Understanding the What, Why, and How of Becoming a Smart City: Experiences from Kakinada and Kanpur

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Abstract: Rapid urbanization can result in challenges, such as overcrowding, congestion, and a lack of urban services. To address these challenges, an increasing number of communities are exploring the concept of a smart city (SC). Although rapid urbanization is a problem for cities around the world, its consequences can be severe for those located in developing nations. While previous studies have focused on SCs that were built from the ground up, there is a critical need for studies that focus on how to advance SC initiatives in developing regions faced with limited land and resources. This study identified two proposed SCs in India—Kakinada and Kanpur—which are currently implementing SC projects to explore their SC transformation. This case study aims to explore how "smartness" is understood in these cities and examines the local conditions shaping SC objectives by studying the existing issues in the cities, the proposed projects, and the perception of SC experts on a) what they understand by "smartness"; b) why cities want to become smart; and c) how they will become smart. The study findings indicate that although the high-level goals of the proposed SCs in India are similar to those of existing SCs in developed nations, the underlying objectives and strategies vary and are shaped by the urbanization challenges facing the Indian cities. This research also highlights the key questions a SC planning effort should address, especially in a developing nation context.

Keywords: smart cities; smart cities mission; rapid urbanization; inclusivity; public convenience

1. Introduction

The idea of the "smart city" (SC) has become popular in the last decade with experts world-wide highlighting that SCs present promising solutions to existing urban issues caused by rapid urbanization. For instance, SC strategies can assist in reducing emissions, increasing energy efficiency, and improving the over-all quality of life for citizens [1]. Both developed and developing nations are welcoming the concept by initiating and investing significant capital in SC programs. India is one of them. In 2030, India is projected to have the largest concentration of mega cities [2]. In an effort to manage these urbanization challenges, the governing authorities have established initiatives such as the Mega City (1995) and Jawaharlal Nehru National Urban Renewal Mission (JNNURM) (2005). These programs have mainly focused on providing basic infrastructure services and utilities to cities without paying much attention to advancing sustainability. Recently, the Ministry of Housing and Urban Affairs (previously known as Ministry of Urban Development (MoUD) initiated the Smart Cities Mission (SCM) with the purpose of promoting economic growth and improving quality of life through the Smart Cities Challenge in 2015 [3]. To take part in this challenge, cities competed for central government funding to implement SC strategies by submitting their Smart City Proposal (SCP) to the Government of India (GoI). Through this mission, the GoI used a competitive framework for the first time to advance a major

urban development mission via three components [4]: (a) Area-based developments that will transform existing areas, including slums, into better-planned ones by retrofitting and redevelopment, thereby improving the livability of the whole city; (b) pan-city developments that envisaged the application of selected smart solutions to existing city-wide infrastructure; and (c) greenfield development. Further, proposed SCs can also utilize a combination of the three strategies to become smart. The SCM marks a shift in India's urban development policy as it permits greenfield development in much the same way as other developing nations, such as the United Arab Emirates (Masdar) [5], South Korea (Songdo) [6], and China (Hangzhou) [7], which built some SCs from ground up.

Four years from the formulation of the SCM, 100 cities have been selected to implement their proposed smart activities through various rounds of the mission. In most of the proposed smart cities, several projects have been completed and many more are in the pipeline. The SCM provides a valuable opportunity for researchers to uncover the evolution of the SC process by closely studying cities currently implementing SC projects. Moreover, future urban development will be faced by growing land constraints and limited available resources, especially in developing and under-developed nations, so understanding how cities in these regions are approaching SC development will be increasingly important. In addition, studying SC development in Kakinada and Kanpur in India has the potential to provide insights for researchers, communities, and organizations that are involved with planning similar missions/developments. Through this research, we explore a) how the cities and SC experts interpret "smartness"; b) why the cities want to become smart; and c) how the cities can become smart.

2. Review of Smart City Definitions and Practices

In the last two decades, the term "smart city" (SC) has been widely discussed and debated in policy and planning circles across the globe. There are several schools of thought on how to define a SC, and these are not limited to academic scholars but also include businesses, such as CISCO and IBM, as well as government institutions, such as city municipalities and urban centers. For instance, a community development SC definition states: "A smart city will be a city whose community has learned to learn, adapt and innovate within the emerging technological age" [8]. A more popular academic definition provided by Giffinger et al. [9] describes SCs as "Well-performing modern cities built on the smart combination of endowments and activities of self-decisive, independent and aware citizens looking to develop intelligent solutions to enhance the quality of life and services." While an industry-led definition argues that a SC is "An instrumented, interconnected, and intelligent city that uses information and communication technology (ICT) to sense, analyze, and integrate critical information on core systems in running cities" [10]. A similar approach was discussed by the Smart Cities Council [11] that describes a SC as one "which uses ICT to enhance its liveability, workability, and sustainability." In contrast to the above definitions that focus on the city and its attributes, the Department for Business Innovation and Skills [12] defines a SC as "a process, or series of steps, by which cities become more 'liveable' and resilient and, hence, is able to respond quicker to new challenges." Another study defining the enablers and outcomes of a SC states: "A city is smart when investments in traditional infrastructure, social development and modern (ICT) communication infrastructure fuel sustainable growth and a high quality of life, with wise management of natural resources" [13].

