Enhancing Urban Living through Smart Cities in Saudi Arabia: A Thematic Analysis

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ABSTRACT

Purpose: This study aims to analyze the impact of the smart city initiative on Saudi urban living regarding features creating quality of life, mobility, sustainability effects, and community participation by perceptions and experiences among residents. **Method:** Twenty-two semi-structured interviews were conducted with a mix of urban planners, residents, and technology experts in the realm of smart cities. Thematic analysis allowed identifying and understanding patterns and insights in the interview data. **Findings:** Findings revealed that smart cities greatly enhance quality of urban living through adoption of advanced technologies, efficient facilitation of public services, and sustainable practices. Concerns regarding the digital divide and data privacy have surfaced, however, which appears that not all communities have equal access to benefits offered by smart cities. Citizens demand more openness as well as involvement in smart governance. **Originality/ Implications:** This research contributes to literature on the smart city, stressing the necessity for an inclusive and equitable nature of technological diffusion. This study demonstrates the citizen engagement needed to ensure a smart city-by-design approach, with ethical considerations involved in policies for the smart city, providing valuable input for policymakers and urban planners oriented toward an urban environment that is compatible with the attainment of technological progress and social equity.

Keywords: Smart City, Urban Living, Resident Well-being, Public Opinions, Sustainable Development.

INTRODUCTION

In recent decades, technology has progressed swiftly, resulting in "smart cities," urban regions that utilise information and communication technology to manage municipal assets, enhance services, and elevate residents' quality of life. These cities employ sensors, data analytics, and various digital tools to enhance transportation, power, water, and other services, while fostering community engagement via e-governance platforms (Aina, 2017). Accelerated urbanisation, environmental deterioration, and the necessity for improved public services have given rise to the concept of smart cities, which advocates for sustainable and efficient urban governance (Aldegheishem, 2023). Shelley-Anne (2022) asserts that smart cities address urban complexity, necessitating innovative solutions for economic and environmental sustainability. Smart technologies were initially implemented in Singapore and Barcelona in the early 2000s to enhance urban management (Kan et al., 2022). Policymakers and experts have concentrated on this matter as cities globally endeavour to enhance infrastructure efficiency and sustainability. Smart cities address difficulties related to traffic, electricity, and waste management (Thatcher, 2022). Public safety, healthcare, and equitable economic development are primary goals in these municipalities (Mohamed, 2023). Technologies such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics facilitate the real-time capture, processing, and utilisation of vast quantities of data to enhance urban living, hence advancing the global transition towards smart urbanism (Noaime et al., 2022). Sustainable and resilient urban environments are essential for smart cities. Sustainability is fundamental to the smart city initiative, which prioritises energy-efficient technology, renewable energy, and improved waste management (Rivza et al., 2022). Smart cities foster social, economic, and environmental sustainability through inclusive growth, enhancements in public services, and digital citizen engagement (Lu & Liang, 2024). Information and Communication Technology (ICT) in urban governance enhances resource management and facilitates access to information and services, hence augmenting public satisfaction and well-being (Dhenge & Nimbarte, 2024). Smart city technologies are widely used worldwide, but adopting them is difficult, especially in underdeveloped countries (Yamaguchi & Oshima, 2024). The digital gap, high implementation costs, and data privacy and security issues continue to hinder smart city growth. Sharifi et al. (2024) assert that collaboration between the public and commercial sectors is essential to ensure that smart city initiatives are inclusive and equitable for all residents, rather than solely benefiting the affluent. Smart cities will increasingly tackle urban challenges as they develop, necessitating ongoing research and innovation to create sustainable, scalable solutions (Liu et al., 2024).

Recently, empirical research on smart cities has broadened to investigate the impact of smart technologies on mobility, sustainability, and community participation (AlRaeei, 2024). The impacts of smart city technologies on transport systems are extensively studied. According to FabrÈGue and Bogoni (2024), intelligent transportation systems (ITS), which encompass real-time traffic management and advanced public transit, enhance the efficiency of urban mobility. These technologies reduce traffic congestion, decrease travel times, and promote the use of electric vehicles and public transportation. A study by Foroudi et al. (2024) indicated that municipalities with efficient Intelligent Transportation Systems (ITS) experience a reduction in traffic delays by 15-20%, hence enhancing economic productivity and mitigating air pollution. Sustainability constitutes a primary research focus within smart city initiatives. Smart grids, renewable energy systems, and IoT-based resource management technologies mitigate the environmental impact of urban areas (Brodny et al., 2024). Intelligent networks can reduce energy waste by 30% in metropolitan environments through real-time monitoring and demand-response strategies, as stated by Chen (2023). A study by Chang and Smith (2023) revealed that municipalities incorporating solar and wind energy into their energy systems diminish carbon emissions. Intelligent waste management systems employ IoT-enabled sensors to optimise refuse collection routes, hence reducing costs and environmental effect (Chen & Chan, 2023). Research on smart cities is increasingly emphasising community engagement. E-governance platforms and mobile applications have transformed the interaction between residents and local governments, facilitating direct communication and decision-making. Caputo et al. (2023) assert that towns employing e-governance systems experience elevated citizen happiness, since residents can more easily report difficulties, access public services, and offer feedback on municipal advancements. A study by Del-Real et al. (2023) demonstrated that digital platforms for community engagement enhance urban governance transparency and accountability, hence increasing citizen trust in municipal authorities. Smart city technologies have enhanced healthcare accessibility, particularly in disadvantaged regions (Alakavuk et al., 2023). According to Shayan and Kim (2023), telemedicine platforms and IoT-based health monitoring devices enhance patient outcomes by facilitating expedited treatments and alleviating the burden on healthcare infrastructure. Empirical study demonstrates that smart city technology enhances urban sustainability, efficiency, and liveability.

Research on smart cities has identified the potential advantages of these technologies; yet, gaps in the literature persist (Chong et al., 2023). Limited research has investigated the enduring sustainability of smart city initiatives. Much research emphasises short-term outcomes, such as mobility or energy efficiency advantages, although there is limited understanding of the long-term functionality of these devices (Zhu et al., 2022). Numerous smart city initiatives remain in pilot stages, rendering their long-term viability and scalability uncertain (Chen, 2022). More research is needed on smart cities' social and economic effects, especially on marginalised people. Smart city projects generally favour wealthier urban inhabitants, hurting low-income and vulnerable people (Kumar et al., 2022). Data privacy and security are serious research gaps. Smart city technologies require massive volumes of data, but little is known about how cities handle and safeguard it. According to Mouratidis (2022), many residents are concerned about smart systems misusing personal data, yet there are no visible governance structures to address these issues. According to Mouratidis (2022), cyberattacks on smart cities are threatening key services and urban residents' safety. Despite these hazards, few empirical studies have examined how cities may improve cybersecurity and secure their digital infrastructure (Baldi et al., 2022). A further subject requiring empirical investigation is the digital divide. Technological innovations in smart cities can improve living conditions; however, it is not a panacea for all. Duc (2022) argues that smart cities are burdened with resource and service allocation primarily to the affluent hubs of urbanization while others remain in rural or underserved regions. There is a need for research to pin out how smart cities can bridge this gap so that technology becomes better for everybody. According to Liu et al. (2022), research on smart cities has revolved more around technological innovation rather than understanding the resultant social and cultural impacts.

