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A Framework for Effective Design Thinking Based Smart Cities Projects in Qatar

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Abstract: With the growing implementation of smart city projects and the significance of the research problem related to effective design thinking, the opinion of the ordinary citizens have become very relevant and contemporary. The current paper presents a quantitative empirical study focused on the attitudes towards and the readiness to accept smart cities in the specific context of Qatar. The study employs a survey questionnaire as a data collection tool. The survey is distributed online among a sample of 40 respondents from Qatar, including both residents and non-residents of smart cities in the country. Even though the sample is not representative of the Qatari population, the present study provides preliminary findings and fundamental insights into this novel topic in a specific socio-economic context. The major findings of the study uncovered that the respondents show quite positive attitudes toward diverse aspects related to smart economy, smart people, smart governance, smart mobility, smart environment, and smart living, as well as significant readiness to accept this lifestyle. However, the respondents demonstrate concerns related to the privacy and security of the people living in smart cities. The superiority of fundamental aspects of life like housing and healthcare in smart cities compared to conventional ones are also questioned by the respondents.

Keywords: smart cities; Qatar; smart economy; smart people; smart governance; smart mobility; smart environment; smart living

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1. Introduction

The urbanization of cities and the need to provide quality services to citizens have become among the major challenges for government. As a result, authorities have expedited the use of technologies to provide different services and address the complexities and challenges related to lack of quality housing, transportation, geographical challenges, pollution, and economic challenges, among others [1,2]. This is being seen in the concept of smart cities which has become a trend and is expected to solve a majority of the urban problems. Nowadays, smart cities are gaining vast popularity in diverse socio-cultural contexts. Therefore, the research problem related to the different aspects of the smart city projects is attracting the interest of various academics and practitioners.

Researchers have pointed out that the use of technology such as mobile-based based services, advanced analytics, and the Internet of Things has the potential to provide a higher quality of life to its citizens across their daily lifestyles [3,4]. Having said this, there is limited research that provides a holistic framework to incorporate the different components of the smart city ecosystem. Considering this, the present research delves into the factors which facilitate the adoption of smart cities, specifically in the case of Qatar.

This paper creates a methodological approach that investigates the readiness of citizens to accept the different aspects of smart cities. It also involves a review of the existing theoretical knowledge which has been used as the foundation to delve into the different aspects of smart cities and conduct a quantitative investigation. The quantitative primary research has been conducted to identify the attitudes of Qatari citizens to different aspects of smart cities: smart economy, smart people, smart governance, smart mobility, smart

environment, and smart living. Furthermore, the primary research investigates the readiness of Qatari citizens to accept the smart city concept. The quantitative primary data has been collected using a survey questionnaire and the results are analyzed using descriptive statistical techniques.

The present article is organized into six separate sections. After the current introductory section, a critical review of the literature is carried out to provide the conceptual basis for the performed primary research. The following section presents the methods used in the empirical research in this article. In addition to that, the results of the performed quantitative primary research, outlining the sample demographic and the survey analysis are exposed. The primary research findings are discussed in light of the existing academic knowledge in the discussion section, while the main findings are summarized in the concluding section.

2. Literature Review

The literature review presented in this section provides the conceptual basis for understanding the topical research problem investigated in this article. This section offers a critical review of the existing knowledge related to important aspects of the smart city projects. This section covers the conceptualization of smart cities, representation of design-thinking frameworks, success factors for smart city projects, readiness to accept smart cities are reviewed from the perspectives of both citizens and the state, as well as the benefits and challenges connected to smart city projects. In the end, it outlines the identified research gap.

2.1. Conceptualization of Smart Cities

The present section begins with the conceptualization of smart cities aimed at providing a theoretical basis for the study. While literature identifies that the provision of services in the last century has significantly transformed the way cities operated, the increase in industrial activities and populations has strained urban resources all across the world [5]. This transformation has presented a significant challenge to administrators and urban planners. As a result, the term "smart cities" has surfaced. Otherwise, these cities are referred to as "digital cities", "electronic cities", or "information cities" [6].

Broadly, the concept of smart cities is relevant to various political, industrial, and scientific entities. Factors such as the overwhelming influx of population from rural to urban areas are also identified in the discussion justifying the imminent need for smart cities [7]. Literature draws relevance of the modern concept of smart cities to stem from the early works of urban planners who proposed the transformation of slums into neighborhoods that were equipped with facilities for comfort and convenience [8]. The author's emphasis on the use of modern technology for this purpose provides a solid basis for the theoretical approach toward smart cities. However, this theoretical premise was not sufficient to attend to the rising complexities regarding overpopulation, energy consumption, resource management, and environmental protection [9]. Even though cities of the future have been continually planned over the last century, the recent decades have led to more precise theoretical frameworks being developed for the concept as a result of the stagnant rise in technological adoption across the world [10].

Various definitions of the smart city concept are available in the present academic literature. A city "connecting the physical infrastructure, the information technology (IT) infrastructure, the social infrastructure, and the business infrastructure" is regarded as a smart city [11]. This connection between the various entities is primarily grounded on the purpose for improvement of the quality of life and efficiency of urban operations and services [12]. At the same time, definitions of smart cities address the needs of present and future generations in terms of economic, social, and environmental aspects [13]. While such definitions lay the premise of the smart cities concept, other definitions precisely refer to the use of Internet of Things (IoT) sensors, cloud computing, big data, artificial intelligence, mobile devices, and applications to enable smart cities [14]. The contemporary

model of smart cities also relies on the discussion of the digital divide, particularly from a social point of view, and identifies four characteristics that are essential in a smart city model: appropriate IT infrastructure, accessible and affordable internet access, generalized ability to use IT, and availability of useful content [15]. The use of these technologies has been referred to in case studies planning models for projects related to smart energy, smart transportation, smart building, smart healthcare, sustainable resource management, and environmental protection [16].