The above SC definitions highlight that the concept has come a long way from its inception, since SCs are no longer seen as "an end" objective, but as "the means" to attain a better quality of life. Researchers Albino et al. [14] and Bakıcı [15] noted this transition and describe the concept as becoming more holistic than technology centric. In the early 2000s, SC development was mostly about reforms based on technological advancement through data, monitoring, interconnectedness, and automatic steering mechanisms, leading to profit making for tech companies [16] and less about city development. As argued by Caragliu, Del Bo, and Nijkamp [17], these early initiatives were heterogeneous, unfocused, had limited effectiveness, and impacted a limited number of people. However, in the present-day scenario, technological advancement is seen as providing new ways for decision-makers and planners

to tackle immediate urban issues [18], such as traffic congestion, the lack of affordable housing, inefficient utility services, and poor health care. In addition, recent SC studies also provide several frameworks to assess these smart solutions when responding to pressing urban issues [19,20]. These urban issues tend to be more severe in a developing country context due to the high urban population density and poverty, increasing migration rates from rural to urban areas, budding slums, and a lack of basic infrastructure, including water and wastewater services, power supply, and sanitation [21].

With the abovementioned issues, SC development in developing country cities not only requires projects that include ICT, but projects that focus on providing basic infrastructure to citizens and ensuring that a decent quality of life can be achieved [22]. Gupta and Hall [22] undertook a qualitative assessment of the proposed smart city vision statements and city descriptions provided by city officials in the SCPs submitted to the GoI. They found there are similarities and differences between Indian cities' vision statements and existing smart city definitions. The top 10 keywords that appeared most frequently in the smart city definitions included ICT, Economy, Governance, Sustainable, Quality of Life, Human and Social Capital, Infrastructure, Efficiency, Energy, and Environment. On analyzing sixty vision statements for the proposed smart cities in India, the 10 most frequent characteristics that were identified were Eco-friendly, Sustainable, Inclusive, Vibrant, Economy, Tourism, Liveable, Heritage, Quality of Life, and Safe. These keywords describe the city official's vision of a smart city and reflect the city's goals to be achieved in the next 5–10 years. The most frequently occurring keywords in the smart city definitions, such as "ICT" and "Governance", were almost absent in the vision documents, whereas keywords like "Inclusive," "Vibrant," and "Safe" were found more frequently in the vision statements. Additionally, the qualitative analysis of the concept of "Smart Urban form", described by six randomly selected proposed Indian smart cities, highlighted the prevalence of "ease of access" as a key outcome. The SCP for these six cities indicated that more than half of the characteristics identified did not employ ICT, but still were associated with "Smart Urban form" given their connection with creating safer and more environmentally friendly neighborhoods.

Most SC initiatives began in the more affluent regions of the globe, such as Europe, the United Kingdom, the United States, and in some parts of Asia. These regions put forward their version of a smart city by implementing strategies that relied on key technologies such as modern transport technologies, efficient and sustainable systems [13,23], and smart governance frameworks [24–26]. Consequently, SC studies have tended to highlight the objectives and frameworks of developed regions [5,27,28], which may not align with those of developing nations that face unique challenges, such as rapid and unplanned urbanization. Further, recent SC studies that focus on cities in a developing nation context [5] present the characteristics of already established SCs built from the ground up—i.e., using a green field model of development. There are only a few studies that discuss developing smart cities using a retrofitting or redevelopment approach [29].

Previous studies that discuss the components, outcomes/goals, and enablers/drivers of SC development, tend to focus on already built or soon to be built cities. For instance, Songdo (South Korea) deployed technology applications when building city infrastructure and utilities to enhance the efficiency of the city [30–32] and the planned King Abdullah Economic City (Saudi Arabia) will be wired with high-speed broadband infrastructure with all urban operations managed through Integrated Operation Centers [33,34]. While some studies indicate that economic development and quality of life improvements are the primary objectives of SC projects [35], these studies lack a holistic discussion of how such projects could be implemented in a developing nation context. Moreover, recent studies have indicated that SCs, such as Tianjin (China) and Songdo (South Korea), which received much attention for their efficiency, environmental sustainability, and eco-technologies, failed to recognize the complexity of the sociocultural and economic processes that form a city [36]. Additionally, there is evidence that these cities were not able to deliver substantive change relating to the desired outcomes [37].

Since the development of a SC is a highly complex endeavor, it is important to examine how SC experts understand "smartness", why cities want to become a SC, and how a city is becoming smart to

help identify the approaches that are likely to result in measurable benefits accruing to citizens. Further, few studies examine projects early in their implementation phase, which is when critical decisions are made that can shape project outcomes [38]. This study attempts to address these knowledge gaps by exploring the case of two proposed SCs in India—Kakinada and Kanpur—which were selected in different rounds of the Indian SCM and are currently implementing SC projects.