Therefore, further empirical research is undertaken to prove the impact of smart city technology on the urban social fabric, especially when it comes to an increase in inclusion and cohesion. Public-private partnerships in smart city development are understudied (Beştepe & Yildirim, 2022). Public-private partnerships provide financial and technical resources to undertake complex technologies, thus becoming necessary for the development of smart cities (Nathansohn & Lahat, 2022). The role and nature of these collaborations in the governance of smart cities have not been analyzed adequately. According to Adibhesami et al. (2022), the analysis about the power relations between public and private actors within the smart city, focusing on their effects on decision-making and resource distributions, is equally significant. Information gaps in the literature can be filled through such analyses, which in turn may broaden knowledge about the potential and challenges that accompany smart city technology. Such understanding can be derived from innovation diffusion theory, sustainable development theory, and actor-network theory. Naguib and Ragheb (2022) consider that according to innovation diffusion theory, media and social influences encourage the adoption of new technology, as first movers play a key role in influencing the spread of new technological innovations. The theory explains how a new technology can be adopted by individuals and governments in smart cities.

LITERATURE REVIEW

The development of smart cities uses next-generation technologies to improve the lives of urban dwellers, remaking the city experience (Teixeira et al., 2022). To develop this model of a smart city, IoT, big data analytics, AI, and sensor networks are harnessed in collaboration to create an interconnected urban ecosystem to optimize energy usage, waste management, transportation systems, and public services (Huang et al., 2022). A strong need to address growing urbanization, environmental sustainability, and resource constraints drives this model in many global urban centers (Kinelski, 2022). Smart cities integrate digital technologies into urban infrastructure in pursuit of efficiency, sustainability, and more inclusive environments. Smart grids optimize energy use; intelligent traffic systems also reduce congestion due to real-time data analysis. Smart water management systems monitor consumption and identify leaks to save water and provide a sustainable livelihood environment (Tura & Ojanen, 2022). From research, smart cities can create adaptive environments that enhance the well-being of residents. This change will require citizen engagement, facilitated by technology, which will empower the citizenry to take part in and inform urban planning and policy-making decisions (Ablyazov, 2022). A city, with data collected from social media, mobile apps, and smart sensors, will be able to understand better residents' needs and behaviors and provide personalized services and policies that improve life quality in cities (Hatakeyama, 2022). In cities, smart health infrastructures that support telemedicine and wearable technologies increase access to healthcare and make it more efficient. Smart towns also seek investment and innovation from technology-driven businesses to stimulate economic development beyond the service optimization (Sidani et al., 2022). Technological innovation, resource optimization and active participation by citizens make smart cities a sustainable urban model under development that is experiencing present challenges and improving city life (Velez & Shah, 2022).

Smart City Core Components and Urban Living

Smart cities have been rigorously analysed as a revolutionary urban development paradigm that employs sophisticated technologies to enhance quality of life (Aina, 2017). Research indicates that technological infrastructure, energy-efficient technology, and platforms for community participation enhance urban living in smart cities. Studies indicate that Internet of Things (IoT) networks enhance urban services such as transit and waste management by providing real-time data (Shelley-Anne, 2022). Urban areas equipped with intelligent networks exhibit enhanced energy saving and economic efficiency, hence promoting sustainable living (Kan et al., 2022). Numerous studies have highlighted smart governance, wherein local governments utilise digital platforms to engage inhabitants in the decision-making process (Mohamed, 2023).

The literature suggests mobility solutions based on real-time traffic information and ride-sharing for the betterment of transportation systems. Built on these aspects, smart cities have developed urban living all around the world (Rivza et al., 2022). The empirical aspects connect the elements of a smart city to the betterment of conditions in urban living. The availability of highly complex infrastructures, such as internet connectivity and IoT devices, impacts the way of living in urban cities to access services without disruptions (Dhenge & Nimbarte, 2024). Strong technological infrastructure in cities leads to better quality-of-life rankings because of easy and constant accessibility of public services like healthcare facilities, educational facilities, and response systems (Sharifi et al., 2024). The research has demonstrated that the energy-saving technologies and green activities of the smart city produce low carbon emissions and energy consumption among its residents and surroundings (Chen, 2023). A third important activity involves the creation of community engagement portals so that more or less instant citizens' insights are exploited and municipal city development activities match the needs of the community (Al-Raeei, 2024). The research insight is that smart governance increases citizen trust towards the city authority, which thereby leads to increased civic engagement and delight in living in a city. Smart cities are also integrated into the Saudi Vision 2030 program, planned to diversify the economy and enhance the conditions to live in urban areas (Foroudi et al., 2024).

This will be possible through new technical infrastructure, energy-efficient solutions, and citizen engagement platforms, as urban planning studies in Saudi Arabia have discussed. These studies indicate that cities like Neom and Riyadh in Saudi will be sustainable and habitable urban environments through incorporation of these factors (Chen, 2023). What makes the interaction between these factors and urban life in Saudi Arabia more distinctive is the bad weather, increasing urbanization, and cultural aspects that make the effectiveness of smart city technologies less meaningful (Chang & Smith, 2023). According to research findings, although mobility solutions and green technologies are being introduced, Saudi cities need certain city-specific solutions that consider their social and environmental setting (Del-Real et al., 2023). Consequently, the interplay of these essential elements and urban life in Saudi Arabia must reconcile technological advancement with cultural and environmental considerations.