Essentially, smart cities remain a holistic term that broadly comprises various characteristics of concepts such as eco-cities and digital cities [17]. Using Howard's model [8], the term future cities is commonly regarded as an alternative to smart cities. Furthermore, indicators including public expenditure on research and development (R&D) and education, as well as economic indicators like gross domestic product (GDP) and employment rate are identified as integral in defining the context of smart cities [18,19].

Moreover, sector strength, international transactions, and foreign investment can qualitatively determine the potential of a smart city [20]. Other researchers have also identified models of smart cities through their socio-economic contexts and innovation [21]. The literature review has revealed that there is limited research regarding the theoretical aspects of the smart city concept with most research undertaken from a policy perspective. The next section of the present literature review uncovers popular models of smart cities.

2.2. Design Thinking Framework

This section of the literature review is focused on the design thinking framework because design thinking has become a critical component of discourse and planning regarding smart cities. Large leaps and evolutions in the theoretical development of the design thinking concept have occurred parallel to the development of the smart cities concept in recent years.

By its intrinsic characteristics, design thinking is a framework used for problem-solving. The premise of this concept is based on the identification of problems existing in a process, and how these problems can be eliminated efficiently [22]. This concept has proposed a unique perspective of design, which suggests a thinking process that is both analytic and creative. It presents opportunities to experiment, create, and prototype models before gathering feedback and implementing redesigns [23]. Based on these characteristics, the design thinking concept remains critically relevant for smart city projects. Past research presents the idea that design thinking is most applicable in designing complex systems for living, working, playing, and learning [24].

The research concludes that the smart cities concept would entail all of these characteristics [25]. The complex ways through which smart cities attend to the pain points and inefficiencies in pre-existing systems require analysis, deliberation, and a process-oriented approach that is complemented by design thinking frameworks [26]. This research recognizes that since the design thinking process is oriented toward engaging end-users with the relevant product and service, it remains a useful tool for governments and administrations to employ. Since issues of metropolitans are multidisciplinary in their nature, design thinking offers a multidisciplinary response system [27]. Case studies of Brazilian and European smart cities based on design thinking processes conclude that the attempt to apply design thinking frameworks provides significant value because the characteristics of design thinking that effectively address confusing and complex issues are very close to the nature of problems found in today's urban agglomerations [28]. Issues such as food supply, waste management, urban traffic, maintenance of infrastructure and services, and improvement in citizens' lifestyles have utilized an approach enabled by design thinking to provide adequate solutions [28].

In the context of Qatar, various researchers have discussed design thinking frameworks for smart city projects [29,30]. For example, the implications that will occur regarding citizens' privacy and security due to the sharing of data, as smart cities rely on data collection and processing to enable the services that they offer were investigated [29]. The

research proposes that a design thinking framework should be constructed around the principles of regulations that highly regard data privacy and security. Similarly, Qatar's growing indulgence in smart cities and the risks associated with them have also been discussed in the literature [30]. These risks are expansive and multidisciplinary in nature, as identified.

Research suggests that an efficient design thinking framework would enable such smart city projects to carefully diagnose and identify any potential risks that may incur in the process [31]. Furthermore, it is argued that design thinking offers a bottom-up approach to problem-solving which can be implemented from the initiation stages of a smart cities project, rather than being imposed from the top [32]. In addition to that, it is also established that there are two essential ways through which design thinking can enable smart city projects— firstly, by engaging the untapped potential of innovative urban ecosystems, and secondly, particularly within the scope of the needs and interests that citizens have [33]. An effective design thinking framework would also constitute a cross-industrial and cross-sector approach which would enable the smart city projects to be executed with increased cohesiveness and efficiency [34]. Therefore, the existing literature justifies the importance of design thinking frameworks in the light of smart city projects.

2.3. Success Factors for Smart City Projects

The current section is aimed at identifying the factors accounting for the success or failure of smart city projects is another important aspect of the present review that contributes to the thorough understanding of the focal research topic. Success factors for smart city projects are studied in the works of different authors [11,35–37].

A significant portion of the existing research focuses on the role of information and communication technology (ICT) as a critical success factor of smart city projects [38–42]. Nevertheless, it is argued that even though the role of ICT in smart cities is important, it is not a sufficient condition for the transformation of a conventional city into a smart city [35]. It is emphasized that the role of intellectual capital is underestimated, while governance and the engagement of citizens as critical factors for the success of a smart city project [35]. On a similar note, other researchers add the importance of the human factor as users of the technologies and agents of change enabling the shift towards smart cities [43–45]. In addition to that, the process established and strictly followed throughout the smart city project is highlighted as a key determinant of their success [43].

Past investigation of smart city experiences in 10 countries in Europe, North America, and Asia (the Republic of Ireland, Netherlands, Denmark, Sweden, Austria, the USA, United Arab Emirates, Japan, Republic of Singapore, and South Korea) provides lessons which need to be employed in the context of Thailand [37]. The authors highlight the initiative and goal of smart city development, government transparency, and the government's pioneering role in the smart city development, establishing a board to oversee the development of smart cities, creating a space for testing equipment, and establishing laws protecting personal information and rights as critical success factors for smart city projects. The importance of smart governance is pointed out as a critical success factor based on a case study of 15 cities in Indonesia [46].

The success factors for a smart city project are presented in Figure 1 [11]. The authors present two major groups of factors affecting the success of smart city initiatives–inner and outer factors. While the inner factors–technology, policy, and organization– are considered more influential, the external factors–governance, people and communities, economy, built infrastructure, and natural environment– are simultaneously affecting and affected by the inner factors to shape the conditions for smart city success. To a high extent, Patel, Pitroda, and Bhavsar [47] conform to the above view [11] in their representation of smart city success factors. Their study is based on an extensive review of previous literature, and the authors present a classification of the factors affecting the design of smart infrastructure in smart city projects [47]. Their classification groups identified success factors into six groups: 1. basic factors, consisting of power, water,

and transportation; 2. smart materials, including fiber-reinforced concrete and sensor-embedded; 3. smart infrastructure, combining the integration of infrastructures and technology-mediated services with governance for institutional improvement and citizen engagement; 4. environmental factors (natural resources and their quality and sustainable management, recycling of used resources, greenhouse gas emission and energy consumption, environmental protection and biodiversity); 5. factors contributing to building a new understanding such as technology, management, and organization, policy context, governance, people and communities, economy, built infrastructure, and natural environment; 6. physical factors including water and power supply, sanitation, solid waste, and storm-water management, urban development, heritage maintenance, education, and infrastructural facilities, affordable housing. A more comprehensive model which provided six dimensional concepts and indicators of smart city ecosystem under each dimension is presented in Figure 2 [48]. The main strength of this model is the consideration of social and human capital along with the participation of citizens, as well as consideration of quality of life. However, this model does not emphasize much on the challenges related to security and privacy of citizens in a smart city ecosystem.