3. Data and Methods

To explore how Indian cities are conceptualizing "smart cities" we used in-depth case studies of two proposed SCs in India—Kakinada and Kanpur. We chose the city level given the focus of the SCM on transforming cities across India. Under the SCM, the proposed SCs mostly belong to Tier II (~50%) and Tier III (~43%) cities. The cities Kakinada (Tier III) and Kanpur (Tier II) (shown in Figure 1) represent a range of SC implementation activities. However, both the cities do not belong to the larger group of metropolitan cities, such as Delhi or Mumbai, which have better access to SC expertise and resources.
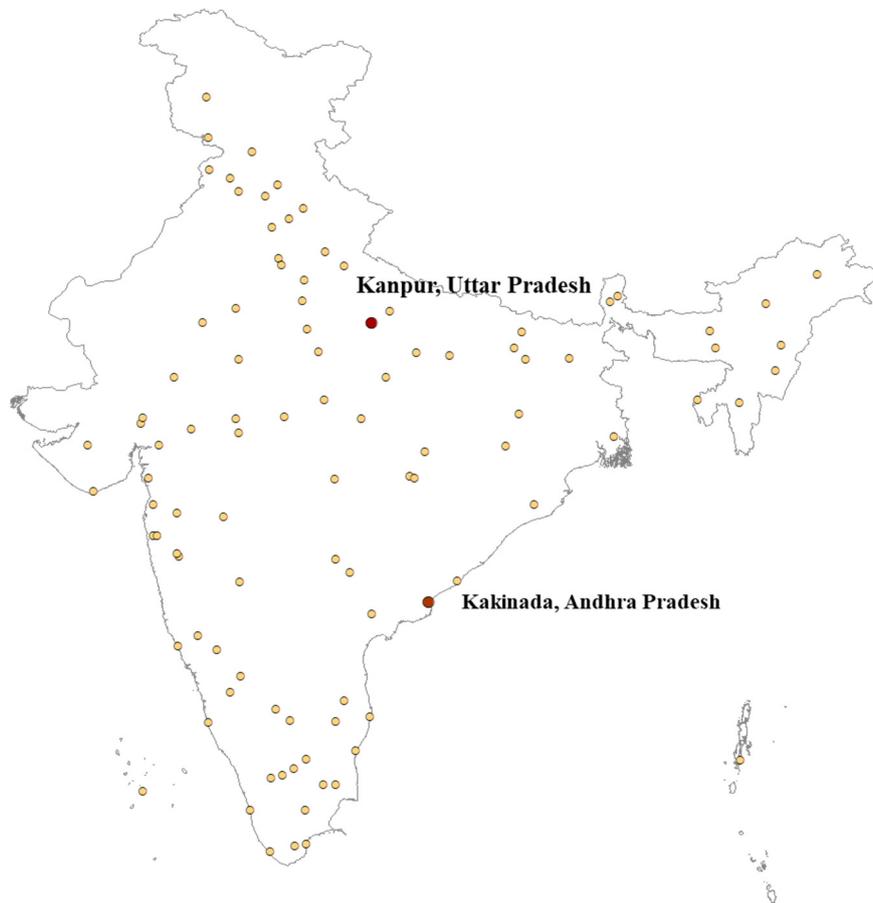

Figure 1. The 100 cities selected under the Smart Cities Mission (SCM) with red bullets indicating the location of Kakinada and Kanpur.

Kakinada was ranked 13th in Round 1 of the SCM, while Kanpur was ranked 13th in Round 2 [4,39]. Since the results of Rounds 1 and 2 were announced at different times, the implementation of SC projects varies for the two cities. For example, more projects have been implemented in Kakinada than Kanpur. The selection of these two cities was based on the lead author's familiarity with the cities, which helped reduce some of the barriers to obtaining access to SC experts and enabled a more nuanced interpretation of the findings. Table 1 briefly describes the two cases.

Table 1. Description of the two cities.

	Kakinada	Kanpur
State	Andhra Pradesh (located on the south eastern Indian coast)	Uttar Pradesh (located in north-central India)
City Area *	164 km^2	403.70 km^2
City Population *	312,538 (Tier III)	2,765,348 (Tier II)
Population Density	1906 persons per km^2	6850 persons per km^2
Population Increase * (2001–2011)	0.53%	9.92%
Literacy Rate *	80.62%	79.65%
Total Funds Allocated for SCM **	1993.03 Cr	2311.97 Cr
City's self-assessment of urban features described as basic city level features (Scenario 1) **	Underground Electric Wiring Water Management Transportation and Mobility Sanitation Air Quality Wastewater Management/ Water Quality Energy Efficiency Economy and Unemployment	Underground Electric Wiring Water Management Transportation and Mobility IT Connectivity Walkability Intelligent Government Services Public Open Spaces

* 2011 Census, District Census. ** Smart City proposals and annexures of Kakinada and Kanpur. Note 1: Cities in India are classified based on HRA (House Rent Allowance) into Tier-I, Tier-II, and Tier-III, respectively. The existing qualifying threshold of population for HRA classification is 5,000,000 and above for Tier-I, 500,000–5,000,000 for Tier-II, and below 500,000 for Tier-III class cities [40]. Note 2: SCP's annexure provided a self-assessment of the city's urban features, such as walkability, environment, citizen participation, etc., to describe its current state. The framework used four scenarios to describe the existing condition of the proposed SCs with respect to each city feature. Scenario 1 describes the features present in a basic city and Scenario 4 describes those present in an advanced/smart city. For instance, a city's Scenario 1 for walkability might include features such as "designed mainly for the automobile", "long bus rides", "walking is difficult and often dangerous", "few pavements, existing pavements need repair and lack trees to provide shade for pedestrians", "lack of marked pedestrian crossings", and "traffic signals are often disobeyed". While Scenario 4 features might be "highly walkable", "pavements exist on every street and are maintained", "trees line many sidewalks to provide shade for pedestrians", "traffic signals control the flow of automobiles and are enforced", "a network of bike lanes exists to promote cycling", and "traffic rules are followed and enforced with great seriousness". The scenario framework was provided in the SCM's guidelines. The feature description and the description of each scenario can be found in the annexures of each smart city proposal [4] (at http://smartcities.gov.in/content/city_challenge.php?page=winning-city-proposals-in-round-3.php).

We adopted the comparative case study method to perform an in-depth examination of the two cities—Kakinada and Kanpur. Previous studies have used the comparative case study method to produce more generalizable knowledge about questions such as how and why a particular program works or fails to work [41]. The comparative case study works well in cases where the context is very important in understanding the process of implementation. This method often incorporates both qualitative and quantitative data. In this exploratory study, the comparative case study method was used to answer our research questions: what, why, and how are the Indian cities Kakinada and Kanpur transforming into smart cities?

