Strategies for redevelopment in the context of smart cities Prayagraj

Thesis Submitted in Partial Fulfilment of the requirements
for the award of the degree of

MASTERS IN URBAN & REGIONAL PLANNING

By
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Under The Guidance of
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(Er. Ashish Rana)

Strategies for redevelopment in the context of smart cities Prayagraj

Abstract

As cities around the world increasingly adopt smart technologies to improve urban life, there is a growing need to develop strategies for redeveloping urban areas in the context of these new technologies. This paper explores the current state of knowledge on strategies for redevelopment in the context of smart cities, identifying key research gaps and proposing potential avenues for future research. Drawing on a review of the existing literature, the paper identifies several key challenges associated with redeveloping urban areas in the context of smart cities, including the need to integrate new technologies into existing urban infrastructure, the importance of engaging with local communities, and the need to balance the benefits of smart technologies with potential privacy and security concerns. To address these challenges, the paper proposes several potential strategies for redevelopment in the context of smart cities, including the use of participatory planning processes to engage local communities in the redevelopment process, the adoption of flexible and adaptable urban design principles to accommodate changing technological and social trends, and the development of new models of urban governance to facilitate collaboration and coordination among stakeholders. Overall, the paper highlights the need for further research in this area to develop a more comprehensive understanding of the strategies and approaches that are most effective in redeveloping urban areas in the context of smart cities.

UNDERTAKING

I, Mr. Ashish Rana , the author of the thesis titled "Strategies for redevelopment in the context of smart cities Prayagraj",hereby declare that this is an independent work of mine, carried out towards fulfilment of the requirements for the award of the Masters in Urban & Regional Planning at the Department of Architecture and Planning, BBDU, Lucknow. The work has not been submitted to any other organization / institution for the award of any Degree/Diploma.

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CHAPTER 1
INTRODUCTION

1.1.BACKGROUND

During the past twenty years, strategic planning for urban growth has been oriented towards making cities more sustainable, livable and inclusive, both in a social and a physical sense. Achieving dynamic urban economies, managing urban systems, promoting sustainable urban forms and enabling participatory democracy have been some of the major flagships of urban growth. More recently, however, a series of new challenges in the cities' economies and needs have arisen. The increasing population and urbanization are putting city authorities under great pressure to provide advanced services to an expanding number of people. City administrations now have to solve the wicked problems of how to accommodate an increasing number of citizens and businesses, while allocating their recourses effectively. At the same time, recent advancements in Information and Communication Technologies (ICT) are changing urban life and highlighting innovative ways for improving it. Cities and nations now strive to take advantage of the new ICT landscape to offer innovative services for capital attractiveness and sustainable growth. On top of the previous, the ever existing competition among cities is becoming more intense, as they compete to attract investment, healthy businesses and skilled people on a global scale.

The smart city word is more popular from the last decade, and the urbanization is growing rapidly. The smart city word is to combine information and communication technology to define smart living. A smart city has an infrastructure to provide life quality, a safe and clean environment to its citizens by smart technology. These days' people want to live a smart life. So, the urban planner/ researcher is evolving "smart city models" based on the following six dimensions, "environment," "economy," "people," "governance," "mobility," and "living." This model was developed based on "American" and "European" cities.

The urban area growth is increasing from the last decade, and people desire to stay in a smart city. In the previous 60 years, the metropolitan area expanded from 62 million to 377 million approximately in 1951-2011, the five-time extension of the urban area. India is rapidly increasing towards the urbanization, 30% of increment is shown from the year 2001-2011 from 1951 to 2011. The Globally urban population is more than 50 % and generated nations having 80% of the urban population, this reality validates that India has more urbanization in the

arriving decades. India becomes the market for the smart city project. It assumed that 600 million transaction economies would achieve up to 2030. The smart city concept in India boosted by the prime minister of India, with the announcement to developed 100 smart cities in 2014. The Smart City starts the project for developing the smart city after the declaration of “Make in India” smart city. “Smart Cities Mission”, “Atal Mission for Rejuvenation and Urban Transformation (AMRUT)", this is start for the transformation of cities to become the smart city, the Swachh Bharat Mission (SBM),” is initiative for environment to make clean and green smart city, Sardar Patel Urban Housing Plan (SPUHS), is launched for the housing for all, to decrease the poverty area in the city. “National Heritage City Development and Augmentation Yojana (HRIDAY)” is made for the fast development of the cities. The "Information and Communication innovation" (ICT) is to developed technology about e-governance and smart services for smart cities. The "Information and Communication innovation" (ICT) to improve the gathering of information for the development of the city.

The “smart city model” was proposed by many researchers from the start of 2006. Some popular basic model is given by “Ruddolf Giffinger”. This model is covering the indexing of mid-size European cities based on six basic dimensions of the smart city indicators taken according to the smart European cities.

These new developments have triggered the development of many urban development models aiming to address the challenges of functionality, sustainability, development and competitiveness in a modern, globalized economy. “Smart cities”, “intelligent cities”, “digital cities”, “knowledge cities”, “eco cities” are some of them, to name a few. “Smart Cities” and “Intelligent Cities”1, in specific, represent a conceptual development model that aspires to use ICT for the development of a city’s human, collective, and technological capital to achieve sustainable urban development. The working definition of smart cities for the purposes of this thesis is the following: ‘Smart cities are all urban settlements that make a conscious effort to capitalize on the new ICT landscape in a strategic way, aiming for (i) environmental sustainability, (ii) urban system functionality, (iii) quality of life for all, (iv) knowledge-based development and (v) community-driven development. In this sense, their basic components are the urban setting, ICTs, people and communities and a strategic approach towards one or more of the previous aims. Without one of these components, a city cannot be regarded as a fully-fledged ‘smart’ city. The development of an appropriate smart city strategy stands for a significant socio

- economic value for cities, by soliciting:

- Better management and close monitoring of a city's functions (government, safety, healthcare, energy, transport, education).
- Growth and competitiveness by making urban systems more efficient, helping businesses to develop, attracting investment, creating new jobs, etc.
- Social sustainability and inclusion, by organizing and making accessible vast amounts of knowledge, enhancing connectivity and inclusivity, developing new communication channels, facilitating participatory democracy and user engagement, etc.
- Environmental sustainability, through the reduction of energy consumption, the use of alternative energy recourses and the increase of environmental awareness.

More or less embracing the smart city idea, hundreds of developed urban agglomerations worldwide seek to become "smart", working strategically or intermittently in this direction. Besides, the current socio economic situation renders smart cities and other related strategies even more important for economic development in the urban context. The recent global financial crisis attributes specific importance to tech-driven growth: more than ever before, cities are in need to build urban development strategies which are focused on attracting foreign investment, creating new jobs, streamlining procedures, developing human capital and enhancing social inclusion – all that in a most prudent and effective manner. The vivid interest for tech-driven growth is further sustained by the rapidly expanding global market of smart city solutions and products that are being developed by global technology vendors. In fact, the topic of smart cities attracts interest from a broad range of disciplines, originating from the spheres of academia, industry and government. Nam and Pardo (2011b) distinguish three different contexts in which the notion of smart cities is broadly used: marketing, urban planning and technology. This 'polyphony' of different approaches (economic, social, and technical) has raised many disagreements and incomplete views about what a smart city is. Falconer and Mitchell (2012) describe the situation very concisely: 'Urban experts and academics think about the "why" at great length, while technology companies and consultants focus on the "what." Overall, less time is spent discussing the "how," which ironically is where city leaders need the most assistance'.
Nevertheless, in the specific field of urban planning and development, becoming 'smart' naturally predisposes a strategy or at least some programmatic actions in this direction. However,

despite the general interest in smart cities, strategic planning for the development of smart cities remains largely abstract and undefined. Only a few comprehensive strategies regarding the development of smart cities can be found to have been proposed or applied. This phenomenon can be attributed to several reasons:

- The notion of smart cities is relatively new and unexplored. There are many different views about what a smart city is. There is also a big number of involved stakeholders, who are driven by different interests. The results are diverging and vague arguments about how a city can become 'smart'.
- Smart cities are often seen as a means for creating marketing buzz, rather than achieving real smartness. Consequently, many smart city strategies revolve abstractly around embedding ICT infrastructure in the urban environment, usually in a fragmented, non-methodological and non-strategic way.
- Smart city strategies are oriented to addressing the specific problems of an urban area. What worked for one city, may not work for another. There is no single best way to become a smart city – what is needed, instead, is a toolkit of principles and guidelines that a smart city strategy can use to improve its chances for success; that is, methods to facilitate the development of effective smart cities.

This is exactly the place where this thesis comes in, attempting to provide useful information. This thesis is concerned with how cities can take advantage of smart city strategies to foster urban and economic development. What strategic tools can they use? Which points should be specifically addressed? Which are the most common pitfalls that could arise during the process? Fortunately, with the implementation of numerous smart city programs underway in different parts of the world, the ability to examine them is real, allowing us to compare them in terms of their goals, structure, business models and implementation procedures. This thesis aims to study those smart city programs and reach valuable conclusions. Ultimately, the outcomes of this thesis will provide constructive input on how to strategically develop successful smart cities and serve in comprehending better the steps and decisions towards becoming a smart city.

One the one hand, as described, becoming a smart city is (or should be) included in the development agenda of every innovative city. One the other hand, however, there is great challenge in developing and implementing smart city strategies in an integrated and meaningful way, with so much unstructured and disorienting information available. Based on the previous

observations, the purpose of this PhD thesis is to conduct original scientific research on strategic planning for the development of smart cities, providing comprehensive theoretical and applied guidelines and strategic recommendations about how to become a successful smart city.

1.2.NEED OF THE STUDY

The need for this study arises from the growing importance of smart city development in addressing the challenges of rapid urbanization and population growth. As cities continue to grow and become more complex, there is a need for innovative approaches to urban planning and development that can promote sustainable and efficient use of resources.

Smart city development is seen as a potential solution to these challenges by leveraging digital technologies and data to improve the quality of life for citizens, enhance public services, and promote economic growth. However, there is a lack of consensus on the best practices and strategies for smart city redevelopment, as well as the challenges and limitations that need to be addressed. This study is needed to identify the key factors and strategies that contribute to successful smart city redevelopment, analyze case studies of successful projects, and provide recommendations for effective strategies. The findings of this study can help urban planners, policymakers, and developers in implementing smart city redevelopment programs that can achieve sustainable and efficient urban development. Additionally, the study can provide valuable insights to researchers, scholars, and practitioners interested in the field of smart cities and urban redevelopment.

1.3.AIM AND OBJECTIVE OF THE STUDY

Research Aim: The aim of this research is to explore strategies for redevelopment in the context of smart cities.

Research Objectives:

- To identify the key factors that contributes to successful redevelopment in the context of smart cities.
- To analyze the case study of successful redevelopment projects in smart cities.

- To assess the role of technology in enabling successful redevelopment in smart cities.
- To identify the challenges and limitations of implementing smart city redevelopment strategies.
- To provide recommendations for effective strategies for smart city redevelopment.

1.4.SCOPE OF THE WORK AND LIMITATION

The scope of this research is to explore strategies for redevelopment in the context of smart cities. The research will focus on reviewing existing literature on smart cities and urban redevelopment, identifying key factors that contribute to successful redevelopment, analyzing case studies of successful redevelopment projects in smart cities, assessing the role of technology in enabling successful redevelopment, and identifying challenges and limitations of implementing smart city redevelopment strategies. The research will provide recommendations for effective strategies for smart city redevelopment.

However, it is important to acknowledge the limitations of this research. The scope of this study may not be comprehensive enough to cover all aspects of smart city redevelopment. The research may be limited by the availability and accessibility of relevant data and case studies. Furthermore, the study may be limited by time constraints and the resources available to conduct a thorough analysis. Nonetheless, the research will aim to provide valuable insights into the strategies for redevelopment in the context of smart cities.

1.5.METHODOLOGY

1.5.1. Research Design

The research design for this study will be a mixed-methods approach, incorporating both qualitative and quantitative data collection and analysis techniques. The study will begin with a comprehensive literature review to establish the existing knowledge and theories related to smart city development and urban redevelopment. This will be followed by a case study analysis of successful smart city redevelopment projects. The case studies will be selected based on their relevance to the research objectives and the availability of data.

1.5.2. Population of the study

The population of the study for researching strategies for redevelopment in the context of smart cities would be urban areas that are undergoing or planning to undergo redevelopment projects. This would include cities that are implementing or planning to implement smart city initiatives, which typically include the integration of technology and data into various aspects of urban planning and management.

1.5.3. Sample Size

300 policymakers, urban planners, and other stakeholders involved in the planning and implementation of smart city initiatives.

1.5.4. Sampling Technique

The choice of sampling technique would depend on various factors, including the research design, population characteristics, available resources, and feasibility. Probability sampling is generally considered the gold standard for sampling, but it may not always be feasible or practical for certain studies. The sampling technique used should be appropriate for the research questions and objectives and should ensure that the sample is representative of the population.

1.5.5. Data Collection

The data for this study will be collected through a combination of primary and secondary sources. Primary sources will include interviews with key stakeholders involved in successful smart city redevelopment projects, while secondary sources will include academic literature, government reports, and news articles. The interviewees will be selected based on their expertise and involvement in successful smart city redevelopment projects.

Instrument used for Data collection

- Interviews and Surveys: Interviews and surveys can be conducted with experts in the field of smart city development, urban planning, and redevelopment. The aim is to gather additional insights and perspectives on the challenges, opportunities, and best practices for successful smart city redevelopment.
- Case Study Analysis: Several case studies of successful smart city redevelopment projects will be analyzed to identify the key factors and strategies that contribute to their success. These case studies will be selected based on their relevance to the research objectives and the availability of data.

1.5.6. Data Analysis

The data gathered from the literature review, case study analysis, and interviews will be analyzed using qualitative and quantitative analysis techniques to identify patterns, trends, and key themes. The results of the analysis will be used to develop recommendations for effective strategies for smart city redevelopment.

1.5.7. Ethical Considerations

It is important to consider ethical issues such as informed consent, privacy, and confidentiality when conducting research involving human subjects. These ethical considerations will be addressed and the necessary measures put in place to ensure compliance with ethical standards. Overall, the research methodology will be a combination of qualitative and quantitative approaches to achieve the research objectives and scope.

CHAPTER 2
LITERATURE REVIEW

2.1.INTRODUCTION

This section aims to give an overview of the recent literature on smart city concept and projects. The literature on the smart city is very fragmented addressing different issues from technical to ethical ones. The main perspective to sample the literature has been generally in line with the context of the thesis which aims to look at the smart city from social and urban science perspective in relation to sustainability. I will focus on 5 objective of my study such as:

- To identify the key factors that contributes to successful redevelopment in the context of smart cities.
- To analyze case studies of successful redevelopment projects in smart cities.
- To assess the role of technology in enabling successful redevelopment in smart cities.
- To identify the challenges and limitations of implementing smart city redevelopment strategies.
- To provide recommendations for effective strategies for smart city redevelopment

2.2.PREVIOUS STUDIES

Several concepts were developed from architects, planners, environmentalists in order to create sustainable cities, improve the current urban structure and tackle socio-economic challenges. In the 1960s, Jane Jacobs an American-Canadian journalist was one of the first activists who drew attention with her book The Death and Life of Great American Cities on the negative effects of urban renewal policies that destroy urban communities and create isolated urban spaces. Her book influenced both planning professionals and the general public by focusing on the needs of residents and the social aspects of urban planning (New York Times, 2006; Gehl, 2007; 2013).
Jacobs' book and fresh approach created a solid foundation for new urbanism movements such as "just city," walkable and carless cities which attempt was to design cities for people. The concept of "just city" by Susan Fainstein (2000) argues that urban planners need a normative theory of justice because their motivation to tackle inequality did not produce workable alternatives under pro-growth regimes. Inequality remained in cities mainly due to the imperfection of planning procedures, thus she emphasises the need for involving marginalised social groups by creating democracy, diversity and social justice (Fainstein, 2000; Healey, 2003).

Furthermore, Fainstein (2000) highlights the importance that public investments and regulations should support and produce equitable outcomes rather than make the wealthy wealthier.

These new urbanism movements also strived to improve quality of urban life by re-orienting and rethink urban design towards pedestrians and cyclists which ideas were the most popular in European cities, especially in Scandinavian cities such as Copenhagen, and later from the 2000s in New York and some Australian and New-Zealander cities. For instance, by implementing sustainable concepts in urban planning, Copenhagen transformed from a car-dominated city into a pedestrian- and cyclist-oriented city in less than 30 years (Gehl, 2007; 2013).

Furthermore, various concepts were inspired by biological systems and using biologist and environmentalist terms to understand urban structures as ecosystems. For instance, the urban metabolism concept represented a holistic approach to urban planning by modelling complex urban systems' flows such as water, energy, waste and people etc. (Rotmans et al., 2000).

During the last decade, European cities have implemented "compact city" strategies in their urban development. These strategies focused on effective urban development policies in relation to renewal within the existing urban fabric. These were various densification policies, intensive land use, including the redevelopment of brownfields and other types of underused lands (Van der Waals, 2000; Nefs, 2006). Professionals argue that with densification and intensive land use cities can slow down and control urban spawn, thus cities do not have to occupy more lands for the built environment from the natural environment. Although densification can slow urban sprawl down, research shows that this type of concentration of people and buildings generate more air and noise pollution (Nefs, 2006). Also, building high rise buildings are consequences of densification which often causes alienation and a weak sense of community among residents, therefore it has a negative social and environmental impact (Gospodini, 2002; Nefs, 2006).

The rapid development of technology, particularly information and communications technology (ICT) in the 1990s created a solid foundation for involving new digital solutions and increasing efficiency in tackling urban complexity. Thus monitoring, analyzing and optimising complex urban systems and interacting directly with communities and citizens became more accessible than ever before. The concept of "smart city" and other similar terminologies such as digital city, intelligent city, information city and knowledge-based city emerged and started to appear in urban developments and strategies. The concept of the smart city was introduced already in 1994, and after the appearance of smart city projects which were supported by the European

Union, the number of publications regarding the topic has considerably increased since 2010 (Dameri & Cocchia, 2013). By nowadays, “smart city” became a buzzword and a part of a new trend of sustainable urban development, while this concept is widely used today, there is still not a clear and consistent understanding of its meaning (Caragliu et al., 2011; Chourabi et al., 2012). Researchers, national planning agencies, municipalities and even private companies often use their own fabricated definitions (Dameri & Cocchia, 2013).

According to Cohen (2015), three generations of smart cities are identified. The first generation is driven by large multinational technology companies to adopt their technologies in order to increase efficiency and innovation in cities, therefore it potentially generates economic growth and attracts Richard Florida’s creative class to the city. In this case the public sector does not have sufficient knowledge of the implementable technology, thus basically they implementing the companies’ plans and solutions without questioning them (Cohen, 2015).

The second generation is led by forward-thinking mayors and city officials to use smart city solutions as tools to improve quality of life. Several leading cities have recognised the opportunity for implementing technology to increase the quality of public services for their residents and visitors as well. These cities often use the latest technologies in their smart city projects and supporting the growth of smart city industries by facilitating network and hold specific smart city expos in their cities (Cohen, 2015).

And the third generation started to appear in recent years with a strong focus on collaborative planning and co-creation in smart city initiatives. In this type citizens are important partners in developing projects and active public participation plays a key role by encouraging a bottom-up planning process (Cohen, 2015).

Several European cities such as Amsterdam, Vienna, Barcelona, Stockholm, Copenhagen and Manchester are considered as leaders and role models for implementing the concept of smart city in their cities. Although the majority of smart city initiatives are implemented and get attention in highly developed countries and regions (e.g. EU, USA, South Korea, Japan etc.), large and developing economies such as China, India, Brazil with rapid urbanisation are also focusing on integrating the concept of smart city in their urban strategies and policies, therefore they have started to become an attractive market for investors (Cohen, 2015). The implemented smart city initiatives have various characteristics by each city or country. Several cities implement smart city projects in one specific district and concentrating on smart city solutions by creating high-

quality housing, these are for instance in Hafencity (Hamburg), Nordhavn (Copenhagen), Hackbridge (London), Hammerby Sjöstad (Stockholm), Oulu Arctic City (Oulu, Finland) and also Hyllie in Malmö while the others are promoting e-governance which is the application of ICT for delivering public services and exchange of information between the public sector and citizens. The City of Amsterdam created, for instance, an online platform for public participation and co-creation in order to develop a better city for their residents (Cohen, 2015; Trivellato, 2016). The City of Barcelona established a wide collaboration with private sector and research institutes within the scope of Barcelona's smart city strategy. Thus, the strength of Barcelona's smart city strategy relied on its comprehensive approach which based on a clear governance model to support the smart city strategy which also resulted in better and more efficient coordination of the different internal and external stakeholders (Ferrer, 2018).

Knowledge-sharing and cooperation are fundamental in smart city projects due to its complexity, therefore the distribution of tasks between different actors and stakeholders is essential. Neither local authorities, urban planners nor private companies able to run smart city projects on their own, so they have to bring new ways of partnership to get complex and multidisciplinary smart city projects workable. Public-private partnership (PPP) is often the framework between them which is, in general, a long-term cooperative arrangement between one or more public and private actors (Klijn & Teisman, 2002). Although public authorities and municipalities have the policy-making powers and access to wide range of data, they do not have the financial resources and knowledge to execute a smart city project, especially when the latest technologies are implemented there, thus experienced private companies with the knowhow are involved (Klijn & Teisman, 2002; Anthopoulos et al., 2016). However, this process can question the credibility and independence of the public decision- and policy-makers in general due to the large transnational companies' financial and influential power (Buck & While, 2017). In addition to this, national and local governments often lack sufficient expertise to bid effectively, let and negotiate contracts, and the legal instruments to enforce the contracts of those projects (Buck & While, 2017).

Since the newer technologies for implementing digital solutions in cities are getting more affordable and available, the need for integrating the concept of the smart city in urban strategies and policies became relevant and urgent (Trivellato, 2016). In fact, numerous cities are struggling with the interrelated phenomenon, and urban planners are responsible for dealing with

and tackling them. This indicates the key role of urban planning in relation to the smart city concept, especially by considering the recent critiques against the smart city concept that challenge the sustainability of the smart city concept. The representatives of the smart city concept often claim that it is a solution to manage complex environmental and socio-economic challenges, however, many critiques have emerged in need of redefining smart city model and initiatives as it might neglect the complexity of a city, especially the social aspects.

Many of the concepts mentioned above have become integrated parts of urban policies and sustainable urban strategies. The concept of the smart city, such as other concepts, was created recently as a solution to solve urban complexity and improve the quality of urban life, and assisting sustainable urban development. However, the current application and understanding of smart city concept have faced intense criticism from different perspectives, raising this question if this concept is as beneficial as it is advocated by developers or not.

There has been a growing body of literature which criticising the smart cities in recent years, especially from urban scholars, suggesting in general that there is taken insufficient account of social and political consideration in envisioning smart cities (Cowley et al., 2018). In fact, although the smart city is expected to lead society towards sustainability and is meant to improve quality of life (Sujata et al., 2016), there are some controversies over its contribution toward sustainable development, communities, and people. The main concerns relate to its possible destructiveness end to the societal aspect which might be overlooked by the current interest of leading cities to implement some certain smart policies and projects

Four main schools of thought among literature in relation to smart cities are recognized by Kummithaa and Crutzen (2017), namely restrictive, reflective rationalistic, or pragmatic, and Critical school of thought. Through these categories, they aimed to show that the critical debates within the literature have attracted attention dramatically since 2014, however, the first type of critiques had started among the second school of thought.

At the beginning, the debates were some reflections on smart cities, taken a positive stance and claimed that these technologies would enhance the humane capacities, economic prosperity, and ecological integrity, though they expressed concern about the dominant role of private markets or some speculative “risky and arcane” conditions under which municipalities have to invest massively in private-oriented smart products as infrastructure (Kummithaa & Crutzen, 2017).

This is because most of smart cities activities are associated with large private companies like

IBM, Cisco, and Siemens, etc. as the main promoters (Vanolo, 2016; Grossi & Pianezzi, 2017; Martin et al., 2018) while city is a complex socio-economic phenomenon so there is a concern about overlooking this complexity and taking the city as an implicit phenomenon by private corporates (Greenfield, 2013), especially regarding social challenges. The sensitivity of this issue becomes more considerable if we remember that many urban and social policies developed by planners and public sectors have failed to solve or anticipate the interrelated problems in some cases, if we, for example, observe the process of gentrification and segregation in urban planning (Batty, 2014).

In this sense, there is a concern about taking control by the private sector which seeks mainly profit and competitiveness, not the public concerns in the condition that studies claim the competitiveness and social cohesion cannot be convergent (Monfaredzadeh & Berardi, 2015; Trivellato, 2016).

The dichotomy between sustainability and competitiveness or entrepreneurialism has been a highlymentioned concept in smart city debates in order to show that the former has been sacrificed for the latter. This debate tries to remark that these two dichotomies might not have much in common (Monfaredzadeh & Berardi, 2015; Grossi & Pianezzi, 2017) or elaborating that technocratic and entrepreneurial approach to urban development not rooted in the substantial requirements for urban transformation (Haarstad, 2016). Experiences in many cities have shown this scarification. For example, City of Austin has attempted to merge the entrepreneurial agenda with the sustainability agenda, but in practice, it used the latter just as a selling point to facilitate the former (Mihailova, 2017).

Since the contribution of literature, which was dominantly technology-oriented, could not justify the benefits of the smart city over its possible negative implication, the discursive tried emphasising on prioritising people over the technology such as engaging people and other stakeholders in planning or focusing on innovation. By doing so, they drew attention to humanistic elements over technology (Eger, 2003 and argued that smart cities would need to focus on people and their capabilities more than just concentrating around ICTs or technology (Kummithaa & Crutzen, 2017).