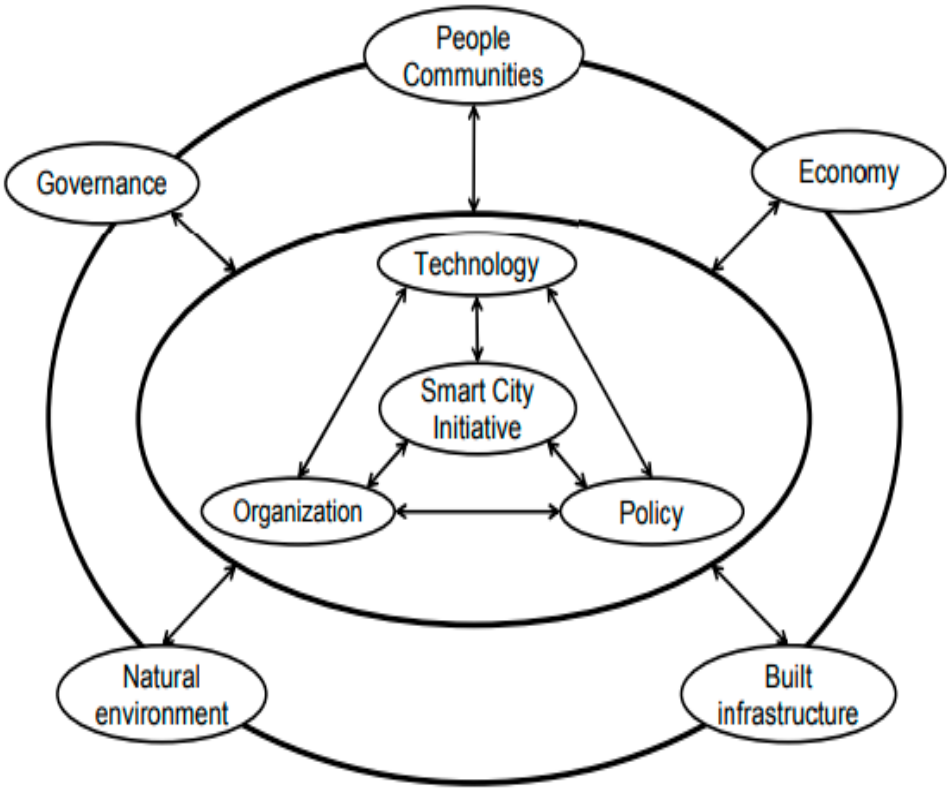


Figure 1. Smart city success factors framework [11].

In contrast, other scholars [36] emphasize the importance of civic participation, governance including stakeholders, locally based, clear vision and sharing, smart city initiative, financial and political support and governance, ICT problem-solving and technical competence, political and institutional net-working served by technologies, the importance of sectors or clusters' selection, sharing success stories, test, demonstration, and living lab, performance measurement index, other-punctuality and culture.