Qualitative interviews, site visits, and observations were made in the two cities. In addition, a document analysis of reports, proposals, and related annexures was performed, which included existing issues in the cities, the proposed smart city visions, and the types of projects proposed. In addition, 20 SC experts were interviewed from October 2018 to January 2019 who were closely associated with the mission activities at the city level. The interviewees consisted of government officials and industry professionals, who were identified and contacted using information available on the SCM and city websites and on social platforms, such as LinkedIn, Twitter, ResearchGate, etc. The government officials contacted included members from Special Purpose Vehicles (SPVs) and local municipalities at the city level who were responsible for implementing projects under the SCM. SPVs are limited companies led by a full time Chief Executive Officer and have representation from the

Central Government, State Government, and the Urban Local Body (ULB). SPVs can plan, approve, implement, and evaluate SC projects at the city level [4]. The contact information of the government officials were obtained from the city municipality's website. Industry professionals were identified through LinkedIn, referrals from the respondents, and other known contacts from the lead author's internship experience at the National Institute of Urban Affairs, India, and by the publications/reports showcased on ResearchGate (https://www.researchgate.net/), a public forum where researchers share their reports, papers, and data.

A total of twenty experts were interviewed (see Table 2): 13 government officers (seven in Kakinada and six in Kanpur) and seven industrial professionals/consultants. An open interview technique with probing questions was used. The interview questions addressed the type of SC projects being implemented, the current situation of SC projects, the value that the projects may bring to the city, and the factors enabling project implementation. Interview memos were written during interviews and detailed notes were prepared after each interview. Rather than asking the interviewees to rank the most important projects and their outcomes, the order in which the projects and their outcomes were mentioned were treated as the revealed sequential importance of these projects and outcomes. The outcomes that were mentioned by more than 50% of the interviewees were treated as the primary outcomes, with the remaining outcomes being classified secondary (this structure is described in Section 4.2 in the Results section).

Table 2. Description of interviewees.

	Industrial Professionals	Kakinada Government Officials	Kanpur Government Officials
Total Interviewees	7	7	6
Age Range	30–45	30–50	28–50
Gender	All males	Six males and One female	Four males and Two females
Educational Qualifications	A Bachelor's degree and above (one Ph.D.)	Graduation and above	Graduation and above
Work Experience	5 years to more than 15 years	2 years to more than 10 years	6 months to 10 years
Interview Duration	35–55 minutes	20–55 minutes	15–45 minutes

Local exploration of the concept of a SC also allowed the assessment of how the local municipalities and other professionals, closely associated with the SCM, have interpreted and translated the strategies of the national mission. Our approach in this study begins with the assumption that local actors, such as municipalities and other government officials, have a greater role in planning and implementing SC strategies. Although, local exploration does not mean that these proposed SCs are studied in isolation; instead, it was found that the strategies of the national SCM largely shaped the implementation of projects at the city level.

Since the research objective was to understand the perspectives of SC implementers, a purposive sampling approach was considered the most appropriate way to identify who can best describe the framing and implementation of SC projects. A snowball technique was used to identify the interviewees. In an effort to enhance the trustworthiness of the study, the sample covered a diverse range of professionals involved in project delivery, from decision-makers (approving projects) to people planning and designing these projects (junior engineers and team leaders), to people executing (PMCs professionals) and monitoring project implementation (executive engineers, etc.).

4. Results

This results section begins by discussing the perspective of municipality and industry professionals of the SCM. The interpretation of the mission is important as these interpretations later translate into how these experts are planning and shaping SC development at the local level. Next, the three research questions uncover the what, why, and how of the proposed SC development in Kakinada and Kanpur by providing the interviewees' and authors' comments on the SC process.

4.1. Interpreting the SCM through the Lens of Municipality and Industry Professionals

Some view the SCM as a national program that is critical for addressing growing urban challenges, but others see it as an election agenda. Most SC experts from industry who were interviewed seemed happy with the mission and described it using phrases such as "timely", "began a positive conversation between cities, academia, industrial professionals", "making citizen engagement essential", and "making cities compete with each other". One of the industrial professionals stated that the SCM is "A good initiative which lacks the bigger picture". One of the SC consultants described the mission as "an initiative to generate new ideas and to compel local municipalities to think out of the box solutions (to respond to the urban issues faced by the cities) but the mission was rolled out in haste (by the GoI and was not thought through)".

This meant that the broader stages of the mission, such as the selection of cities, proposal development, etc., were well documented, but intricacies of the mission, such as the role of various local agencies, the integration of proposed projects with the city development plan, etc., were left unquestioned. Further, local agencies with a lack of expertise on the SC concept were made responsible for transforming the existing cities into SCs.

The professionals from municipalities and SPVs were enthusiastic and welcoming of the mission and its related activities, and used phrases such as "holistic", "strategic", "not project based but idea driven", "involving citizens in the process", and "a step towards comprehensiveness, unlike previous missions". In contrast, one of the government officials considered the comprehensiveness of the mission as one of its biggest drawbacks and stated: "The biggest challenge with the mission is that there is no definition of a smart city which should have been the first thing to do in the mission". This situation leaves government officials at the city level who are responsible for implementing the mission's activities wondering what is "smart". Another government official stated that the SCM is "A very good concept which fails to provide a framework (to the city officials) to implement the mission". Moreover, few government officials praised the comprehensiveness of the mission, but at the same time worried about the pressure such missions may place on the city officials without providing them with the needed resources.

These findings indicated that the SCM has brought a new level of energy to city municipalities with regards to forming SC strategies for their respective cities. This energy has resulted in the recruitment of a new and young workforce (on a contractual basis) for the local implementation of SC projects and the identification of affordable and environmentally friendly solutions to existing urban issues. Second, the SMC has improved city development programs/missions through citizen engagement. In the first phase of the SCM, citizen participation created a process where the opinion of citizens was directly influencing city development strategies. Finally, the SCM came with the ambition to develop cities more holistically, but the mission lacked a concrete SC definition that could narrow down the vision into definite SC strategies that could be implemented by municipalities. Most interviewees were positive about the mission's outcomes. However, some of the interviewees seemed to have difficulty managing daily city functions while planning SC strategies. With the SC concept being new to municipalities, detailed strategies/guidelines from the SCM on how to implement SC projects could help municipalities achieve their SC goals much more efficiently.