The final and the recent school of thought, by Kummithaa and Crutzen (2017), which was recognised as the Critical school of thought aims to “encapsulates the growing dissatisfaction around the very concept of the smart city and its practice.

The critiques go even further to tackle the softer social issues which is difficult to measure such as happiness: if people in this very smart city have necessarily happy life, good relationship, and sense of community? Do they really enjoy and perceive their life as good standard (Hollands, 2015)? In some projects, smart initiatives could positively contribute to improving healthcare service like smart housing for elderly or patients. Yet, even in those projects, the challenges remain such as potential over-reliance on automation, the "medicalization" of the home environment, privacy and security, informed consent, plugging issues, and psychological aspect (Demiris & Hensel, 2009).

In these debates, the central concern are toward citizens and their communities who might be the final loser of this game due to the threat of losing social inclusion, their right to the city, and being burdened more with the economic and social implications which will happen by privatisation of urban space (Beretta, 2018). In fact, although the smart city concept and those who advocate it are claiming 'smart city is for people,' critics argue that it is not much clear that what exactly people means, to what extent, and in which ways it can help them (Haarstad, 2016). Cowley et al., (2018) by looking at public perception towards smart projects aimed to show that the magnitude of current dystopian speculative to smart city in the literature is not near to reality, but finally they could not deny that there is a dominance of 'entrepreneurial' and 'service user' modes of smart city than the real social perspective towards citizens.

Vanolo (2016) who analysed the role and place of citizens in envisioning the smart city concludes that "all imaginaries in smart city concept speak about the citizens of the smart city and speak in the name of them, but very little is known about citizen's real desires and aspiration (Vanolo, 2016, P.36)." He mentions that the citizens' voice is absent in many envisioning smart city and where they are considered as an active citizen they are discounted as an urban sensor. So, he raises concern about the future of citizens, as political subjective with the right to speech or privacy being with responsibilities, in the smart city in which they might be subjected by technologies that will hamper their freedom.

All the given challenges implying the threat for social justice in general (Mihailova, 2017; Beretta, 2018) because the studies showed and argued that for example, digital innovations have potential to disempower and marginalize citizen and the benefits of these innovations will not be distributed evenly (Martin et al., 2018). Generally, critics are calling that there is a need for re-thinking about our life in a "very technologically driven, corporately controlled, heavily

marketed, even environmentally sound smart (Hollands, 2015, P.73)", and ask the smart city about its contribution toward social and political aspect of development (Kummithaa & Crutzen, 2017; Han &Hawken, 2018).

The technical perspective in the smart city is also seen in tension with the real demands of society (Angelidou, 2015). The domination of technology in practicing current smart city is mentioned as a force in smart city concept.

Smartness is right now identified with innovation hinged on the technology, precisely those technologies that the economic actors involved in the process of providing public goods are able to provide (Grossi & Pianezzi, 2017). It is projected that the annual spending on the smart city projects will be $16 billion by 2020 (Angelidou, 2015) or by another estimation, the global smart city technology market will worth more than $27.5 billion by 2023 (Grossi & Pianezzi, 2017). And, with the help of the technology advancement, an increasing number of technology vendors and consultancies are looking for a niche in smart city product market (Angelidou, 2015) and the benefit that they can obtain out of that, based on the given figures, is huge (Grossi & Pianezzi, 2017).

This technology push, which implies continual releasing new products into the market due to the rapid advancement of technology, is based on supply without considering the expressed need of society. Therefore, it is seen in tension with the demand pull, referring to the solutions and products which is developed and commercialised based on the scientific research in response to the demand on the side of society (Angelidou, 2015; Buck & While, 2017). In studies, it is mentioned that there are asymmetries in the supply-and-demand side of the smart city so that the current smart city projects are more supply driven (Angelidou, 2015; Buck & While, 2017)

All these increasing critiques can be related to the insufficient consideration of social dimension which is overlooked on the expense of understanding more technical aspects of smart cities to the benefit of environmental practices (Monfaredzadeh & Krueger, 2015). However, many critics argued that primary objectives of the smart city like economic growth or energy efficiency, which are still defined in a consumerist culture, not only could not promote social equity, also cannot protect the environment alone (Martin et al., 2018).

So, among all, one of the most recognisable critiques is about the unsustainability of the smart city. Many scholars are questioning if smart city is sustainable or recall it as unsustainable (Yigitcanlar & Teriman, 2014; Haarstad, 2016; Beretta, 2018; Cugurullo, 2018; Yigitcanlar &

Kamruzzaman, 2018) not because of possible breakage of three main pillars of sustainability and lack of social consideration, but even based on sustainability criteria even in environmental goals which is the dominant aspect of current smart city (Yigitcanlar & Teriman, 2014; Cugurullo, 2018). Colding et al., (2018) by an extensive review of Smart City discourses concluded that there is a lack of clear sustainability contribution within the smart city concept. Moreover, some scholars by conducting empirical study proved this claim, showing this is not only based on the theoretical and political analyses e.g. economic growth and neoliberal ideology (Buck, 2017; Grossi & Pianezzi, 2017; Martin et al., 2018), citizen right (Vanolo, 2016), urban future (Angelidou, 2015), entrepreneurial competitive urbanism (Buck, 2017), etc.

For instance, Yigitcanlar and Teriman, (2014) showed that smart project could not necessarily succeed in CO2 emission, adding that smart city lack sustainability contribution. Cugurullo (2016, 2018) also showed the same shortcoming in eco-city which was disconnected from the natural environment and insensitive to the rest of the built environment in one case (2018) or just was a means of preserving some specific economic and political targets -seeking economic growth to preserve political institution ruling classes (2016).

So, several scholars are recommending further investigation and research on sustainability in smart city or even re-defining the smart city concept and model (Haarstad, 2016; Ahvenniemi et al., 2017; Bibri & Krogstie, 2017; Colding & Barthel, 2017; Ibrahim et al., 2017; Trindade et al., 2017; Macke et al., 2018; Yigitcanlar & Kamruzzaman 2018).

It should be mentioned that this critiques towards sustainability of smart city are in the condition that smart city concept and projects are branded as a sustainable city or utopia by its main advocates (Grossi & Pianezzi, 2017), became a buzzword even, in some cases, as a replacement for ‘sustainable.’

Our literature review showed that as much as the call for re-thinking about the smart city is emerging, there is still no specific and holistic framework and common definition which based on that contribution of the smart city in social sustainability can be mapped. Almost all articles mention to this fact that the smart city does not have a common and agreed definition (Hara et al., 2016; Vanolo, 2016; Grossi & Pianezzi, 2017) as well as a strategic vision to design long-term strategies (Hara et al., 2016).

Explanation of Valono (2016) might shed light on this dominant trend by the private sector or technical perspective which mentioned among critiques. He elaborates that the smart city

concept did not have a theoretical foundation and defined mainly by companies like IBM and Cisco. He explains that the (valid) process for conceptualising smart city cannot track back as a theoretical concept.

In another study by Mora et al. (2017) it is indicated that "the knowledge necessary to understand the process of building the effective smart city in the real world has not yet been produced nor have the tools for supporting the actors involved in this activity (Mora et al., 2017, P.20)." He concludes that there is a lack of intellectual exchange among those conducting research and isolation from each other, the disconnection which can also be seen between communities lives and the knowledge of the smart city. This point is mentioned in another way by Pierce et al. (2017) who believes the smart city is pluralistic and incoherent social organism with blurred boundaries and conflicting logic and extremely complex challenges. In this sense, Mora et al. (2017) believe that this trend can put future development of this new but divided area of research at risk.

2.3.CURRENT PERCEPTION ABOUT 'SMART CITY'

The European Parliament stressed that massive urbanization requires new and inventive approaches to deal with the multifaceted nature of urban living; requesting better approaches to target issues of congestion, energy consumption, asset administration, and ecological security. It is in these settings that Smart Cities rise not just as an innovative way of doing things for future urban living but also as a key technique to handle scarcity and inequality, unemployment and energy administration (European Parliament, 2014).

The idea of the smart city has been initiated to highlight the significance of Information and Communication Technologies (ICTs) over the last 20 years. It focuses on a city's capacity to react as promptly as possible to the requirements of residents. Quality of life and city growth are significantly affected by the principal frameworks of a city: transport, government services and education, environment, public safety and wellbeing (Schaffers, 2011). Caragliu discussed that for a smart city to operate efficiently it is very important for its occupants to be informed and educated. Later, educated residents along with intelligent frameworks can influence the path in which the data is received, utilized, comprehend and learned by clients. If the inhabitants are educated, they will be discerning enough to work for city improvement and be able to perceive the limits of natural resources. An intelligent educational framework depends on three components: interconnection asset sharing innovation training, instrumentation (aggregation of

fundamental information) and intelligence (taking decisions that improve the learning procedure) (Caragliu, 2009; Schaffers et.al, 2011).

Schaffers observed the nations that executed the smart city concept around the world, and identified three steps in which the same could be smoothly implemented elsewhere-

- The first step for the smart city relies upon the physical media network infrastructure, incorporating the wiring, the wireless, together with any servers and routers must for operating the framework.
- The second step is concerned with applications that empower operations in the city, like traffic control, live video footages etc. Such applications will be provided by various sellers, using the given infrastructure.
- The third step depends on the availability of ubiquitous network connectivity for one and all (Schafferset.al, 2011; Viaenea, 2016).

Despite the fact that the term ‘smart city’ has come to light since 1998 (Van Bastelaer 1998), it is confounding how its importance and setting remain unclear even today. Its definition ranges from urban living labs to the 'smart impression' of a city, which is measured with various parameters, for example, the level of education of its residents, the innovative soul of its enterprises, and so forth. The term is still advancing to include ecourban communities. Their concept is also similar to existing or older ones like digital city, the eco-city, the wireless city, intelligent city etc. (Anthopoulos and Fitsilis, 2013; Giffinger et al. 2007; Castells, 1989; Mahizhnan 1999).

Even today, numerous contemporary government authorities see smart cities merely as systems of sensors spread over the city, joined to servers overseeing unlimited streams of information, improving city’s way of dealing with issues like traffic, waste, crime and money, which is part of the self-administration model of the smart city. Scholars and business community slowly realized that this concept goes beyond the ICT revolution. Therefore, it has attracted worldwide attention of global associations, namely the European Union and huge merchants from the ICT business (i.e., CISCO, IBM Institute for Business Value); the gadgets (i.e., Hitachi); and the development enterprises (i.e., Storm, POSCO, and HGC Group). These institutions are keen to create products and to use this developing business sector (Kresin, 2013).

With the announcement of ‘Smart City Mission’ in 2015 in India, strong guidelines were issued by the government to help the chosen cities in reaching their goal of becoming a smart city. The

execution of this Mission at the City level will be finished by a Special Purpose Vehicle (SPV) made for the same reason. The SPV will plan, appraise, approve, release funds, implement, manage, operate, monitor and evaluate the Smart City advancement ventures. Each smart city will have an SPV with a full time CEO (City Executive Officer) and candidates of Central Government, State Government and ULB on its Board. The States/ULBs must guarantee that, (a) a committed and considerable income stream is made accessible to the SPV in order to make it self- sustainable (b) Government commitment for Smart City is utilized just to make infrastructure that has public benefit outcomes. The execution of tasks might be done through joint partnerships, subsidiaries, public-private partnership (PPP), turnkey contracts, and so on reasonably merged with revenue sources. The SPV will be a limited organization under the Companies Act, 2013 at the city-level, in which the State/UT and the ULB will be the sponsors having 50:50 value shareholdings. The private sector or monetary organizations could be considered for taking equity stake in the SPV, given the shareholding example of 50:50 of the State/UT and the ULB is maintained and the State/UT and the ULB together have larger shareholding and control of the SPV (Smart City Mission, 2015).

As stated by European Parliament, every one of the undertakings have a blend of members drawn from (local) government, business industry and civil society, however the degree and nature of cooperation fluctuates, as do the contributions of the members. Municipal governments and the local neighbourhoods majorly need extra development skill, technical access and support and subsidizing. These undertakings along these lines commonly include close associations with external partners from the business and research groups (financial institutions, programming and application designers, technology providers and colleges). Furthermore, the private entities should give services to the people, with local government working as an intermediary. The small-scale infrastructure initiatives, while comparable in scale and geographic extension, are highly mechanically orientated, capital-intensive and commercially significant. Local inhabitants are passively involved and for the most part do not affect its execution. Private sector stakeholders give mechanical and service support. ‘Smart meter' or ‘Smart grid’ ventures are introduced to enhance the proficiency of power distribution. Different projects utilize similar advances to other utilities (e.g. gas, water)and ways to deal with distribution and take-up of alternative energy sources (by and large renewable) (European Parliament, 2014).

Jones found that in an increasingly urbanized world, it will be crucial to ensure that public

services in urban areas deliver for poor people as well as the wider population, and it is now well known that governance factors are important in constraining or enabling effective service delivery (Jones, 2014). The main challenge for urban communities is to gather assets and improve their citizen's standard of life. Smart cities confront this test with extreme utilization of innovative data advancements to move urban administration toward a citizen centric exercise and encourage citizen–infrastructure corporations (King and Coterill, 2007; Belanchea, 2015; Junget.al., 2015). Past research confirmed that the success of these activities emphatically relies upon accomplishing a minimum amount of consistent users, to ensure the productivity and manageability of local services in the long term. In order for this to happen, individuals ought to know enough about such services and about regular changes occurring in it (e.g., Neirotti et.al., 2014). A contextual investigation of the Summer Olympics of 2000 asserted the same point. Sadly, earlier writings on urban services administration for the most part concentrated on performance measures, giving less consideration to the inspirations of nations to utilize these services and the related benefits for the city's welfare (Mulley and Moutou, 2015; James, 2009). Angelidou observed that city technological advancements make technical and managerial complications. For instance, obsolete frameworks and incompatible data frameworks entangle the execution of citizen-centric smart plans and escalate operation costs. In a conceptual study embraced by him, he demonstrated that to achieve effectiveness and supportability, local officials require small-scale smart city test cases programs that empower them to finish both long and short term objectives. Past research recommends that consolidating hard and soft infrastructures and making a stage to coordinate urban services can collect closer information- and transaction-oriented arranged associations with residents in a genuine setting (Angelidou, 2014; King and Coterill, 2007)

Earlier literature likewise has stated that the productivity of urban services delivery enhances when local governments have improved understanding of peoples' preferences and necessities (Cuadrado-Ballesteros, 2013). On examining Smart Cities, the World Bank observed two common characteristics: i. A technology-intensive city, with sensors all over the place and very productive public services, because of data that is accumulated continuously by a large number of interconnected gadgets. ii. A city that develops a superior connection amongst nationals and governments which is made possible due to accessible technology. They depend on input from residents to help enhance service delivery, and make mechanisms to assemble this data. They

said that both these methodologies are fundamentally not unrelated, and that they can be embraced by urban areas in creating nations to enhance the delivery of public services (The World Bank, 2015). According to Bolivar, the governments are yet disregarding two noteworthy issues, which could end up being colossal deterrents in the way to smart cities' prosperity. Firstly, the public agents are just accepting enormous quantities of massive information on regular routine yet managing it in the old traditional method of organization: bureaucracy. Moreover, these operators and political pioneers need innovative abilities to benefit from smart city activities and in this way may come up short of real outcomes (Bolivar, 2015).

A noticeable case of a smart city made by Bakici and others can be found in Barcelona, a city that tries to be "a Smart City model for the World", which emphasizes that the process of becoming a smart city is a long and continuous process as exhibited by the fact that Barcelona has been pursuing the smart city ambition since the 1990s and could accomplish it only recently. They discuss local engagement and coordinated effort amongst divisions, and the mix of new public products and services in the social and financial projects of the city. They point out that Barcelona, has made mediator associations to encourage crossdepartmental cooperation as a major aspect of the process, (Bakici, 2013; M. Gasco, 2016).

A study undertaken by Organization for Economic Co-operation and Development and Bilbao, 2012, expressed that to make individuals comfortable with different ICT intercessions, numerous steps should be taken. For instance, students in secondary school and junior school ought to be presented and acclimatized with different online entries, selections, feedbacks and grievances instruments, advancing activities recommended by nationals themselves-in this way reassuring and retaining talent, taking the assistance of NGOs to cover urban poor and illiterate people and so forth (OECD, 2016). Barcelona is the first city in the Spanish State coined a 'Smart City' and is named the fifth overall in Europe in 2013 ahead of Paris, Stockholm, and London. Making a wise investment in direction of improving green living spaces, Barcelona introduced 'smart parking spaces'. Usually a lot of traffic in city centre areas is caused by drivers looking for parking spaces which lead to increased congestion, noise and pollution in areas where citizens live and work. By utilising display panels and by embedding sensors in free parking spaces, alongside apps that allow the information to be received and payment to be managed, the Catalonian capitol has managed to reduce wasted time, facilitate fluid traffic flow through the city and reduce the petrol use, a benefit to the environment. Drivers can get real-time information

on their smart phone to best locate a free parking space using ApparkB so they donot have to go in circles. These street sensors help motorists find parking, but they also provide data about parking patterns, helping officials improve management of urban mobility (Ancheta, 2014). Sweden with its efficient waste management is another example of smart operations. Less than 1% of Sweden's rubbish goes to landfill. The Swedes integrated recycling as part of their everyday lives and that which cannot be recycled is sent to incineration plants. Their waste management system sees 50% of the country's annual 4.4 million tonnes of rubbish recycled and 50% of that rubbish is devoted to energy recovery at incineration plants. The heat from the incineration plants is used to power Swedish homes. For example, in Helsingborg, 40% of homes are heated via this recovered energy. This recovered energy is attached with the plants operating at only half capacity, creating an unusual market: the UK has begun to impose heavier taxes on landfill sites, leading to an agreement to export rubbish to Sweden. Sweden largely sidesteps this problem by using an advanced, lowemission process in its WTE systems. That greatly reduces airborne pollutants. The Swedish institute reports that heavy metal emissions from plants have been reduced by 99% since 1985, even though Sweden emits three times more waste today (Cooley, 2014). Similarly, a study directed by International Business Machines Corporation (IBM) and Cisco at Amsterdam reasoned that a ton of progress can be made by basically making individuals mindful of their utilization patterns and they will make essential modifications. This was realized through smart city changes like smart meters, energy displays, smart plugs and smart lighting etc., which helped in diminishing CO2 releases by 18% (by saving energy and also by switching to green energy) (Government of Amsterdam, 2013).

Smart city initiatives usually shape an ungraceful arrangement of tasks that are associated with the term smart city since that label gives budget and prominence. To get past this stage, the city organization needs to introduce formal and informal systems to support and facilitate smart city ventures. Viaenea confirmed that business-IT arrangement is a central administration issue that is particularly applicable for smart city tactics with a solid digital presence. Numerous urban communities do not have a flawless IT or digital strategy, concerning settling on decisions for a digital schema. The smart city is as much about social change as it is about embracing innovation, planning procedures, and outlining structures. In the end, smart city undertakings ought to discover their way to the production environment of the city, its front and back office service offices where they can truly have any kind of effect on the city, its people, and its

stakeholders (Viaenea, 2016). Till now, we have not seen many studies trying to measure the existing level of awareness in citizens about the concept of smart city and steps in order to increase it. Many of them take it for granted that as people are exposed to internet most of the time, therefore they will figure out ways to use it productively to register complaints, feedbacks, booking tickets, filing tax refunds etc.

The research here tries to underline the fact even though majority of the respondents were from the youth demographic (well-educated and regular smart phone users) they did not have a deep understanding about the concept beyond its one aspect: digitalization and technological intervention to a possible extend. According to Holden, one of a city's most fundamental infrastructures is its water framework; therefore we can no longer ignore the problems surrounding it. The world faces grand challenges for water as population continues to grow, as climate change alters the global and local water cycles. There are also major questions to be answered like how are we going to supply or make water all the time in a sustainable manner, while at the same time conserving delicate ecosystems from disasters. And simply merging our current governing style with latest technology will not get us out of this fast approaching endless pit (Holden, 2014). As noted by Hashim in his study, shortage of water assets in the long run can prove to have a non-manageable negative effect on the improvement of a city and on the lives of its occupants (Hashim et al., 2013). Sreekumar discussed in her study that a smart water framework is intended to assemble significant and noteworthy information about the flow, pressure and distribution of a city's water. Consequently, it is important that the utilization and projections of water usage is precise. A city's water distribution and administration framework must be sound and suitable for long run to keep up with its development and should be prepared with the ability to be monitored and well-coordinated with other basic frameworks to acquire more modern and granular data on how they are performing and influencing each other (Sreekumar, 2017). Samudranil stated in one of his papers that in India on one hand there is an intense shortage of water and on the other, the lanes are frequently overwhelmed amid the monsoons, reflecting administrative wastefulness of the urban local units to utilize the surplus water of the season to defeat the insufficiency in different seasons. Being a third world country, India can never escape from water issues unscathed. It has many a times encountered genuine and severe water emergency in the previous decades i.e. in 1982, 1987, 2002 and 2009 (Samudranil, 2013).

Along with solving all these problems, Rain Water Harvesting (RWH) can highly reduce the chances of clogging of water on streets and prevent spill over of water from roofs and ending in drains. Thus, this paper focuses on rainwater harvesting and water reuse to lessen the reliance on ground water. Due to many conceivable vulnerabilities of ground water in future, a family unit or society based reusing framework should be promoted to make effective utilization of water (Sreekumar, 2017). Droege discussed that the advancement of distributed water frameworks plans to accomplish a move from centralized systems to small-scale and neighbourhood based ones in urban areas. It can empower a city to decrease its ecological footprint, since water can be effectively provided utilizing the advantages of electronic control frameworks and community-oriented utility administration. The appropriated water framework approach is regularly called 'water sensitive urban design'. It incorporates utilizing the entire water cycle, that is, utilizing precipitation and local water sources like groundwater to bolster into the framework and afterward to reuse 'grey' and 'black' water locally and territorially, consequently guaranteeing critical reductions in water utilized (Droege, 2006). O'Mara in her study emphasized that a city's water distribution and administration framework must be sound and practical in the long haul to keep up its development and that it ought to be prepared with the ability to be monitored and coordinated with other basic frameworks to get more accurate and granular data on how they are performing and influencing each other. Efficiencies increase when divisions share important and noteworthy data.

Fusing brilliant water advancements permits water suppliers to limit non-income water (NRW) by discovering spills rapidly and even carefully utilizing on-going supervisory control and information securing or SCADA information and contrasting with model system re-enactments. Decreasing NRW additionally permits regions to recoup costs brought about in treatment and pumping (O'Mara, 2016). As stated by WHO, 85% of India's urban populace has access to drinking water. However, just 20% of that water meets the wellbeing and security benchmarks. Besides, there are grave inequities in the circulation of water (WHO, 2014). India's precipitation is temporal (with as much as 70% of precipitation happening in four months) and likewise an uneven disperse of downpour can be observed. Not enough pressure is put by the government on huge industrialists to hold fast to effluent treatment standards. While contamination is an issue, a similarly vital issue is to keep the groundwater levels from declining further (Hashim et al., 2013). The chosen components of this study: reuse of water and rainwater harvesting come to

our rescue, as shortage of water assets in the long run can prove to have a non-manageable negative impact on the improvement of a city and on the lives of the occupants. Kallis points out that the construction of large and sophisticated infrastructures such as dams or water transfers has been the main strategy followed to meet the growing water demand of urban agglomerations and irrigated agriculture. Opposition to these types of megaprojects, however, is growing, since these expensive infrastructures produce severe damages on aquatic ecosystems and local populations (Kallis and Cocossis, 2003; Mc Cully, 1996; World Commission on Dams, 2000). One viable method for battling water scarcity is to reuse the wastewater generated at the family unit level. There are two kinds of wastewater produced at family unit level: grey water and black water. As defined by Aquacell, grey water is characterized as wastewater from restrooms and laundries; greywater can originate from our showers, bowls and clothes washers. It might be contaminated with a range of dissolvable and insoluble substances, for example, cleansers, skin, salivation, dirt and lint. Each kind of contaminant, regardless of whether it is cleanser/surfactant, natural, microbial or particulate, must be dealt with fittingly. Also, black water is any wastewater that is polluted with water released from a toilet. Contrasted with greywater reusing, it is regularly more effective to reuse black water as most pipe frameworks do not separate greywater streams from black water ones e.g. showers, basins (Aquacell reusing, 2016).

Allen found in her study that a precarious aspect for wastewater reuse is that the quality of wastewater must be fitting for its reuse. There are various sorts of wastewater produced at the family unit level that have altogether different levels of contaminants (i.e. supplements, pathogens) and reuse potential, including rainwater, greywater (all family wastewater aside from toilet flushing water), urine, blackwater, and faeces. Isolating these surges of wastewater lessens the measure of wastewater defiled by pathogens by keeping it from coming into contact with less tainted water (i.e. greywater, rainwater), in this manner permitting greywater and rainwater to be utilized for a more extensive purposes. Especially in Third world nations where wastewater frameworks are inadequate, actualizing source partition of grey and blackwater is key to creating economical frameworks that will profit clients over the long haul. Sewage effluents contain high chemical loads and, as such, reclaimed water is, at origin, the most contaminated of the non-conventional sources studied. However, advanced treatments such as MBR processes reduce health risks to acceptable levels. Domestic grey water is less likely to contain hazardous compounds but simple treatment and control processes may lead to relatively lower health risks.