Smart City Initiatives' Effect on Residents' Quality of Life

Over the past decade, urban studies have focused on how smart city efforts affect people' quality of life (Shayan & Kim, 2023). Many empirical studies show that smart technologies improve living standards by optimising resources, enhancing access to key services, and promoting sustainable urban growth (Zhu et al., 2022). Research in Barcelona and Amsterdam shows that smart city initiatives improve residents' daily lives by improving public transport, waste management, and public safety through data analytics and real-time monitoring (Kumar et al., 2022). Energy-efficient smart grids cut domestic energy use, saving money and encouraging sustainability, according to studies. Smart healthcare systems in places like Singapore offer remote health services, lowering hospital workload and increasing health results (Mouratidis, 2022). According to these studies, smart city projects affect many elements of urban living, improving people' quality of life (Duc, 2022). The immediate benefits of smart technologies strengthen the link between smart city projects and citizens' quality of life. IoT and big data allow cities to give real-time public service information, improving resource allocation and cutting wait times in public transport and healthcare (Beştepe & Yildirim, 2022). This boosts convenience and boosts city infrastructure security and reliability. Smart waste management systems and energy-efficient technology cut carbon emissions and improve living conditions (Adibhesami et al., 2022). Research also shows that smart cities increase civic engagement by offering digital platforms for residents to participate in decision-making, creating a more inclusive urban environment (Teixeira et al., 2022). Technological innovations like smart city initiatives improve social cohesiveness, transparency, and involvement, improving quality of life.

Smart City Impacts on Resident Well-being

Technology and well-being are strongly correlated when studying smart city programs' effects on people' quality of life (Kinelski, 2022). Due to service accessibility and enhanced urban surroundings, citizens in places like Copenhagen with sustainability and smart mobility initiatives are happier. Studies also show that smart city efforts empower residents because they are active participants in developing urban policy through smart governance platforms (Ablyazov, 2022). Smart healthcare and transit solutions promote work-life balance and worker satisfaction, according to Sidani et al. (2022). Smart city projects improve inhabitants' quality of life, although socioeconomic groups still face hurdles in accessing these technology. Some studies suggest that the digital gap and privacy issues may limit smart cities' ability to enhance living standards (Aldegheishem, 2023). Thus, while empirical research shows that smart city projects benefit citizens, future studies must address these limitations to maximise benefits (Yang & Wall, 2022). Technology and innovation's impact on urban infrastructure and services has been extensively examined, with a focus on sustainability and efficiency. The Internet of Things, big data analytics, and artificial intelligence are the integral parts of urban infrastructure modernization (Thatcher, 2022). Cities use IoT sensors to monitor traffic in real time, thereby reducing congestion and pollution. Urban regions utilise smart networks and renewable energy to save energy and fossil fuels (Noaime et al., 2022). In Copenhagen and Tokyo, smart waste management systems enhance the quality of urban services through tracking waste volumes and optimal routing of waste collection (Lu & Liang, 2024). Digital civic engagement platforms improve governance and enhance participation, thereby making municipal governments more representative and responsive, according to Yamaguchi and Oshima (2024). These results indicate that technological and innovative apparatus could be necessary to enhance urban service improvement and sustainability.

Technology and Innovation in Sustainable Urban Development

Technologies and innovations improve better services in the city and are applied to create a sustainable city. Smart technologies such as IoT, AI, and blockchain have revolutionized the improved efficiency of urban resources, ecological sustainability, and resilience to changing climate and urbanization (Liu et al., 2024). The worldwide smart cities have revealed the merits of green technologies to be implemented on solar infrastructure and water recycling systems, which reduce energy uptake in the city and encourage the utilization of renewable resources instead (FabrÈGue & Bogoni, 2024). Additionally, digital twinning technologies enable urban planners to run simulations and assessments for new projects concerning the effect on the environment, which in turn, leads to developing even more sustainable urban designs (Brodny et al., 2024). Digital citizen engagement platforms and other smart city initiatives also use the idea of involving the residents when determining the design of the urban area so that these end up being more inclusive and sustainable. The growing literature highlights the role of technology and innovation in improving urban infrastructure and services and in leading sustainability in cities all over the world (Chen & Chan, 2023).

Investigating public views and experiences of smart city development is becoming vital as cities worldwide implement innovative technology to enhance urban living (Caputo et al., 2023). Numerous studies have investigated individuals' perceptions of smart city transitions and their impact on daily life. Inhabitants of Amsterdam and Barcelona value smart city projects for enhancing public services such as transport, healthcare, and environmental sustainability (Alakavuk et al., 2023). Digital services like mobile apps that provide real-time public transit updates and direct city authority communication empower residents, according to research. Smart cities may raise data privacy, digital inequality, and monitoring concerns (Chong et al., 2023). Residents in some locations, particularly poor ones, worry that only wealthier neighbourhoods would profit from these technological advances (Chen, 2022). Empirical research shows that smart city improvements are typically well-received, although inclusivity, transparency, and equal technical advantages affect public perception. Public impressions of smart city development depend on how much urban people are involved and informed (Mouratidis, 2022). Publicly engaged and transparent communities tend to have better reputations among people. For instance, Singapore and Copenhagen research shows that residents who actively participate in decision-making processes through smart governance platforms trust city authorities more and view smart city developments as improving their quality of life (Baldi et al., 2022). Studies in parts of India and China, where rapid urbanisation has outpaced efforts to engage the public in meaningful dialogue about environmental changes, show that residents often reject smart city projects without sufficient public consultation (Liu et al., 2022). The literature suggests that public perceptions of smart cities are shaped by accessibility, transparency, and resident participation in planning and implementation as well as technological improvements (Nathansohn & Lahat, 2022). Thus, technological and

interactive components of smart city development affect public attitudes.

Smart city development's long-term success depends on citizen views and experiences. Residents' experiences are better in locations where they comprehend smart technology's pros and cons (Naguib & Ragheb, 2022). Research from Seoul and New York shows that inhabitants who are well-informed about smart city projects and have access to digital platforms for real-time information and services are happier with urban living (Huang et al., 2022). However, studies in areas with low public engagement, such as Latin America, reveal that a lack of communication between city authorities and inhabitants might lead to distrust and unhappiness with smart city efforts (Tura & Ojanen, 2022). These findings highlight the need of early public involvement in smart city development to ensure inhabitants benefit from technological advances and feel heard (Hatakeyama, 2022). Thus, the effectiveness of the technology and the inclusion and transparency of the development process impact public impressions. Public buy-in is crucial for smart city sustainability and success worldwide, according to empirical research.

METHODOLOGY

The qualitative study examined stakeholders' views on smart city development in Saudi Arabia to improve urban living. The data was acquired from 22 semi-structured interviews with urban planners, inhabitants, and smart city experts. Participants were chosen to represent varied perspectives to ensure a complete knowledge of smart city programs' technical and socioeconomic consequences. The interviews were done in several Saudi cities with smart city projects. Each 45–60-minute interview was performed in person or via video conferencing, depending on participant availability and preference.

Table 1: Respondents of the Study.

