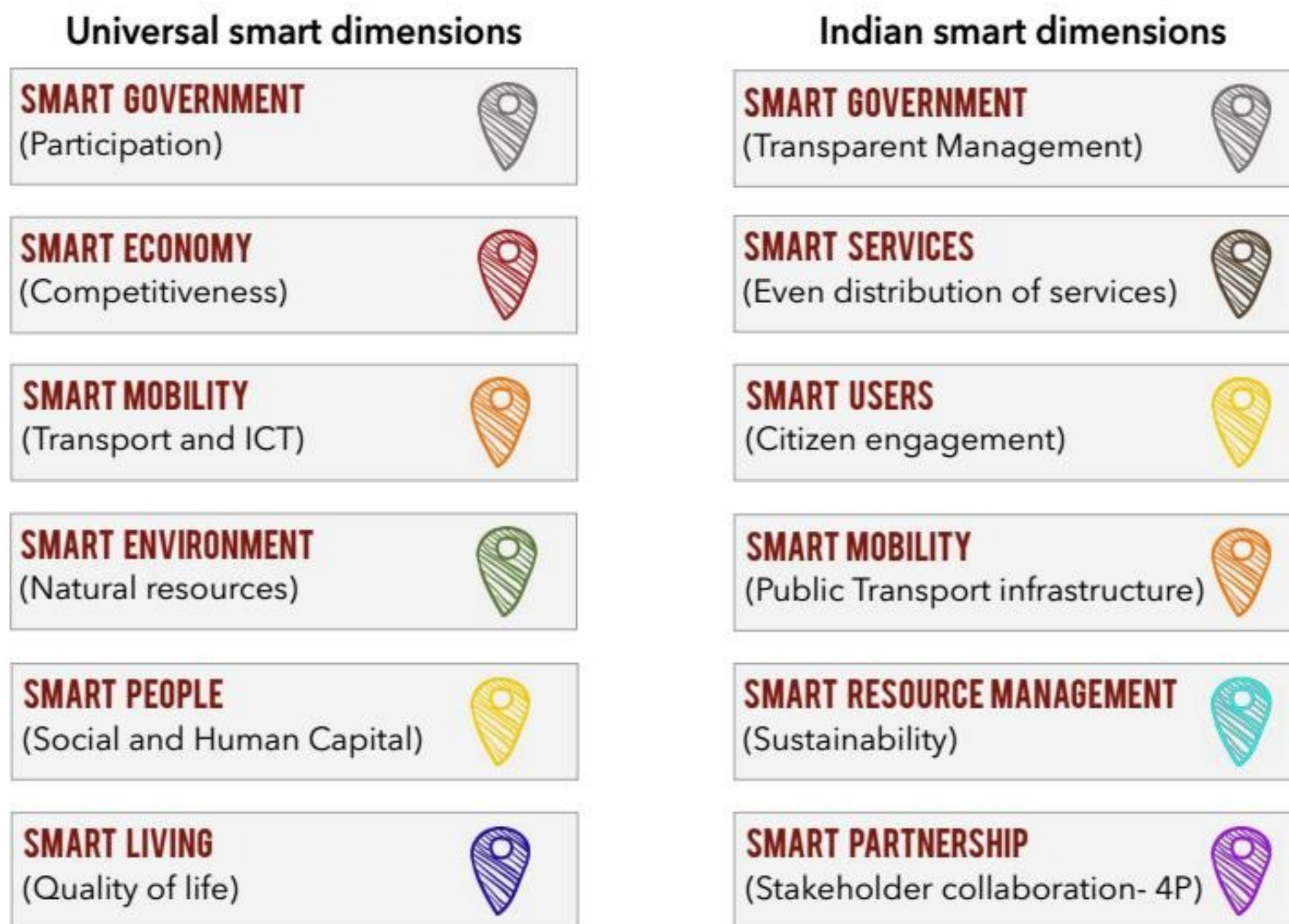


Fig 9.4: Indian smart city dimensions and relations
Source: Drawn by author

III. REFLECTION

In this project, I endeavoured to understand the concept of smart cities in different cities and further how smart city initiatives can guide the growth of Indian cities. The main research question was to investigate the approaches proposed by the government in the Indian Smart City Proposal and how the planning and design strategies can be altered to upgrade the quality of urbanization. The process from research, analysis, design and evaluation, went through a lot of ups and downs in each intermediate thesis evaluation stage.