Similarly, in rooftop rainwater run-off faecal and chemical contamination is a priori low and therefore, if adequate maintenance practices are followed health risks remain relatively low (Allen, 2010; Pain, 2012). Domenech and Sauri, in a study, conducted a survey among 120 households of Sant Cugat del Valles, Barcelona to check public acceptability of grey water reuse. The households interviewed used treated grey water to flush their toilets. It had been asked from the respondents to make a hypothetical choice: whether they would prefer to use grey water or reclaimed water to flush their toilets. Both alternatives registered a high number of supporters. The preference over decentralised models is attributed to the higher sense of control associated with on-site treatment technologies like reverse osmosis, Membrane Bioreactor (MBR), filtration, disinfection and the end use of water (drinking, toilet flushing, landscape irrigation, etc.) (Domenech and Sauri, 2010). Chougule in his study mentions treatment options of greywater i.e. Anaerobic Baffled Reactor and Anaerobic Filter. These can also be used to treat blackwater. There are also other methods like MBR which is a small-scale version of a municipal sewage plant. It uses use micro- and ultra-filtration membranes to filter water more effectively and rapidly.

Although soak pit is a low cost option, it tends to have a negative effect on ground water (Chougule, 2013; Ecoideaz, 2016). Allen in her research discusses the advantages of wastewater recovery and re-use enjoyed by most States in the United States. For instance, in Irvine Ranch Water District (IRWD), Irvine, re-claimed water now makes up 20% of IRWD's aggregate water supply, decreasing the need to import water and keeping water rates low. A separate distribution framework that incorporates more than 394 km of pipeline and 12 pumping stations is used to convey the recycled water (Allen, 2010). Numerous water resources, for example, fountains and the lake at Mason Park are loaded with recycled water. Recycled water as of now being used for latrine flushing as a part of IRWD's offices and in a few skyscraper office structures built with double plumbing frameworks. Consumable or drinking water requests in these structures have dropped by much as 75%. There are four essential uses for recycled water inside IRWD- (i) Landscape watering system – parks, greens, school playfields, athletic fields, and numerous regular regions kept up by mortgage holder affiliations. (ii) Agricultural watering system – recycled water is being used to irrigate croplands. The District gives recycled water to 44 farmers, nourishing more than 405 ha (hectares) of yields. (iii) Industrial uses – a few ventures use re-guaranteed water in their creation forms. One carpet mill factory changed over its rug

colouring process from household to recycled water. This one transformation alone increased the conservation of drinking water from 1892 m3/d to 3785 m3/d (metric per day). (iv)Toilet flushing – recycled water is being used to flush toilets in a couple of double plumbed skyscraper and other business structures. In a commonplace office setting, around 80% of the water is being used for latrine flushing (Chang, 2015). Environment Agency mentions in a report that with numerous groups drawing closer to the limits of their accessible water supplies, wastewater recovery and reuse has turned into an appealing choice for conserving and amplifying accessible water supply by potentially (i) substituting recovered wastewater for applications that do not require drinking water, (ii) giving an optional source of supply to help with meeting both present and future water needs, (iii) and securing aquatic biological systems by diminishing the redirection of freshwater, decreasing the amount of supplements and other harmful contaminants entering water-ways (Environment Agency, 2011).

Holden pointed out in his book that while wastewater recovery and reuse is a sustainable approach and can be financially perceptive in the long run, the extra treatment of wastewater past optional treatment for reuse and the establishment of recycled water dispersion frameworks can be expensive when compared to imported water. With regards to coordinated water assets administration of the district, government subsidies or sponsorships might be required to implement wastewater reuse. Unfortunately, institutional boundaries, and differing government and office priorities, make it hard to actualize water reuse ventures some cases. He also emphasized that general society's awareness of sustainable water assets administration is vital. In this way, planning needs to advance through a community value based decision-making model: including all partners from the beginning in water reuse operations and guaranteeing multi-partner platforms to encourage discourse, participatory innovation improvement, innovation uptake and social learning (Holden, 2014). Yi and other authors emphasized that India is still in a nascent phase of wastewater recovery and reuse, and there are numerous critical difficulties (listed below) to extend wastewater reuse and make it functional and maintainable at the local levels. a) Slow pace in embracing urban wastewater reuse programs- Broadly, wastewater reuse in urban areas expanded with the expanding of wastewater release, yet the measure of utilization was still low. Around 71% of waste water in Class I urban communities and 96% in Class II urban communities stay untreated (Central Pollution Control Board, 2015)

b) Foundation of coordinated water assets administration structure and guidelines for wastewater

reuse programs- In numerous locales of India, incorporated water assets administration including recycled water is still at its outset. Some related laws and directions have been issued for controlling incorporated water assets administration, yet they are still shy of definite strategies in India. In Europe, European Union and its part states have progressively executed European Union wide and national measures and their imperative result is the Water Framework Directive (WFD). It advances the execution of coordinated water assets administration, and favours municipal wastewater recovery and reuse on a bigger scale. For advancing the improvement of coordinated water assets administration, including recycled water, the proper strategies ought to be set up taking into account the local conditions. The United States Environmental Protection Agency gave 'Guidelines to Water Reuse' as a far-reaching specialized reference to encourage wastewater reuse programs all through the United States. Based on the guideline, effective reuse programs were created in numerous states, especially in Arizona, California, Florida, and Texas. The States in the European Union and United States can issue the strategies and direction of wastewater reuse under the national wastewater reuse system in the light of their own real circumstances. The current wastewater treatment experts in India lack engineering knowhow and experiences to widen wastewater reuse particularly in managing public opinions, market-based financing and promoting, advanced treatment technologies, water quality control and certification issues (Daigger, 2003). Liu and other authors in their studies discuss the problem of inconsistent waste water standards. Also, recycled water from one organization is dispersed frequently to various end users. Further-more, there is no connection between the recycled water quality standard and the sewage release standard. The recycled water producer at some point has the trouble to meet the water quality prerequisites because of the uncontrolled water source from wastewater treatment plants (Environment Agency, 2011; Liu, S. and Persson, 2013). Chen, in his study, discusses the concerns about constrained commercial improvement of reclaimed water and also importance of fines. In Beijing, fines, jail terms, and/or administrative orders are charged on the violators, but that is not the case in India. Wastewater reuse requires expansive capital ventures and the perceived long-term steady economy. Moreover, it is necessary to keep the recycled water cost low. Normal expense of wastewater treatment is Rs.4.50 to Rs.6/Kl (kilolitre) which can be utilized for agribusiness and gardening, and if the wastewater must be used for direct drinking use, then treatment with RO would roughly cost Rs.12/Kl. Then again, metropolitan urban areas spend more than Rs.20/Kl to convey consumable water to its

occupants, similar to Chennai's spending around Rs.40 to Rs.60/Kl, Hyderabad spends Rs.28/Kl, Bangalore Rs.24/Kl and Delhi Rs.20/Kl (1 kilolitre= 1000 litres) (Chen et al., 2013). The reclaimed water producers do not have the motivating force to commit to capital ventures and grow the client markets. Public institutions have constrained capacity to put resources into or even keep up wastewater recovery and reuse projects because of the high initial expense (India Water Portal Report, 2012).

Studies of water reuse, including Liu's, in Asian countries suggest several potential concerns about the national approach to water reuse, which India could avoid. Firstly, there has been a clear focus on investment in treatment capacity but much less attention to constructing distribution networks so the reclaimed water could be used productively. Secondly, the government has sought to keep tariffs for reclaimed water low to stimulate demand, but it has not adequately addressed the issue of the financial sustainability of reuse investment projects and is filling the gap with subsidies, which may not be sustainable (Liu & Persson, 2013). Studies modelling health risks in different system structures have found that health risks from waterborne diseases are lower in distributed systems instead of a centralized one, as a single source of contamination does not affect the whole distribution area. The cost of membrane-based systems has also fallen dramatically, bringing these technologies within reach of local governments (Faneet.al, 2002). Strict restrictions on wastewater discharges have compelled industries to reuse process water and chemicals. This lead to intensive research in new advanced treatment technologies and some of which made their way to full-scale installations. Direct wastewater reuse is also currently practiced between businesses. The exchange of waste products for the mutual benefit of two or more businesses is known as 'industrial symbiosis.' There are also many advantages to this move including decrease in the volume of generated wastewater, reduced water bills etc. There are many studies dedicated to industrial waste water reuse, as it can successfully bring down huge water demands (Duarte et al., 2013; Kim et al., 2012; Choi et al., 2013; Gutterres, 2013; Jeongyun Choi, 2015).

The main aim behind wastewater reuse in agriculture was to increase food security by reducing the volume of water diverted for agriculture. The wastewater used in irrigation is from various sources. Sometimes it is the partially treated municipal wastewater or mechanically purified industrial wastewater. Also wastewater is available throughout the year; therefore farmers do not have to depend heavily on conventional water sources including rains. Before initiating this

process on any land it is advised to conduct an economic analysis to estimate the value of resources invested in the project to construct and operate it and to quantify its impact on neighbourhood. A financial analysis is necessary to test the local ability to raise money from government subsidies or grants and loans.

2.4.RESEARCH GAP

The concept of smart cities has gained significant attention in recent years, with governments and municipalities worldwide seeking to leverage technology to improve urban life. However, there is a research gap in the area of strategies for redevelopment in the context of smart cities. Some potential research questions that could help address this gap include: What are the key drivers of redevelopment in smart cities? Are these different from traditional urban redevelopment drivers?

CHAPTER 3
CASE STUDY

3.1.INTRODUCTION

The smart city is more popular in the last decade; more than 100 definitions proposed by the researcher, academician, corporate, government. Some of the literature reports define the smart city for making some standard definition the “ISO 37120:2014”, TMB smart city definitions defined in “ISO/IEC JTC 1 report” published in 2014. The ISO also update the definition in “ISO 37120:2018” updated in the “ISO/IEC JTC 2 report” published in 2018. The ITU-T Group also defines the smart city in the report FG-SSC report 2014 and again updates in 2015. The BSI Group is also defining a smart city in 2014 with the vocabulary in PAS 2014.

All the definitions focused on the six basic dimensions like governance, mobility, economy, people, living, and environment. The researcher does improve with the small changes in the definitions. The currently exiting model focused on these six dimensions of the definitions. All models designed to consider the indicators of the European and American cities. The mid-size European model had the six basic dimensions with a smart word like “Smart Governance,” “Smart Economy,” “Smart Mobility,” “Smart Environment,” “Smart Living”. India is growing towards the smart city concept the urban area growth increased in India, so the Indian prime minister has been imitating the 100 smart cities made in the project in 2014.

The current model is not focused on the Indian urban area. So, the model for the Indian smarty city needs to developed, which has the dimensions and indicators according to Indian cites. The “Indian Smart City Model” in Figure 3.1 is proposed with eight dimensions, “Demographics Profile”, “Economic Profile”, “Infrastructure Profile”, “EGovernance & computerization”, “Finance”, “Environmental”, “Progress Track”, “Security”, and with 80 indicators according to Indian cites. The data collection, according to the dimensions, is done with the help of big data techniques. The information in each dimension has its indicators. Demographic Profile has information about the population growth, social structure of the society, the one important indicator about the youth and young working-age population. The profile has 13 such important indicators, all shown in Table 5. The “Economic Profile” is very important to develop the smart city for all the existing model having this dimension, the indicators in focused in this dimension based on the income of cities with the available working sectors and its also considered the poverty rate and unemployment rate for the proper assumption of the economic growth. This

profile has 21 indicators. Infrastructure is playing a vital role in the growth of the city. This profile is about the number of schools, colleges, hospitals, etc. The infrastructure development calculated on the based of different 15 indicators shown in Table 5.

“E-Governance & computerization” is measuring development in the field of technology and smart services. The city should provide e-governance services for the smart management and living of the citizens. This profile has 12 indicators. The “Finance” is describing the sustainability of the city, the financial indicators like expenditure, income sources, and allocation budget to manage the city. This profile has 11 indicators to show the status of “Finance” of a city. The “Environmental” dimension is to make a clean city. It shows the green and clean city parameter, which manage by Swachh Sarvekshan to conduct the environment Assessment of Indian cities. “Progress Track” dimension is kept for keeping an eye on the growth of work done for the smart city. The progress of work is tracked by the percentage of work completion and utilization of funds. “Security” is important with smart living as the smart crime rate would increase, so the safety index of the cities with crime index could be an indicator in this profile. The all-embracing of “Indian smart cities” is defined using these eight dimensions.

Figure 3.1 Indian Smart city Proposed model

3.2.INDIAN SMART CITY PROPOSED MODEL

Demographics Profile

Demographic Profile is a collection of information about the population. This information is gathering through the surveys and the District Census Handbook, Census of India. The information contains the urban area total population, district urban area population, the growth rate of population, the area in a kilometer, percentage area of the district, the population density per square kilometer, the literacy rate, Percentage of social elements.

Economic Profile

The economic profile is a collection of economic data from various sources. This profile shows the per capita income of the city, the rate of unemployment, the ratio of urban poverty, rate of

work participation, self-employment, salaried employees, labor, percentage of professionals, technicians, elementary occupations, clerks, workers not classified by occupation.

Infrastructure Profile

The infrastructure profile is the facility pillar for the smart city. It is about basic infrastructure like tap water, electricity, toilet, internet, mobile phones in households. The percentage of owned houses and rented houses. The main facility in number like hospitals, schools, colleges. It is a very important profile for "Make in India" smart city.

E-Governance & Computerization

E-government & Computerization profile is about the e-services available in the city. The smart city is to provide smart governance for smart living. It is having the egovernance facility of Property Tax, utility payments, Citizens' Grievance Monitoring, LAN, WAN, State Data Centre, and e-Procurement. The technology used for smart monitoring of life.

Finance

Finance is about the income source and expenditure of the smart city. It is the source of income from taxes, municipal, and budget with banking facilities. This information is very useful to calculate the sustainability of a city. The money expenditure for the development of the city.

Environmental

The Environmental dimension for the smart city is for green living. The development of a smart city with a green environment is important. This dimension covers the indicators for the clean and green city. The information collected through the surveys.

Progress Track

The tracking dimension is keeping the control and progress of smart city work. The progress tracking was done by monitoring the percentage of complete project and allocation and utilization of the project cost.

Security

The security is another dimension about the safety index and crime index of the city; the data is important for the safe and smart living. The smart city provides a clean, safe with smart work.

3.3.DATA SET

The data set of 20 Indian cities which name with symbols given in Table 3.1. The criteria of the

smart Indian city for ranking given in Table 3.2. Indian Smart City Indicators Symbols are given in Table 3.3, the 80 indicators of 8 dimensions. The data value of 20 cities given in Tables 3.3 to 3.6. The data is an input to the ranking algorithms as 20 X 80 matrix of city-data.

Table 3.1: Indian Smart City Name Symbols

S.NO.	CITY	SYMBOL
1	Kakinada	C1
2	Vishakhapatnam	C2
3	Guwahati	C3
4	Delhi	C4
5	Ahmadabad	C5
6	Surat	C6
7	Belgaum	C7
8	Davanagere	C8
9	Kochi	C9
10	Bhopal	C10
11	Indore	C11
12	Jabalpur	C12
13	Solapur	C13
14	Pune	C14
15	Bhubaneswar	C15
16	Ludhiana	C16
17	Jaipur	C17
18	Udaipur	C18
19	Chennai (M. Corp)	C19
20	Coimbatore	C20

Table 3.2: Indian Smart City Criteria Symbols

S.NO.	CRITERIA	SYMBOL
1	Demographics Profile	A
2	Economic Profile	B
3	Infrastructure Profile	C

4	E-Governance & Computerization	D
5	Finance	E
6	Environmental	F
7	Progress Track	G
8	Security	H

Table 3.3: Indian Smart City Indicators Symbols

S.NO	INDICATORS	SYMBOL
1	"Total Population"	A1
2	"Total Population of UA" (if)	A2
3	"Share of ULB population in District Urban population" (%)	A3
4	"Population Growth Rate" (AEGR) 2001-11	A4
5	Area" (sq. km)	A5
6	"Share of ULB area in the district" (%)	A6
7	"The density of population" (person per sq. km)	A7
8	"Literacy Rate" (%)	A8
9	"Scheduled Caste" (%)	A9
10	"Scheduled Tribes" (%)	A10
11	Youth, 15 - 24 years" (%)	A11
12	"Slum Population" (%)	A12
13	Working Age Group, 15-59 years (%)"	A13
14	Per Capita Income (Rs.) at 2004-05 constant price "	B1
15	"Urban Poverty Ratio" (% of urban population)	B2
16	"Unemployment Rate," 2011-12	B3
17	"Work Participation Rate," 2011-12	B4
18	"Work Status, 2011-12 (%) Self-employed."	B5
19	"Work Status, 2011-12 (%) Regular/wage salaried employees"	B6
20	"Work Status, 2011-12 (%)" Casual labor:	B7
21	"Sectoral Distribution of Workers, 2011-12 (%) Primary."	B8
22	"Sectoral Distribution of Workers, 2011-12 (%) Secondary."	B9
23	"Sectoral Distribution of Workers, 2011-12 (%) Tertiary."	B10

24	“Legislators, senior officials, and managers.”	B11
25	“Professionals”	B12
26	“Technicians and associate professionals”	B13
27	“Clerks”	B14
28	“Service workers and shop and market sales workers.”	B15
29	“Skilled agricultural and fishery workers.”	B16
30	“Craft and related trades workers.”	B17
31	“Plant and machine operators and assemblers.”	B18
32	“Elementary occupations.”	B19
33	“Workers not classified by occupation.”	B20
34	“no. of sanctioned SEZ.”	B21
35	“% of households with access to tap water (from treated source) within Premises.”	C1
36	“% of households with access to electricity.”	C2
37	“% of households having toilet facilities within premises.”	C3
38	“% of household Waste water outlet connected to the drainage.”	C4
39	“% of households with access to computer/laptop with internet.”	C5
40	“% of households with access to computer/laptop without internet.”	C6
41	“% of households with access to mobile phones.”	C7
42	“Ownership Pattern of Housing (%) Owned.”	C8
43	“Ownership Pattern of Housing (%) Rented.”	C9
44	“% of households living in congested houses.”	C10
45	“No. of Hospitals per 1,00,000 people “	C11
46	“No of Schools per 1,00,000 people Primary.”	C12
47	“No of Schools per 1,00,000 people Middle.”	C13
48	“No of Schools per 1,00,000 people Secondary.”	C14
49	“No of Schools per 1,00,000 people College”	C15
50	“Property Tax”	D1
51	“Accounting”	D2
52	“Water Supply & Other Utilities”	D3
53	“Birth & Death Registration and Health programs.”	D4

54	“Citizens' Grievance Monitoring”	D5
55	“Personnel Management System”	D6
56	“Building Plan Approval”	D7
57	“e-Procurement”	D8
58	“Does ULB has the facility to Accept Online Payments.”	D9
59	Are ULB offices connected through local area network (LAN)/ wide area network (WAN)	D10
60	“Do you have access to the State Data Centre (SDC)? “	D11
61	“Does the ULB have their website#.”	D12
62	“% of households with access to banking facilities “	E1
63	‘Property Tax Coverage (%)”	E2
64	“Property Tax Collection Efficiency (%) “	E3
65	“Property Tax Amount (Rs.)”	E4
66	“Details of municipal income (Rs. Lakhs) 2009-10”	E5
67	“Details of municipal income (Rs. Lakhs) 2010-11”	E6
68	“Details of municipal income (Rs. Lakhs) 2011-12”	E7
69	“Details of municipal expenditure (Rs. Lakhs)2009-10”	E8
70	“Details of municipal expenditure (Rs. Lakhs)2010-11”	E9
70	“Details of municipal expenditure (Rs. Lakhs)2011-12”	E10
72	“% of municipal Budget reserved for urban poor.”	E11
73	“Swachh Sarvekshan was conducted between 5 January 2016.”	F1
74	“Comprehensive Environmental Assessment for available cities”	F2
75	“Total Approved Cost of projects (Rs. Lakhs)”	G1
76	“Share of Central Assistance released (%)”	G2
77	“% of work completed (Physical Progress)”	G3
78	“Funds Utilised (%)”	G4
79	crime index	H1
80	safety index	H2

Table 3.4: Indian Smart City Data Set Part 1

Objective 2: To analyze the case study of successful redevelopment projects in smart cities.

3.4.Case Study on Smart City Projects in India: An analysis of Nagpur, Allahabad and Dehradun

As the global population continues to grow at a steady pace, more and more people are moving to cities every day. Cities accommodate nearly 31% of India's current population and contribute 63% of GDP (Census 2011). Urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030. This requires comprehensive development of physical, institutional, social and economic infrastructure. All are important in improving the quality of life and attracting people and investment, setting in motion a virtuous cycle of growth and development. Development of Smart Cities is a step in that direction. Smartness in city means smart design, smart utilities, smart housing, smart mobility, and smart technology. There is need for the cities to get smarter to manage complexity, increase efficiency, reduce expenses, and improve quality of life. Smart Cities focus on their most pressing needs and on the greatest opportunities to improve lives. They tap a range of approaches - digital and information technologies, urban planning best practices, public-private partnerships, and policy change - to make a difference. They always put people first. 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 and the idea is to look at compact areas, create a replicable model, which will act like a lighthouse to other aspiring cities.

Smart Cities Mission Strategies

- Pan-city initiative in which at least one Smart Solution is applied city-wide
- Develop areas step-by-step – three models of area-based developments
- Retrofitting,
- Redevelopment,
- Greenfield

The study mainly focuses an effective analysis of SWOT based on the smart city, to promote the sustainable development of urban development of the mentioned cities.

SWOT analysis of Nagpur, Allahabad and Dehradun

Strengths

Dehradun

1. Strategic location: Dehradun is strategically located and has good connectivity to New Delhi by air, rail and road. It serves as gateway for the key tourist destinations of state. The floating population recorded for Dehradun is 20,000 people per day. (Source: city development plan, 2015)
2. City of Schools: Dehradun is an important educational hub of India embraced with large number of leading public schools and colleges in both government and private sector with over 1.70 lakh students enrolled. Dehradun is considered as the citadel of prestigious public schools such as The Doon School, Welham Girls & Boys School, Convent of Jesus & Mary, Rashtriya Indian Military College.
3. Literacy rate: The average literacy rate is over 84%, which is much higher than the national average of 74%. This augments the quality of human resource available in the city
4. Dehradun is anchor to organizations of national importance viz. Geological Survey of India, Wadia Institute of Himalayan Geology, Indian Institute of Remote Sensing, Forest Research Institute, Indian Military Academy and Headquarters of ONGC, Survey of India
5. Colonial age heritage structures viz. Astley hall, Clock tower (hexagonal form), Jesus Mary Church, Forest Research Institute (FRI), IMA, Khalanga War memorial. Ashoka's Rock Edict (under ASI) & Ashvamedha Sthal of Raja Sheel Barman (Under ASI).

Nagpur:

1. Strategic location- Nagpur, the geographical center of the country enjoys seamless road, rail and air connectivity to major urban centers such as Delhi, Mumbai, Pune, Hyderabad, Bangalore and Chennai. Riding on its geographical location and a robust connectivity profile, Nagpur has the potential to become a key logistics hub of central India.
2. Rich in Natural Resources- The presence of perennial rivers such as Pench, Kanhan and Vena endow the Nagpur region with abundant water resources; Vena dam has a capacity of 23.5 million cubic meters and the total line storage capacity is 380 million cubic meters. Nagpur is also one of the greenest cities in the country. For every 10 persons, there are 9 trees in Nagpur. Additionally, industrial land available in Butibori (Asia's largest industrial estate) & other industrial areas can propel industrial growth with industrial land prices being only 10% & 14% of the industrial land prices in Thane &

Pune respectively. A variety of minerals such as coal (23% of state's reserves), manganese (45% of state's reserves), & limestone & iron ore (76% state's reserves) are found in the Nagpur Metropolitan Region.

3. Competence to implement PPP projects successfully- Nagpur is perhaps the only city in the country with a broad-based PPP implementation competence. Nagpurs' marquee PPP success is the 24*7 water supply project pilot project. With the immense success of the pilot, the project is now being scaled up to the entire city and will be completed by 2019. In addition, Nagpur has also implemented projects such as recycling and reuse of 130 MLD wastewater, installation of LED street lights in place of conventional street lights, city bus operations and collection and treatment of solid waste management. The city has cleverly leveraged private sector efficiencies for efficient service delivery.
4. Established medical and education hub of Central India- With nearly 625 hospitals, the city has a total bed capacity of 12,000. With 3 beds per 1,000 population, Nagpur is a medical hub for the central India region. With 35 engineering colleges, 3 medical colleges & a host of research & professional education institutions, Nagpur has emerged as the education hub of central India. Reputed institutions such as VNIT, NEERI, IIM-Nagpur, Animal Husbandry & Fisheries University & Nagpur University are present in the city. With the upcoming IIIT and AIIMS, Nagpur will be able to expand on its reputation as an education hub & also facilitate setting up of startups & other entrepreneurial ventures.
5. Vicinity of Tiger tourism hot-spots- There are an estimated 243 tigers and 3 Project Tiger within the Vidarbha region. The region also has 4 national parks which attracts tourists in large number (520,000 in 2009). Nagpur is the key access point for reaching these tourist locations that add to city's economic potential.
6. Experience in set up and management of SPV- The NMC has already set up an SPV in the form of the Nagpur Environment Services Ltd. for implementing the 24*7 water supply project in Nagpur. In addition, the Nagpur Improvement Trust is also akin to an SPV that has been executing urban development projects in the city's periphery. Thus, Nagpur has substantial experience in setting up & management of SPVs.