4.2. What Do Municipality and Industry Professionals Understand by "Smart"?

To understand what a SC might look like and what kind of urban form is being planned in the proposed SCs in India, we asked interviewees to reflect on what do they understand by the term "smart" in the SCM. Most interviewees agreed that the SC projects proposed in Indian cities are different from the SCs that exist in North American, European, and/or Australian cities. One of the industry professionals described this difference by stating "Smartness is a gradual process starting with provision of infrastructure, for instance, smart road for Indian cities is about building a road which can be accessed by one and all. This is a first step and should aim at building a strong foundation for becoming smart". Another industry expert described the focus on SC components by mentioning "It is

important to focus on citizen's convenience (as smart cities are for citizens) and provide basic need infrastructure (for commuting, roads, water, electric supply, and waste management) apart from city beautification and promoting tourism". Thus, most projects implemented (or under implementation) were citizen focused and have fewer smart components.

In contrast, city officials used phrases such as "streamlining infrastructure development", "using data driven strategies in planning urban services", and "connecting the urban services" to describe "smart". Further, when clarifying their statements, the officials mentioned that traditionally urban services planned by the city were done in silos and thus the focus of the mission activities was to develop urban projects in a more holistic way. However, the officials agreed that there are fewer smart elements in place than initially envisioned and mission activities are more focused on getting the basics right. The city officials also highlighted that their focus is on improving physical infrastructure and strengthening local institutional mechanisms.

Both Kakinada and Kanpur proposed a retrofitting model for the area-based development (ABD) projects in their central business districts that were comprised of a mix of residential, commercial, and institutional projects alongside parks and stadiums. The areas chosen for ABD have places that are recognized as containing a city's identity and culture, have most of the basic infrastructure in place, have residents in the selected area who were more receptive to the planned SC initiatives, and were willing to pay for better services and improved living. Although the government officials of Kanpur and Kakinada advanced similar types of projects and development models, the rationale for choosing the type of development model and area selection varied. In Kanpur, the government officials selected 1475 acres to retrofit that consisted of a central business district area with a good mix of residential, commercial, and public buildings surrounded by parks and stadiums, and a 4.3 km stretch of river bank over a green field area, since city officials wanted to develop an area that was struggling with urban issues [42]. On the other hand, the Kakinada government officials chose 1375 acres to retrofit since it was difficult to find a single 250 acre parcel of land in and around Kakinada's municipal boundary for a green field development [39]. Some of the major SC projects implemented (under implementation) and their perceived benefits discussed by the city government officials are described in Figure 2.

The analysis of interviews with city officials indicated that outcomes such as increased safety, environmentally sustainable, and inclusive development are more readily mentioned than the other outcomes (Figure 2). Further, similar projects may have different outcomes. For instance, the Command and Control Centre (CCC) in Kakinada was referred to as the brain of the city system, since the CCC combines real-time data and information about traffic and law and order to facilitate data-driven decision making. While, in Kanpur, the CCC was more narrowly focused on the surveillance of road intersections, which improved traffic management, reduced traffic congestion, and made the streets safer. City officials in both cities referred to the CCCs as the eyes of the city system. Additionally, the primary outcome mentioned for mobility projects in Kakinada was universal access to roads, while in Kanpur the primary outcome mentioned was improving citizen road safety.

Urbanization in the two cities has been haphazard, resulting in a lack of urban services and increasing inequalities. While the previous missions/programs focused on these urban challenges, they were more of a knee-jerk reaction than a well-conceived strategy to improve the livability of the city for residents. Thus, traditional city planning had not received the emphasis it needed to support a holistic city planning and transformation effort.
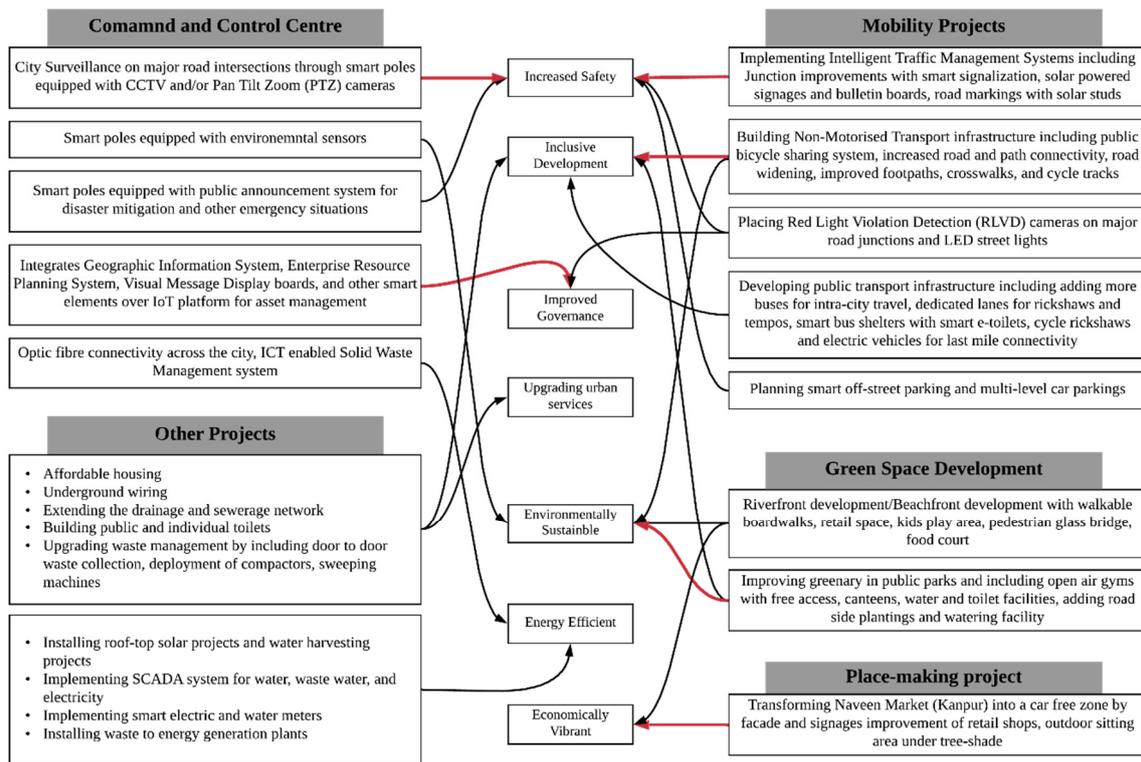
Figure 2. Smart city components and their outcome. Note: Red arrows indicate the primary outcomes of the project and black arrow indicate the secondary outcomes.