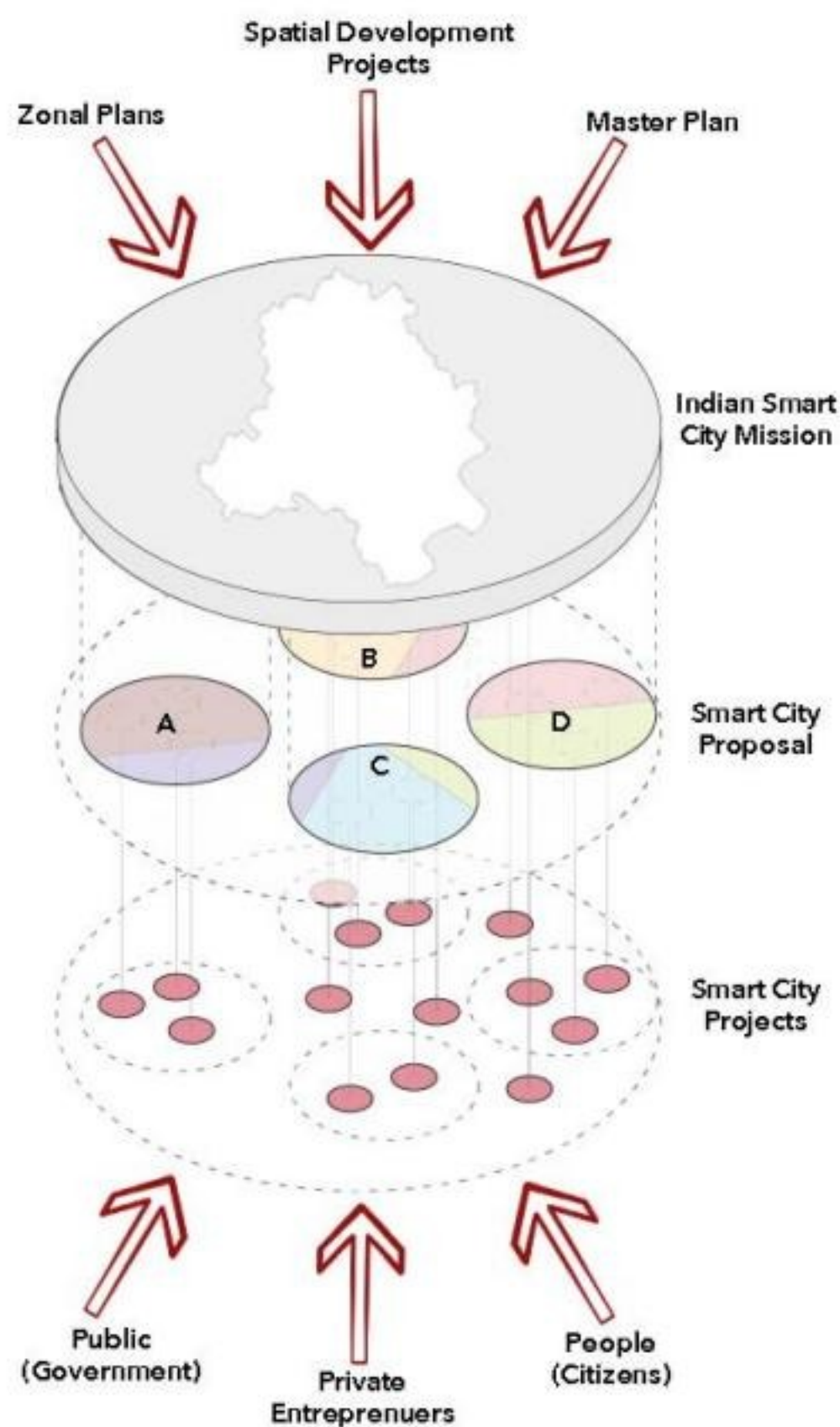


Fig 9.4: The Design structure
Source: Drawn by Author

There were a lot of modifications in the thesis structure if we compare the beginning and the final stage.

1. In the beginning the project had a bigger scope and expectation to provide city-specific solutions with regard to policies and strategies for three example cities and small scale pilot projects.
2. A detailed comparative study integrated with assessment charts for 25 cities was targeted. But to cope up with the one year time of the project, the comparison of only the attributes effective for Indian context were conducted (Chapter D).
3. The methodology and the thesis structure were reconsidered at every stage to simplify the project understanding. Moreover, the factor of scale played a critical role to formulate the structure of the project, as there were change of scales regarding analysis, research, planning and design.