Allahabad

1. Strong Historical and Cultural Identity: Well established pilgrimage Centre; one of the four sites in India hosting the Kumbh Fair every 12 years;
    a. Annually 4 crore visit Allahabad; around 0.3% comprise foreign tourists; over last 5 years there is a 27% increase in tourist inflow. The Maha Kumbh Mela (fair) in 2013 itself hosts close to 7.5 crore visitors (with 3.5 lac foreigners)
    b. Fairly large inventory of built heritage comprising of nearly 30 temples of various styles; Ananda Bhawan and other colonial era spaces such as Khusro Bagh; Chandrasekhar Azad Park and Minto Park
    c. River shoreline of around 40 kilometers comprising of both Yamuna as well as Ganga.
    d. Zonal cultural Centre under Ministry of Culture, Government of India and Prayag Sangeet Samiti promotes Indian music and culture
2. Known Zonal Centre for Higher Education: A number of renowned and premier educational institutions of higher learning present in the city.
    a. Allahabad University (central), Motilal Nehru National Institution of Technology, Motilal Nehru Medical College; Indian Institute of Information Technology, GB Pant Social Sciences Institute, Agricultural University and the Allahabad State University
    b. Coaching classes for competitive examinations comprise a major industry in the city.
3. Natural Resource Base of Agricultural Produce and Silica:
    a. Has a history of glass manufacturing works and
    b. High yield of guava, amla and bananas
4. Well-connected Transport and Water:
    a. Rail Connectivity: Located along the rail route of New Delhi – Howrah
    b. Starting point on the proposed National Waterway no. 1 (Allahabad and Haldia)
5. Urban Services Well Developed:
    a. Water supply exceeds National standard of 135 lpcd
    b. High capacity of wastewater treatment & disposal inventory created under GAP and NGRBA schemes, present capacity is over 280 MLD

c. Integrated solid waste management programmes operational for almost a decade

Weaknesses

Dehradun

1. Less than expected level of urban utilities: While the DMC has been taking initiatives towards SWM and sanitation issues, but the identified municipal services are below the expected level to cater to ever increasing migration
2. High Population Density: The population density of Dehradun is 1900 sq. km. persons per sq. km. In 2001-2011, Dehradun had a growth rate of around 32.48%, which is higher than the national average of 7.64% resulting in congestion in the city core.
3. Ribbon development along major transport corridors: All the primary radial transit routes, particularly Rajpur Road, Chakrata Road, Saharanpur Road, and Haridwar Road in the city are marked with high density unplanned developments. This leads to poor utilization of the right-of-way, increased travel times, increased air pollution, and reduction in the efficiency of the urban economy
4. Inefficient Transport & Parking: 48.1 % of roads in Dehradun are change by on-street parking on both the sides. Weak public transport system has led to plying of Vikrams without permits adding to the level of pollution in the city. There is significant amount of mismanagement in terms of the route planning for the vikrams and city buses
5. Lack of employment opportunities: Low workforce participation, in 2011, the workforce participation ratio was about 34:66. The share of main workers is 30% in the total workforce, 4% is shared by the marginal workers, and share of non- workers are 66%. Absence of enough employment opportunities in the service sector in line with the employable population of the city
6. Dilapidated Heritage structures: The city boasts of heritage structures of colonial times, which are all in very bad shape due to lack of attention towards preserving them and unplanned growth in the city center
7. Depleting green cover with negative impact on the weather of the city: The city located in the foothills of Himalayas, has been traditionally known for its green cover, and excellent weather conditions. The unplanned growth has negatively impacted the green cover of the city and thus the weather

Nagpur

1. Multiple planning institutions & dichotomy in growth- Nagpur has multiple planning agencies which shape urban growth but in an uncoordinated manner. This has resulted in dichotomous urban growth with a significant portion of the city's population living in unplanned, haphazard & vulnerable areas with paucity of services and a sub-par quality of life.
2. Unplanned & haphazard development- The eastern periphery of Nagpur is made up of a number of unplanned layouts inconsistent with the Development Plan land-use provisions. It is estimated that there are over 2450 layouts where existing land-use is inconsistent with proposed land-use of the Development Plan of Nagpur. This includes Mauzas such as Nara, Nari, Wanjara, Wanjri, Bharatwada, Pardi, Watoda, Tajbagh, Dighori, Manewada & Somalwada.
3. Inequitable distribution of civic services- The 2450 unplanned layouts are estimated to house ~30% of the city's population. Being unplanned, these layouts are unable to access civic services & continue to subsist in squalor. Services such as adequate water supply, sanitation & sewerage, public transport and street lighting are hardly available to this section of the city. This has severely affected livability parameters & offers compromised quality of life to the residents of such layouts.
4. Weak public transport system- Bus services are the only means of public transport available in the city which has led to an increasing number of private vehicles plying on the city roads. Currently, public bus transport caters to only 12% of the commuting population. Despite efforts such as route rationalization & procurement of additional buses, the city has had limited success in shifting its commuting population to the public transport system.
5. Administrative & operational inefficiencies affecting quality of public service delivery- While NMC has developed more than 60 e-governance modules, reach of these services is limited. Further, limited convergence & compartmental approach of departments has also affected overall service delivery. The use of IT/smart technology for operations is extremely limited at present and hence it is critical to scale up the use of technology to achieve incremental benefits of improved operations.

6. Lack of employment opportunities- Nagpur's economic growth has not picked up pace over the years which has resulted in the young & educated not finding adequate employment opportunities. An estimated 11,000 engineers, ~800 management graduates and ~250 doctors graduate from Nagpur each year; retaining this skilled workforce is a challenge since local employment opportunities are limited.

Allahabad

1. Lack of Integrated strategy to support and Sustain Tourism:
    a. Most of the State support is 'reactive', i.e. responds to specific events and not targeted at maintaining tourism-based infrastructure.
    b. Lack of formal approach to guide visitors on the pilgrimage and other sites in the city
2. Higher Education Centers do not foster the Local Economy: Most students move on to other cities and towns after completing education; institutions have limited engagement with industry
3. Stagnant Manufacturing and Industry:
    a. Most large industrial units have closed down or are exiting the State
    b. MSME sector is not supported well in terms of new, emerging areas, viz. skill based support services
    c. Limited focus on knowledge based industries
4. Limited Air Connectivity to the City: Only one airline and single flight servicing Allahabad (from Delhi) - impacts tourism an
5. Urban Form does not Encourage Compact Development:
    a. Most areas show considerably lesser density than what is supported except organic and unplanned built-up areas; very few flatted systems in the city
    b. No provision for mixed use development in master plan;
    c. New residential schemes are heavy on 'plots' of land, and are increasing urban sprawl more than compacting; viability of many line services suspect on account of high sprawl and low density. This is because the development authority is not encouraging redevelopment of high density areas.

d. ‘Own vehicle’ centered development - modal share of buses is 8% only; even as motorized trips have an average length of just under 7 km
e. Only 1% of the road network have foot paths; high instances of on-street parking
f. Limited focus on street and intersection design; increase in road accidents over last 3 years (844 to 1019); limited signages
g. New rolling stock for buses has not been acquired since 2009; most buses have reached condemnation stage

Opportunities

Dehradun

1. Gateway to tourist destinations: Investment towards promotion & development of facilities catering to floating population could serve as making the city a “Hub” for key tourist cities under Hub & Spoke model wherein the routes to the identified cities could be strengthened, promoting RRTS, implementing the Mussoorie Dehradun Ropeway. Significant volume of tourist footfall could be retained for an extra day in the city by restoration and conservation of the heritage structures in the city and creating places of tourists’ interests and information within the city
2. Infotainment hub (hospitality, vocational, higher education, Information & Entertainment centers for kids and tourist): Given the high number of schools and educational institutions, policy incentives towards attracting institutions of repute would help to start a Dehradun center. Currently the city has only one IHM, given the hospitality sector growth opportunities in the city, such institutes could be set up. Given the high number of educational institutes, the convergence with GoI schemes viz. skill India could be undertaken through tie-ups with the existing institutes. The city presents the opportunity to set up facilities with informational, educational and entertainment values for the large mass of students and tourists
3. Qualified employable workforce: About 75% of the population in Dehradun is below the age of 45 years. Because of high literacy rate & good institutions, the city has good quality of employable population. This provides an opportunity for strengthening employment opportunities in line with strength of the city i.e. in hospitality, tourism related sectors within the city to provide more employment opportunities to captive human resources.

4. Potential to develop as counter magnet city to NCR: Situated at around 250 Kms from Delhi and with over saturation of NCR due to immigration, the proposed 4/6 laning of Delhi-Dehradun Highway, and good road, rail and air connectivity of Dehradun with NCR, provides potential for development of the city as counter magnet city to the NCR. NCRPB has already included Dehradun in the list of counter magnet cities to NCR

Nagpur

1. Potential to become a multi-modal logistics hub with MIHAN playing a key role- While GST will make Nagpur a cost-effective distribution center, its connectivity via rail, road and air will make it an attractive location for multi-modal logistics activity. The growth of MIHAN will also ensure creation of a diverse economic base propelling all round development in Nagpur.
2. Potential for Transit Oriented Development (TOD) due to Metro Rail project- Two Metro routes of 38 km have been planned across the city. Works for 6 kms are already underway. High density mixed development, through FSI of 4 or more, along the Metro alignment will encourage TOD in areas like Sitabuldi and Jail ward. Shifting the Central Jail will unlock prime real estate, which can be utilized for developing high-density retail / medical / entertainment zones.
3. Availability of government land- A large number of government, industrial & NMC land is available for development. Land along metro corridor (Jail land) & other important locations (Wathoda, Bhandewdi) will be utilized for various purposes. Leveraging the government institutions' land bank can generate resources to fund infrastructure expansion.
4. A host of infrastructure projects will add to city's economic agenda: Implementation of in-pipeline projects: Orange city street project, 142 acre International standard sport complex & sports university complex at Watoda, 100 acre Skill Development Centre at Watoda, Gorewada international zoo & Nagpur-Mumbai super communication expressway will exert much needed push to the local economy.
5. Rejuvenation of water sources due to Nag Riverfront Development- The Nag Riverfront Development project focuses on pollution abatement as well as place making by developing promenades and open spaces for recreation. The pollution abatement DPR has

received in-principle funding approval from the MoEF. The Nag River will be rejuvenated through these interventions.

6. Potential to boost tourism- Deekshabhoomi, a much-vaunted Buddhist memorial, can be aggressively marketed as a tourist destination. The Gorewada International Zoo can add to the tourism potential of the city.

Allahabad

1. Organizing and Formalizing the Triveni and Sangam Experience:
    a. Provision of infrastructure and other amenities in all over the riverfront, positioning the same as a group of 'managed' sites which improves visitor experience; including developing areas for new activities viz. boating;
    b. Development of a comprehensive and easily accessible information base of cultural elements, potential itinerary for visiting and support services that would essentially (1) market Allahabad's cultural and historical identity, (2) facilitate smooth visits and passage of tourists and pilgrims alike.
2. Positioning the other New Allahabad
    a. Areas of the city, which generate economic activities may also be used to attract tourists and visitors; viz. Civil Lines, Katra as elements of 'contemporary & living culture
    b. Certain old and run down areas offer potential to be resuscitated and redeveloped (urban renewal) as centres of mixed use supporting local economic development; Government lands – which are vastly underutilized.
    c. Option for retrofitting/ adaptive re-use of old premises with a Victorian character, viz. Nagar Nigam premises for mixed use and commercial capitalization.
3. Rich deposits of Silica

Even though the glass industry has all but closed, potential lies in ceramic and other such materials which now have advanced applications in power, aerospace & defense.

4. High Yields of Agro Produce, Particularly Guavas and Amla:

Potential for development of cooperative or privately owned manufacturing units for fruit based products

5. Making Education Work for the City:

a. Establishing centers for excellence, innovation hubs and R&D centres within Allahabad University and other similar setups.
b. Fostering start-ups, industry – academia linkages for laboratory testing and application development
c. Improving market access and outreach of major university setups to improve employability

6. Connectivity:
    a. AAI fund (Rs.300Cr.) sanctioned for Modernization of Airport to increase tourists' footfalls.
    b. Land available for Infrastructure Development and ILS system being implemented for night landing.
7. Urban Amenities:
    a. City-wide implementation and up-scaling of Hari-Bhari PPP initiative for Door To Door waste collection planned. The initiative has potential to support waste to energy initiative.
    b. Availability of funds under Urban Transport Fund, Employment Generation and Self- income development scheme by DUDA and development of ITMS plan.
    c. Redevelopment of unutilized and encroached "Nala's " (open drains); and creation of recharge ponds within the city
    d. A metro rail is proposed (feasibility study ongoing) to be taken up within the city

Threats

Dehradun

1. Depleting environment resources: There is a decline in the urban green spaces in Dehradun city from 22.98% of total area in 2004 to 15.13% in 2009. Additionally, growing environmental pollution personalized vehicles has adversely affected the livability in the city
2. Possibility of unplanned growth along the Haridwar: The city has found natural expansion along the Haridwar road, and with the ongoing strengthening of the highway; there is high chance of further unplanned growth along the corridor
3. Crime rate: The large section of non-working population can give rise to an increased crime rate in the city if not channelized productively

4. Migration: There is likelihood of large-scale migration to the city from the nearby peri-urban areas and other parts of state putting strain on its infrastructure and creating further housing shortages.

Nagpur

1. Presence of unauthorized layouts in the eastern periphery - A large number of unauthorized layouts exist on the eastern periphery of the city abutting the Bhandara road. The Bhandara road is fast emerging as a warehousing and logistics center which will attract population due to employment opportunities. Abysmal quality of life in these unauthorized layouts can limit the growth of a logistics hub along the Bhandara road.
2. Brain-drain phenomenon- The young & educated are increasingly moving out of Nagpur in search of employment. The lack of employment opportunities compels the youth to migrate out of Nagpur to other centers. This out-migration is evidenced by the Census 2011 figures; the decadal growth rate declined from 27% to 19%.
3. Underdevelopment in MIHAN- The industrial growth in Nagpur has not been dynamic enough to create a vibrant economy. Additionally, Multi-modal International Cargo Hub Airport Nagpur (MIHAN) was expected to fuel the economic growth of Nagpur with an estimated 125,000 direct jobs. However, the slow growth of MIHAN has further accentuated the lack of employment avenues in Nagpur. With the political capital that Nagpur currently has, growth of MIHAN can be accelerated. However, if the growth in MIHAN continues to be slow, Nagpur will continue to witness out-migration which can impact the city's all-round growth prospects.
4. 36% population lives in slums; supply of affordable housing limited- Despite attempts to provide extensive affordable housing, 36% of Nagpur still lives in slums. This indicates that the supply of affordable housing has not kept pace with the demand. Efforts under the Slum Rehabilitation Authority (SRA) and Housing for All should doggedly focus on providing good quality of life and affordable housing.

Allahabad:

1. Flooding in Ganga; encroachments within flood plain;

2. Continuing practice of development of housing schemes resulting in uncontrolled urban sprawl and an imbalanced property market; ad-hoc changes in land use with limited land consolidation.
3. Increasing inventory of para-transit and unorganized sector in transport leading to skewing of modal share and trip lengths; cycle based trips have an ATL of 4.3 km
4. Minimal focus on affordable housing; last two years have seen only about 850 units produced
5. Over-dependence on the existing tube-wells for water supply will lead to depletion of water levels.

3.5.CONCLUSION

Nagpur has emerged as the topmost smart city in India. In just five months, Nagpur has beaten other cities chosen before it to get the best implementation of smart city plan. A recent stock-taking exercise conducted by urban development ministry has revealed that Nagpur, though chosen as a smart city in September 2016 much after 33 smart cities in two previous rounds has achieved the best investment conversion ratio. India's smart city program hopes to revolutionize city life and improve the quality of life for India's urban population. In the absence of a zonal plan, many parts of Dehradun have witnessed haphazard development over the years, which has already caused much damage to the vision of a planned smart city. Smart City would require smart economy, bright people, smart organization, smart communication, smart engineering, smart transit, fresh environment and bright living. Nevertheless, with mass migration leading to basic problems, like water shortages and overcrowding, the rate at which these cities will be developed will be the key. Several initiatives are being led by the Government of India to convert 100 Cities into Smart Cities. Government to Actively Use PPP Route and Encourage FDI for Effective Implementation of Smart Cities Project in India. The government is concentrating on encouraging Public Private Partnership (PPP) for successful implementation of the smart city project in India. Financial and IT services sectors are on the priority list of the government to garner investments from leading companies such as Cisco, EMC, GE, IBM, Bajaj, etc. in coming years. Few of the major companies that are currently involved in project planning of these cities include Halcrow, Synoate, Knight Frank and AECOM India. The real challenge before the Government is to build inclusive smart cities for all its residents, regardless of whether they are rich or poor. Creating a smart city is not just about creating the physical infrastructure

— roads, clean water, power, and transport. It is desired that public private partnerships (PPP) will deliver, but the mechanism appears to require a lot of plucking in order for it to work, a fact recognized in the recent Budget. The big challenge will be to create self-sustaining cities, which create jobs, use resources wisely and also train people. The idea should be to make cities work for the masses. India has to now take an important decision in the context of creating smart cities. It has to determine if it desires to opt for making new cities or upgrade existing ones.

CHAPTER 4
STUDY AREA

4.1.INTRODUCTION

The ranking is a relative comparison view, which gives knowledge of the standard relative position of growth. The smart city ranking provides a relative view of growth position among the cities, the race of improvement measured by ranking. The rank of each dimension of a city gives a clear direction for improvement. The algorithm DBA and TDBA defined for computing the optimal ranking solution for the smart city.

The Distance-based algorithm used for finding the optimal ranking solution for the ranking problem. In this, we are using all indicators value as an input to an algorithm to process and find the optimal ranking solution.

4.2.DISTANCE-BASED ALGORITHM (DBA)

The DBA working methodology aims to specify the optimal objective point defines through the optimal model, i.e., Cities and the finest value in every criterion of the ranking having in the computation activity. The all ranking criteria set of finest values in vector Cities, (c1, c2, …. cn) space optimal points in n-dimensional.

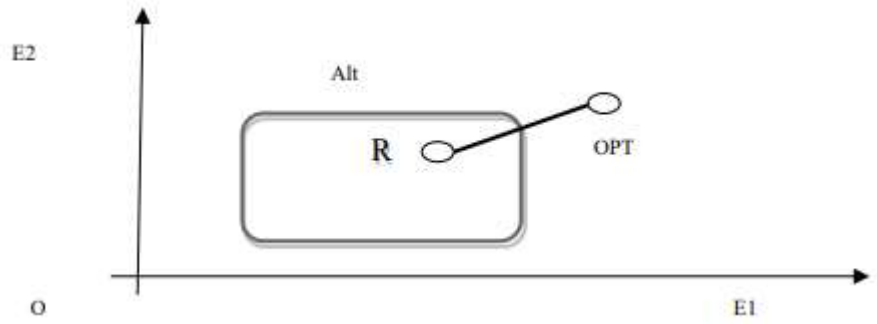

Figure 4.1: DBA Distance Approach

In this strategy for research, the ideal/best worth processed from all criteria taken the best estimation of the criteria. Thus, OPT implies different Cities having the best incentive for each foundation estimated. The probability of the presence of any elective Cities is less than outcomes regarding numerous choices to recommend the urban areas. Or this situation, OPT works as a suggestion point to compare every choice.

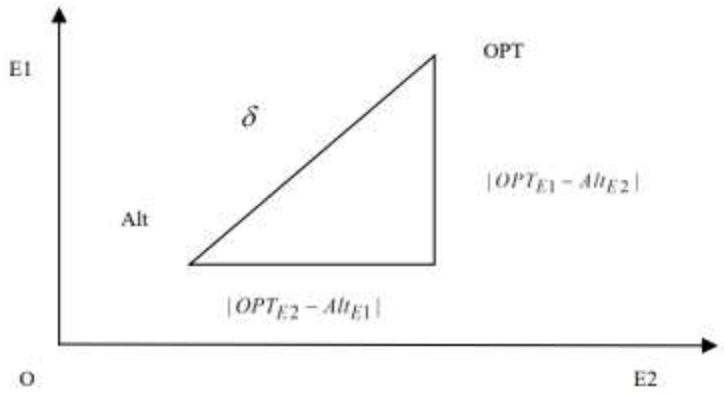

Figure 4.2: DBA Distance of Real Vector

The optimal position, i.e., OPT fitness value calculated by the quantitative comparison of alternate cities. Therefore, here, we need to find the solution closest to OPT to solve this decision problem. The objective function can be defined to find a solution as:

$$Min \ \delta\{Alt(y), OPT\} \qquad 1$$

Subject to y ς Y

Here $\{Alt(y)\}$, and δ demonstrate a Cities in the n-dimensional space, and the good ways from OPT, separately. The arrangement is reliant on the two targets, OPT. The arrangement portrayal in the 2D region given in Figure 4.1. Here R is a conceivable region, and OPT is the optimal point.

The DBA locates the point in the possible region 'R' closest to the OPT, and this shows in Figure 4.2. The figure shows that the axis E1 and E2 have a parallel line

$(Alt - OPT)_{E1}$ and $(Alt - OPT)_{E2}$ correspondingly. So $(Alt - OPT)_{E1} = |OPT_{E1} - Alt_{E1}|$, and $(Alt - OPT)_{E2} = |OPT_{E2} - Alt_{E2}|$. In 2-dimensional space, δ is given by

The DBA finds the point in the conceivable region 'R' nearest to the OPT, and this shows in Figure 4.2. The figure demonstrates that the axis E1 and E2 have a parallel line

$(Alt - OPT)_{E1}$ and $(Alt - OPT)_{E2}$ likewise. Along these lines, $(Alt - OPT)_{E1} = |OPT_{E1} - Alt_{E1}|$, and $(Alt - OPT)_{E2} = |OPT_{E2} - Alt_{E2}|$ In 2-dimensional space, δ is given by

$$\delta = \left[(OPT_{E1} - Alt_{E1})^2 + (OPT_{E2} - Alt_{E2})^2 \right]^{1/2} \quad \textbf{2}$$

In exact terms, the "distance δ" entrapped as

$$\delta = \left[\sum (OPT_{xy} - Alt_{xy})^2 \right]^{1/2} \quad \textbf{3}$$

Here x = 1, 2... n = alternate Cities and y=1, 2... m = ranking criteria.

To apply DBA needs to replicate 'n' Cities and 'm' positioning criteria related to every City, for example $Alt_1(c_{11}, c_{12}, ..., c_{1m})$ $Alt_2(c_{21}, c_{22}, ..., c_{2m})$, $Alt_n(c_{n1}, c_{n2}, ..., c_{nm})$; and the Cities $(c_{b1}, c_{b2}, ..., c_{bm})$ where c_{bm} = the ranking criteria best worth 'm.'

Along these lines, the total arrangement of cities can be appeared by the estimations of the ranking criteria in the accompanying matrix:

$$[c] = \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1m} \\ c_{21} & c_{22} & \cdots & c_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ c_{n1} & c_{n2} & \cdots & c_{nm} \\ c_{b1} & c_{b2} & \cdots & c_{bm} \end{bmatrix} \quad \textbf{4}$$

Presently expelled the estimation units' impact by grid utilizing the equation:

$$Z_{xy} = \frac{c_{xy} - \overline{c_y}}{S_y} \quad \textbf{5}$$

Here, $\bar{c}_y = \frac{1}{n}\sum_{x=1}^{n} c_{xy}$, and **6**

$$S_y = \left[\frac{1}{n}\sum_{x=1}^{n}(c_{xy} - \bar{c}_y)^2\right]^{1/2} \quad \textbf{7}$$

Here x = 1, 2, ... , n, and y = 1, 2… , m.

For each ranking criteria of all alternative Cities calculate $\bar{c}_y$, and S_y provides the average of value and the standard deviation.

$$[Z_s] = \begin{bmatrix} Z_{11} & Z_{12} & \cdots & Z_{1m} \\ Z_{21} & Z_{22} & \cdots & Z_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ Z_{n1} & Z_{n2} & \cdots & Z_{nm} \\ Z_{OPT1} & Z_{OPT2} & \cdots & Z_{OPTm} \end{bmatrix} \quad \textbf{8}$$

Here $Z_{11} = \frac{c_{11} - \bar{c}_1}{S_1}$, $Z_{12} = \frac{c_{12} - \bar{c}_2}{S_2}$, $Z_{1m} = \frac{c_{1m} - \bar{c}_m}{S_m}$.

After this, calculate the distance matrix [zd] by subtracting the value of the optimal set by a subsequent value in the alternatives set. This matrix gives the cities differences to the OPT.

$$[Z_d] = \begin{bmatrix} Z_{OPT1} - Z_{11} & Z_{OPT2} - Z_{12} & \cdots & Z_{OPTm} - Z_{1m} \\ Z_{OPT1} - Z_{21} & Z_{OPT2} - Z_{22} & \cdots & Z_{OPTm} - Z_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ Z_{OPT1} - Z_{n1} & Z_{OPT2} - Z_{n2} & \cdots & Z_{OPTm} - Z_{nm} \end{bmatrix} \quad \textbf{9}$$

Presently, at last, the distance, CD determined in one another Cities to the OPT utilizing:

$$CD_{OPT-Alt} = \left[\sum_{y=1}^{m}(Z_{OPTy} - Z_{xy})^2\right]^{1/2} \quad \textbf{10}$$

This Euclidean distance is mathematical expiration to calculate many distances on each rank criterion for which cities are evaluated and finally ranked. The flow of the algorithm shows in

Figure 4.3.

4.3.EVALUATING "INDIAN SMART CITIES" RANKING

Information on data set gathered from a report distributed by govt. of India. Measure 8 criteria are "Demographics Profile," "Economic Profile," "Infrastructure Profile," e-Governance and Computerization, "Finance," "Environmental," "Progress Track," "Security," and 80 Indicators/sub-criteria. All Indicators/sub-criteria have equivalent wattage 59 number of criteria's have high qualities as ideal/best criteria, and 21 numbers of criteria's having low an incentive as ideal/best. There are 20 Smart City in table-3 that is too positioned dependent on these 80 criteria. Ligated qualities have been changed over to numerical qualities by doling out 0 and 1 for criteria E-Governance and Computerization. In Table 3, the cities spoke to C1 to C20, and all criteria are symbolled as an AS A1-A13, B AS B1-B21, C AS C1-C15, D AS D1-D12, E AS E1-E11, F AS F1-F2, G AS G1-G4 AND H AS H1-H2. All the emblematic portrayal clarified in Table-3,4,5. The info grid has 20 lines spoken to competitor cities for ranking, and 80 sections of the framework spoke to the criteria for the count of the rank of these 20 cities.