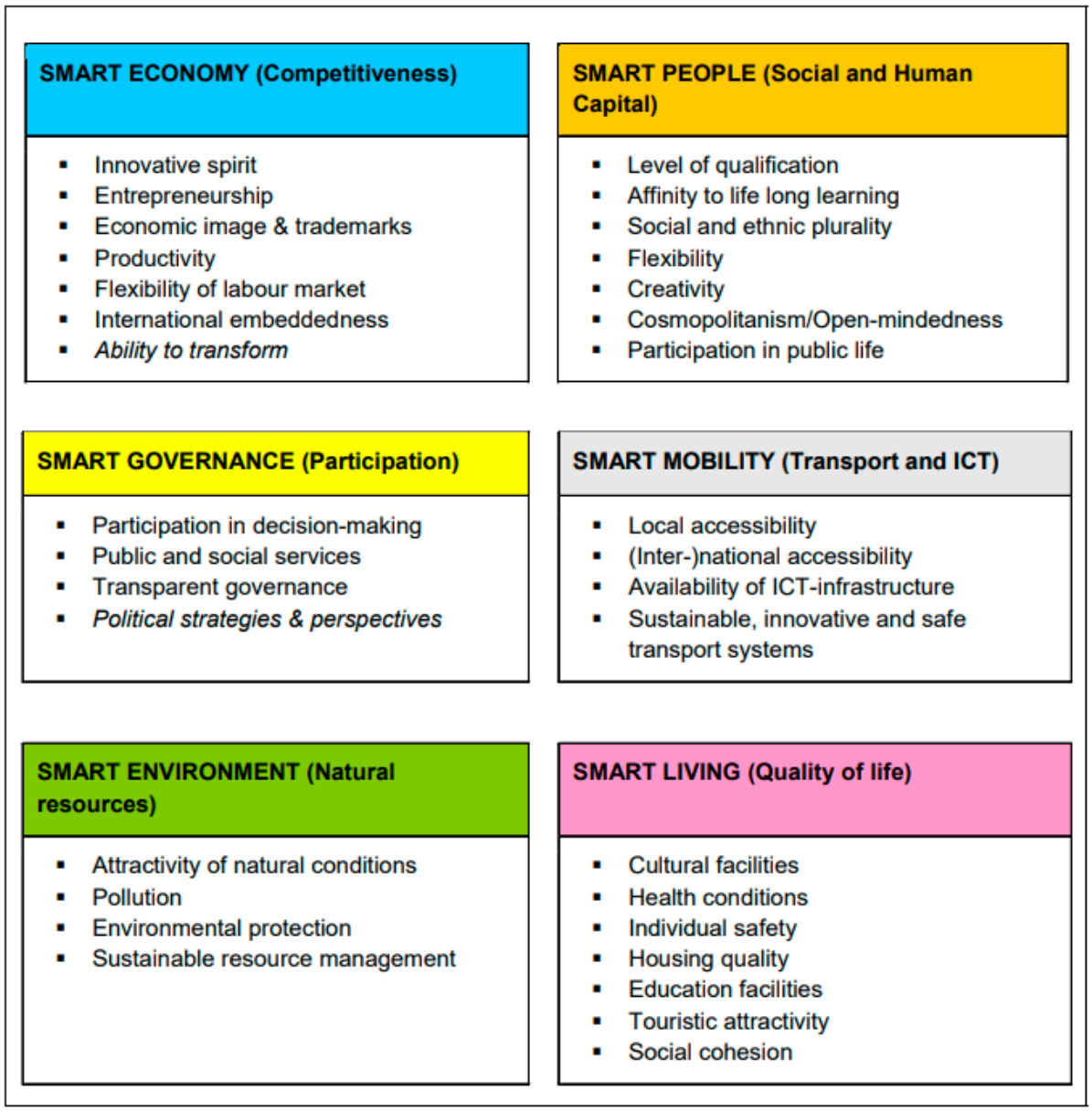


Figure 2. Characteristics of smart cities [48].

The smart cities experience is a fundamentally holistic urban experience for the people residing in these cities. For example, the optimization of travel and transport around the city is an integral feature of smart cities [49]. The urban issue of traffic congestion is expected to be resolved, and smart city citizens can experience simplified travelling experiences through simplified routes, easy to understand travel information, and economically viable transport. Therefore, the levels of professional and social competency are expected to be high [50]. At the same time, it is also expected for the parameters of their contribution to social development to increase, thus the social fabric of the society can become very self-sufficient. In addition, smart cities are designed to provide a high-quality environmental experience to their citizens [51]. For example, the environmental infrastructure in the Lusail smart city has been built around the provision of delivering water, electricity, and waste management in a sustainable manner. The quality of life is naturally expected to improve as a result. With educational institutes and workplaces becoming more adaptive and providing a more affluent daily experience, with pain points being addressed in a smart manner, the living culture of smart cities is expected to become more harmonious in relation to the people

and environment [52]. The experience enabled by smart governance is also integral in improving the quality of experience. In fact, other scholars call for a systems approach for smart cities comprising of living labs, innovation districts, and information marketplaces to provide for a robust design of smart city [53]. Further evidence for effective co-governance in smart cities through living labs was presented in the case of Amsterdam, Barcelona, and Helsinki smart cities [54]. In these cases, the researchers highlight the usefulness of Living Labs for development of an inclusive smart city ecosystem with participation from public and private actors to design services, thereby underlining the importance of open innovation.

A different classification is provided from the perspective of building technology solutions which groups the smart city projects' success factors into 4 categories of key performance indicators (KPIs)–technological, socio-cultural, economic, and environmental indicators [55]. Furthermore, sustainability, ecosystems, and digital citizen are suggested as three key factors with a focus on the digitalization of smart cities [40].

The review of literature has identified ICT as an unquestionable critical factor for the success of smart city projects, together with other factors including policy, governance, and stakeholder engagement among others. Even though the problems related to the smart city projects success factors is studied from different perspectives in diverse geographic contexts, no evidence has been identified for the specific case of Qatar. Furthermore, the majority of the findings are based on secondary research. These gaps call for the performance of empirical research in the context of Qatari smart cities which will enrich the existing academic knowledge.

2.4. Readiness to Accept Smart Cities

The present section of the review of literature is focused on the current academic knowledge related to the readiness to accept smart cities. This problem is important as the readiness is critical for the effective implementation of smart city projects in different socio-economic contexts. This section is divided into two sub-sections–readiness from the perspective of the state and citizens' readiness in order to present a multi-dimensional understanding.

2.4.1. State Readiness

As discussed in the previous section, governance and policy are identified as critical success factors of a smart city project. This emphasizes the important role of the state and its readiness for the success of the smart transformation. The readiness of the state to accept smart cities is studied by different scholars [56–59].

To begin with, state readiness refers to the capabilities of the state institutions represented by the national government, as well as the local authorities to accept smart city projects and contribute to their effective implementation [59]. Further, readiness is defined as "the preparation of the city hall to manage the processes of going through the smart city path" [58] (p. 9). The smart city framework illustrated in Figure 3 presents a complex of technology enablers, as well as the city's responsibilities [57]. This framework provides evidence that state readiness is a multidimensional construct combining multiple aspects and capabilities which need to be developed by the state authorities to ensure a successful transformation towards a smart city.

The smart city framework depicted in Figure 3 was employed in a study of the smart city readiness of the institutions in Yogyakarta, Indonesia [57]. The framework places the focus on the interplay between technology enablers and city responsibilities in the context of smart cities. The empirical results show that state readiness is not sufficient for the effective implementation of the smart city project. Furthermore, the authors recommend the development of a readiness measurement framework going beyond the progress and technological indicators like infrastructure (hardware) and info-structure (software) to include non-technical aspects like supra-structure (brain ware). A study based on two case studies in Indonesia confirms the need for further improvement of the readiness of the local government for effective implementation of smart islands [60]. The popular assessment

methods for state smart city readiness, including rankings and standards, are criticized as insufficient to cover the multidimensional and complex nature of this concept [58]. Therefore, the author proposes a novel framework for state readiness based on the smart city path and the importance of the respective stakeholder (the city, IT companies, non-governmental organizations (NGOs)) in the process.