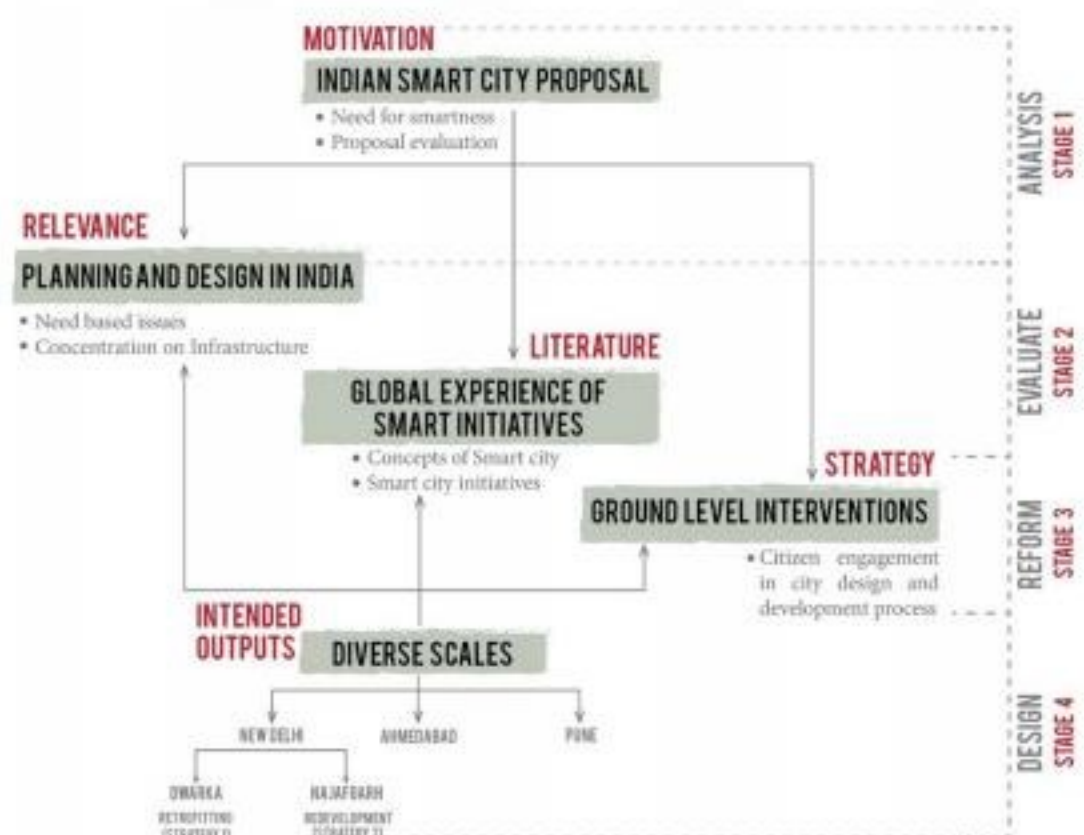


Fig 9.5: Final Methodology Framework
Source: Drawn by Author

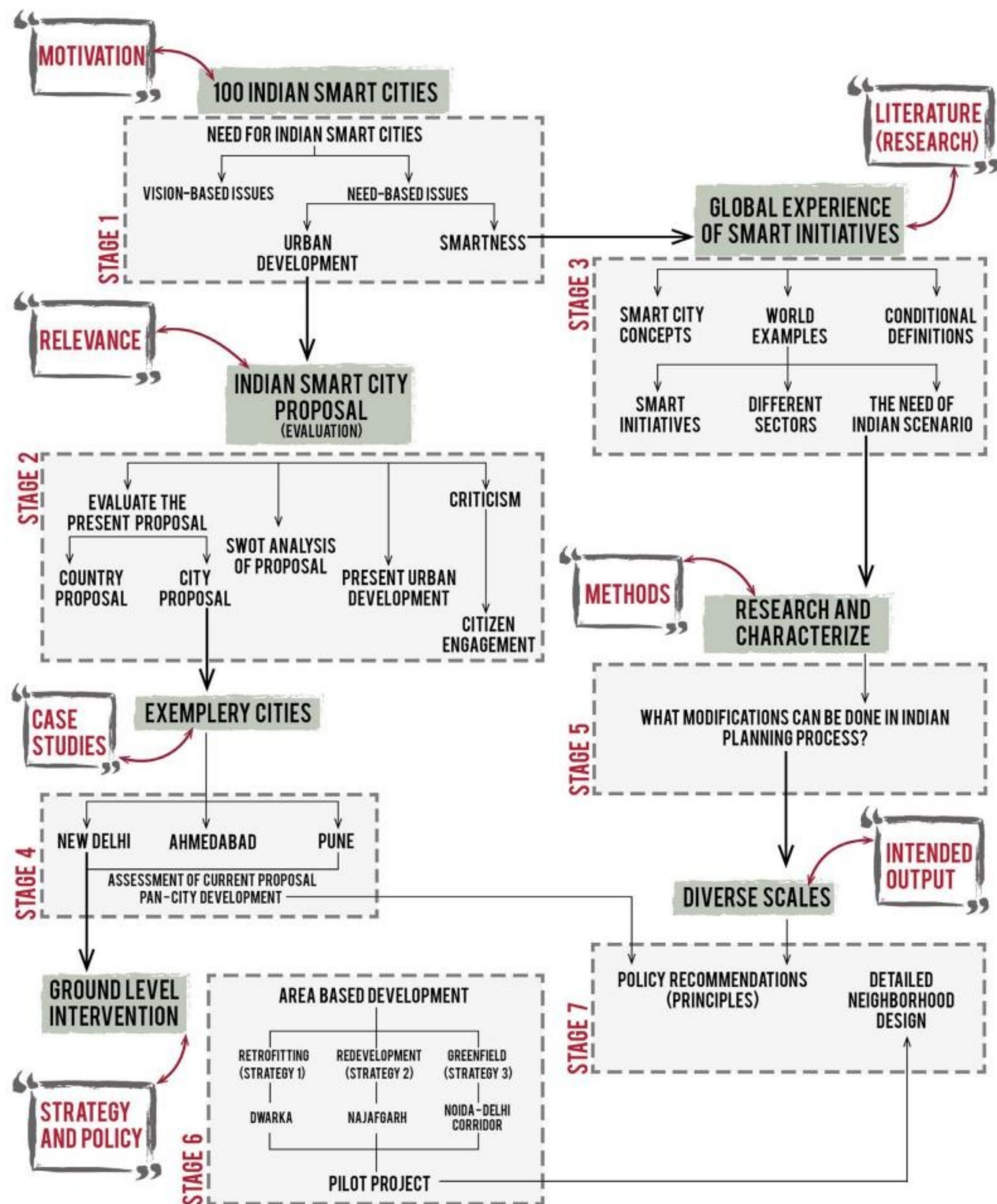


Fig 9.6: Preliminary Framework
Source: Drawn by Author

A very crucial part of the learning exercise was to simplify the scope of interventions to extract a clearer framework during the whole process. Among the bunch of huge issues that exists in the site, it was difficult to choose the issues or limit the scope to intervene in the provided amount of time. Following is the explanation of my aims and achievements on this graduation project.

1. The relationship between research and design

The motivation for the project that I got from the extensive news coverage on Indian smart city proposal was a strong beginning for research on the topic of smart cities. The application of the latest concept was being questioned in the Indian scenario. So the research began with the understanding of the ambiguity of the topic. Due to broadness of the topic, the research for the graduation thesis became multi-dimensional and it gave room for many approaches and elaborations. The research was focused on three objectives: universal attitude of smart cities, existing Indian proposals and planning systems, and the new practice of user centric approach. Unfolding the contextual complexities was the first objective, which led to the evaluation of the current proposal. Reviewing the proposal embarked the premature insights on the design possibilities. While on the other hand, there were numerous ideas in mind that evolved from the universal learning of the smart city initiatives and applications. I made sure to continue with the positive strategies and approaches that were already there in the Indian smart city mission. But also, I tried to understand the real problems of the citizens from the site analysis. Two areas were chosen based on the ISCM, where significant spatial problems were identified specific to each site. There were fundamental issues found on a bigger (city) scale.

The design in itself revolves around the research of theory and implementation. How the city, Delhi and its citizens, adapts to the new organizational structure and technological initiatives with the present socio-economic and spatial configuration of the city? Also the question was, how the design answers to the demands and expectations of the citizens? Thus while answering these loops of questions I came to the conclusion, even before the design phase, that the development needs to be done by the people, for the people and from the people. Therefore, the theory citizen engagement was studied thoroughly. The project began with boundless ambition of city modification using planning and design, but in later stages when inferences from

detailed site analysis were contemplated, the vision was rethought upon. The final vision for the project was to upgrade the lifestyle of the citizens by smart local scale interventions that will have bigger impacts for the city. A professional guidance by my mentors Vincent Nadin and Ulf Hackauf helped significantly on making a natural transition from the research outcomes and the vision to the design product.