Case -1: When a lower value of a criteria shows the best match with the real data, then adjusted criteria value = maximum criteria value- criteria value in the data set so value

$$(c = c_{max} - c_i).$$

Case-2: When a higher value of a criteria shows the best match with real data, then adjusted criteria value= criteria value – minimum criteria value in data set so value ($C = C_i - C_{max}$).

The condition 5 and 9 are utilized to ascertain the institutionalized framework and separation lattice generally, and the condition 10 gives the CD "Euclidean composite separation" between each elective city to the ideal position, OPT. The CD and positioning of "Indian Smart City" in light of all impacting criteria appeared in Table 14. The DBA discover positioning dependent on the CD, which gauging every one of the 80 affecting criteria of every one of the other cities. The rank one assigned to the smallest CD in respect and by the next smallest given position two and proceeds.

The outcome demonstrates that the Chennai has accomplished position number one after investigation 80 criteria and next succession is Pune, Jaipur, Ahmadabad, Surat, Vishakhapatnam, Indore, Coimbatore, Bhopal, Davanagere, Delhi, Udaipur, Ludhiana, Bhubaneswar, Jabalpur, Kochi, Guwahati, Belgaum, Solapur, Kakinada respectively. The

individual positioning of all criteria appears in Table no. 15. This outcome knows the development of positioning in each component of the city. The individual position thinks about shows which city needs more development in which measurements. City C1 (Kakinada) having rank 5 in b ("Economic Profile") measurement and 20 in measurement e("Finance"), so this demonstrates the city has financial profile is dynamic, yet fund the executives is expected to improve. The city C9 (Kochi) got rank 1 in measurement f ("Environmental") and 20 in a("Demographics Profile"), so it needs to focus on measurement "Demographics Profile," etc. The accompanying diagrams demonstrate the positioning situation of each component of each city. Figure 4.4 to 4.25 gives a graphical view of ranking.

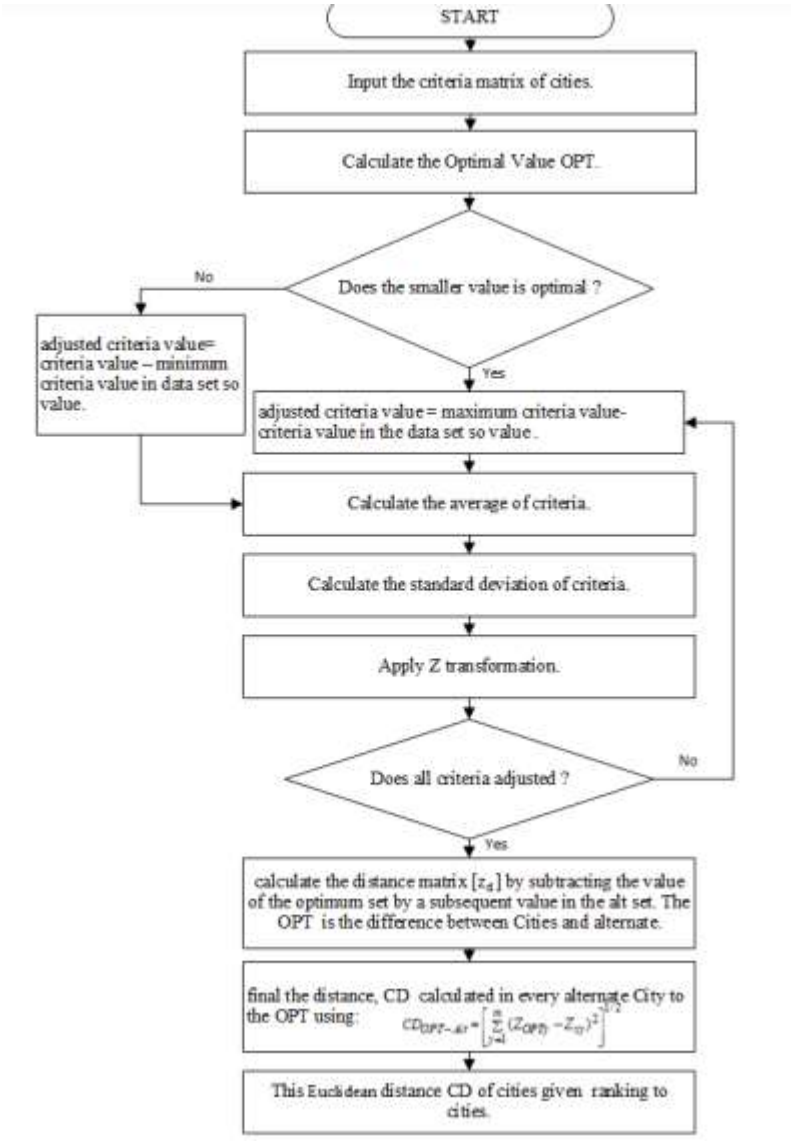

Figure 4.3 Flow Chart of Smart City Ranking Using DBA

S. No	City	Sum	CD	Rank
1	Kakinada	595.6275	24.4055	20
2	Vishakhapatnam	441.6107	21.0145	6
3	Guwahati	530.7805	23.0387	17
4	Delhi	471.2837	21.7091	11
5	Ahmadabad	404.0672	20.1014	4
6	Surat	437.8815	20.9256	5
7	Belgaum	544.017	23.3242	18
8	Davanagere	464.8986	21.5615	10
9	Kochi	528.3442	22.9857	16
10	Bhopal	461.8994	21.4918	9
11	Indore	450.1009	21.2156	7
12	Jabalpur	516.5996	22.7288	15
13	Solapur	550.2184	23.4567	19
14	Pune	358.2065	18.9263	2
15	Bhubaneswar	514.9869	22.6933	14
16	Ludhiana	493.736	22.2202	13
17	Jaipur	394.2057	19.8546	3
18	Udaipur	489.0682	22.1149	12
19	Chennai	343.7742	18.5411	1
20	Coimbatore	458.2866	21.4076	8

Table 14 Indian Smart City Ranking Result Using DBA

	A	B	C	D	E	F	G	H	OVERALL
C1	19	5	11	19	20	16	17	12	20
C2	10	3	8	1	14	10	4	5	6
C3	9	7	12	20	12	7	8	15	17
C4	12	18	16	2	1	14	18	19	11
C5	2	12	17	3	3	8	5	9	4
C6	3	20	15	4	4	11	2	1	5
C7	17	4	6	18	16	17	19	8	18
C8	15	13	5	10	9	18	12	2	10
C9	20	2	20	11	8	1	16	13	16
C10	8	14	7	12	13	13	10	11	9
C11	5	19	10	5	6	4	7	18	7
C12	7	17	19	6	18	5	11	20	15
C13	18	11	14	17	19	19	14	6	19
C14	4	10	3	13	2	15	1	7	2
C15	6	15	18	14	17	12	13	16	14
C16	13	16	13	16	7	2	15	17	13
C17	11	1	1	7	10	3	9	14	3
C18	14	9	2	15	15	20	20	10	12
C19	1	8	4	8	5	9	3	3	1
C20	16	6	9	9	11	6	6	4	8