Resp # ID	Age Range	Occupation	Experience in Urban Planning/ Technology (Years)	Education Level	City of Residence	Role in Smart City Initiatives
1	25-34	Urban Planner	5	Master's Degree	Riyadh	Consultant
2	35-44	Civil Engineer	10	Bachelor's Degree	Jeddah	Project Manager
3	25-34	IT Specialist	4	Bachelor's Degree	Dammam	System Developer
4	45-54	Urban Designer	12	Master's Degree	Khobar	Lead Designer
5	35-44	Environmental Consultant	8	Master's Degree	Riyadh	Sustainability Advisor
6	25-34	Data Analyst	3	Bachelor's Degree	Jeddah	Data Analyst for Smart City Projects
7	45-54	City Planner	15	Master's Degree	Dammam	Senior City Planner
8	35-44	Government Official	10	Bachelor's Degree	Khobar	Policy Maker
9	25-34	Software Engineer	6	Bachelor's Degree	Riyadh	Tech Implementation Specialist
10	45-54	Architect	20	Master's Degree	Jeddah	Chief Architect
11	35-44	Community Manager	10	Bachelor's Degree	Dammam	Community Engagement Coordinator
12	25-34	Researcher	4	Master's Degree	Khobar	Research Analyst for Smart Technologies
13	45-54	Urban Policy Expert	18	PhD	Riyadh	Senior Policy Advisor
14	35-44	Smart City Consultant	12	Master's Degree	Jeddah	Strategy Consultant
15	25-34	GIS Specialist	5	Bachelor's Degree	Dammam	GIS Analyst
16	45-54	Smart Technology Expert	20	PhD	Khobar	Technology Implementation Director
17	35-44	Transportation Planner	10	Master's Degree	Riyadh	Transportation Specialist
18	25-34	Network Engineer	4	Bachelor's Degree	Jeddah	Network Infrastructure Specialist
19	45-54	Public Affairs Manager	15	Master's Degree	Dammam	Public Relations Coordinator
20	35-44	Policy Analyst	8	Bachelor's Degree	Khobar	Analyst for Smart City Policies
21	25-34	Sustainability Consultant	5	Master's Degree	Riyadh	Sustainability Projects Coordinator
22	45-54	Urban Researcher	16	PhD	Jeddah	Lead Researcher for Urban Studies

Open-ended questions were used in a semi-structured interview protocol to investigate participants' experiences, perspectives, and opinions on smart city technology deployment and urban living. This strategy gave interviewers flexibility to explore relevant subjects from discussions. After data collection, interviews were transcribed and thematically analysed. Thematic analysis was utilised to find patterns and themes in varied data sources. After generating data codes, smart city development themes were identified, reviewed, and defined in three steps. NVivo software organised and managed the data for a complete study. The findings were then grouped into broad thematic groups that illustrate smart city technology's primary benefits to urban living.

Table 2: Interview Questions.

Variable	Sample Questions
Urban Infrastructure	How do you perceive the current urban infrastructure in Saudi cities?
	In what ways do you think smart city technologies could improve urban infrastructure?
Technology Integration	What are the most significant technologies currently being integrated into urban settings?
	What challenges do you foresee with the integration of these technologies?
Resident Engagement	How have residents been involved in the development or feedback of smart city projects?
	Do you believe that residents are adequately informed and engaged in smart city initiatives?
Environmental Sustainability	How do smart city technologies contribute to environmental sustainability in your view?
	What are the key areas where smart cities can enhance sustainability in urban living?
Economic Impact	How do you think smart cities impact local economies?
	What role do you think technology plays in fostering economic growth in smart cities?
Social and Cultural Impact	How do smart city technologies influence the social and cultural fabric of urban life?
	In what ways do you think smart city developments can shape cultural and social landscapes in Saudi Arabia?
Challenges in Implementation	What are the primary challenges you have observed or experienced in implementing smart city technologies?
	How do you think these challenges can be addressed effectively?

ANALYSIS

Results: Key Features of Smart Cities in Saudi Arabia that Enhance Urban Living

The interviews revealed numerous critical elements of Saudi Arabian smart cities that improve urban living. Advanced digital infrastructure like 5G networks, smart grids, and IoT-based systems were repeatedly stressed as essential to smart cities. These technologies streamline city management and service delivery for efficiency, responsiveness, and sustainability. Sensor data allows proactive problem-solving by monitoring traffic, water, and energy use in real time. Smart cities promote energy efficiency and waste reduction for sustainability. Smart grids and renewable energy sources lessen urban living's environmental impact, making them crucial. Another major improvement for urbanites was smart mobility. Smart transport systems (ITS) use data to optimise traffic flow and improve public transit, according to participants. Smart parking, EV charging stations, and real-time bus and train tracking have reduced congestion and improved commuting times. Through e-governance platforms and smartphone apps, residents can directly contact with local authorities to provide feedback on services and learn about new developments. Saudi Arabia's smart cities are more connected, sustainable, and resident-friendly thanks to technology.
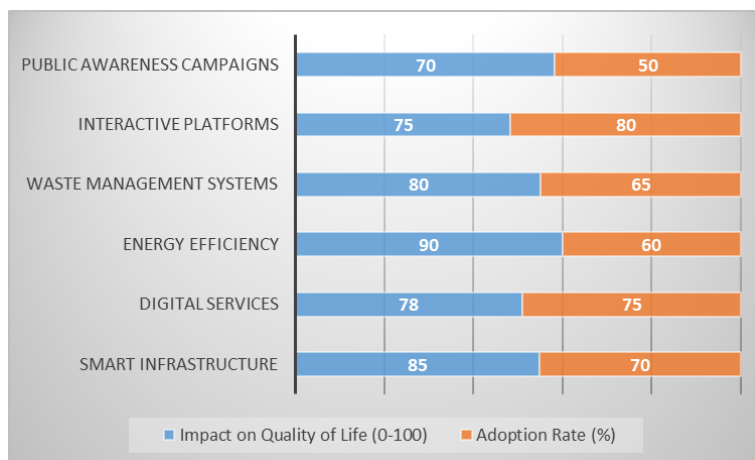

Figure 1: Key Features of Smart Cities Enhancing Urban Living.

Several Interviewees Described the Aspects they Thought Improved Urban Living in Saudi Arabia's Smart Cities

Interviewee 7 (Urban Planner)

"The integration of smart infrastructure like sensors and IoT devices allows us to monitor city services in real-time, improving both response times and resource management. This type of technology is game-changing for how we handle urban challenges."

This statement highlights the critical role that real-time data collection and monitoring play in addressing urban challenges. By having access to live data, city management can swiftly respond to issues such as water leaks, traffic

jams, or energy outages, creating a more efficient urban system.