The project vision was based on two focal goals (Provision of quality urban infrastructure and Provision of quality urban organization and structure), followed by eight precise and descriptive objectives based on the needs and conceivable upgradations in Delhi. The objectives were operated using technological strategies already manifested in smart cities around the world. The challenge was to implement these strategies in two strikingly contrasting neighbourhoods by means of local projects and a strategic plan to execute them. The projects were braced with few policies, that can happen on a city scale, including all the stakeholders (4P model). Personally the attempt was to create pilot projects that portrays local smart solutions for a socially responsible urban development in India.

2. The relationship between the theme of the graduation lab and the subject chosen by the student within this framework

The research group chosen for this graduation project is the Complex Cities- Planning change. They explore how radical transformations of metropolitan structures influence sustainability, how planning and design resolves territorial conflicts and how urbanism addresses poverty, extreme environmental threats, weak governance or urban emergencies in neighbourhoods, cities and regions around the world. (cities, n.d.)

My research topic is directly relevant to their theme as this project extends to obey all the five mission statements of the Complex Cities research group.

- i) An interdisciplinary approach/integral thinking: An integral thinking between the social mindset, technological effect, spatial change and design was vital to take critical decisions for practical interventions.
- ii) Internationalisation/understanding differences: A comparative study of 25 worldwide cities is a substantial study done in the research stage of this project. This step was taken mainly to understand the contextual differences of the term smart cities.

iii) Institutional context/developing a critical perspective: The critical evaluation of the Indian smart city proposal prepared by the Government of India was crucial, not to detect the drawbacks but in order to appreciate the positives and adapt them into real design phases. Acquiring knowledge from the world and selecting the effective solutions for this project was a learning process.

iv) Planning methods and tools/manage change: The most demanding challenge was to stimulate flexibilities in the present planning methods and prepare them to adjust with the technological advancements.

v) Decision-making/participation: As an urbanist, my job doesn't end with the designing but also to realize and evaluate the consequences of that. The decision making process was done with an ideological mindset a) to fulfill the needs of the citizen; b) the affordability and beliefs of the government and; c) the profits of entrepreneurs. As a citizen of India (especially Delhi), I could think strategically about the potentials of the site for in depth realistic planning.

3. The relationship between the methodical line of approach of the graduation lab and the method chosen by the student in this framework

In this project, a lot of traditional methodologies were employed such as literature studies, location analyses, observational research and workshop. Most of these methodologies are long established, and each was used in specific parts of the project to advance the research. Therefore, all of these traditional methodologies have led the research findings eventually to formulate the design objectives. My previous internship on contextual study of smart cities provided me a clear method to research and gather data from worldwide.

In relation with complex cities research group, a lot of schematic diagram and structural framework has been devised to understand the findings and make the project more simpler for its audience. The fundamental ideas on design has been sketched, accompanied with doodle mappings on the existing documented maps. There was a flexibility in terms of final outcomes of the projects, which was the product of mentoring from different teachers with different academic and professional backgrounds. The method of my first mentor (Vincent Nadin) from complex cities research group assured me to plan, investigate, structure and write the findings of research and design for a better and sharp document. It was easier to define the

practicalities in terms of implementation (stakeholders/ time phasing/ financing) with this planned approach. The uncertainties about the site, the urgencies of development and the demonstration projects were established based on analytical reasoning throughout the process. While, as my second mentor (Ulf Hackauf) from Urban Metabolism and Smart cities, aided me to analyse and generate crisp design decisions and technicalities. There was a difference in the approach while working of different scales as well. Distinct steps were taken for research, analysis, evaluation and designing of the different scales. To my opinion, the restriction for choosing the mentors from different research groups appeared to be a successful attitude.

4. The relationship between the project and the wider social context

The importance and relevance of considering the social and traditional concepts in spatial planning and design is made explicit through the project. In each stage of the project the findings were kept strictly related and relevant with the socio-cultural Indian context. Having a native attachment to the project location, the graduation thesis resulted on changing my perspective of analysing the urban issues from a bigger perspective. The new learning was inclusion of dynamic and adaptable planning process in India.

The design possibilities or the intended outputs I had in mind while starting the project was remarkably different than what I produced at the end. I got a totally new insight about the sites (which were known to be beforehand), when I visited India after the literature study. The differences in the approaches taken in each continents become very much evident during the study. While deciding the potential projects and proposals for this graduation thesis, the wider social context was envisaged.

To my opinion thesis aims not only to understand what you have learned from this academic program but also to report what is your contribution to the topic. After abundant research on the topic of smart cities and proving (by designing) that local scale projects can achieve a greater impact, I am determined to build and develop better cities and communities, with improved social, economic and environmental conditions and to transit together towards resilience and make small difference to the world.



10



APPENDIX

Source: <https://noisypilgrims.com/2013/05/15/busy-street-of-hyderabad/>

I. GLOSSARY

- **Cities/ Urban areas-** The definition of 'urban' varies from country to country, and, with periodic reclassification, can also vary within one country over time, making direct comparisons difficult. An urban area can be defined by one or more of the following: administrative criteria or political boundaries (e.g., area within the jurisdiction of a municipality or town committee), a threshold population size (where the minimum for an urban settlement is typically in the region of 2,000 people, although this varies globally between 200 and 50,000), population density, economic function (e.g., where a significant majority of the population is not primarily engaged in agriculture, or where there is surplus employment) or the presence of urban characteristics (e.g., paved streets, electric lighting, sewerage). In 2010, 3.5 billion people lived in areas classified as urban. (Unicef, 2003)

- **Citizen Engagement-** Citizen engagement is an overarching theme, of a form of governance and policy making and design, process oriented, where involving citizen is the key issue. It can be regarded as a ladder on which different forms of citizen participation are possible to be enhanced. From top-down oriented, co-design driven processes, up to top-down oriented, consulting and facilitating types of governance. (Newman, Janet; Barnes, Marian; Sullivan, Helen and Knops 2013)

- **Contextual/ Conditional Development-** Referring to an action that takes place only if a specific condition is met.