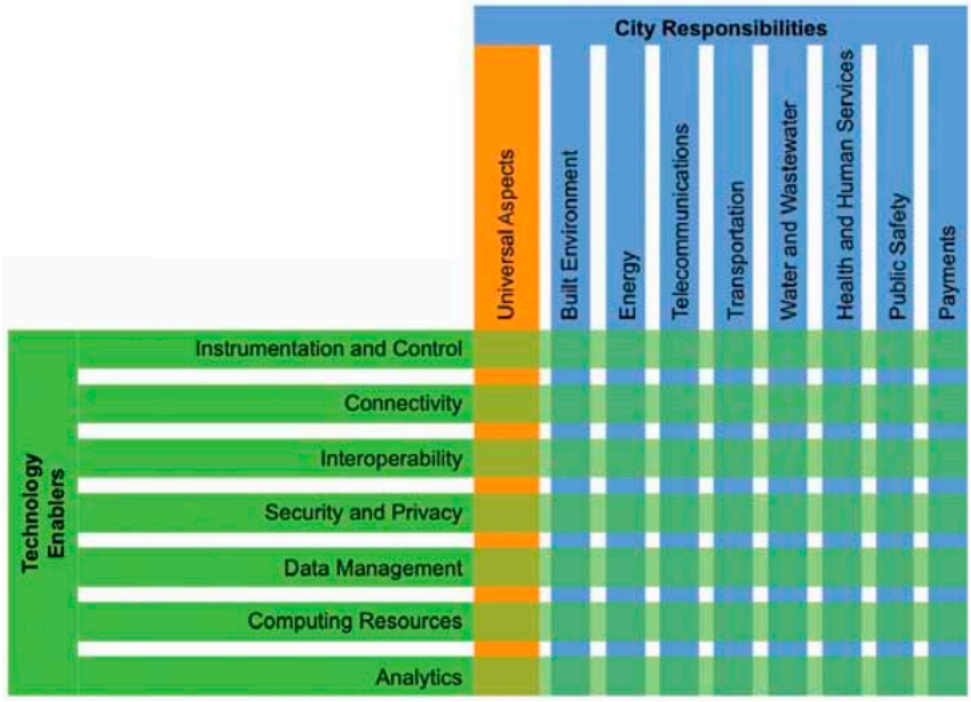


Figure 3. Smart city framework [57].

In a study of the readiness of Russian municipalities it is discovered that the digital rate, clear objectives, and targets of the digitalization process, as well as financial and organizational resources, contribute to enhancing the smart city readiness of local and national institutions [61]. Furthermore, another research presents the limited financial resources, lack of adequate infrastructure, strategic leadership and investors, inefficient decision-making process, inability to implement the outcomes from research, as well as corruption among the role players are significant factors deterring the readiness of municipalities in South Africa to accept and implement smart city projects [62]. In addition to that, the population shift from rural to urban areas in the case of emerging economies, requires the state to develop sufficient expertise in educating the potential users of smart city services as a critical step toward enhancing the city's readiness to withstand any possible emerging problems [63].

Other major factors that impact the readiness of the state to accept smart cities identified in the scholarly literature and valid for the context of Australian smart cities entail: proximity to major infrastructure objects (capital, sea, and airports) [59], density of the population [64], remoteness value [65], diversity in cultures [18], level of unemployment [66], and labor productivity [67].

The present review aimed at the readiness of the state to accept smart cities uncovers vast empirical research undertaken on this topic. The findings present different national perspectives–Indonesia, Russia, and Australia among others. Though, no studies related to the readiness of the Qatari state to accept smart cities have been identified. This finding leads to the detection of another research gap which needs special attention in the present study. Empirical findings and directions regarding the readiness of the state of Qatar would be of significant value for academics, smart city practitioners, and policy makers.

2.4.2. Citizens' Readiness

Citizen readiness refers to the extent to which citizens are willing to proactively accept change with respect to the different modes of governance in a smart city while change refers to both technological as well as non-technological changes which are envisaged in the context of smart cities [56]. It is important that the citizen readiness is assessed using a variety of parameters. In this regard, the smart city readiness is studied in the context of Iranian cities and identified that citizen readiness can be assessed using the parameters of urban transition, technology readiness, socio-economic readiness, and political readiness [68]. The urban transition refers to the creation and normalization of urban practices [69]. For this purpose, significant transformation and system level changes are required to facilitate the transition and create awareness among the citizens when transitioning to smart city ecosystem. In support of this view, it is further stated that ecological modernization of cities requires an alignment of the expectations, resources, and interests of the network of actors within this ecosystem [70]. This can also be emphasized as focusing on the linkage between local, regional, and national levels to adhere to the vision of the smart city and ensure that the different levels are aligned to realize the vision and goals.

The next level of citizen readiness can be explained using the technology readiness which refers to the extent of adoption of technology to achieve personal, professional, and social goals. In this regard, the four dimensions of technology readiness-optimism, innovativeness, inconvenience, and insecurity are proposed (Figure 4) [71].