Table 15 Indian Smart City Each Dimension Ranking Result Using DBA

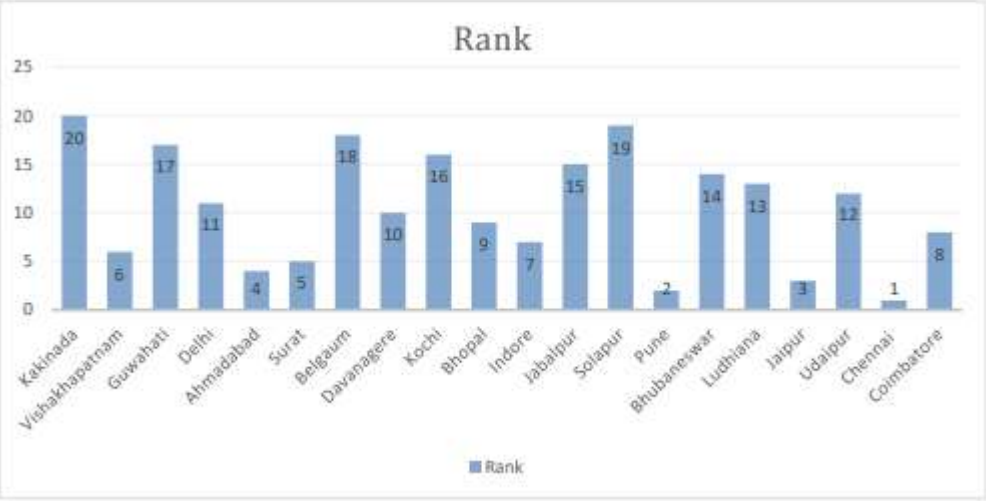

Figure 4.4 Indian Smart City Ranking Result Using DBA

Figure 4.5 Indian Smart City Each Dimension Ranking Result Using DBA

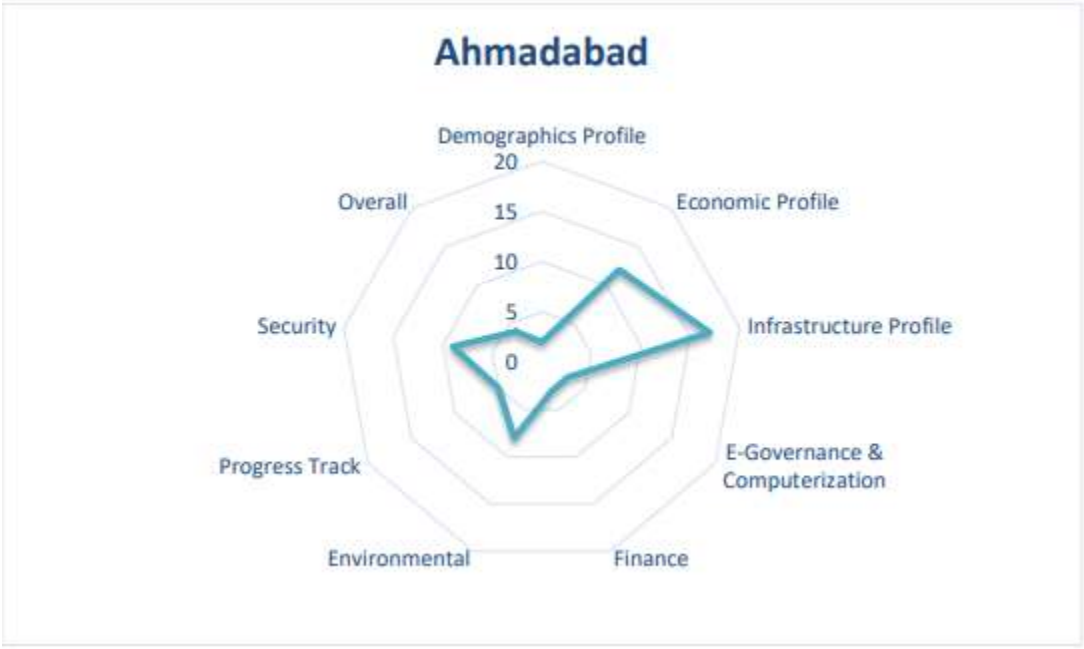

Figure 4.6 Ahmadabad Dimensions Ranking using DBA

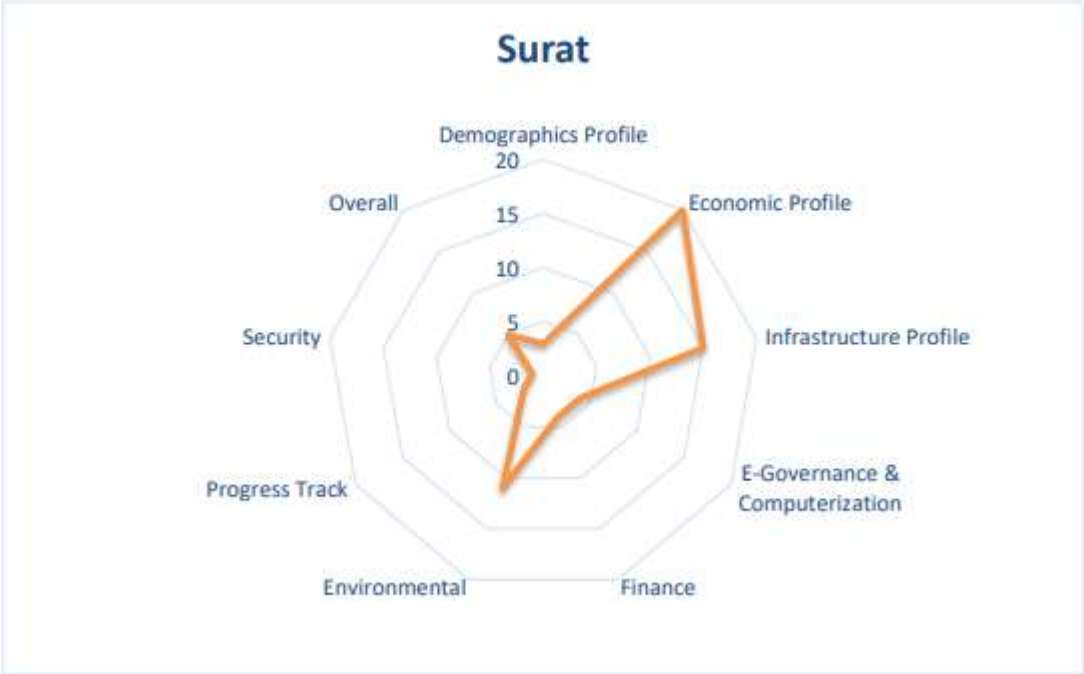

Figure 4.7 Surat Dimensions Ranking using DBA

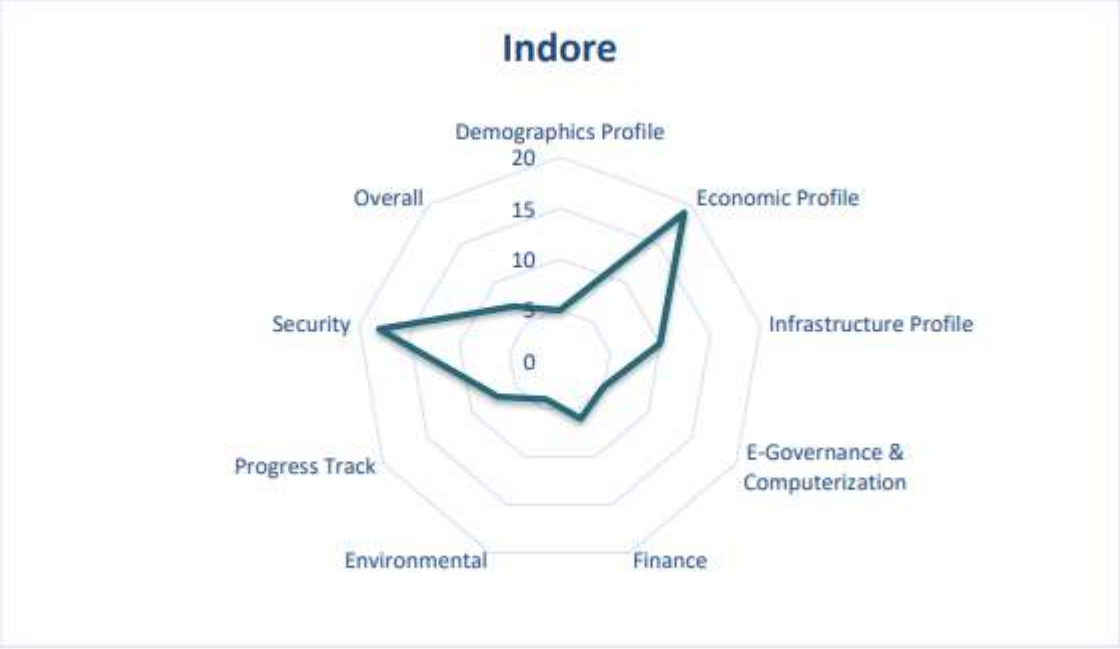

Figure 4.8 Indore Dimensions Ranking using DBA

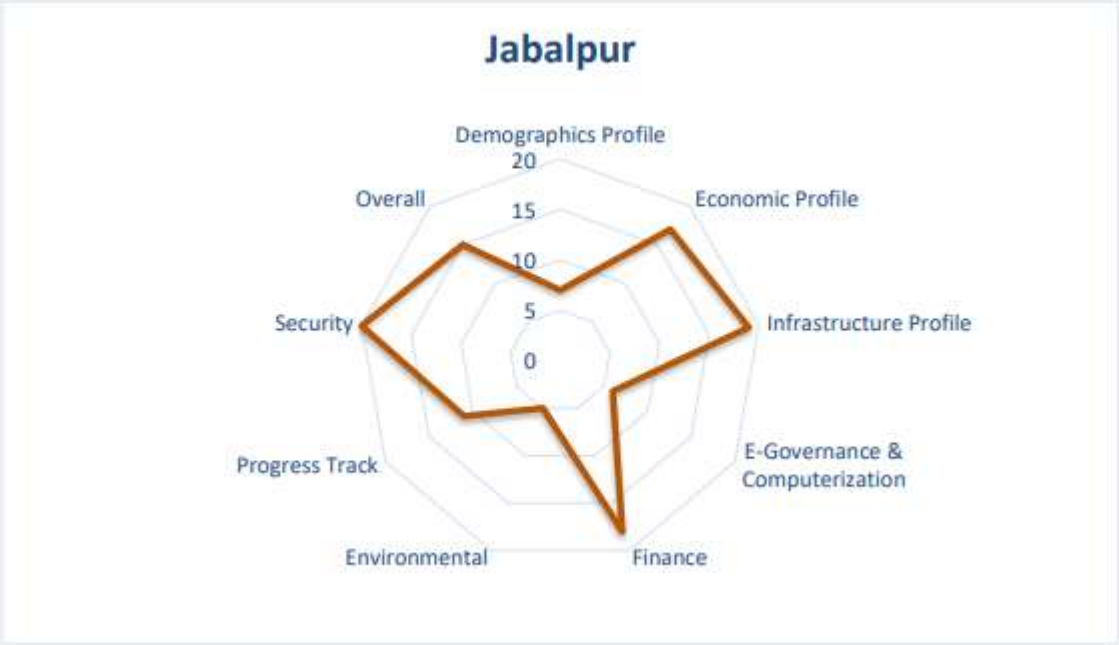

Figure 4.9 Jabalpur Dimensions Ranking using DBA

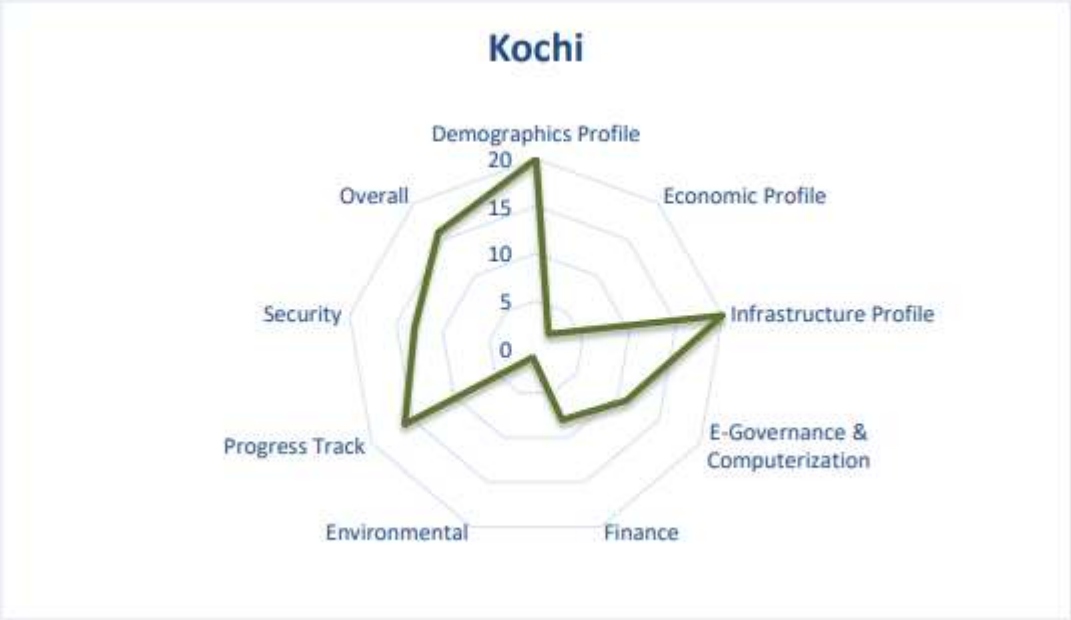

Figure 4.10 Kochi Dimensions Ranking using DBA

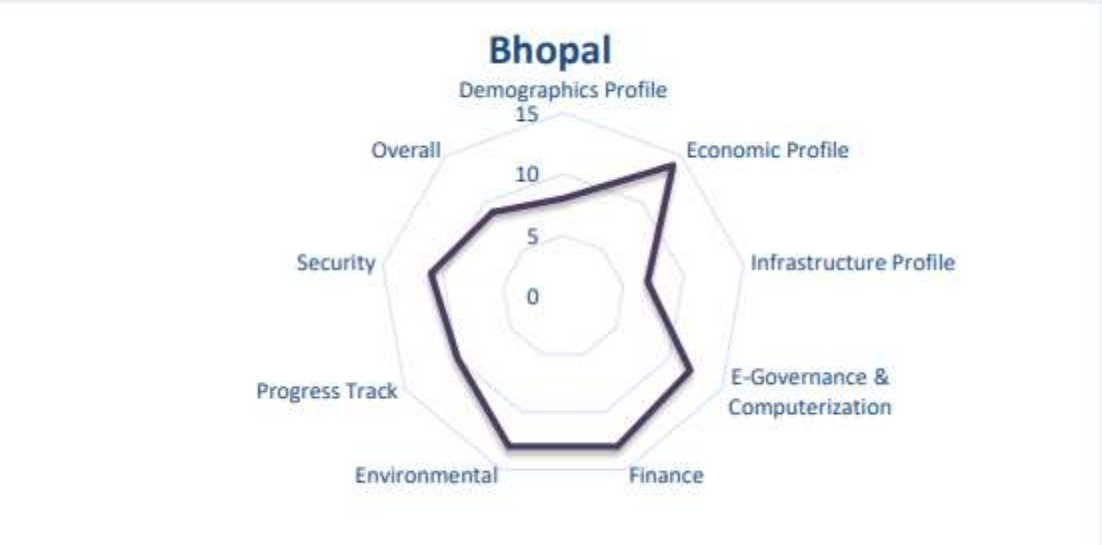

Figure 4.11 Bhopal Dimensions Ranking using DBA

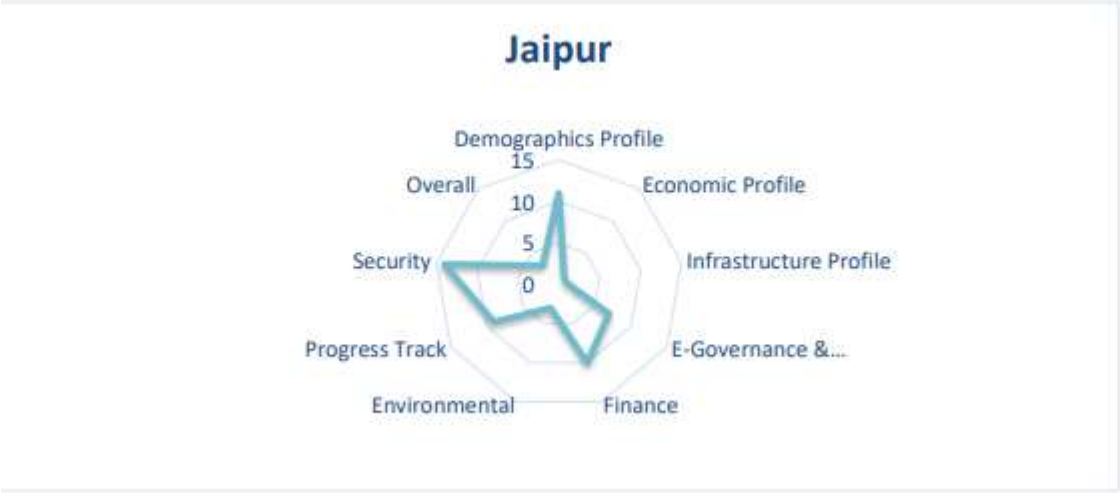

Figure 4.12 Jaipur Dimensions Ranking using DBA

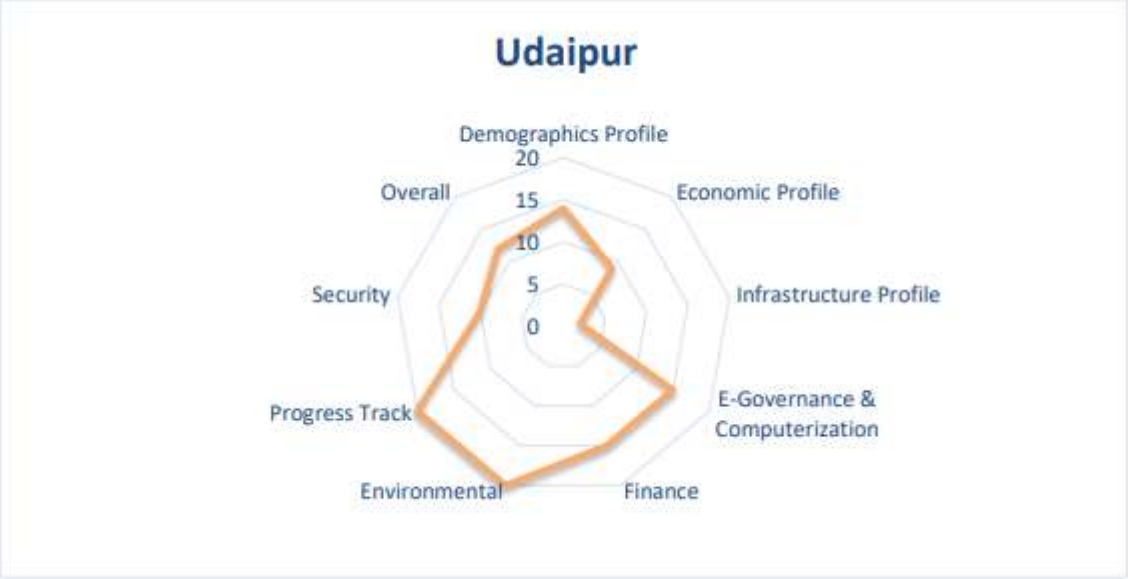

Figure 4.13 Udaipur Dimensions Ranking using DBA

Figure 4.14 Coimbatore Dimensions Ranking using DBA

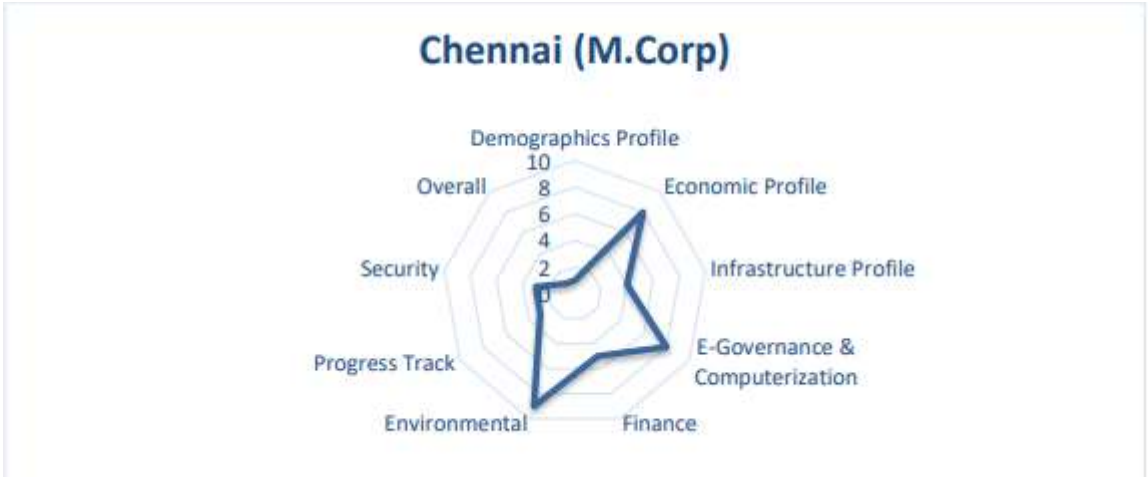

Figure 4.15 Chennai Dimensions Ranking using DBA

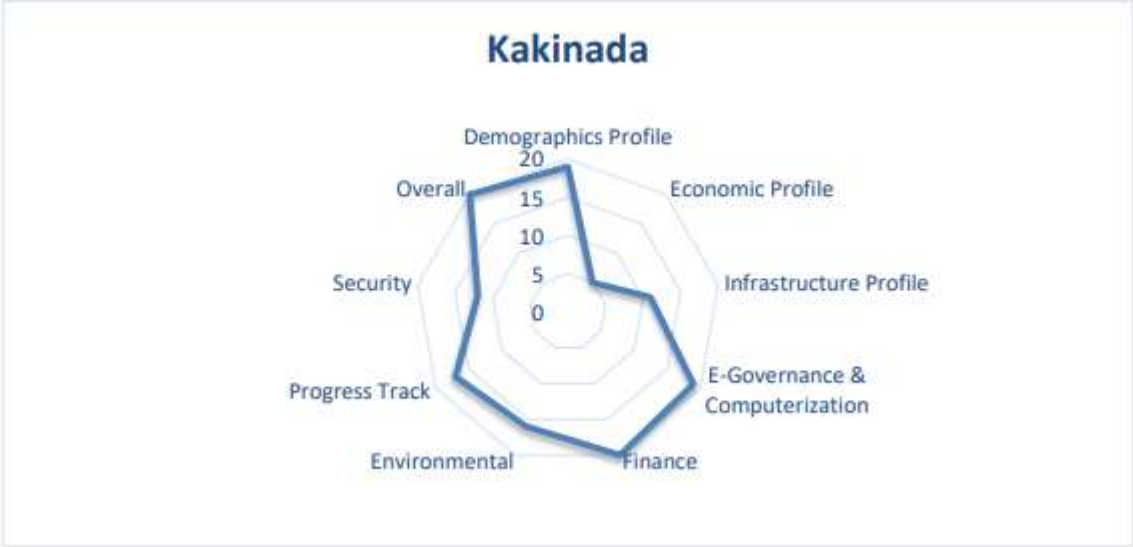

Figure 4.16 Kakinada Dimensions Ranking using DBA

Figure 4.17 Vishakhapatnam Dimensions Ranking using DBA

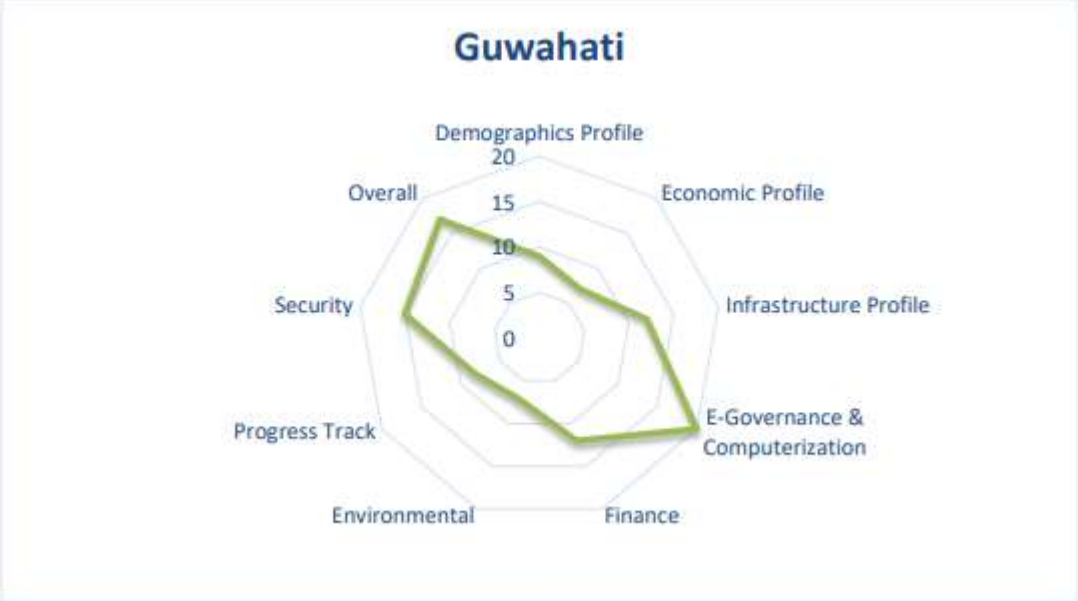

Figure 4.18 Guwahati Dimensions Ranking using DBA

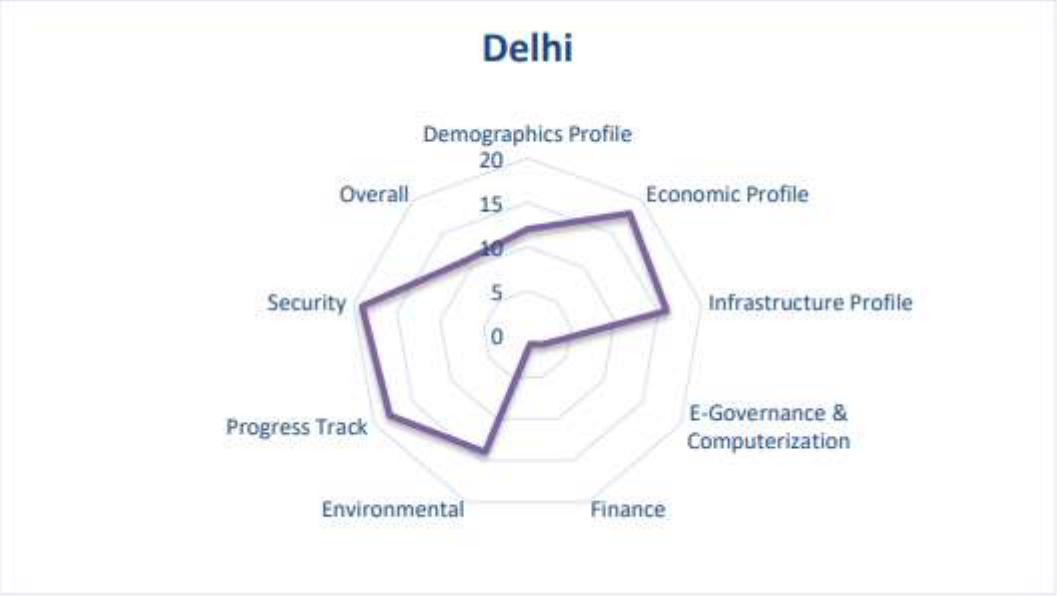

Figure 4.19 Delhi Dimensions Ranking using DBA

Figure 4.20 Belgaum Dimensions Ranking using DBA

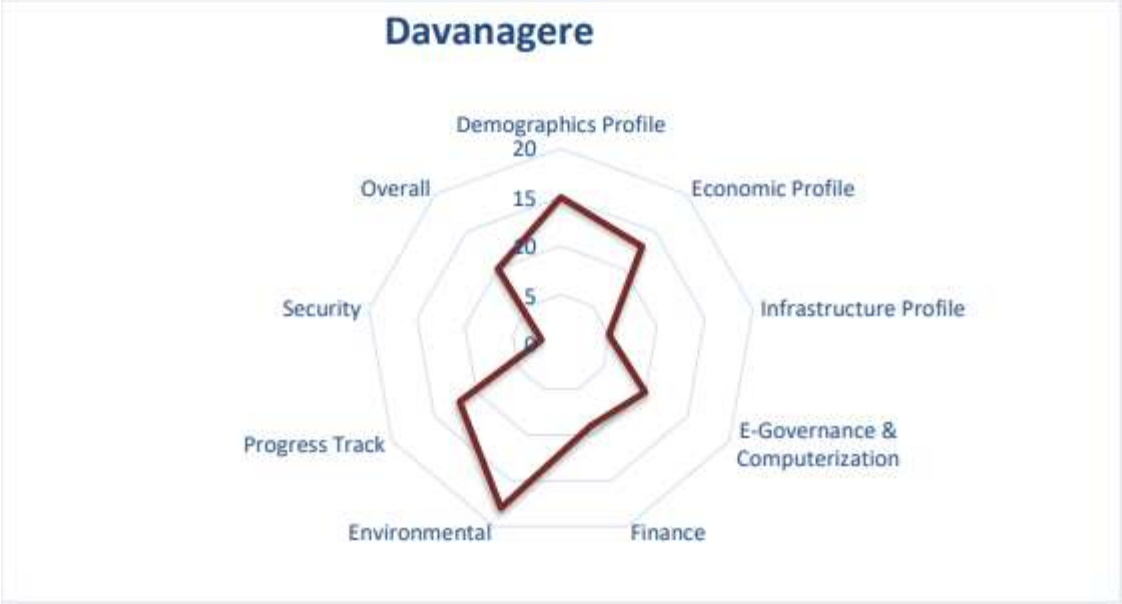

Figure 4.21 Davanagere Dimensions using DBA

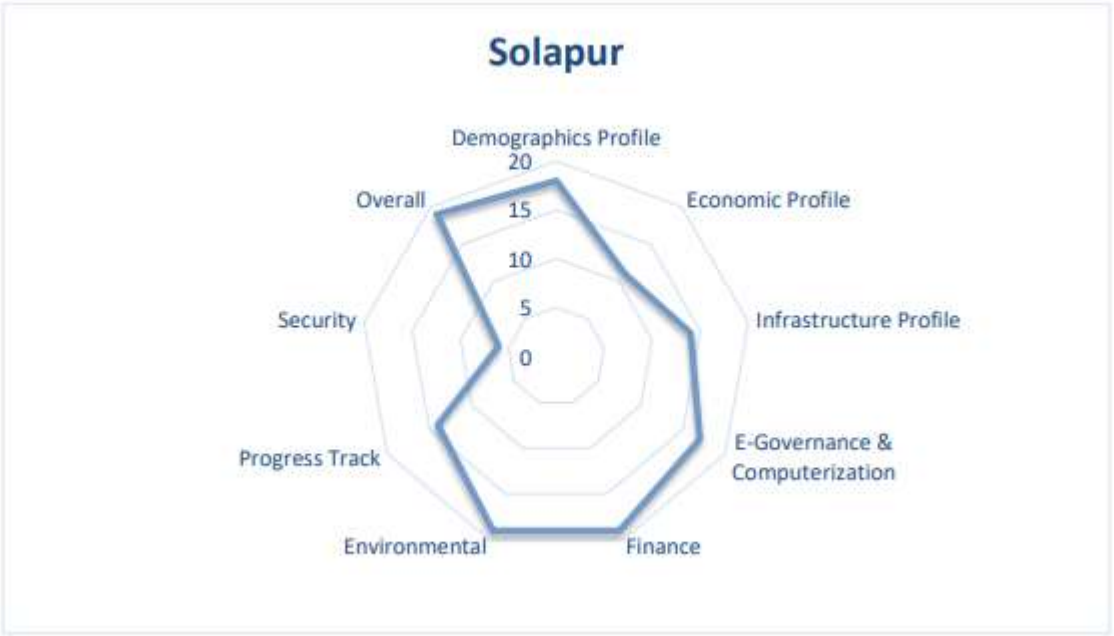

Figure 4.22 Solapur Dimensions Ranking using DBA

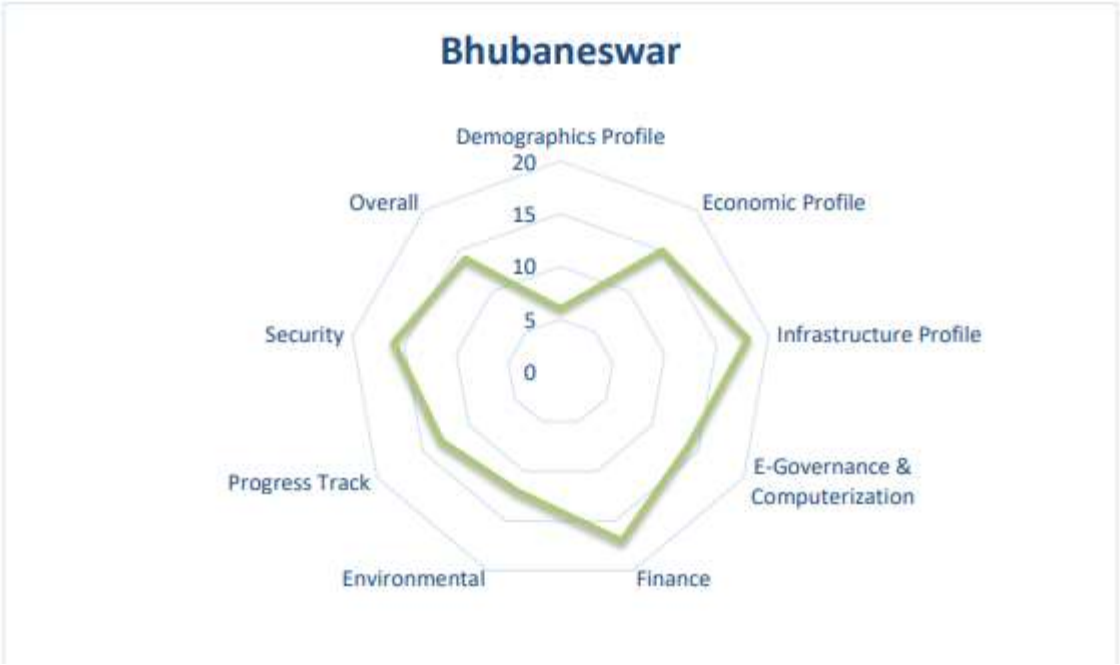

Figure 4.23 Bhubaneshwar Dimensions Ranking using DBA

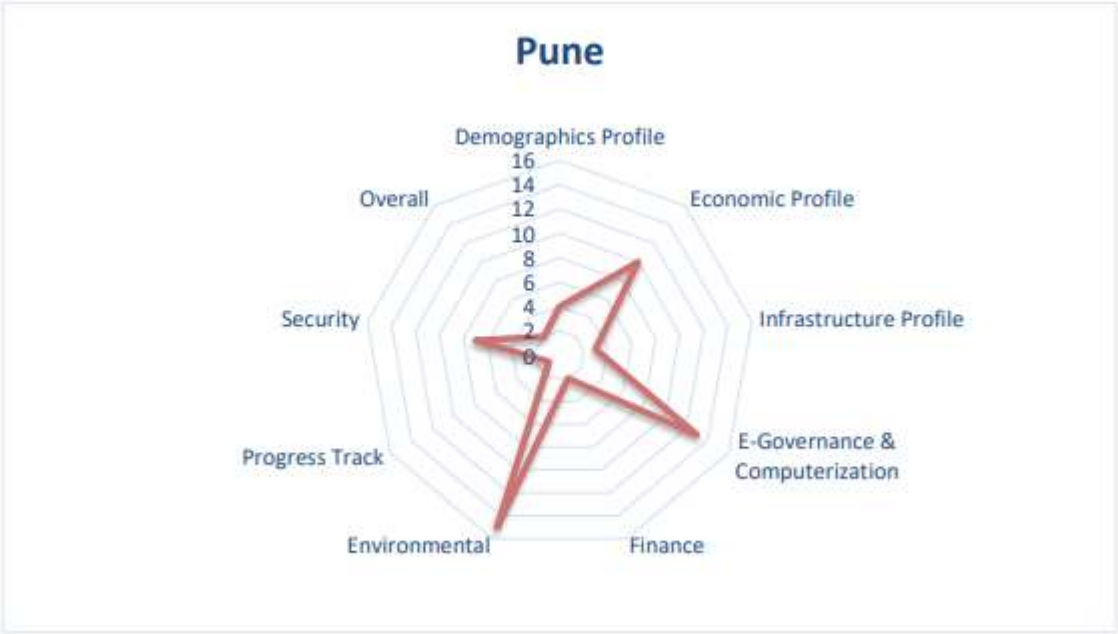

Figure 4.24 Pune Dimensions Ranking using DBA

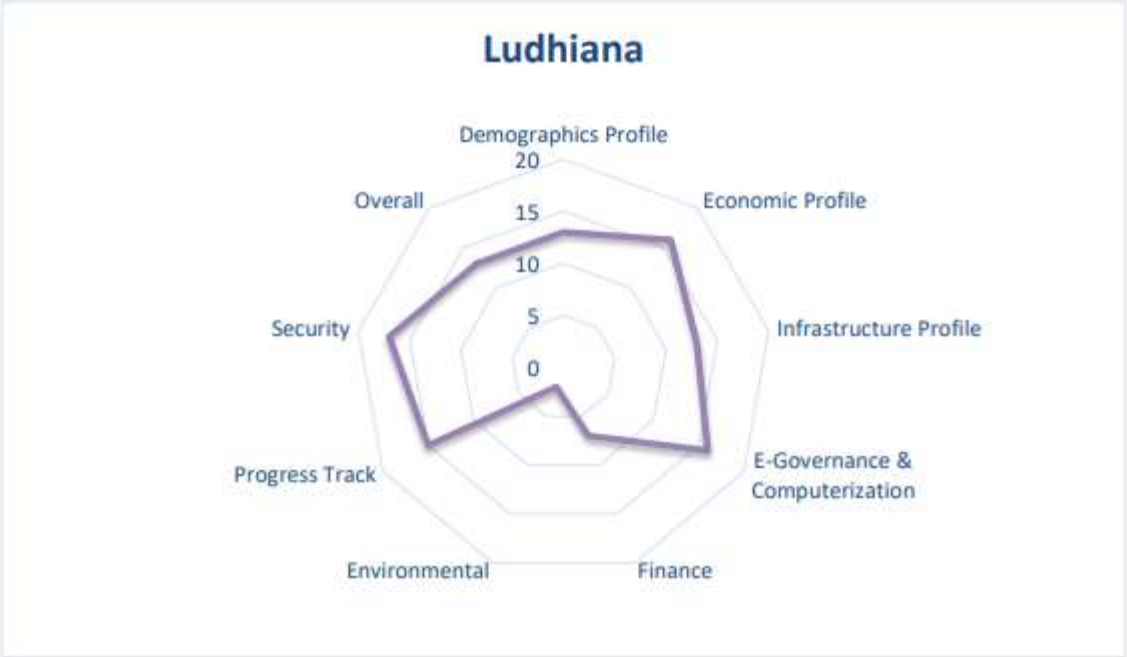

Figure 4.25 Ludhiana Dimensions Ranking using DBA

This chapter has explained algorithms DBA, for ranking Smart City on the base of 80 indicators of twenty Indian smart cities. The graphical presentation of rank given a perfect comparative understanding of the growth of smart cities. Spearman's rank correlation coefficient of ranking algorithms shows a similarity association of algorithms in the same direction ranking.

CHAPTER -5
SURVEY AND QUESTIONAIRE

5.1.DEMOGRAPHIC PROFILE OF THE STUDY

Table 5.1: Gender of the respondents

	Frequency	Percentage
Male	75	30%
Female	125	70%
Total	250	100%

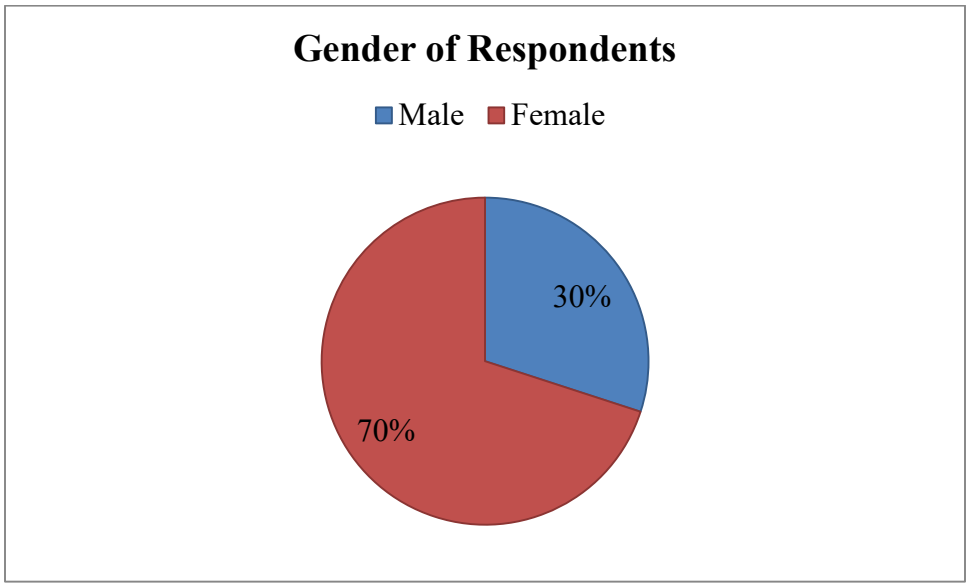

Figure 5.1: Gender of the respondents

The data provided shows the gender distribution of a sample of 250 individuals. Out of the sample, 75 individuals were male, which represents 30% of the total sample, while 125 individuals were female, which represents 70% of the total sample. This suggests that the sample is skewed towards female participants, with almost twice as many female participants as male participants. It is important to note that this may have implications for the generalizability of any findings or conclusions drawn from the sample, as it may not accurately represent the gender distribution of the larger population being studied.

Table 5.2: Age of Respondents

	Frequency	Percentage
21-30	35	14%
31-40	113	45%
41-50	30	12%
51-60	32	13%
>60	40	16%
Total	250	100%

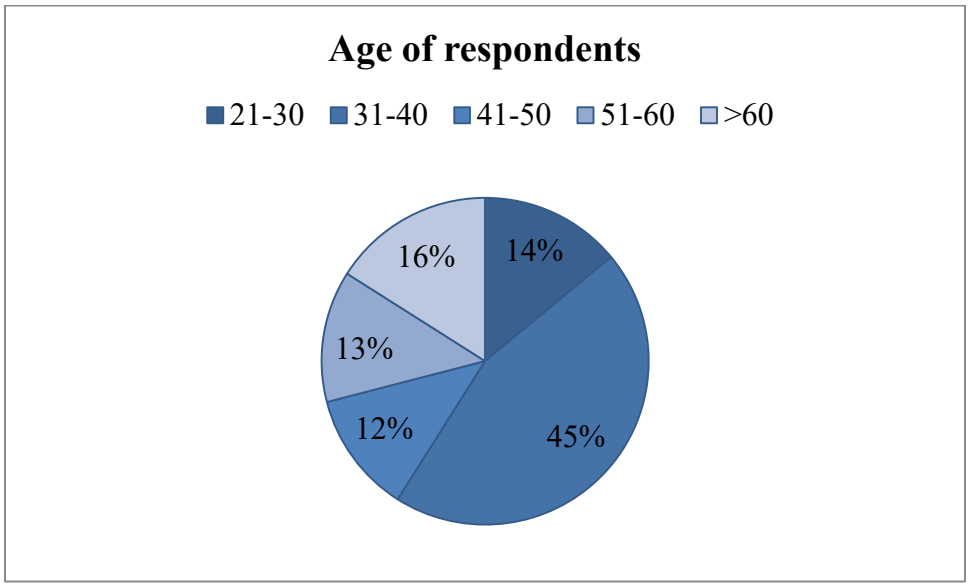

Table 5.2: Age of Respondents

The data provided shows the age distribution of a sample of 250 individuals. Out of the sample, the largest age group was 31-40 years old with 113 individuals, representing 45% of the total sample. The next largest group was >60 years old with 40 individuals, representing 16% of the total sample.The remaining age groups were less represented in the sample, with 21-30 years old representing 14% of the sample (35 individuals), 41-50 years old representing 12% of the sample (30 individuals), and 51-60 years old representing 13% of the sample (32 individuals).