- **Global examples-** Present examples around the world from different sources.

- **Ground level intervention-** Intervening the local areas using Bottom up approach.

- **Inclusive city-** An inclusive city is one that values all people and their needs equally. It is one in which all residents—including the most marginalized of poor workers—have a representative voice in governance, planning, and budgeting processes, and have access to sustainable livelihoods, legal housing and affordable basic services such as water/sanitation and an electricity supply." (www.inclusivecities.org)

- **Indian cities-** Indian cities are classified on the basis of population. Reserve Bank of India classifies cities based on population, number of electoral constituencies into six tiers. This was based on 2001 Census.

- **Multi-level approach-** Concepts applicable for different scales or concepts designed for catering different scales.

- **Policy-**

1. A definite course or method of action selected (by government, institution, group or individual) from among alternatives and in the light of given conditions to guide and, usually, to determine present and future decisions.

2. A specific decision or set of decisions designed to carry out such a course of action.

3. Such a specific decision or set of decisions together with the related actions designed to implement them.

4. A projected programme consisting of desired objectives and the means to achieve them. (ILRI, n.d.)

- **Strategy-** it is perspective, position, plan, and pattern. Strategy is the bridge between policy or high-order goals on the one hand and tactics or concrete actions on the other. Strategy and tactics together straddle the gap between ends and means. In short, strategy is a term that refers to a complex web of thoughts, ideas, insights, experiences, goals, expertise, memories, perceptions, and expectations that provides general guidance for specific actions in pursuit of particular ends.(Nickols 2016)

- **Public Participation-** Citizen participation is a process which provides private individuals an opportunity to influence public decisions and has long been a component of the democratic decision-making process. The roots of citizen participation can be traced to ancient Greece and Colonial New England. Before the 1960s, governmental processes and procedures were designed to facilitate "external" participation. Citizen participation was institutionalized in the mid-1960s with President Lyndon Johnson's Great Society programs (Cogan & Sharpe, 1986 p. 283). Public involvement is means to ensure that citizens have a direct voice in public decisions. The terms "citizen" and "public," and "involvement" and "participation" are often used interchangeably. While both are generally

used to indicate a process through which citizens have a voice in public policy decisions, both have distinctively different meanings and convey little insight into the process they seek to describe. (Planning Analysis: The Theory of Citizen Participation)

- **Smart City-** There are numerous definitions of smart cities, well-defined by various authors for different contexts over the world. But the only thing common is all, which separates the term 'smart city' from other related terms is the concern towards people (user friendly) with the combination of technology. Following are few selected definitions which stands precisely for specific conditions.

- a. A smart city can effectively process networked information to improve outcomes on any aspect of city operations. (Irene Celino, Dec 2013)

- b. A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement. (Report, 2014)

- c. A city in which ICT is merged with traditional infrastructures, coordinated and integrated using new digital technologies. (Batty et al. 2012)

- d. Smart City is used to describe a city with a "smart" industry. That implies especially industries in the fields of information and communication technologies (ICT) as well as other industries implying ICT in their production processes. Also for business parks or own districts comprising of companies within this field the name Smart City is used. (Giffinger 2007)

- e. The term Smart City is also used regarding the education of its inhabitants. A Smart City has therefore smart inhabitants in terms of their educational grade. (Shah 2014)

- f. In other literature the term Smart City is referred to the relation between the city government resp. administration and its citizen. Good governance as an aspect of a smart administration often also referred to the usage of new channels of communication for the citizens, e.g. "e-governance" or "e-democracy". (Aikins 1996)

- g. Smart City is furthermore used to discuss the use of modern technology in everyday urban life. (Lombardi et al. 2012)

- **Technologically driven-** The main motive behind development is technology.

- **Urbanization-** It is generally accepted that urbanisation involves the shift in population from rural to urban settlements. From a demographic perspective, the urbanisation level is best measured by the urban population share, with the urbanisation rate being the rate at which that share is growing. (Mcgranahan & Satterthwaite 2014)

- **Urban growth-** The (relative or absolute) increase in the number of people who live in towns and cities. The pace of urban population growth depends on the natural increase of the urban population and the population gained by urban areas through both net rural-urban migration and the reclassification of rural settlements into cities and towns. (Unicef, 2003)

II. QUESTIONNAIRES SUMMARY

The questionnaire for citizens consisted of following questions:

1. What issues are you facing staying in Delhi (daily life problems)? Prioritize three issues. Are the objectives of Smart city mission (mentioned above) accommodating your issues?

2. How much do you know/are informed about Indian smart city mission? On a country level/ on a city level?

3. How do you perceive the changes or new projects? Are you willing for smart solutions?

- ☐ Smart technologies traffic monitoring
- ☐ Smart strategies like land pooling
- ☐ Encouragement of non motorised transport in parts of the city
- ☐ Accessible local govt bodies
- ☐ Other: _____

4. Do you want to be engaged in the planning process by the government? How much involved would you like to be?

- ☐ Social media/technologically involved
- ☐ City scale decision making (stand on govt proposals)
- ☐ Local scale participation (local strategy implementation)
- ☐ Involvement only where things are going wrong
- ☐ No involvement at all (I chose the politician to take a decision for me)
- ☐ Other: _____

5. What is your perspective on smart development? Any ideas to share?

Answered by citizens of Delhi of different age groups and professions. The names and designations are enlisted in the following table.