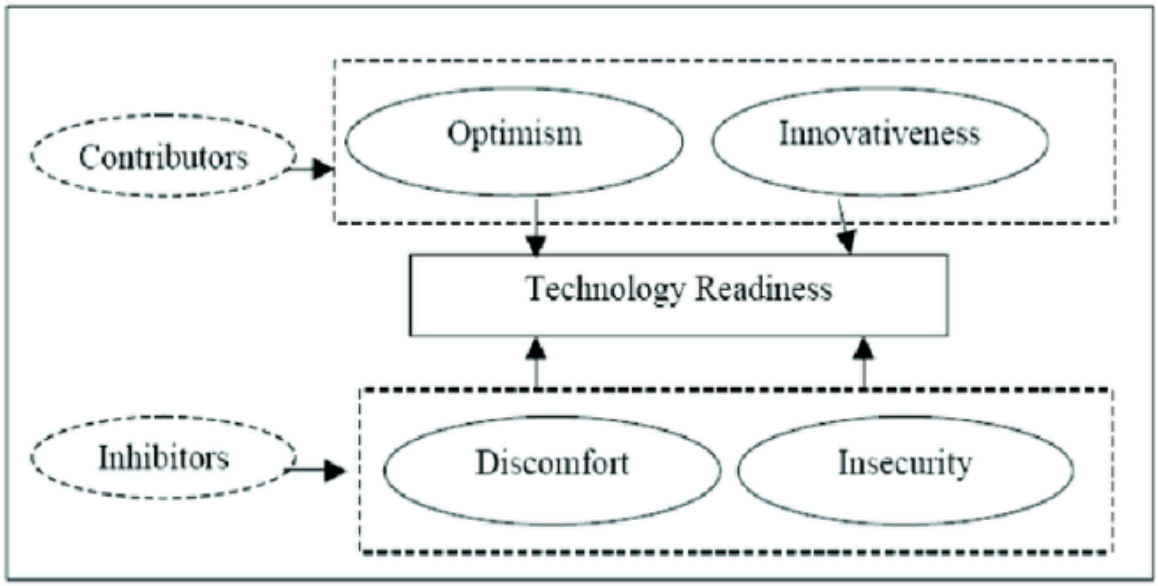


Figure 4. Technology Readiness Model [71].

The optimism dimension relates to positive perception about the technology and the extent to which it is flexible and efficient to achieve the goals of the individual. The innovativeness dimension relates to the use of technology towards innovation. The inconvenience dimension refers to the extent to which individuals feel that they do not have control of technology and are overwhelmed by it. Finally, the insecurity dimension refers to the skepticism regarding the effectiveness and use of technology. These contributors and inhibitors explain the factors which influence technology readiness and can be evaluated in-depth with respect to the citizen readiness towards technology adoption in smart cities. These factors also relate to the technology acceptance model which considers perceived usefulness and perceived ease of use of technology towards influencing the behavior of the consumers to use any technology [72]. However, this model presents a limited picture with respect to assessing the technology readiness in smart cities where the adoption is evaluated by a number of interrelated systems rather than an isolated system or technology.

The third level of citizen readiness is assessed in terms of the socio-economic adaptability of the citizens in a smart city ecosystem. In this regard, it is pointed out that the creation and normalization of the urban ecosystem supported by technology interventions also need to be supported by social networks [73]. This entails various facilities, for example social learning, participation in community events, and adoption of smart application across different fields such as transport, healthcare, education, and citizen centric governance, among others. This view is also supported by past research, pointing out that the culture and the social dynamics of the citizens often dictate the acceptance of smart cities and their ecosystems [5]. Another crucial factor that is pointed out relates to the ability to gather knowledge and use of the facilities in smart cities for improved decision-making [74]. This aspect not only enhances the utility of the technology enabled systems in smart cities but also contributes towards readiness and acceptance of the citizens in a smart city ecosystem.

The fourth level of citizens' readiness is associated with the policy environment and the political readiness towards adoption of smart cities [68]. In this regard, it is also concurred and highlighted that there must be political will towards transition to a smart city ecosystem which can act as a catalyst in the transition [75]. However, this may prove to be a challenging effort due to the divergent interests of the different stakeholders [76]. Nevertheless, there are examples such as Dubai and Amsterdam where the transition was facilitated by the initiative from local government and was governed by the vision of smart city implementation and supported by the transition policy as well as adequate funding [77].

2.5. Benefits and Challenges to Smart City Projects

After reviewing the conceptual basis of the smart city concept and design thinking, as well as the success factors and citizens' readiness to accept smart cities, the present section presents a discussion of the benefits and challenges to smart city projects. Considering the multidimensional nature of the smart cities and their impact on a wide number of stakeholders, this section uncovers the current knowledge related to the benefits and challenges of smart cities from the perspectives of the state, the business, and the smart city residents.

The existing literature has recognized several benefits reaped by states that indulge in developing smart city projects. As these cities are developed on the premise of efficient utilization of space and resources, the primary idea of enabling data-driven smart cities is to enable data-driven decisions in allocating and managing these resources [78]. Such efficient disposal enables smart city projects to make effective decisions based on information. Since information has become a critical tool in the digital age, the use of data analytics can enable real-time delivery of services and increase the quality of administration [79].

Smart city projects are also characterized by increased interaction between the state and people, and the exchange of valuable information and responses through the collection of feedback data and data patterns via digital mediums that can enable governments to make digital cities a more attractive place to live in [80]. Similarly, the integration of technologies to detect and mitigate potential criminal actors also enables safer communities. Projects that enabled safer communities through the use of technology have represented the greatest number of smart city projects around the world [81]. Similarly, smart city projects also rely on smart public transport infrastructures, energy efficient buildings and processes, and sensors for air quality and environmental control to collectively enable a cleaner environment. Therefore, developing smart city projects can enable governments to mitigate the effects of climate change and simultaneously establish precedence for the future [82]. A major benefit of smart city projects is the technological infrastructure they present to the population, and the digital equity provided therein. Resultantly, people engaging with applications of the smart city can potentially attract new development opportunities with increased technological exposure to people [83]. Moreover, infrastructure failures can be predicted and avoided, utilities can be efficiently distributed, and the possibility of the workforce to achieve their full potential through improved services can be improved [84].

On the contrary, several challenges are also identified by literature in the development of smart cities. For example, the high reliance on technology and data enables the threat of cyber-security breaches. Cyber breaches are identified as a major threat to contemporary information systems, and smart city projects face the critical threat of breaches as these would directly affect citizens of the smart cities [85]. This threat can occur to the state of security, infrastructure, and resource allocation of the city [86]. More literature focuses on the high costs related to the acquisition of the complicated digital equipment and skilled labor for the development of the smart city projects. Furthermore, growing concerns regarding privacy are making citizens more repulsive towards surveillance and information gathering well [87]. Smart city projects rely on information gathering and intelligence gathering through data collection, which can have implications based on the privacy concerns identified.