With the SCM's implementation focusing on holistic development, it is important to first understand how city managers understand "smartness". The interviews indicated that the term "smart" is understood slightly differently by the industry professionals and city officials. It was interesting to note that the industry professionals defined "smartness" with respect to the users (citizens, in this case) while the city officials focused on the process. For example, using data to plan cities. It is understandable that the foremost priority of the city officials of Kakinada and Kanpur was to provide basic amenities, using technological solutions wherever they were needed, which is also reflected in some of the projects mentioned above. However, the cities needed to be cautious in relying too much on CCC-generated data for planning, as they faced the issue of informality, which may not necessarily be predicted by data analytics.

4.3. Why Do Cities Want to Become Smart?

To understand the goal of making cities smart, we analyzed the vision statements of the proposed SCs. Kakinada's succinct vision statement is further elaborated by providing SC objectives. City officials plan to "Transform Kakinada from Pensioners' Paradise to Economic Destination". The proposed smart city aspires to become "economically vibrant", "inclusive", "livable", and "sustainable" based on "its existing and potential strengths", including the Port, Tourism, and the Oil and Gas sector. However, city officials realize that economic development associated with industrialization activities is accompanied by pollution and the degradation of natural resources. Therefore, to become sustainable in the long run, Kakinada plans to add more green cover and harness renewable energy to become energy efficient. Additionally, the city plans to overcome its weaknesses by providing high-quality urban infrastructure and services in a smarter way. Like Kakinada, Kanpur also focuses on its industrial strength to become smart but at the same time puts emphasis on improving the city's sustainability. Kanpur outlines its SC goal by mentioning five key themes (or projects) the city plans to achieve through the mission activities. Kanpur aspires to "Transform into an inclusive, vibrant

city of opportunities with efficient urban services, sustainable growth, and healthy living keeping Ganga, Industries, and commerce in focus". The five key projects to achieve this vision were aimed at becoming a regional growth center, embedding smart mobility, "Citizen First" city governance, sustainability-related goals in providing essential services to the citizens, and reducing air and water pollution levels in the city.

When asked, "Why is it important to become a smart city?", city officials usually paused before answering. This question was a follow-up to "Is it important to become a smart city?", to which 12 out of 13 interviewees said "Yes". These questions were specific to city officials to understand what values they seek in becoming a SC. The officials from both cities used phrases such as becoming a SC is "a step to integrate the various urban missions", "important for holistic development of a city", and "will bring in more tourists and businesses". Other phrases, which reveal the perceptions of the interviewees on becoming smart, included "safer and cleaner cities", "healthier cities", "ease of access to urban services to each and every citizen", and "city beautification". The Kakinada government officials mentioned phrases such as "building transparency", "improving public convenience", and transforming into "livable cities" as their major goals for becoming a SC. One of the government officials from Kakinada expressed that the mission activities were bringing accountability to government procedures. Moreover, a government official from Kanpur stated that the "city's focus is on making streets safer for one and all under smart city mission activities". Another Kanpur government official mentioned: "A smart city needs to be greener, cleaner, and a city where people care for each other".

The visions and proposed projects reiterated the need to become economically vibrant, however, this concept was not frequently spoken about during the interviews. The current *city scenario* (see Table 1, Note 2) of Kakinada and Kanpur for "Economy and Employment" is 1 and 2, respectively [42]. Hence, the focus on the urgent need to significantly enhance economic opportunities in the cities. The vision statements for both cities reflect this focus by emphasizing economic vibrancy. Kakinada indicated the need to attract more investment in real estate, tourism, and transportation in addition to reviving a boat building yard to improve the local economy. While Kanpur plans to use its strategic location and proposed metro-development and airport to connect with other regions, opening up new business opportunities and strengthening old ones. Further, the emphasis on economic development is also indicated by the cities' SCPs, which state that while both the cities have a strong educational base with well-known technical, medical, and other research institutes, a large section of the workforce is unable to participate in industrial development due to a lack of skills and increasing out-migration. While livability, inclusion, and sustainability were emphasized more than economic vibrancy in the city official interviews, the officials did recognize that better connectivity, improved livability conditions, and a cleaner environment will attract more businesses and tourists. The emphasis on making cities livable can be explained by reviewing the current state of the cities through the lens of transport and mobility, air quality, etc. (see Table 1). Kakinada's SCP identifies a lack of affordable housing and public facilities, such as a comprehensive underground sewerage and storm water drainage systems, as their city's major weakness. Whereas, Kanpur lacks a 24x7 electricity supply that disrupts industries and affects the city's economy. Kanpur also has high levels of pollution and major sources include poor treatment facilities at industrial sites. In addition, both cities recognize congested roads, a lack of public transport (with demand met from unorganized private modes), and unorganized parking (with high levels of on street parking reducing the capacity of roads), combined with an unsafe environment for non-motorized traffic and fewer footpaths, as other weaknesses.