S.No.	Citizen Name	Age	Designation
1	Rakesh Kumar	28	A.S.O. (M.H.A)
2	R.K. Rana	34	Govt. Servant
3	S.K. banerjee	65	Retd. Govt. Servant
4	Vikas Kumar Singh	34	S.S.A.
5	Praphul	39	J.D.
6	Om Prakash Pandey	36	Govt. Officer
7	Prabhat Singh	30	Govt. Officer
8	Manish Rajan	33	Govt. Officer
9	Bipin Kumar	25	Govt. Officer
10	Gourav Paul	26	A.S.O.
11	Elina Das		
12	Rakesh Singh Bisht	39	A.S.O.
13	Shivangi Dutta	17	Student
14	Amrita Sajeey	25	Student
15	Neeraj Kumar	27	T.S.M.
16	Akash Sarkar	18	Student
17	Utkarsh Kumar	18	Student
18	Vaibhav Aggarwal	19	Student
19	Akash Malviya	25	Architect
20	Dhananjay Chakarvarty	19	Student
21	Rahul Ranjan	27	
22	Pranay Kumar Tode	28	Architect
23	Mayank Kumar Chittoria	24	Architect
24	Taruna Bhatia	44	Govt. Officer
25	Ruma Sarkar	53	Govt. Officer
26	Tapan Sarkar	54	Businessman

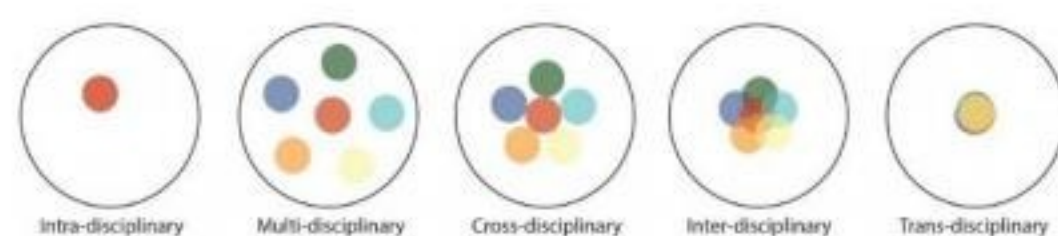
Table 10.1: Citizen questionnaire list
Source: Drawn by Author

The questionnaire for professionals consisted of following questions:

1. How much are you aware about/are involved with the Indian smart city mission?

2. What urban development projects are happening in Delhi that you know off/ or are a part of? Are they more strategy oriented or infrastructure oriented or related to spatial development?

3. How much interdisciplinary is the system of urban development and planning?



4. What is your standpoint on the smart city proposal? How effective is the proposal according to you? Any additions?

5. How much involvement of citizens is encouraged in the planning and development process? What is the current situation and what is proposed?

6. What is your perspective on smart development? Any ideas to share?

Answered by professionals of Delhi who are working with the government and are in relation with the smart city aspects (directly or indirectly). The names and designations are enlisted in the following table.

S.No.	Professional Name	Designation	Email
1	Meenakshi Singh	Deputy Director (Planning) - Zone A,B,C & G. Delhi Development Authority (Ministry Of Urban Development), Government Of India	msingh.03@gmail.com
2	Amit Kumar	Student(Architect)	amit.spab@gmail.com
3	Dr. Vishakha Kawathekar	Head Centre for Cultural Knowledge systems, SPA Bhopal	vishakhakawathekar@spabhopal.ac.in
4	Alka Arya	Deputy Director (Planning) Delhi development authority	Alka25arya@gmail.com
5	Dr. Meena Vidhani	Asst. Director Master Plan section, (Planning Department) DDA	Meena.vidhani@gmail.com
6	Kshitij Mehra	Planning officer DDA	Mehra.kshitij@gmail.com
7	Rajesh Kumar Jain	Director Planning Department DDA	rkjaindda@yahoo.co.in
8	Jana Das Chaudhuri	Deputy Director (Architect) Urban parks and DUHF, DDA	janadaschaudhuri@gmail.com
9	Smita Saxena	Deputy Director (Architecture) Urban parks and DUHF, DDA	Saxena.smita@gmail.com
10	Swarup Shankar Basu	Section officer MHA	Shankar.swarupmha@gmail.com