Table 5.3: Education Level

	Frequency	Percentage

Bachelor	187	86%
Master degree/Professional	35	14%
Total	250	100%

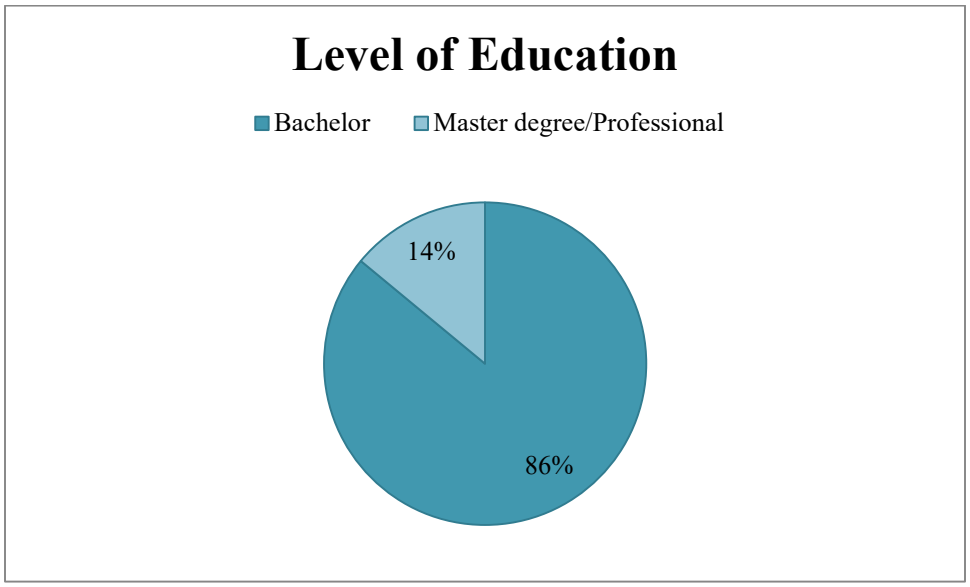

Figure 5.3: Education Level

The data provided shows the educational qualifications of a sample of 250 individuals. Out of the sample, the largest group was individuals with a bachelor's degree, which represents 86% of the total sample, with 187 individuals. The next largest group was individuals with a master's degree or higher, which represents 14% of the total sample, with 35 individuals.

It is important to note that this may have implications for the generalizability of any findings or conclusions drawn from the sample, as it may not accurately represent the educational distribution of the larger population being studied.

5.2.RESPONSES OF QUESTIONNAIRE

Objective 1: To identify the key factors that contributes to successful redevelopment in the context of smart cities.

Some factors that contribute to successful redevelopment in smart cities.

1. Mobility

Most of the cities have gone rapid motorization and this has led to congestion, increasing energy bills, road accidents and poor air quality. Ease of being able to move from place to place and sound transport system is at the core of a “Smart City”. The smart transport system emphasizes walking, cycling and public transport as the primary means for mobility with personal motor vehicles being discouraged.

2. Utility Services

Reliable, adequate and high-quality utility services like electricity, sanitation and ICT are part of a smart city. Similarly, municipal services such as water supply, drainage, solid waste management are of very high quality and available round the clock. A Smart City cannot have only a few hours of water supply a day or electricity that goes off for several hours or the streets littered with garbage

3. Internet and telephone

In a smart city most of the services are offered online and it has at least 100 Mbps internet speed. Majority area is covered completely by cell phone towers and has high level of telephone penetration. Local service providers have multiple service kiosks that are accessed by people for evaluating public services and accessing public information. Telephone services based on Direct-to-Home Fiber should be available for every household with Wi-Fi in all public places and educational institutions are important features of smart cities.

4. Electricity

Smart cities have inclusive access to quality electricity throughout the day and each household unit is outfitted with smart metering. They have smart grid integrated with renewable sources like wind and solar energy to meet the demand with established and strengthened power backing system. Further, smart cities have focus on green building and green transport to reduce the need of electricity. Integrated billing system is important frame-work of a smart city for services like electricity, water, gas, house tax and internet tax. It also has common customer care centers and user-friendly payment platform for online payments.

5. Education and Entertainment

Every neighborhood in smart cities has accessed to quality education, both for schools and higher education through e-education and digital content. Good entertainment facilities like

theatres, concert calls, auditoriums, cultural centers, open spaces, plazas make the people in a smart city happy and offer opportunities for recreation. Good sports facilities – Children Park, stadium, swimming pools, neighborhood sports complex, and golf courses are essence of a smart city.

Some Survey collected from the Respondents:

To what extent do you believe that smart city initiatives can support successful redevelopment projects?

Table 5.4: Response of 1 Question

	No. of Respondents	**Percentage**
Strongly Agree	117	47%
Agree	97	39%
Neutral	23	9%
Disagree	5	2%
Strongly Disagree	8	3%
TOTAL	**250**	**100%**

Source: Primary Data

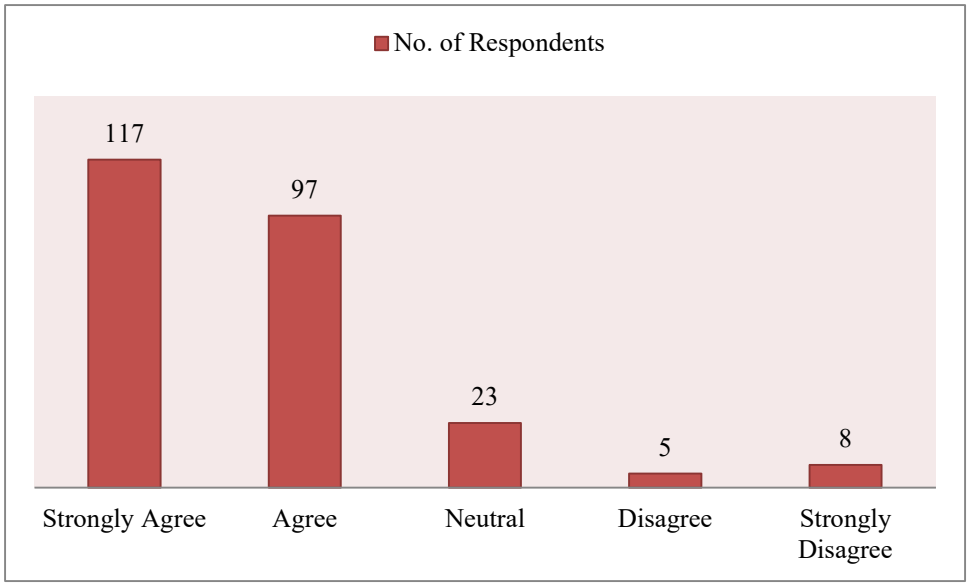

Figure 5.4: Response of 1 Question

Based on the data presented in Table 5.4, it can be interpreted that digital campaigning has had a positive impact on the awareness of new products and services for a majority of the respondents. About 86% of the respondents either strongly agreed or agreed that digital campaigning has

increased their awareness of new products/services. Only a small percentage (5%) of respondents disagreed or strongly disagreed with this statement, suggesting that digital campaigning has had a limited impact on their awareness. The neutral responses (9%) indicate that some respondents did not have a strong opinion on the matter. Overall, the data suggests that digital campaigning is an effective way to increase awareness of new products/services among a significant proportion of the population.

How effective do you believe smart city initiatives have been in supporting redevelopment projects in your city?

Table 5.5: smart city initiatives for supporting redevelopment projects

Preference	**No. of Respondents**	**Percentage**
Strongly Agree	84	34%
Agree	110	44%
Neutral	5	2%
Disagree	33	13%
Strongly Disagree	18	7%
TOTAL	**250**	**100%**

Source: Primary Source

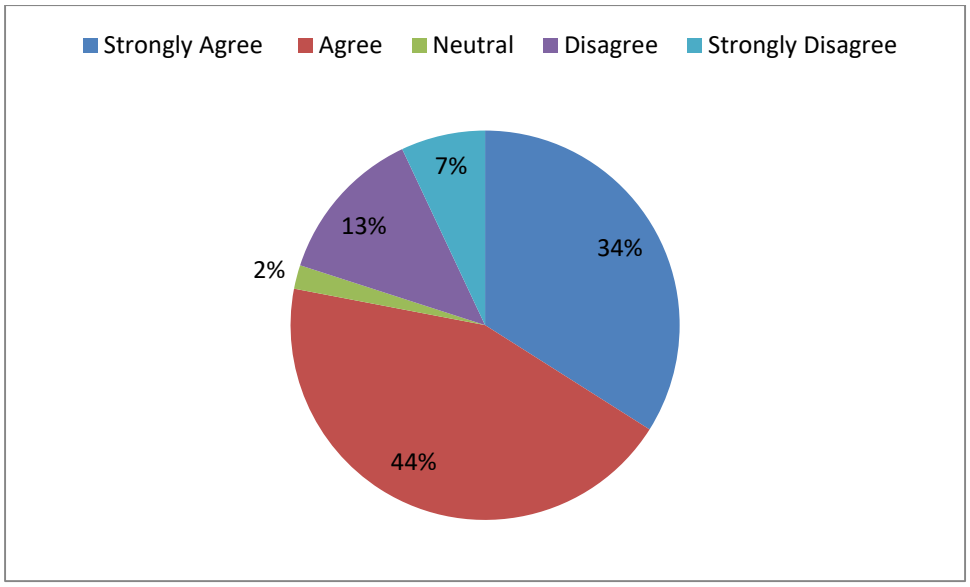

Figure 5.5: smart city initiatives for supporting redevelopment projects

Based on the responses provided in Table 5.5, which represents the preferences of the respondents regarding smart city initiatives for supporting redevelopment projects, the following

interpretation can be made: Strongly Agree: 84 respondents (34%) strongly agree that smart city initiatives are effective in supporting redevelopment projects. Agree: 110 respondents (44%) agree that smart city initiatives are effective in supporting redevelopment projects. Neutral: 5 respondents (2%) have a neutral opinion on the effectiveness of smart city initiatives in supporting redevelopment projects. Disagree: 33 respondents (13%) disagree that smart city initiatives are effective in supporting redevelopment projects. Strongly Disagree: 18 respondents (7%) strongly disagree that smart city initiatives are effective in supporting redevelopment projects. Overall, a majority of the respondents, comprising 78% (Strongly Agree + Agree), believe that smart city initiatives can support successful redevelopment projects. However, a notable proportion, 20% (Disagree + Strongly Disagree), hold a contrary opinion. The small percentage of respondents (2%) with a neutral stance suggests a relatively low level of uncertainty regarding the effectiveness of smart city initiatives for supporting redevelopment projects.

How important do you believe it is to incorporate sustainability principles into smart city redevelopment strategies?

Table 5.6: Incorporate sustainability principles into smart city

Preference	**No. of Respondents**	**Percentage**
Strongly Agree	88	35%
Agree	112	45%
Neutral	5	2%
Disagree	30	12%
Strongly Disagree	15	6%
TOTAL	**250**	**100%**

Source: Primary Source

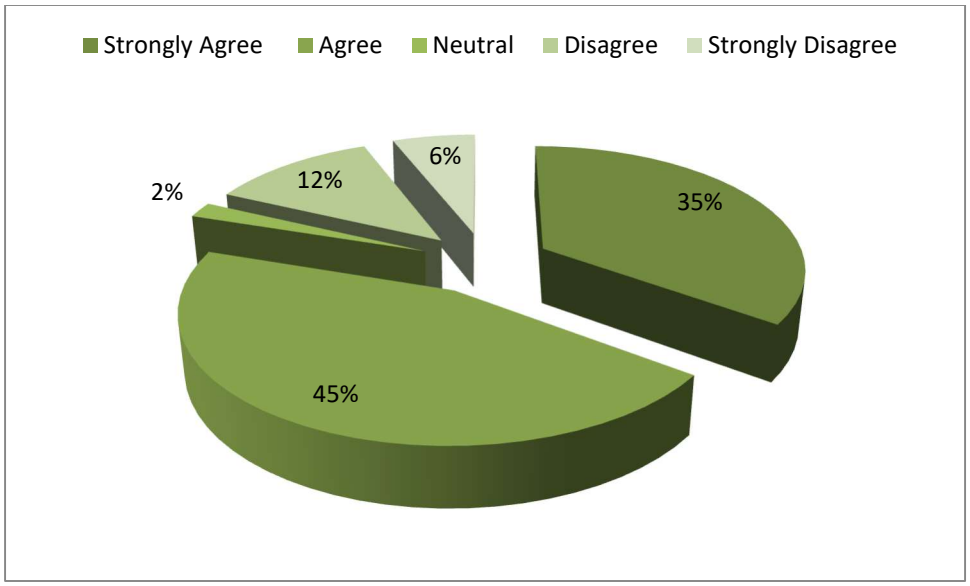

Figure 5.6: incorporate sustainability principles into smart city

For the statement "give my personal data for the purpose of obtaining targeted digital adverts," the above results show that 35% of respondents are very agree, 45% are agree, 2% are neutral, 12% disagree, and 6% strongly disagree.

To what extent do you believe that collaboration among stakeholders is necessary for the success of smart city redevelopment projects?

Table 5.7: collaboration among stakeholders

Preference	**No. of Respondents**	**Percentage**
Strongly Agree	62	25%
Agree	80	32%
Neutral	5	2%
Disagree	58	23%
Strongly Disagree	45	18%
TOTAL	**250**	**100%**

Source: Primary Source

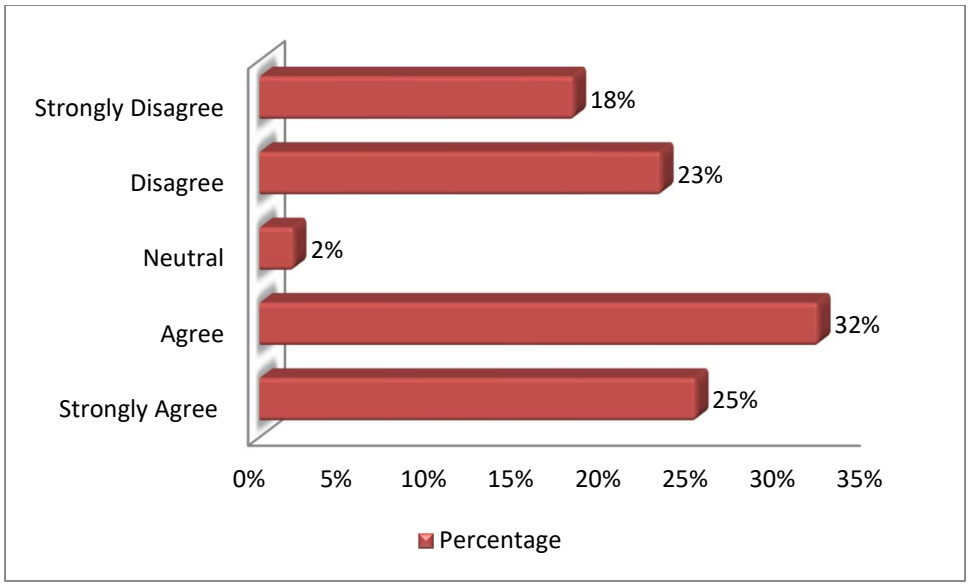

Figure 5.7: collaboration among stakeholders

250 participants 32% of respondents highly agree, 25% agree, 5% are neutral, 23% disagree, and 18% strongly disagree that digital campaigning has the ability to alter the way businesses connect with customers. The proportion of people who agree with the statement "digital campaigning has the potential to revolutionize the way organizations communicate with consumers" is rather high (57 percent; 25+32 responses).

Objective 3: To assess the role of technology in enabling successful redevelopment in smart cities.

In order to offer sustainable socioeconomic development, smart cities use a variety of technologies. In smart cities, institutions and residents may be extremely connected. In order to offer inhabitants access to high-quality services in real-time, all elements of smart cities must operate as a cohesive system (Donepudi, 2018). Only modern technologies, including artificial intelligence, the internet of things, machine learning, and deep learning, among others, can perform such tasks. The parts that follow go over the numerous uses of artificial intelligence, the internet of things, machine learning, and deep learning to address issues and promote the growth of smart cities.

artificial Intelligence

Smart city development can benefit greatly from the use of artificial intelligence. Urbanization can become wiser with the aid of artificial intelligence if new features are added to cities.

Artificial intelligence has the potential to drastically alter lives when used properly (Donepudi, 2018).

Internet of Things

The majority of the world's population uses the internet as a means of data transmission and collecting. However, as more gadgets and sensors become connected, this is altering. The connectedness of the many gadgets that may gather data and are connected served as the foundation for the creation of smart cities (Gade et al., 2016).

Machine Learning

The intelligent component of programs for smart cities is provided by machine learning, just like artificial intelligence. First, machine learning has a crucial role to play in the healthcare industry. As was already stated, enhancing the lives of residents of Smart Cities depends on providing high-quality healthcare (Mohapatra, 2019). For instance, machine learning can be used to identify chronic diseases early. It can be used to determine a person's behavior based on how they utilize gadgets like computers, smartphones, and even social media platforms. This can assist doctors in determining a person's mental state. Additionally, doctors are using machine learning to research conditions like diabetes and provide helpful data that can help them deliver beneficial and exceptional treatment (Donepudi, 2017).

Deep Learning :

In-depth Learning Data insights can be effectively obtained using deep learning. It can also be used to recognize data trends, aid in the categorization of the data, and make predictions about the data. Deep Learning has several applications in Smart Cities. First, modeling for smart cities can be done using deep learning. Cities may utilize deep learning to examine data to determine which regions are developed and underdeveloped, and then use that information to model their development strategies. Deep Learning can be used in Smart Cities to model intelligent infrastructure that can accommodate the billions of people that are anticipated to live in cities in the future. Respondents have completed some surveys:

To what extent do you believe that technology can enable successful redevelopment in smart cities?

Table 5.8: Technology can enable successful redevelopment in smart cities

	No. of Respondents	**Percentage**
Strongly Agree	85	34%

Agree	91	36%
Neutral	10	5%
Disagree	25	10%
Strongly Disagree	39	15%
TOTAL	**250**	**100%**

Source: Primary Data

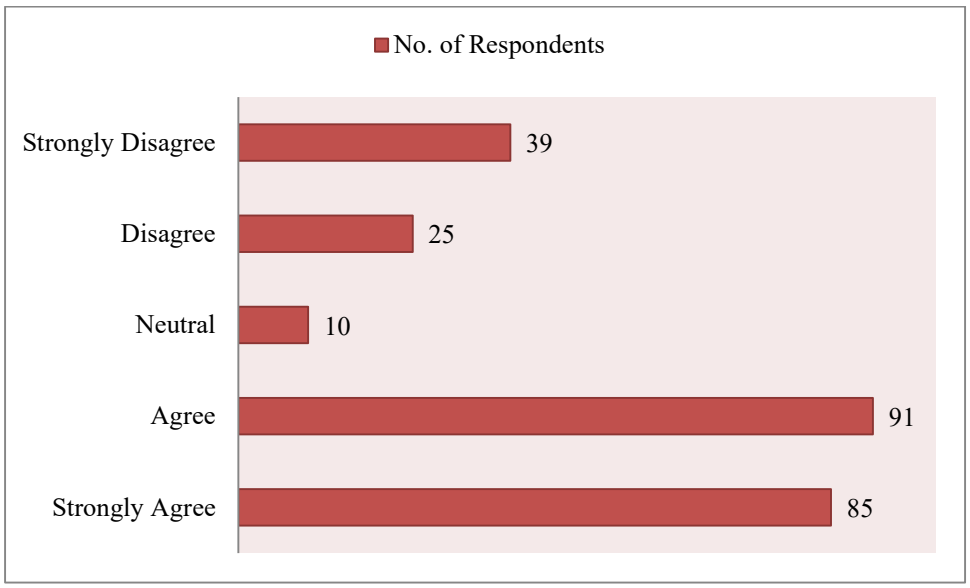

Figure 5.8: Technology can enable successful redevelopment in smart cities

Based on the data presented in Table 4.10, it can be interpreted that digital campaigning has had a mixed impact on the purchasing decisions of the respondents. While a majority of the respondents (70%) either strongly agreed or agreed that digital campaigning has influenced their purchasing decisions, a significant proportion of the respondents (25%) disagreed or strongly disagreed with this statement. The neutral responses (5%) indicate that some respondents did not have a clear opinion on the matter. Overall, the data suggests that digital campaigning has some influence on the purchasing decisions of a significant proportion of the population, but it is not a deciding factor for everyone. Other factors such as personal preferences, product quality, and price may also play a role in the purchasing decisions of consumers.

How important do you believe it is to incorporate technology into redevelopment projects?

Table 5.9: Incorporate technology into redevelopment projects

	No. of Respondents	**Percentage**

Strongly Agree	98	39%
Agree	90	36%
Neutral	25	10%
Disagree	17	7%
Strongly Disagree	20	8%
TOTAL	**250**	**100%**

Source: Primary Data

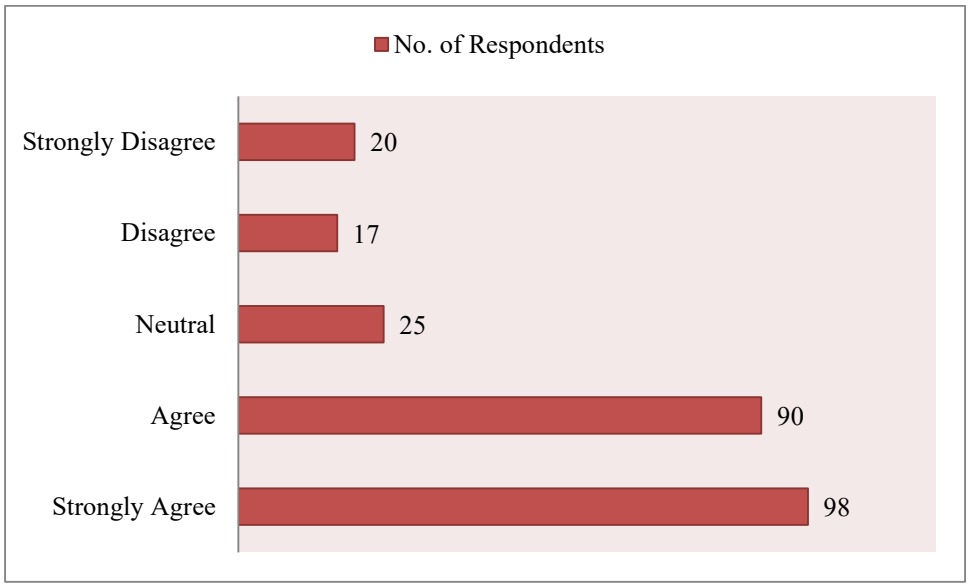

Figure 5.9: Incorporate technology into redevelopment projects

Majority of the respondents (39%) either strongly agreed or agreed that Digital campaigning has improved my overall online shopping experience; a significant proportion of the respondents (36%) agreed with this statement. The neutral responses (10%) indicate that some respondents did not have a clear opinion on the matter. Overall, the data suggests that Digital campaigning has improved my overall online shopping experience.

To what extent do you believe that technology can help to address social and economic inequalities in the context of redevelopment?

Table 5.10: Social and economic inequalities

Preference	**No. of Respondents**	**Percentage**
Strongly Agree	60	24%
Agree	80	32%
Neutral	10	4%

Disagree	58	23%
Strongly Disagree	42	17%
TOTAL	**250**	**100%**

Source: Primary Source

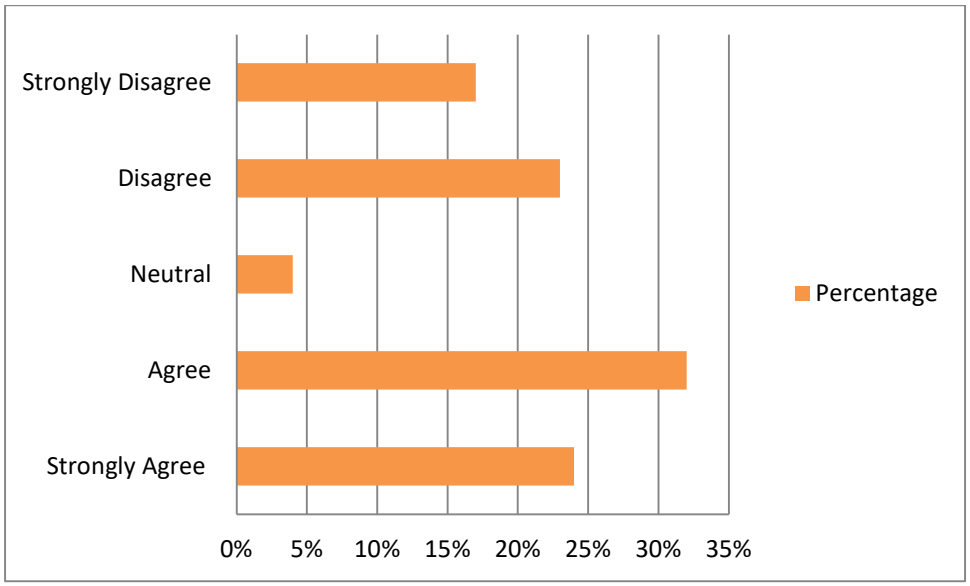

Figure 5.10: digital campaigning can be beneficial if done in a responsible and ethical manner

Among 250 respondents 60 (24%) highly agree; 80 (32%) agree; 10 (4%) neutral; 58 (23%) disagree, and 42 (17%) strongly disagree that digital campaigning may be useful if done in a responsible and ethical way.