The interviews with government officials and relevant documents indicate that the officials focused their efforts on identifying the key concerns of citizens and proposing projects that benefit city residents. Upon examination, the SC projects appear more like traditional infrastructure projects, with effort being made to make the cities' current infrastructure, including physical structures such as roads and institutional capacity, more welcoming to technology-based solutions. An SC expert mentioned similar thoughts, stating the "SC is not a destination but a journey" that provides opportunities for change along the way. Further, he mentioned "physical infrastructure cannot be treated independently

and needs to use technology to plan them well" [43]. Therefore, it is not appropriate to wait for the physical infrastructure to be established before including the technology. Instead, both these components are intertwined and need to be advanced together. Additionally, since a leapfrogging approach to urban development is currently being adopted in India and other developing nations [43], new and existing infrastructure needs to be transformed in a way that integrates or accommodates technological advancements.

4.4. How Will Cities Become Smart?

In a previous study [38], SC risks were explored in the context of the Indian SCM. The study found that social, institutional, and partnership risks were some of the major barriers to implementing SC projects. Results from this study were further explored through the interview questions in this research. More specifically, respondents were asked: "What is needed to become a Smart City?". One of the industry professionals highlighted that "better coordination between the city departments and willingness to share data and resources across departments should be the first step" to plan and implement mission activities. Similar thoughts were expressed by another industry professional who mentioned that "Firm and quick decision-making machinery can implement SC projects at a much faster rate". Another industry official argued that cooperation from citizens can increase the pace of data collection, ensure projects target the needs of citizens, and improve the overall delivery time of projects. In addition, one industrial professional emphasized the role of stakeholder collaboration, stating, "Stakeholder collaboration is important (for SC projects to take off and be sustained), but this will require time as it involves building trust (amongst the stakeholders) and should not be done in haste".

One of the high-level government officials in Kakinada stated: "To become a smart city, there is a need to marry technology with the existing process and in order to do so we need to develop built infrastructure that is welcoming to technology". He further added: "We need more responsible, hygiene caring, and tax-paying citizens (to become a smart city) and we need a strong political will". The city officials in Kakinada mentioned that with mission activities in progress, there have been changes in the system to ensure accountability, such as a biometric attendance system that is already in place in the local government administration. Another government official mentioned that a "Lack of local contractors (with SC expertise) often delays the project implementation". Further, the city municipality's website provides the relevant information for the citizens, such as property tax rates and user fees, birth/death registration, etc., to provide easy access to these services. An online grievance redressal system is also in place. The Kakinada SPV (known as Kakinada Smart City Limited) has a website that contains up-to-date information on their SC projects executed and planned for the city (http://139.162.51.246/p/aboutus.php). The officials mentioned that online platforms and citizen-care call centers are promoted to obtain feedback from the citizens to further improve the existing and planned services.

Kanpur's government officials indicated that for Kanpur to become smart, "citizens need to become smart", meaning they need to recognize their duties and come forward to become a part of the mission by contributing to the mission's activities. Some simple contributions they mentioned included "not violating the traffic rules", "not littering the streets", and "judiciously using the public services". Another government official specifically mentioned that students, local businesses, and NGOs are all contributing towards the mission, which is important for the successful implementation of projects. For example, the NGO Parivartan is focusing its efforts on making Kanpur cleaner and greener by organizing activities at the city level, in collaboration with Kanpur Municipal Corporation, to educate citizens about the importance of sanitation, especially in low-income housing areas. Further, the city officials mentioned that for the successful implementation of projects, the information about the mission activities needs to be communicated clearly to the citizens. For instance, the city's municipality website provides relevant information for citizens related to urban services. Further, the website for Kanpur SPV—known as Kanpur Smart City Limited (https://kanpursmartcity.in/index.html)—provides the

contact information of city officials associated with the SCM in Kanpur and provides details about ongoing and proposed activities. With the SCM, the accountability and transparency of the city agencies has increased, beginning with a manual employee attendance system in Kanpur. However, an Enterprise Resource Management (ERP) e-Nagar Nigam initiative is planned to improve attendance monitoring and support better urban service delivery. Additionally, a government official stated that support from local leaders is important for such missions to be implemented successfully. However, the government officials in Kanpur recognized that poor operation and maintenance of existing infrastructure and limited interdepartmental coordination reduces worker productivity and efficiency. Further, the officials mentioned that city-level agencies must come together to implement the mission activities in an organized fashion.

The interviews also revealed that a robust institutional machinery, a strong political leadership, and collaborative efforts across various stakeholders, including private partners and citizens, were the most important enablers to successfully implement a SC initiative. Mr. Rajat, CEO of Raipur Smart City, stated in his Ted Talk that a smart city cannot be built without smart citizens [44], which echoes the above findings. He added that it is not merely the responsibility of the local authorities to build a SC, but active citizen participation was needed to ensure the successful implementation of a project. He further stressed that SCs are "people powered cities" [44]. This can be evidenced by the popularity of SC projects, such as the Open Gyms in Kakinada and Kanpur and the place-making project of the Naveen Market. With the SCM activities involving a number of stakeholders, developing institutional systems and practices that are more transparent, accountable, and trustworthy in nature is important to successfully execute projects in a collaborative manner. Dr. Prashant Dhawan, a SC and bio-mimicry expert mentioned in his Ted Talk: "To transform Indian cities into smart cities, we need to focus on feedback loops, inter-relations between the processes, and connections between the subsystems" [45].