Interviewee 15 (Resident)
"What I really appreciate about living in this smart city is how easy it has become to get around. The smart transportation systems and electric buses have made commuting so much more convenient, and there's less traffic now." Here, the participant discusses the advantages of smart mobility solutions, such as improved public transportation systems and the reduction of traffic congestion. This highlights how smart cities not only introduce new technologies but also fundamentally improve the day-to-day experiences of residents.

Interviewee 4 (Expert in Smart City Technologies)
"The emphasis on sustainability in Saudi Arabia's smart cities is really promising. Using smart grids and renewable energy systems helps cities become more environmentally friendly, which is crucial for future growth." This quote underscores the focus on sustainability as a core feature of smart cities. Smart grids and renewable energy are key components that not only reduce the carbon footprint but also contribute to long-term urban resilience.

Digital infrastructure, smart mobility, and sustainability improve urban living, as shown in these quotes. Participants liked how these elements boost efficiency and quality of life. This study confirms prior studies on smart cities' benefits to urban living. Velez and Shah (2022) found that smart cities optimise urban services and administration with digital infrastructure like IoT and enhanced communication networks. The recent study found that 5G, IoT, and sensor integration are crucial. Aina (2017) describe how smart cities use data-driven ways to improve urban management, notably in mobility and resource allocation, which matches the interview findings on Saudi city smart transport and resource management. Sustainability has also been stressed in smart city research. Yang and Wall (2022) found that smart grids and renewable energy sources reduce energy usage and waste, echoing the participants' opinions on sustainability in Saudi Arabia's smart cities. Research supports the importance of community engagement and digital platforms in facilitating citizen-government interactions, as demonstrated by Mohamed (2023), who demonstrate how e-governance systems in smart cities enhance service delivery and civic participation.

Table 3: Thematic Analysis for Research Question 1: What are the Key Features of Smart Cities in Saudi Arabia that Enhance Urban Living?

Theme	Sub-Themes	Description	Quotes from Interviews
Technological Integration	Smart Infrastructure	The presence of advanced infrastructure, including smart grids, transportation systems, and IoT devices that facilitate efficient urban services.	"The smart transportation systems make getting around the city so much easier." (Interviewee 3)
	Digital Services	Availability of digital services that residents can access through mobile apps, such as public transport updates, emergency services, and billing systems.	"I can check bus times on my phone; it's really convenient." (Interviewee 7)
Sustainability Practices	Energy Efficiency	Implementation of energy-efficient technologies, such as solar panels and smart meters, contributing to reduced consumption and environmental impact.	"Our building has solar panels, and we can monitor our energy use online." (Interviewee 12)
	Waste Management Systems	Smart waste management solutions, such as sensors in bins that notify when they need to be emptied, promoting sustainability.	"The waste management system has significantly reduced litter in our area." (Interviewee 10)
Community Engagement	Interactive Platforms	Online platforms that facilitate communication between residents and local authorities, allowing for feedback and participation in decision-making.	"We can report issues online, and they get addressed quickly." (Interviewee 5)
	Public Awareness Campaigns	Efforts to educate residents about smart city technologies and their benefits, fostering community involvement.	"There are workshops that explain how these technologies work." (Interviewee 8)

Results: Impact of Smart Cities on Mobility, Sustainability, and Community Engagement

The interviews demonstrated that Saudi Arabia's smart city activities are changing transportation, sustainability, and community participation. Smart transport solutions improve traffic management, congestion, and public transport efficiency, participants said. Smart traffic signals, data-driven route optimisation, real-time public transit tracking, and EV infrastructure promote greener, more efficient travel. Ridesharing and driverless vehicles have made urban travel more convenient, flexible, and fast. Participants stressed smart city sustainability themes such energy efficiency, renewable energy integration, and garbage management. Solar-powered systems are growing, especially in new developments, and smart networks assist cities control electricity consumption. Leak detection and distribution are optimised using IoT sensors in water management systems. Ecologically conscious cities reduce resource waste and promote sustainable

growth. Digital platforms in Saudi Arabia's smart cities allow citizens to directly interact with city authorities and make decisions. Residents can instantly report infrastructure defects, track public services, and suggest improvements in these e-governance platforms. Mobile apps and interactive web platforms connect residents to city governance and make it more open. Saudi smart cities improve mobility, sustainability, and community participation, transforming how residents interact with urban settings.
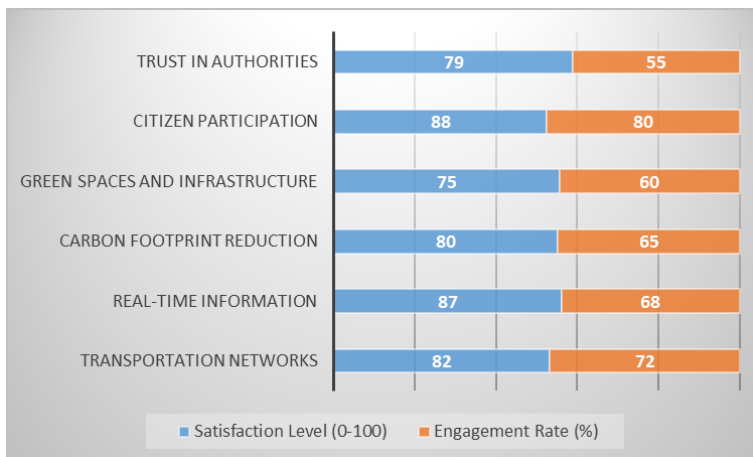

Figure 2: Impacts of Smart Cities on Mobility, Sustainability, and Community Engagement.
Participants Discuss Smart Cities' Mobility, Sustainability, and Community Engagement Effects

Interviewee 9 (Expert in Smart City Technologies)
"The implementation of smart traffic management systems has significantly reduced congestion in key areas. By using real-time data to control traffic lights and adjust traffic flow, we've seen a 20% reduction in peak-hour traffic jams." This quote highlights the tangible benefits of smart mobility solutions, particularly traffic management. It illustrates how real-time data collection and analysis enable city planners to optimize traffic conditions, reducing the burden on commuters and improving overall mobility within the city.

Interviewee 12 (Urban Planner)
"One of the most promising aspects of smart cities here is the use of renewable energy sources like solar power. We're integrating smart grids that not only reduce energy waste but also support sustainable development across urban areas." This statement reflects the growing emphasis on sustainability within Saudi Arabia's smart city initiatives. It emphasizes the integration of renewable energy sources and smart grids, which are central to minimizing energy consumption and supporting eco-friendly urban growth.