In line with the above, the residents and businesses in the smart cities of Qatar are expected to derive multiple benefits. The use of smart transportation is estimated to lower road fatalities, lower car emissions, and provided improved public transportation [88]. In addition, the use of smart healthcare is expected to offer benefits of innovative and connected health technologies [88]. Other benefits, such as high speed internet connectivity, increased education access, improved health outcomes due to use of smart healthcare, and provided overall faster access to information for the residents and businesses. In the conceptualization of smart cities in Qatar, the focus is on five priority sectors: transportation, healthcare, logistics, environment, and sports. Through these initiatives, the creation of smart cities in Qatar is expected to deliver $11 billion to the economy by 2022 [89]. The above goals are also consistent with the four central pillars of Qatar National Vision 2030-economic, social, human, and environmental development.

However, several challenges are associated with living in smart cities. For example, the social setup of smart cities is expected to consist of technically sound people who can interact with the smart living options enabled in the city–"smart city for smart people". While the increased competencies present in the social setup of smart cities are expected to contribute towards improving the city's quality of life and experiences, they can also present as a challenge to people [90]. This competitive environment can also have a constraining effect on businesses and ventures which will face the challenge of reflecting greater innovative capabilities. Moreover, while services such as internet and other smart living services are widely provided in these cities, it is also likely that faults in these systems can render the city ineffective. The highly complex technological systems can create equally complex challenges for the city's people [91]. Similarly, the heavy reliance on cloud computing to enable data-driven smart processes can also lead to severe privacy and security implications. The loss of data, and other threats to privacy and well-being of the residents of smart city is a challenge that they should be prepared for with cyber-crime growing as a perpetual threat. This threat is not only aimed at people's personal data and privacy, but it can also effectively disable the city's infrastructure. This means that people could lose access to services such as water, sanitation, or healthcare due to the highly technological nature of smart cities. Besides the context of privacy concerns, IT-enabled smart services such as transport and healthcare can also lack efficiency due to insufficient internet speeds and any unforeseen factor influencing the steady and seamless provision of internet [92]. Sensors and gauges are designed to continually collect and communicate data for appropriate actions to be taken, and the analysis and processing of this data is highly dependent on high-speed internet. Therefore, people living in smart cities may occasionally face challenges in their day-to-day functions due to lag in internet and the subsequent effect on the associated services [93].

The major benefits and challenges related to smart cities are summarized in Table 1 below. They are classified into specific beneficial and challenging aspects for the state, for the business, and for the people living in smart cities.

Table 1. Benefits and Challenges to Smart Cities [49,51,52,86,87,90,91].

	Category	Benefits	Challenges
For the state	Economic	Automation brings cost savings	High capital costs
	Managerial	Efficient administration	Skilled labor required
	Resource efficiency	Sustainable and environmentally friendly eco-system	Privacy concerns in data-collection.
	Waste management	Cleaner environment	High capital costs
	IT	High quality of services through data analytics	Cyber-security threat
For the business	IT	More opportunities	Competitive environment
	Administration	Skilled people available	Rigid policies
For people living	Transport	Efficient and economical	Dependency on public transport
	IT	Better connectivity	High risks of privacy concerns
	Services	Efficiency	Prone to internet and privacy related risks

2.6. The Fear of Smart Cities

The use of technology for facilitating governance in smart cities has opened up potential to connect every aspect of the lives of the citizens. However, the use of technology also presents issues of safety, security, and privacy of citizens, which needs to be addressed in order to enhance the transparency in smart cities' governance. Data is generated from different aspects of the lives of citizens including personal life, social life, work life, transport, and home life [94]. While this helps in the advancement of services through the use of technology, academicians have also highlighted the concern for use of such technologies. In this regard, it is noted that IoT devices have the potential for round the clock video surveillance which often undermines the privacy of the citizens [95]. Similar concerns have also been highlighted by other scholars who acknowledged the disparity in privacy policies in the public and private sectors based on the unique purposes served by these sectors [96]. While the private sector relies on generating business opportunities by mining customer data in order to generate more information, the public sector relies on data for improvement of services such as transportation or healthcare. In fact, there are three general areas where security concerns need to be focused—(1) "privacy" and confidentiality of information, (2) integrity of information, and (3) availability of information for its rightful use [97]. Another key challenge in technology-powered smart cities is that botnet activities can infect devices leading to large scale cyber security threats infecting multiple devices with the potential of major disruption of services [98]. Additionally, interconnectedness of the devices and sharing of data also presents the vulnerability of security and data breaches which can cause disruptions in the functioning of smart cities.

Apart from the issues related to privacy and security of data, there have been growing concerns related to totalism in smart cities. Past research [99] highlights the corporate power of private tech companies providing technological infrastructure, which have the potential to create digital totalism with little freedom and flexibility for the citizens. While it may be argued that such technological components are inherent in designing the smart city ecosystem, there are also concerns related to the lack of autonomy of citizens other than to comply with the authority. However, it is also argued that certain privacy policies, such as GDPR in Europe, are designed for data protection and privacy of the citizens, which provides certain levels of comfort when sharing personal data [100]. Nevertheless, researchers have also called for continuous security assessment in order to reduce vulnerabilities of the technological infrastructure used in smart cities to address security, privacy, and other risks [101,102].

2.7. Research Gap and Conceptual Model

The performed review of literature uncovers gaps in the present knowledge connected to the smart city projects and design thinking in these aspects. The detected gaps are summarized in this section.

There have been few studies conducted with the focus on conceptualizing and creating smart cities. A past literature review of smart cities emphasized the data-centric view of smart city architectures [2]. Furthermore, the trends, architectures, and components of smart cities have also been studied, although at a generic level [1].

A more precise approach was provided by authors who used the Smart City Readiness Framework provided by Smart City Council to assess the technology enablers and responsibilities of the authorities to conceptualize and create a smart city ecosystem [49]. However, there is a research gap on the holistic approach to dealing with the intractable problems faced in the urban infrastructure and citizen centric services. Furthermore, the research gap exists with respect to the creation of smart city ecosystem in Qatar. This study aims to address the research gap by applying design thinking framework to develop a common user-centered understanding of the challenges and potential scenarios for cities aiming for "smartness" in the context of Qatar.