5. Discussion

Boosted by advancement in ICT and IoT platforms, access to mobile technologies, and other technological advancements, a global market for SC initiatives is emerging. Towns, cities, and megacities are approaching the SC concept to plan for more livable and sustainable communities. However, the definition of livable and sustainable varies from place to place, as does the definition of a SC. This study uses the cities of Kakinada and Kanpur to uncover the process of becoming smart. Mostly, both cases identified similar SC goals, components, and outcomes, but this research reveals that the city officials in Kakinada are focusing their efforts on integrating urban services and using the data generated to plan future services. In contrast, city officials in Kanpur are more inclined towards ensuring city safety and planning environmentally sustainable urban development. Moreover, this study finds that although the city officials provided clear statements on what they understand as "smart" development, it is still unclear who their "smart" definition is focused on and what components of a project makes it smart. These are some important questions that the groups planning SC programs need to be very clear about from the beginning. Further, the interviews with industry professionals indicated that the mission guidelines at the national level are broad enough for cities to develop their own version of a SC. However, this flexibility means that multiple interpretations of the SC concept are possible, potentially making the concept seem fuzzy to government officials who are new to this area.

The proposed SC projects were a mixture of physical infrastructure projects with some technology-based solutions. From the two case studies, it was evident that the emphasis of smart city projects was on strengthening the existing physical infrastructure, such as road networks and water and waste management systems. However, projects such as the CCC indicate the urgent need to improve safety and law and order in the cities. Further, green space development and open gyms were considered as important projects, which highlight the emphasis given to developing places for citizens to interact. These projects reinforce the cities' vision to improve livability conditions and develop environmentally sustainable places, giving importance to the priorities indicated by citizens. On comparing these SC projects with the projects that have been implemented in developed nations,

it was found that although the type of projects that are (proposed to be) implemented in Indian cities lack the technological sophistication that is seen in developed nation SCs, the domains in which these projects focus on are similar. For instance, most SC initiatives were focused on mobility, environment, and energy efficiency.

HITACHI's (a global smart city solution provider) report on envisioning a smart city stated: "Behind the need for smart cities are the external factors that influence people's lives, namely the global environment and the society in which they live" [46]. These can include climate change, population growth, resource depletion, and the associated adverse effects of urbanization. While exploring why the two cities want to become smart, it was found that like the other SCs in more developed nations of the world, the high-level goals/visions of the proposed Indian cities had similar phrases, such as inclusive, livable, sustainable, and economically vibrant. However, the underlying objectives and strategies varied. These strategies were in response to the challenges posed by spatially and structurally imbalanced urban development and rapid urbanization in the Indian cities. Further, this distinction arises from factors such as a lack of infrastructure, unplanned settlements, and scarce resources, such as land. In addition, many of these urban issues are interconnected, making it difficult to focus efforts on a single issue. Thus, the proposed SC strategies were focused on providing access to basic urban services, such as safe roads, clean water, and improved sanitation to all, in addition to embedding a few new technology solutions, such as the CCC and ITMS.

Lastly, the SC enablers mentioned by the city and industry professionals, such as citizen participation and stakeholder cooperation, were found to be similar to those mentioned in a developed nation context [47]. However, the cities of Kakinada and Kanpur put less emphasis on an important component—i.e., the involvement of higher educational institutions and other research centers. Most developed nations have focused on smart cities in developing their educational curriculum; a significant amount of research is focused on inventing smart technology and understanding its implementation in cities and its impact on citizens [48,49]. In contrast, the concepts of living labs and innovation districts are somewhat foreign to Indian cities, creating an opportunity to further expand the scope of SCs across the nation. There is also a need to introduce more instructional courses on SCs to develop in-country expertise. The SCM is already holding regular conferences where the SC CEOs exchange their ideas related to SC implementation, but there is a need to include SC experts in planning such initiatives, at both the national and local level. Moreover, there is a need for more enthusiasm and courage to experiment and involve small start-ups in SC initiatives, rather than looking at the big planning/technology companies to provide assistance for SC development.

6. Conclusions

This study explores the process of two non-metro cities, Kakinada and Kanpur, aspiring to become smart using a retrofitting development model. Unlike other studies that focus on completed SC projects, this research focuses on two cases that are currently undergoing a SC transformation. The findings present an interesting perspective of industry professionals and city officials on what is smart, why to become smart, and how to become smart in a developing nation context. These perspectives are slightly different from those of SCs in developed nations in terms of how "smartness" in defined. However, the goals and enablers of a SC are found to be similar. It is found that local factors such as a city's urban issues and citizens' perspective shape the proposed SC projects in the cities. Communities (in developing and under developed nations) in advancing a similar concept can use the process of becoming smart presented in this study as a frame of reference. Further, this research can also guide city managers and program directors in developing and under-developed nations to better understand the complex concept of a smart city by breaking the process into goals, components, and enablers.

There are several avenues to expand this research. Firstly, this study highlights several questions that need to be addressed in future research, such as "Smart for whom?" While the current research provides insights from the SC experts involved in implementing projects, future research should also focus on the perspectives of citizens for whom these initiatives are planned. Secondly, this research

can be expanded by studying the what, why, and how of other Tier-II and Tier-III cities in India to understand the applicability of these findings more broadly. Lastly, the research approach can be extended to mega smart cities, such as Delhi and Chennai, which may have access to better resources but are also struggling to manage the challenges that come with rapid urbanization.

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