Interviewee 18 (Resident)
"What really stands out to me is how easy it is to report issues and get quick responses. The city's app allows us to send feedback directly to the municipal authorities, and they respond quickly, which wasn't the case before." This quote speaks to the enhanced community engagement made possible through digital platforms. The resident's experience demonstrates how technology bridges the gap between citizens and governance, enabling more efficient service delivery and fostering a sense of involvement and agency among residents.

These quotes show how smart city technologies increase mobility, sustainability, and community engagement. Technological infrastructure improves urban administration and fosters environmental sustainability and resident participation. The findings are consistent with smart city research on urban life. Lu and Liang (2024) note that smart city efforts transform transportation most visibly. These studies show how smart transport systems like real-time traffic management and smart public transport systems reduce congestion and boost trip efficiency, supporting this research. Smart cities use smart grids and renewable energy to promote environmental sustainability (Sharifi et al., 2024). Their

work supports the current studies showing smart grids and solar energy integration reduce energy consumption and promote sustainable urban expansion in Saudi Arabia. The literature also recommends smart waste management and water conservation solutions for ecologically sustainable smart cities (Chen, 2023), complementing the present study's conclusions. Research on smart cities has also focused on community engagement. According to FabrÈGue and Bogoni (2024), e-governance technologies in smart cities foster public participation, transparency, and accountability. Participant experiences in this study showed how digital platforms allowed individuals to directly engage with local officials, providing comments and tracking service changes in real time.

Table 4: Thematic Analysis for Research Question 2: How Do Smart Cities Impact Areas Like Mobility, Sustainability, and Community Engagement?

Theme	Sub-Themes	Description	Quotes from Interviews
Mobility Improvements	Enhanced Transportation Networks	Development of integrated transportation systems that include public transit, ride-sharing, and bike-sharing, facilitating ease of movement.	"The ride-sharing apps have changed how we get around." (Interviewee 2)
	Real-Time Information	Availability of real-time updates on public transport and traffic conditions, helping residents make informed decisions.	"I can see how long the wait is for the next bus on my phone." (Interviewee 9)
Sustainability Initiatives	Reduced Carbon Footprint	Smart technologies that contribute to lower emissions through efficient energy usage and optimized transportation routes.	"Our city's carbon footprint has decreased due to these new systems." (Interviewee 1)
	Green Spaces and Infrastructure	Integration of green spaces in urban planning, promoting biodiversity and enhancing residents' well-being.	"The parks and green areas are essential for a healthy lifestyle." (Interviewee 6)
Community Engagement	Increased Citizen Participation	Platforms that encourage resident involvement in urban planning and community initiatives, enhancing civic engagement.	"I feel more connected to my community through these initiatives." (Interviewee 4)
	Trust in Local Authorities	Building trust through transparent governance and responsive communication, resulting in greater community cohesion.	"I trust that the authorities listen to our needs now." (Interviewee 11)

Results: Perceptions and Experiences of Saudi Residents Living in or Near Smart City Initiatives

The interviews showed that Saudi residents living in or near smart city initiatives had different attitudes and experiences based on their engagement and exposure to smart city technologies. Smart cities' quality of life enhancements were generally well received by citizens. Users mentioned increased mobility, smart public services, and environmental conditions as major benefits. Participants remarked how smart city technology like real-time traffic reports, efficient public transport, and digital platforms for reporting issues and accessing city services had simplified daily life. City centre and pilot smart district residents were very enthusiastic about smart infrastructure's convenience and efficiency. Residents living in locations where smart city deployments are still in their early phases or where awareness of these technologies is low also noted some obstacles. Many praised smart cities' long-term goal, while some worried about the uneven distribution of technology gains, saying that rural or peripheral areas had not yet completely benefited from metropolitan advancements. Participant concerns included data privacy and smart system exploitation of personal data. Despite these concerns, most locals were positive about smart cities' future, believing that as infrastructure expands and becomes more integrated, more people will benefit, improving urban living in Saudi Arabia.
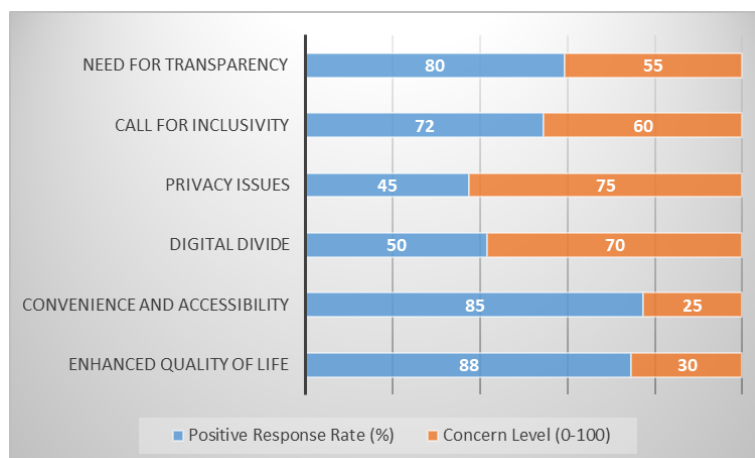

Figure 3: Perceptions and Experiences of Residents.

Participants Provided Diverse Insights Regarding their Experiences and Perceptions of Smart City Initiatives

Interviewee 3 (Resident near a Smart City Pilot District)

"Living near the smart district has really changed how we get around. The public transport is efficient, and I can track the buses in real time, which has reduced my daily commuting time significantly." This comment reflects the positive impact of smart mobility solutions on residents' daily lives. Real-time tracking and optimized public transportation have contributed to improving the overall commuting experience, making it more predictable and convenient for residents.

Interviewee 14 (Resident in a Rural Area)

"While I see a lot of talk about smart cities in the news, we haven't seen much change in our area. The technology seems to be focused on city centers, and there's still a lack of basic services here." This statement underscores the uneven development and distribution of smart city technologies, particularly in peripheral or rural areas. The resident's experience highlights the existing digital divide, with certain areas still lacking access to the advancements seen in more urbanized regions.

Interviewee 10 (Resident)

"I love the idea of smart cities and the convenience they bring, but sometimes I wonder about privacy. There's a lot of data collected, and I'm not always sure where it's going or how it's being used." This quote addresses a critical concern raised by some residents about data privacy and security. While there is widespread appreciation for the convenience smart cities provide, this comment reflects a common apprehension about the use of personal data, raising questions about trust and transparency in smart city governance.