Table 10.2: Professional questionnaire list
Source: Drawn by Author

III. LIST OF REFERENCES

1. Deconstructing Smart Cities: An Intertextual Reading of Concepts and Practices for Integrated Urban and ICT Development- Marc Wolfram
2. Smart Cities of the Future- M. Batty, M. Wachowicz, Kay W. Axhausen, Georgios Ouzounis
3. Making sense of smart cities: Addressing present shortcomings- Rob Kitchin
4. The 'actually existing smart city'- Taylor Sheltona , Matthew Zookb and Alan Wiig
5. Smartmentality- The smart city as Disciplinary Strategy
6. Will the real smart city please stand up?- Robert G. Hollands
7. Smart City- How to create Public and Economic Value with high technology in Urban Space- Renata Paola Dameri, Camille Rosenthal-Sabroux
8. Smart Cities- Andrea Caragliu, Chiara D Bo, Karima Kourtiti and Peter Nijkamp
9. A 100 smart cities, a 100 utopias- Ayona Datta
10. Smart Cities- What values will they bring to Urban Development in India?- Ian Mell, Sejal Patel, Saswat Bandyopadhyay
11. The future of Urban Development and Services: Urban Development Recommendations for the Government of India- World Economic Forum (In collaboration with Accenture)
12. The evolution of the smart cities agenda in India- Kristian Hoelscher
13. O'Grady, and G. O'Hare, "How Smart Is Your City?" *Science* 335: 3 (2012) 1581-1582
14. Harrison, B. Eckman, R. Hamilton, P. Hartswick, J. Kalagnanam, J. Paraszczak, and P. Williams, "Foundations for Smarter Cities," *IBM Journal of Research and Development* 54: 4 (2010) 1-16
15. Ballas, "What Makes a 'Happy City'?" *Cities* 32: 1 (2013) S39-S50. M.N.
16. Anthopoulos, L., & Fitsilis, P. (2010). From digital to ubiquitous cities: defining a common architecture for urban development. *IEEE 6th International conference on Intelligent Environments*, (pp. 301-306). IEEE Xplore.
17. Couclelis, H. (2004). The construction of the digital city. *Planning and Design*, 31(1), 5-19 (Environment and Planning).
18. Ergazakis, M., Metaxiotis, M., & Psarras, J. (2004). Towards knowledge cities: conceptual analysis and success stories. *Journal of Knowledge Management*, 8(5), 5-15 (Emerald Group Publishing Limited)
19. OECD Observed (1999). Learning cities: the new recipe in regional development. (Carmona & Burgess, 2001)
20. *De, L.C., Singh, D.R., SumanThapa and Gurun, R.C., 2016. rticle SWACHHBHARAT ABHIYAN- AN OVERVIEW * De, L.C., Singh, D.R., SumanThapa and Gurun, R.C. , 3, pp.3066-3073.
21. Aikins, S.K., 1996. Public administration and information technology,
22. Albino, V., Berardi, U. & Dangelico, R.M., 2015. Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, 22(1), pp.3-21. Available at: <http://www.tandfonline.com/doi/full/10.1080/10630732.2014.942092>.
23. Angelidou, M., 2014. Smart city policies: A spatial approach. *Cities*, 41, pp.S3-S11. Available at: <http://dx.doi.org/10.1016/j.cities.2014.06.007>.
24. Anthopoulos, L.G. & Vakali, A., 2012. Urban Planning and Smart Cities: Interrelations and Reciprocities *Urban Planning: Principles and Dimensions. Lecture Notes in Computer Science*, 7281, pp.178-189.
25. ASSINK, S., 2017. Who is the smart city for? University of Virginia. Available at: <http://thrivingcities.com/blog/who-smart-city> [Accessed July 2, 2016].
26. Baeck, P., 2015. Rethinking Smart Cities From The Ground Up. , (June), pp.4-6. Available at: <http://www.nesta.org.uk/publications/rethinking-smart-cities-ground>.
27. Batty, M. et al., 2012. Smart cities of the future. *European Physical Journal: Special Topics*, 214(1), pp.481-518.
28. Branchi, P., Fernández-Valdivielso, C. & Matias, I., 2014. Analysis Matrix for Smart Cities. *Future Internet*, 6(1), pp.61-75. Available at: <http://www.mdpi.com/1999-5903/6/1/61/htm>.
29. Catriona MANVILLE, R.E. et al., 2014. Mapping Smart Cities in the EU,
30. Commission on Science and Technology for Development - United Nations, 2016. Smart cities and infrastructure Report of the Secretary-General Economic and Social Council. , 3074(February), p.18. Available at: http://unctad.org/meetings/en/SessionalDocuments/ecn162016d2_en.pdf.
31. Cosgrave, E., Arbuthnot, K. & Tryfonas, T., 2013. Living labs, innovation districts and information marketplaces: A systems approach for smart cities. *Procedia Computer Science*, 16(Cser 13), pp.668-677.
32. Cosgrave, E. & Doody, L., 2014. DELIVERING THE SMART CITY. *Governing Cities in the Digital Age*.

33. Das, B., 1981. Urban Planning in India. *Social Scientist*, 9(2), pp.53-67. Available at: <http://www.jstor.org/stable/3517133>.
34. Development, M. of U. & India, G. of, 2015. Smart cities Mission Statement & Guidelines. , (June). Available at: <http://smartcities.gov.in/>.
35. European Commission, Smart Specialisation Platform. European Union, 1995-2017. Available at: <http://s3platform.jrc.ec.europa.eu/living-labs> [Accessed June 30, 2017].
36. Giffinger, R., 2007. Smart cities Ranking of European medium-sized cities. October, 16(October), pp.13-18. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S026427519800050X>.
37. Güngör, V.C. et al., 2011. Smart grid technologies: Communication technologies and standards. *IEEE Transactions on Industrial Informatics*, 7(4), pp.529-539.
38. Harrison, C. and Donnelly, I. a., 2011. A Theory of Smart Cities. Proceedings of the 55th Annual Meeting of the ISSS - 2011, Hull, UK, (Proceedings of the 55th Annual Meeting of the ISSS), pp.1-15. Available at: <http://journals.issss.org/index.php/proceedings55th/article/viewFile/1703/572>.
39. He, Y. et al., 2014. Smart City,
40. Hirvikoski, T., Schuurman, D. & Stokes, L., Introducing ENOLL and its Living Lab community.
41. Ian Babelon, 2017. Online participatory mapping for spatial planning. AESOP Young Academics. Available at: <https://aesopyoungacademics.wordpress.com/2017/03/31/online-participatory-mapping-for-spatial-planning/> [Accessed April 5, 2017].
42. Keeton, R., 2017. When Smart cities are stupid. International New Town Institute Rotterdam / the Netherlands. Available at: <http://www.newtowninstitute.org/> [Accessed June 30, 2017].
43. Litman, B.T., 2015. Evaluating Criticism of Smart Growth. , (May).
44. Lombardi, P. et al., 2012. Modelling the smart city performance. *Innovation: The European Journal of Social Science Research*, 25(2), pp.137-149. Available at: <http://www.tandfonline.com/action/journalInformation?journalCode=ciej20>.
45. Majamaa, W., 2008. the 4 Th P - People - in Urban Development Based on Public-Private-People Partnership the 4 Th P - People - in Urban Development Based on Public-Private-People Partnership,
46. Marshall, S., 2009. City Planning, Design and Evolution Concepts. , pp.1-4.
47. Mcgranahan, G. & Satterthwaite, D., 2014. Urbanisation concepts and trends. International Institute for Environment and Development, (June), pp.1-27.
48. Miimu Airaksinen, Janne Porkka, Terttu Vainio, Aapo Huovila, Mari Hukkalainen, H. & Ahvenniemi, Pirkko Rämä, I.P.-S. (VTT T.R.C. of F., 2016. Research Roadmap Report Smart City Vision 1st ed., CIB General Secretariat. Available at: http://site.cibworld.nl/dl/publications/CIB_Publication_407.
49. Ministry of Urban Development, G. of I., Industrial Corridors in India, Available at: <https://www.embindia.org/files/Industrialcorridors.pdf>.
50. Ministry of Urban Development & India, G. of, 2015. HRIDAY: Heritage City Development & Augmentation Yojana Ministry of Urban Development Government of India. , (January), pp.0-18.
51. Mulder, I., 2014. Sociable smart cities: Rethinking our future through co-creative partnerships. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*. pp. 566-574.
52. Newman, Janet; Barnes, Marian; Sullivan, Helen and Knops, A., 2013. Public participation and collaborative governance. *Journal of Social Policy*, 33(2), pp.203-223.
53. Nickols, F., 2016. Strategy. Distance Consulting. Available at: http://www.nickols.us/strategy_definitions.pdf.
54. Peris-ortiz, M. & Bennett, D.R., 2017. Sustainable Smart Cities, Creating Spaces for Technological, Social and Business Development,
55. Ramachandran, H., 2014. Urbanisation: A Solution to Poverty? *Social Change*, 44(4), pp.593-603. Available at: <http://sch.sagepub.com/cgi/doi/10.1177/0049085714548544>.
56. S., R. & Roche, S., 2014. Geographic Information Science I: Why does a smart city need to be spatially enabled? *Progress in Human Geography*, 38(5), pp.703-711. Available at: <http://phg.sagepub.com/content/38/5/703.short%5Cnhttp://phg.sagepub.com/cgi/doi/10.1177/0309132513517365%5Cnhttp://www.scopus.com/inward/record.url?eid=2-s2.0-84911981032&partnerID=40&md5=7c704cf0406b31da53366daf81aaf1ab>.
57. Shah, K., 2014. Smart cities | An urban challenge or unnecessary deviation ?, pp.1-13.
58. Singh, B., 2014. Urban Development