In various aspects, objective 3, which examines how technology contributes to effective reconstruction in smart cities, is helpful for my research.

- Understanding Technological Impact: Your study will offer insightful information on how technology might enhance the efficacy and efficiency of urban redevelopment initiatives by evaluating the role it plays in successful redevelopment projects in smart cities. This knowledge can aid in future decision-making and direct the incorporation of technology into redevelopment plans.
- Determining Best Practices: Based on your research, you can pinpoint particular technological interventions and redevelopment strategies for smart cities that have worked well. By learning from these best practices and applying them to other urban areas undergoing reconstruction, policymakers, urban planners, and other stakeholders can maximize success.

- Overcoming Limitations: There are frequently difficulties and restrictions associated with the adoption of technology in smart city redevelopment initiatives. Your study can pinpoint these difficulties and offer suggestions for resolving them by evaluating the role of technology. This can aid in the creation of efficient solutions to deal with any organizational, operational, and technological challenges that may emerge during the execution of technology-driven redevelopment programs.
- Supporting Sustainable Development: The goal of smart city redevelopment is to make cities more resilient, habitable, and sustainable. By enabling effective resource management, upgrading infrastructural systems, and raising the quality of services offered to inhabitants, technology plays a critical role in achieving these goals. Your study can offer insight on how technology-driven methods help to sustainable urban redevelopment by analyzing the role of technology.

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Objective 4: To identify the challenges and limitations of implementing smart city redevelopment strategies

Here are some of the typical difficulties that Smart City solutions now face, along with some suggestions for how developers could start to overcome these difficulties.

- Infrastructure

In order to raise people' quality of life, Smart Cities use sensor technologies to collect and analyze information. Data is gathered by sensors on everything, including rush hour statistics, crime rates, and overall air quality. Installing and maintaining these sensors requires a complex and pricey infrastructure. On what will they run? Will it run on batteries, solar power, or hard wiring?

Major metropolitan regions already face difficulties with deploying high-speed internet and updating decades-old infrastructure, such as underground wiring, steam pipes, and transit tunnels. Although availability to broadband wireless service is expanding, there are still some remote locations in big cities. New infrastructure project funding is scarce, and approval procedures can drag on for years. The installation of new sensors and other enhancements result in brief, although irritating inconveniences for those who live in these cities. By taking these difficulties into account from the very beginning of development, developers may contribute to making smart technology simpler to install and use. By adopting simple-to-install hardware,

developers and tech businesses may hasten the process of making our cities smarter by starting with the end in mind, which is the full implementation of the solution.

- Hackers and security

The level of security threat increases along with the deployment of IoT and sensor technology. If hackers can get into technology and bring down an entire city, is technology really deemed "smart"? Everyone is now a little more wary of technology and security due to recent discussions about cyber-terror threats to weak and antiquated power grids. While IT companies are developing solutions with new built-in mechanisms to guard against hacking and cybercrimes, Smart Cities are spending more money and resources on security. Many developers are seeking for methods to include these encryption techniques to boost security in new applications as blockchain continues to be the hot subject in the technology sector.

- Privacy Issues

There must be a balance between quality of life and violation of privacy in any major city. Everyone wants to live in a more comfortable, tranquil, and healthier environment, yet nobody wants to continually feel as though "Big Brother" is watching them. The installation of cameras on every street corner may assist to reduce crime, but they can also cause law-abiding residents to become fearful and paranoid. The volume of data being gathered from all the smart sensors that locals interact with on a daily basis is another legitimate worry. The ACLU of Northern California conducted a study about privacy issues in smart cities last year. In it, the organization emphasizes how crucial it is to comprehend technology, identify the data types and sources it employs, and decide what will be done with the data gathered.

- Involving and Educating the Community

A Smart City needs "smart" residents who are involved and actively utilizing new technology for it to survive and flourish. The community must be made aware of the advantages of any new citywide tech initiative as part of the implementation procedure. This can be accomplished through a series of live town hall-style meetings, voter registration email campaigns, and an online education platform that keeps individuals informed and involved. A community is more likely to use technology and persuade others to do the same when it feels like it has a voice in the big issues that impact daily life and is being spoken to in a clear and considerate way. The success of a Smart City depends on this. For instance, the French city of Lyon has started around

a hundred projects to enhance urban life, including smart power systems, citizen empowerment, and better air quality. To build a "city of tomorrow," the city is working with locals, business owners, major businesses, and startups.

- Promoting social inclusion

A busy city would benefit greatly from smart transit initiatives that provide real-time updates to passengers. But what if half the people in that city cannot afford to use Uber or the public transportation system? What about the rising number of seniors who don't utilize smartphones or apps? How will smart technology reach these groups of individuals and what will it provide them? It is crucial that planning for Smart Cities takes into account the needs of all demographic groups, not only the wealthy and technologically advanced. Instead than further dividing individuals based on their socioeconomic status or degree of education, technology should always be working to bring people together. The success of a solution will be enhanced if these communities are considered together with the other issues discussed in this article. These communities will go beyond the domain of tech-savvy consumers.

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To what extent do you believe that sustainable and equitable redevelopment can be promoted through smart city initiatives?

Table 5.11: sustainable and equitable redevelopment

	No. of Respondents	**Percentage**
Not at all important	104	41%
Slightly important	84	36%
Moderately important	9	3%
Very important	24	9%
Extremely important	29	11%
TOTAL	**250**	**100%**

Source: Primary Data

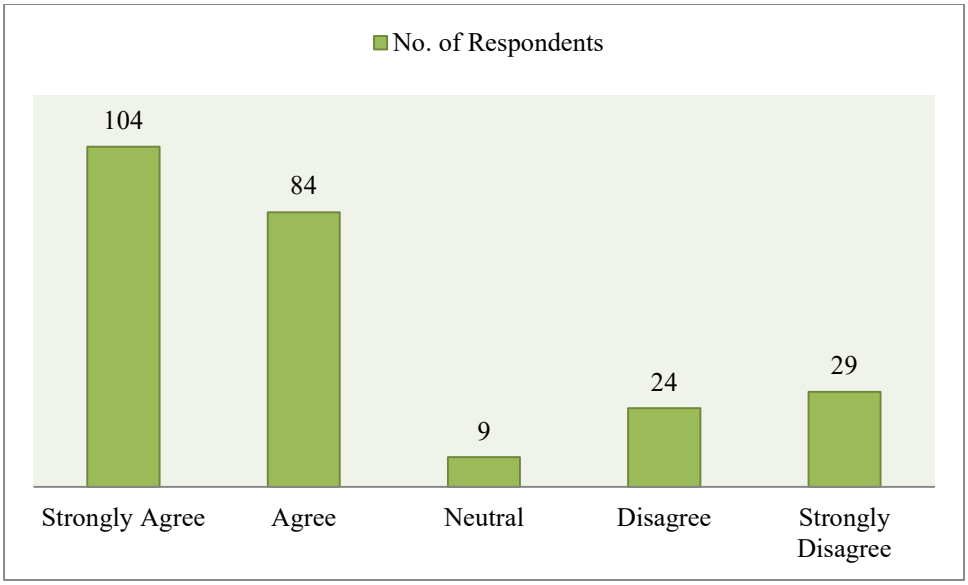

Figure 5.11: sustainable and equitable redevelopment

Majority of the respondents (41%) either strongly agreed or agreed that Digital campaigning has provided me with valuable information about products/services; a significant proportion of the respondents (36%) agreed with this statement. The neutral responses (3%) indicate that some respondents did not have a clear opinion on the matter. Overall, the data suggests that Digital campaigning has provided me with valuable information about products/services, but it is not a deciding factor for everyone.

To what extent do you believe that policy or regulatory changes can support the implementation of smart city redevelopment strategies?

Table 5.12: Policy or regulatory changes can support the implementation of smart city redevelopment strategies

	No. of Respondents	**Percentage**
Strongly Agree	201	48%
Agree	143	34%
Neutral	38	9%
Disagree	21	5%
Strongly Disagree	17	4%
TOTAL	**420**	**100%**

Source: Primary Data

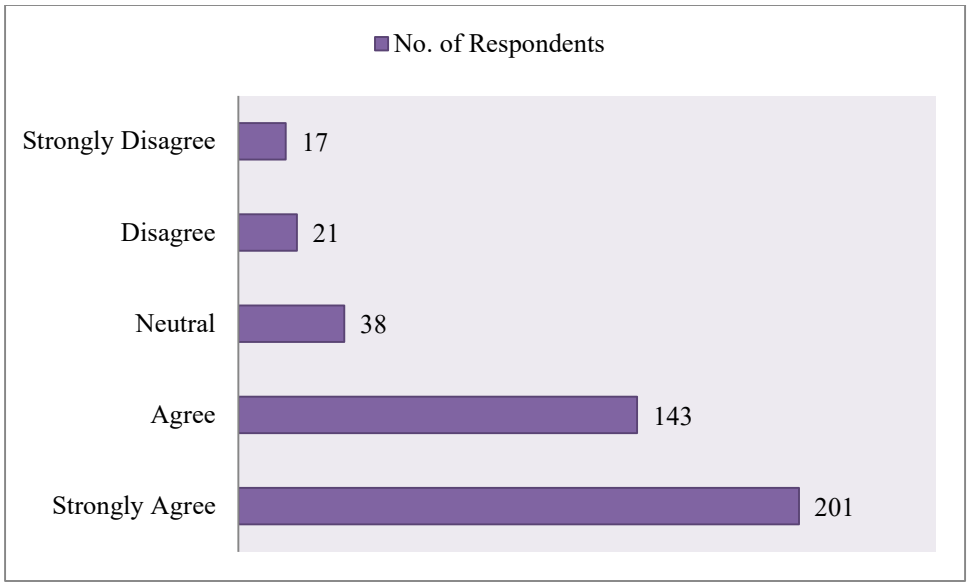

Figure 5.12: Policy or regulatory changes can support the implementation of smart city redevelopment strategies

Majority of the respondents (48%) either strongly agreed or agreed that Digital campaigning has increased my trust in the brands/products/services advertised; a significant proportion of the respondents (34%) agreed with this statement. The neutral responses (9%) indicate that some respondents did not have a clear opinion on the matter. Overall, the data suggests that Digital campaigning has increased my trust in the brands/products/services advertised

To what extent do you believe that smart city redevelopment strategies can address the challenges facing your city?

Table 5.13: challenges facing

Preference	**No. of Respondents**	**Percentage**
Strongly Agree	65	26%
Agree	90	36%
Neutral	7	3%
Disagree	50	20%
Strongly Disagree	38	15%
TOTAL	**250**	**100%**

Source: Primary Source

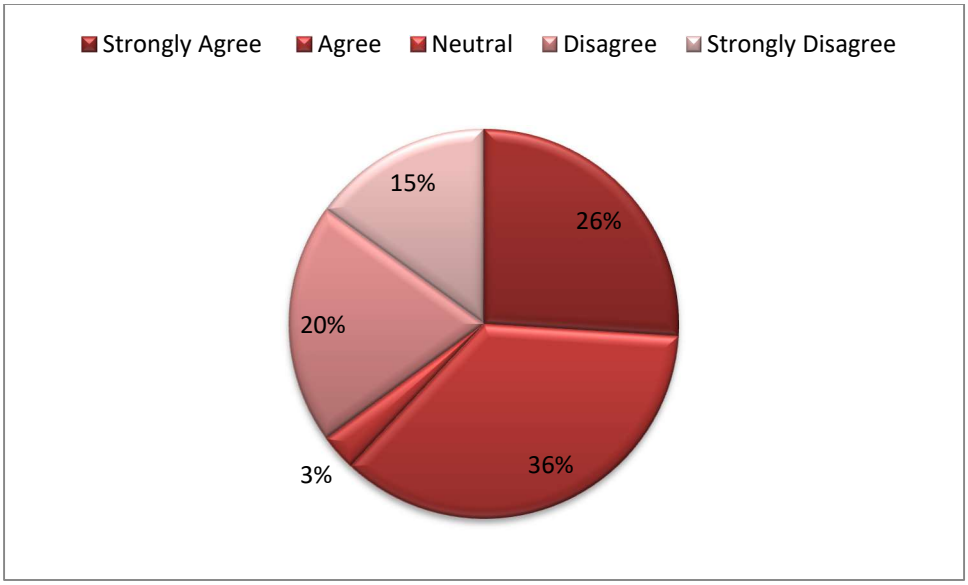

Figure 5.13: challenges facing

Based on the responses provided in Table 5.13, which represents the preferences of the respondents regarding the extent to which smart city redevelopment strategies can address the challenges facing their city, the following interpretation can be made: Strongly Agree: 65 respondents (26%) strongly agree that smart city redevelopment strategies can effectively address the challenges facing their city. Agree: 90 respondents (36%) agree that smart city redevelopment strategies can effectively address the challenges facing their city. Neutral: 7 respondents (3%) have a neutral opinion on the effectiveness of smart city redevelopment strategies in addressing the challenges facing their city. Disagree: 50 respondents (20%) disagree that smart city redevelopment strategies can effectively address the challenges facing their city. Strongly Disagree: 38 respondents (15%) strongly disagree that smart city redevelopment strategies can effectively address the challenges facing their city. Overall, a majority of the respondents, comprising 62% (Strongly Agree + Agree), believe that smart city redevelopment strategies can address the challenges facing their city to some extent. However, a notable proportion, 35% (Disagree + Strongly Disagree), hold a contrary opinion. The small percentage of respondents (3%) with a neutral stance suggests a relatively low level of uncertainty regarding the effectiveness of smart city redevelopment strategies in addressing the challenges of the city.

This objective will benefit from knowing the difficulties and restrictions associated with putting smart city redevelopment concepts into practice in the following ways:

- Comprehensive Understanding: My study can offer a full understanding of the potential roadblocks that might appear during the implementation of smart city redevelopment initiatives by studying the difficulties and constraints. The ability to anticipate and effectively solve these difficulties is vital for policymakers, urban planners, and other stakeholders involved in such efforts.
- Risk reduction: My study can aid in risk reduction in smart city redevelopment projects by identifying the difficulties and constraints. Stakeholders may establish suitable strategies, allocate resources wisely, and put risk-reduction measures into place to reduce negative effects and raise the possibility that the project will succeed by being aware of potential hurdles in advance.
- Lessons learnt: My research can offer important lessons learnt for next initiatives by examining the difficulties and constraints encountered in prior smart city redevelopment programs. It enables stakeholders to draw lessons from the past, steer clear of making the same errors again, and choose wisely when it comes to project planning, execution, and evaluation.

Objective 5: To study under the smart city Prayagraj .

Prayag in modern-day Prayagraj is believed to be the most important pilgrimage centre for Hindus. Traditionally river confluences are regarded as auspicious places, but in Sangam, the significance of the confluence is most pious because here, the holy Ganga, Yamuna and the mythical Saraswati meet to become one.

1. Allahabad is called the city of Sangam.
2. Here the Ganges and Yamuna meet and flow together.
3. Here Lord Brahma performed the first Yagya after the completion of the creation work.
4. The city was named Allahabad by Emperor Akbar.
5. In this city, Akbar had laid the foundation of the fort in about 1574.
6. Its old name is Prayagraj, which is mentioned in many places in the Puranas.
7. Allahabad is called Prayagraj in Ramcharit Manas.
8. Allahabad is one of the four sites of the largest Hindu convention, the Maha Kumbh.
9. Kumbh Mela is held here every twelve years.
10. The old name of Allahabad was Prayagraj.

REDEVELOPMENT

- Urban redevelopment is conceptually similar to land readjustment, with the exception that it happens in existing urban areas and often involves a rezoning by the government of a given area from a low-density to higher-density development. It is also accompanied by a provision of infrastructure improvements (mass transit, such as metro lines) that can support such up-zoning.

Table 5.4 Comparison of land use as proposed and actually developed during the 2001 master plans

Sr. No.	Land Use	Proposed land use as per draft URDPFI guidelines, 2014	As in 2001 (Master plan, 2001)		Actual in 2002		Proposed, 2021(Master plan, 2021)	
			Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
1	Residential	35-40	76.22	35.15%	58.31	61.91%	111.64	36.11%
2	Commercial	4-5	5.45	2.51%	3.93	4.17%	7.46	2.41%
3	Industrial	12- 14	12.17	5.61%	4.82	5.12%	17.22	5.57%
4	Public - Semi Public	14-16	22.31	10%	6.46	7%	18.69	6%
5	Recreational	20-24	15.41	7.11%	1.4	1.49%	49.53	16.02%
6	Govt. land	-	18.71	8.63%	3.15	3.34%	26.24	8.49%
7	Kumbh Mela	-	9.21	4.25%	-	-	-	-
8	Transportation	15-18	24.34	11.22%	15.88	16.86%	37.36	12.08%
9	Religious places	Balance	0.69	0.32%	0.19	0.20%	-	-
10	Others	-	32.34	14.91%	-	0.00%	40.99	13.26%
	Total	100	216.89	100.%	94.18	100.%	309.17	100.%
Source; Master Plan 2021								

There are some recommendations for effective strategies for smart city redevelopment:

- Integrated Planning: Foster collaboration and coordination among different stakeholders, including government agencies, private sector entities, community organizations, and citizens. Develop an integrated approach to planning that considers various aspects of redevelopment, such as transportation, infrastructure, housing, environment, and social equity.

- Citizen Engagement: Involve citizens in the redevelopment process by encouraging their active participation and incorporating their feedback and ideas. Use digital platforms and technology tools to facilitate citizen engagement and gather valuable insights for decision-making.
- Data-driven Decision Making: Emphasize the collection and analysis of data to inform decision-making in redevelopment projects. Utilize smart city technologies and sensors to gather real-time data on energy consumption, traffic patterns, environmental conditions, and other relevant factors. Analyze the data to gain insights and optimize redevelopment strategies.
- Sustainable and Resilient Design: Prioritize sustainability and resilience in redevelopment projects. Incorporate green infrastructure, energy-efficient buildings, renewable energy sources, and climate adaptation measures. Aim for long-term sustainability, minimizing environmental impact, and enhancing the resilience of the city's infrastructure and communities.
- Smart Mobility Solutions: Implement intelligent transportation systems and promote multimodal transportation options. Develop smart mobility solutions like bike-sharing programs, electric vehicle charging infrastructure, and efficient public transportation systems. Foster connectivity between different modes of transportation to reduce congestion and promote sustainable mobility.
- Digital Infrastructure: Invest in robust digital infrastructure to enable connectivity and support the deployment of smart city technologies. Ensure high-speed internet access and reliable communication networks to facilitate the integration and functioning of various smart systems.
- Public-Private Partnerships: Foster partnerships between the public and private sectors to leverage their respective expertise, resources, and capabilities. Encourage private sector investment in smart city redevelopment projects through incentives, collaborations, and public-private partnerships. This can help drive innovation, accelerate implementation, and share the risks and benefits.
- Regulatory and Policy Frameworks: Establish supportive regulatory and policy frameworks that encourage and enable smart city redevelopment. Streamline approval processes, update zoning regulations, and incentivize sustainable and smart development

practices. Ensure that policies promote social equity, affordability, and accessibility for all residents.

- Continuous Evaluation and Adaptation: Implement a mechanism for continuous evaluation and monitoring of smart city redevelopment projects. Regularly assess the impact, effectiveness, and outcomes of strategies and make necessary adjustments based on feedback and evolving needs.
- Knowledge Sharing and Collaboration: Foster knowledge sharing and collaboration among cities and stakeholders. Participate in networks, conferences, and partnerships to exchange best practices, lessons learned, and innovative ideas. Collaborate with other cities and learn from successful smart city redevelopment projects worldwide.

Development Proposals

The master plan 2021 has proposed various development proposal. The glimpse of the type of proposal can be seen as followes :

- ♣ Railway stations: Improvement/expansion of stations at Subedarganj, Naini, Prayag and Rambagh stations.

♣ Widening of roads as per Master Plan. A list has been enclosed as annexure

♣ Widening of junctions - 40

♣ Development of new roads as per Master Plan. A list has been enclosed as annexure

♣ Three Ring road

♣ Improvement of rail underpass – 7

♣ Bridges on Yamuna – One for outer bye-pass road and the other for inner bye-pass road

♣ Bridges on Ganga – 1

♣ Rail and road bridge on Ganga

♣ Bus terminal - 7

♣ Truck terminal – 3

Institutional Framework for sewerage and Sanitation system

Uttar Pradesh Jal Nigam (UPJN) is responsible for pollution prevention and planning capital projects for sewerage.

Key Issues

¡ The existing sewerage collection system is old and dilapidated.

¡ Coverage of the sewerage network is very low.

¡ Slums are not covered by the sewerage network.

¡ There is a need to refurbish the existing sewerage treatment plants.

¡ No separate account is maintained for sewerage, it is part of water supply operations.

¡ Involvement of multiple departments (Jal Sansthan, Jal Nigam and AMC) causes co-ordination issues.

Completed, ongoing and proposed projects

Renovation of Gaughat Main Sewage Pumping Station

¡ Renovation of Intermediate Sewage Pumping Stations

¡ Relieving sewer in Kydganj area

¡ Daraganj sewer and Sewage Pumping Station

¡ Relieving sewer in Daraganj area

¡ Tapping of Mumfordganj nala

¡ 60 MLD sewage treatment works at Naini based on Activated Sludge Process

Proposals submitted

- Sewerage network – 972 Km
- Pumping stations – 10
- STP – 82 MLD

Traffic and transportation

139 Km of new roads in Naini, Phaphamua, Jhusi, roads connecting Naini with Bamrauli, Jhusi with Naini, Sahson with Phaphamua and Bamrauli with Phaphamua

This includes ring road proposal:

1. Kanpur Road to Stanley Road via west of Bamrauli Airport and Parag Dairy along the Cantonment Area and the banks of river Ganga
2. Kanpur Road to Varanasi Road along the outskirts of the city growth across the river Yamuna, crossing and leaving the Rewa Road and Mirzapur Road and then going across the river Ganga to meet Varanasi Road near Jhunsi continuing upto village Sahson
3. Varanasi Road upto Phaphamau via Sahson Road 4. Mirzapur Road upto Naini Bridge 5. Prayag Railway Statio

Road widening proposals

Road widening proposals

S.No.	Road Name	Proposed RoW
1	Nawab Yusuf Road	30
2	Mahatma Gandhi Marg	45
3	Lal Bahadur Shastri Marg	30
4	Maharishi Dayanand Marg	41-62
5	Sarojini Naidu Marg	30
6	Sardar Patel Marg	24
7	Kasturba Gandhi Marg	23-30
8	Stanley Road	30-42
9	Kamla Nehru Marg	30
10	Master Zaharul Hasan Marg	30
11	Laouder Road	24
12	Jawahar Lal Nehru Road	35-40
13	Motilal Nehru Marg	45
14	Phaphamau Marg	45
15	Chintamani Ghosh Marg	18
16	Bank Road	18
17	Mission Road	18
18	GT Road	24-30, 45-60

PROPOSAL

1. AMC would require to appoint a transaction advisor to undertake a detailed feasibility assessment, preparation of bid documents (request for qualification – RFQ, request for proposal – RFP), and bid process management leading to award of contract to private developer.
2. It is observed that in Allahabad there are many agencies that are involved for provision of services delivery, and lack of coordination among them, is the major reason for delay in the implementation of reforms.
3. An online building plan approval system is yet to be developed. Further, a building plan approval system is also required to be developed as a state-level initiative as it falls under the purview of ADA.
4. AMC is facing severe capacity constraints both in terms of availability of manpower and skill set to monitor and maintain the e-governance modules that have already been implemented.
5. An institutional mechanism for handholding and training is required.

CONCLUSION AND SCOPE FOR FUTURE RESEARCH

Smart cities have the most indispensable part in altering distinctive regions of human life, touching segments. Big Data can do in the field of "Make in India," Smart Cities. It will lead to the planning of smart cities. The smart cities developed with the help of big data will have all the resources needed for the growing population demand. Big data is used to collect data from various sources of information. The information is used to rank the cities according to the "Indian Smart City Model." The cities can change and update their planning according to city rank. The data gathering from different departments and surveys of the cities. This information used for evaluation of city rank using the DBA approach. DBA is a mathematical tool that has been used to aggregate and convert data into a standard form that is used to rank "Indian smart cities." The result shows the growth of the city in the individual dimension of the city through the ranking comparison of each dimension of the smart city. The policymaker can make decisions based on the result for achieving the successful, manageable target of the smart city.

The specific major findings of the study are:

The smart city model developed for the Indian smart cities with eight dimensions, “Economic Profile,” “Demographics Profile,” e-Governance& Computerization, “Infrastructure Profile,” “Environmental,” “Finance,” “Progress Track,” and “Security.” The model has eighty indicators, as in Table 5.

The Indian Smart cites data collected according to the model to find the rank of smart cities, and the individual dimensions rank also finds to show the growth level of the individual cites in each dimension.

The distance-based algorithm (DBA) applied for ranking of twenty different Indian smart cities based on a set of eighty selection criteria/indicators. The outcome demonstrates that the Chennai has accomplished position number one after investigation 80 criteria and next succession is Pune, Jaipur, Ahmadabad, Surat, Vishakhapatnam, Indore, Coimbatore, Bhopal, Davanagere, Delhi, Udaipur, Ludhiana, Bhubaneswar, Jabalpur, Kochi, Guwahati, Belgaum, Solapur, Kakinada respectively.

SCOPE FOR FUTURE RESEARCH

This technique needs improvement due to the variety of changes in data. The future is going toward the information age, which provides more future work for cities. The Indian cities are in the developing phase, so the scope for improvement is always occurring. The smart city data collection process can be more advanced with the development of new technology. The model can adopt new advanced techniques. The IoT can embed in the future for collecting the information bases on sensors. The smart city models each dimension can be exploring and evolve with new technological terms.

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