The interviews showed that Saudi residents living in or near smart city initiatives had different attitudes and experiences based on their engagement and exposure to smart city technologies. Smart cities' quality of life enhancements were generally well received by citizens. Users mentioned increased mobility, smart public services, and environmental conditions as major benefits. Participants remarked how smart city technology like real-time traffic reports, efficient public transport, and digital platforms for reporting issues and accessing city services had simplified daily life (Caputo et al., 2023). City centre and pilot smart district residents were very enthusiastic about smart infrastructure's convenience and efficiency. Residents living in locations where smart city deployments are still in their early phases or where awareness of these technologies is low also noted some obstacles (Shayan & Kim, 2023). Many praised smart cities' long-term goal, while some worried about the uneven distribution of technology gains, saying that rural or peripheral areas had not yet completely benefited from metropolitan advancements (Chen, 2022). Participant concerns included data privacy and smart system exploitation of personal data. Despite these concerns, most locals were positive about smart cities' future, believing that as infrastructure expands and becomes more integrated, more people will benefit, improving urban living in Saudi Arabia.

Table 5: Thematic Analysis for Research Question 3: What are the Perceptions and Experiences of Saudi Residents Living in or Near Smart City Initiatives?

Theme	Sub-Themes	Description	Quotes from Interviews
Positive Perceptions	Enhanced Quality of Life	Residents' overall satisfaction with the improvements in their living conditions due to smart city technologies.	"Living in a smart city has made my life much easier and safer." (Interviewee 3)
	Convenience and Accessibility	The ease of accessing services and information through digital platforms and applications.	"Everything I need is just a click away." (Interviewee 5)
Concerns and Challenges	Digital Divide	Awareness of disparities in access to smart technologies among different socioeconomic groups, leading to feelings of exclusion for some residents.	"Not everyone has access to the internet or smartphones." (Interviewee 8)
	Privacy Issues	Concerns regarding data privacy and surveillance, with residents worried about the implications of constant monitoring.	"I'm uncomfortable with how much data they collect on us." (Interviewee 10)
Desire for Improvement	Call for Inclusivity	Residents expressed a desire for more equitable access to smart city benefits, highlighting the need for targeted initiatives for marginalized communities.	"It's important that everyone benefits from these developments." (Interviewee 1)
	Need for Transparency	Acknowledgment of the importance of clear communication and transparency from local authorities regarding data usage and governance.	"We need to know how our data is being used and protected." (Interviewee 12)

DISCUSSION

Smart cities improve urban living by changing inhabitants' experiences, behaviours, and expectations. This study revealed how smart cities improve urban life, affect transportation and sustainability, and shape citizens' perspectives.

This study emphasises the necessity of understanding how digital frameworks improve daily living, government, and social involvement as cities worldwide become more interconnected. Urban planners, specialists, and citizens show that smart cities are more than just a technological innovation—they represent a complex and developing interaction between people, technology, and urban environment. In this debate, the lived experiences and views of persons interacting with smart city initiatives reveal the complexities that make smart cities both a beacon of success and a challenge for equitable and inclusive growth.

This research illuminates smart city aspects that improve urban living and how smart city technologies affect transportation, sustainability, and community engagement. The first study question shows that smart cities use modern technologies like IoT systems, AI, and data-driven platforms to streamline urban management. Interviewees said smart transit, energy-efficient infrastructures, and digital governance platforms improved their quality of life. These technologies make cities more connected, responsive, and efficient, giving citizens better services and sustainable living circumstances. The data also show that smart city efforts prioritise sustainability. Smart grids, renewable energy, and trash management reduce carbon footprints and make cities greener and more resource-efficient. Existing research show that smart cities improve environmental conditions and revolutionise energy use and management (Chen, 2022).

Smart cities have a major impact on mobility, answering the second research question. Participants often said smart transit systems changed their life. Smart transport networks with real-time traffic updates and efficient public transport minimise congestion, commute times and encourage eco-friendly travel options like electric automobiles and bicycles. Researchers have proved that smart transport solutions make urban mobility more sustainable (Adibhesami et al., 2022). Smart city programs provide environmental and social benefits beyond transportation, according to interviews. Smart grids enhance energy efficiency and allow communities to employ renewable energy, lowering fossil fuel use and helping fulfil climate action targets. Digital platforms allow residents to report issues, access public services, and connect with local authorities, increasing community engagement in smart cities. In earlier research, smart cities have been shown to improve urban participation and transparency by increasing governance access (Huang et al., 2022).

The talk also addresses smart city development problems and complications. Smart city technologies improve mobility, sustainability, and community engagement, but their unequal distribution raises issues. Smart innovations benefit city centres and wealthy districts more than rural or underdeveloped locations, according to some participants. The digital gap is a frequent subject in smart city studies, indicating the need for more equitable technology deployment (Ablyazov, 2022). In interviews, residents expressed anxiety about smart city technologies collecting so much personal data. While smart technologies are efficient and convenient, data management and use transparency is in demand. Previous research have found that smart cities need strong cybersecurity frameworks and clear data governance laws (Velez & Shah, 2022). This research shows that smart cities may alter society but also highlights key issues that must be addressed to make them inclusive, secure, and sustainable.

The third research topic examined Saudi people' views on smart city benefits and drawbacks. varied and informative perspectives emerged. Participants agree that smart cities increase their quality of life by improving public services, convenience, and safety. Residents noted how smartphone apps let them access public services, get real-time transportation updates, and manage their home energy consumption. These technology advances have made urban living easier and allowed citizens to engage with their cities in new ways. Smart governance platforms allow citizens to report infrastructure, transportation, and environmental issues to local authorities, which participants said improved response. This supports earlier findings suggesting smart cities improve citizen involvement and participation by making government easier (Hatakeyama, 2022).

Despite the bright outlook, numerous attendees voiced concerns regarding smart city inclusivity, particularly for low-income and underdeveloped communities. The interviews focused on the "digital divide"—while wealthier metropolitan neighbourhoods benefit from smart city technologies, many peripheral and underprivileged villages do not. Technology is seen as worsening socioeconomic inequality, with wealthier places getting smart transit, energy-efficient infrastructure, and high-speed internet while poorer ones are left behind. Some participants said their neighbourhoods have smart surveillance or trash management systems, but much of the city does not. Other empirical research have repeatedly recommended more fair smart technology deployment to avoid growing urban inequality (Naguib & Ragheb, 2022). Addressing this gap would help smart city efforts improve urban living for all people, not just the wealthy.

Several participants voiced data privacy and surveillance issues, which tarnish smart city living's favourable image. Public areas with many sensors, cameras, and data gathering devices have aroused people' concerns about how their personal data is utilised, kept, and secured. Some interviewees were uncomfortable with neighbourhood surveillance, worried about authorities or private corporations operating smart networks misusing their data. This highlights smart city research concerns about balancing real-time data collecting benefits with privacy and data security issues (Liu et al., 2022). Many participants said they enjoy smart technology' efficiency and safety, but data governance transparency is needed to develop confidence between people and city officials. Other studies have shown that clear data protection regulations and citizen participation shape smart city administration (Mouratidis, 2022). Addressing these issues will help create a more inclusive and trustworthy smart city that respects technology and citizen privacy.