Challenges, Risks and Resilience in Asian Mega Cities, Delhi: Springer. Available at: <http://www.springer.com/series/13113>.

59. Smart, Y. & Week, C., 2012. Smart City in Developing Countries.

60. Wan, B. et al., 2015. Smart City Development in China: One City One Policy. , 13(November 2012), pp.4-8.

61. Association, U. H. S. R., n.d. Transit Oriented Development Institute. [Online]
Available at: <http://www.tod.org/>
[Accessed March 2017].

62. Bhardwaj, R. K., 1974. Urban Development in India. First ed. Delhi: National Publishing House.

63. Bollier, D., 1998. How Smart Growth Can Stop Sprawl. In: Washington, DC: s.n.

64. Caldwell, R., 2002. Portland, a city of 'smart growth'. In: The Masthead. s.l.:s.n., p. 29.

65. Carmona, M. & Burgess, R., 2001. Strategic Planning and Urban Projects; Responses to Globalisation from 15 cities. Delft: DUP Science.

66. Cisco, 2005. Dubai: The Smart City. s.l.:s.n.

67. cities, C., n.d. Complex cities - Planning change. [Online]
Available at: <https://complexcitiesstudio.org>
[Accessed May 2017].

68. Development, M. o. U., 2013. Land Pooling Policy, New Delhi: The Gazette of India.

69. Development, M. o. U., 2014. Urban and Regional Development, New Delhi: Mott MacDonald.

70. Development, M. o. U., 2015. Smartnet. [Online]
Available at: <https://smartnet.niua.org>
[Accessed March 2017].

71. Government, D., 2006. Delhi Development Authority. [Online]
Available at: https://www.dda.org.in/planning/master_plans.htm
[Accessed February 2017].

72. ILRI, n.d. FAO Corporate Document Repository. [Online]
Available at: <http://www.fao.org/>

73. India, G. o., September 2014. Make in India. [Online]
Available at: <http://www.makeinindia.com/>

74. Irene Celino, S. K., Dec 2013. Smart Cities. EEE Internet Computing, 17(06), pp. 8-11.

75. Mehaffy, M., 2014. CityLab- From the Atlantic. [Online]

Available at: http://www.citylab.com/design/2014/09/5-key-themes-emerging-from-the-new-science-of-cities/380233/?utm_source=SFFB
[Accessed March 2017].

76. Mehta, V. & Kant, A., 2016. [Online]
Available at: <http://www.bloombergquint.com/opinion/2016/10/06/cities-as-engines-of-growth>
[Accessed January 2017].

77. Mohsen Fadaee Nejad, A. S. a. H. H., . Application of smart power grid in developing countries. , , (), p. .

78. Nair, H. V., 2017. India Today. [Online]
Available at: <http://indiatoday.intoday.in/story/private-town-planners-government-urban-building/1/847441.html>
[Accessed 2 January 2017].

79. Nam & Pardo, T., 2011. Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. College Park, MD, s.n.

80. Partners for Livable Communities, 1977. Partners for Livable Communities. [Online]
Available at: <http://www.livable.org/about-us/what-is-livability>
[Accessed 2017].

81. Paulos, B., 2016. Greentech media. [Online]
Available at: <https://www.greentechmedia.com/articles/read/can-india-really-build-100-gigawatts-of-solar>
[Accessed March 2017].

82. Report, F. G. T., 2014. Smart sustainable cities: An analysis of definitions, s.l.: TELECOMMUNICATION Focus Standardization on ITU.

83. Sarkar, D. A., 2017. Smart Cities: A Futuristic Vision. [Online]
Available at: <https://www.smartscities.com>
[Accessed April 2017].

84. Tank, P., 2017. Hierarchy and Types of Plans in India. [Online]
Available at: <http://planningtank.com/planning-techniques/hierarchy-and-types-of-plans-in-india>
[Accessed February 2017].

85. Tank, P., 2017. Land Use Planning in India. [Online]
Available at: <http://planningtank.com/planning-techniques/land-use-planning-in-india>
[Accessed March 2017].

86. Unicef, 2003. Unicef. [Online]
Available at: <http://www.unicef.org/>
[Accessed October 2016].