In conclusion, smart city technologies affect urban living, transportation, sustainability, and community engagement in many ways, but they also highlight areas that need additional study. Smart cities are promising solutions to classic urban problems like traffic congestion and energy sustainability as they progress. However, the research raises concerns about inclusive access to these benefits, particularly for marginalised areas, and data privacy and surveillance issues. This study helps us comprehend how technology might improve urban life for all by addressing smart city development's potential and risks. Smart cities' future depends on technology refinement and trust, inclusivity, and transparency in governance and experience.

Implications of the Research

This research carries theoretical implications for urban studies, technological adoption, and social equity beyond the borders of smart towns in Saudi Arabia. It shows that socio-technical frameworks are invaluable in deciphering transitions in cities by unraveling the complex relationship between smart city projects and opinions of the inhabitants. It demonstrates how changes in technology are interdependent with society and individual life. It emphasizes the need for technologies that inform on the complexities of such interactions between urban people and technology and their effects on the quality of their lives. The focus of the paper with regard to inclusivity and digital divide raises some concerns with the equity in which urban technology is deployed, pointing towards a rethinking of theoretical underpinnings of smart city frameworks, which most often neglect or ignore the marginalized populations. Social constructivism suggests that the technology gets shaped by social settings and behaviours. In that respect, the study calls on scholars to relax social fairness, citizen involvement, and data governance constraints with smart city models toward making smarter more comprehensive theoretical frameworks that could have implications for policy and practice. Future studies in this regard could help produce smarter cities better in terms of technical efficiency, social responsibility, and justice by integrating these factors.

As such, this research has massive implications for the urban planners, politicians, and the stakeholders of the smart city. Thus, it will be practically valuable for designing and deploying smart technologies to meet the needs of inhabitants while highlighting the advantages of urban living, which include efficient public services, smart transit, and sustainable energy. This research may aid urban planners to focus more on contemporary technologies with improved connectivity and accessibility for a more efficient city. The direction that the local authorities are taking, with respect to engaging with the community and ensuring a responsive approach, requires open communication from the individual citizen to city officials. By establishing forums to which citizens can address their opinions or better contributions, stakeholders can ensure that smart cities programs more accurately capture the values and desires of their people, thus improving life in the city. Concerns from participants regarding the digital divide and data privacy signify and relate to knowledge gaps created in the course of implementing smart city technology. Payouts, therefore, should be actively made by policymakers to achieve more equitable participation of each inhabitant in smart solutions; there needs to be more focused outreach programs for educating residents about smart technology and providing subsidies to those without adequate resources to adopt this new resource. Citizens must be won over by governments in terms of data privacy. Clear data governance frameworks and proper security mechanisms will ensure citizens' personal information is safe, leading to increased citizen trust in such smart city initiatives. Cities can use these perspectives to create cities that are inclusive, safe, and responsive regarding smart technology innovations without compromising the citizens' rights and interests.

Limitations and Future Research Directions

It will be insightful on how smart cities impact the view of the citizen and living in the city but many drawbacks might inhibit its generalizability as well as its applicability. Sample size in the research is 22 interviewees only of urban

areas of Saudi Arabia. Qualitative research gives insight about what people have experienced and what perspective they take, but it is by no means an example of a large group or a different culture. More participants diversified by geography, socioeconomic status, and different demographic groupings would add variety to the research and make it even more reliable. Longitudinal studies that track changes in residents' impressions over time would help explain how smart city programs change and what the long-term effects on urban living are. Another weakness of the study is the use of semi-structured interviews as a primary tool for gathering data. This method is subjective, based on self-reported experiences, and therefore may include some bias; however it offers very rich qualitative data and allows respondents to feel free to express themselves. Experience with smart technology may alter perception and response by the interviewee. Incorporation of qualitative interviews and quanti-tative surveys might triangular the data and carry a better understanding about the attitude of residents in future investigation. Indicators of service delivery efficiency, environmental sustainability, and community involvement, at the very least, can be used to evaluate the actual outcomes of smart city initiatives and reinforce more qualitative insight.

The study also raises very relevant issues related to smart city technology adoption and management, including equality and data privacy. The respondents were concerned with the digital divide and unequal access to smart technologies; yet, the study did not investigate the reasons for this. In socioeconomic position and education research concerning digital literacy, systemic barriers may also emerge to prevent some from fully enjoying the effects of smart city programs. Additional topics to explore might include the study of public-private partnerships in dealing with such issues, which can discover feasible ways of promoting and ensuring equal access to smart services. As a last resort, the ethics of gathering and surveillance of data regarding the smart city must also be canvassed since the participants are concerned about privacy. Future research on the ethics of smart city data may involve investigating the ways these data could be linked to the values and expectations of communities. Others will dwell on best practices in the engagement of inhabitants in governance, openness, and security discussions to increase confidence and cooperation between local officials and citizens. Strengthening such knowledge gaps and elaborating on such future research directions would contribute to scholars' understanding of the complex interplay between smart cities and their impact on urban living better, which in turn can feed into policies and practices that call for the importance of technological advancement vis-a-vis social equity.

CONCLUSION

The study finally lights up the complexity of smart cities and their tremendous impacts on urban life. Thus, this study underlines the impact of smart city projects on mobility, sustainability, and community engagement; thus, demonstrating how technology may improve inhabitants' lives. Implications An improvement in public services and efficiency via smart city technology is pointed out. However, issues related to inequality and challenges on data privacy are indicated. In evaluating the pros and cons of smart cities by the residents, more inclusive approaches become relevant for all communities to participate in the development. The research points out citizens' engagement in policies and practices in smart cities as it argues for environments with regard to innovativeness in technology, well-being of dwellers, and voice. Indeed, this study pertains to international development of smart cities with significant perspectives in many cities worldwide. As cities transition to become smart ecosystems, the distinction between equity, inclusivity, digital divide, and data collection ethics grow thin, and so does the need to focus on equity and inclusivity as the core urban planning concern. The principle of technology application should be mutually balanced with resident rights and community trust. Findings from such studies form evidence in the next study on the structural obstacle to equal access and data ethics in smart cities. How the overcoming of these challenges would facilitate stakeholders to design cybernetic urban areas that would involve the use of technologies to ensure more people get the chance to access a more social, sustainable, and resilient city.

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