The conceptual model developed for the present study, based on the review of literature is presented in Figure 5. It is composed of citizens' attitudes on each of the components of smart cities [48]. The next component of the framework is presented by the readiness of the citizens to accept smart cities. The study based on this framework is expected to provide fundamental understanding of the research problem.

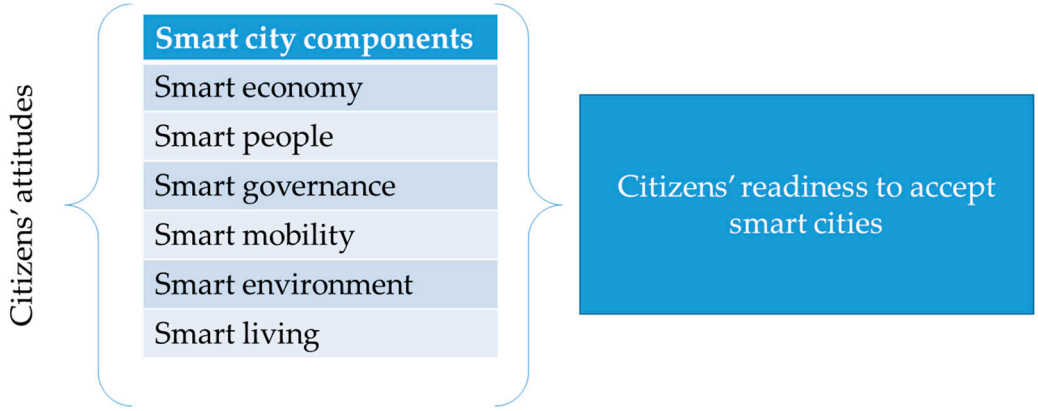


Figure 5. Conceptual Model of the Study.

3. Methods

The underlying research philosophy is a positivist paradigm which is used to assess the experience of the residents and non-residents of smart cities. The present research attempts to address the following research objectives:

RO1: To investigate the attitudes of the Qatari citizens to different aspects of smart cities–smart economy, smart people, smart governance, smart mobility, smart environment, and smart living.

RO2: To establish the readiness of Qatari citizens to accept the smart city concept.

RO3: To propose a conceptual framework of readiness to accept smart cities based on the findings of the performed primary research.

For this purpose, survey research strategy is used to investigate the experience and opinion of participants and work towards a framework for design thinking approach for conceptualizing smart cities and its ecosystem. Primary data was collected through a survey questionnaire which was circulated to the participants through an online link using Google Forms. The survey questionnaire was divided into sections of demographic information and research-specific questions. The research specific questions were further

sub divided into questions related to opinions towards smart cities (with parameters of economy, people, governance, mobility, environment, and living), citizens readiness to accept smart cities and general opinion of a smart city.

The component of the survey questionnaire aimed at the investigation of the respondents' opinions towards smart cities is divided in six separate areas, proposed by Giffinger and Gudrunn [48]. The first of them is smart economy which is focused on the investigation of the competitiveness offered by the smart cities to the residents and economic agents operating in the specific socio-economic environment provided by the smart cities. This scale is composed of 8 separate items based on the components of smart economy [48]. The next aspect is related to smart people, and it studies the quality of the social and human capital in the smart city. It employs five items. The survey contains four questions aimed at smart governance in smart cities are focused on the quality of the governance as well as the participation of the residents in the governance of smart cities. The following aspect included in the survey questionnaire is related to smart mobility in smart cities. It contains seven items connected to the transportation and ICT. The next section of the questionnaire related to the smart environment is composed of 5 items focused on the management of the natural resources in smart cities. The last aspect studied through this part of the survey questionnaire is smart living. It is composed of 10 items aimed at establishing the respondents' opinions regarding the quality of life in smart cities.

The internal consistency of the scale was analyzed via test for reliability based on the Cronbach's alpha coefficient [103]. The analysis shows good internal consistency in each of the six scales included in this section of the survey questionnaire with values of the Cronbach alpha coefficient ranging between 0.695 reported for the smart mobility scale and 0.903 for the smart governance scale [103].

The next section of the survey questionnaire is aimed at the citizens' readiness to accept smart cities. The scale is composed of 10 items based on the aforementioned characteristics of smart cities [48]. The performed test for reliability of the scale shows good internal consistency with a Cronbach's alpha coefficient of 0.977.

The final section in the questionnaire requests a qualitative response from the participants related to their general opinion about a smart city.

The survey questionnaire was distributed online through Qatari groups related to smart living and smart cities on social media. Even though the online data collection medium is prone to technical issues, as well as risk of non-deliverability, sampling, and coverage errors, it is preferred in the present case due to its flexibility, cost efficiency and fast administration [104]. At the present preliminary stage of the research, a non-probability sampling, namely purposive sampling, is selected. The primary reason for this choice is that regardless of the vast popularity of the smart city concept among the Qatari population, the research problem requires specialized knowledge and opinions regarding diverse aspects of the smart cities and the readiness of the citizens to accept this concept. Even though the purposive sampling does not allow for generalization of the research results due to the lack of representation of the entire population, it is preferred due to its relative simplicity, high flexibility, and its strength to facilitate the purpose of the present study [105]. The present stage of the research does not aim to generate representative results, but rather attempts a quantitative study in its qualitative aspect to provide understanding of the research problem related to smart cities. Therefore, these shortcomings of the selected sampling technique are not conflicting with the research objectives.

In order to fulfil the objectives of the present research, the inclusion criteria for selecting the respondents are defined as: (1) age of the potential respondents–over 18-year-olds; (2) willingness to participate in the research; (3) accessible internet, due to the selected survey distribution medium. Respectively, the exclusion criteria include: (1) potential respondents below 18 years of age, who would present a vulnerable group of the population; (2) people who are not willing to take part in the study; (3) people who are not accessible online. Characteristics related to the occupation, ethnic, and social background of the

research participants, as well as the presence and possible duration of their past experience living in smart cities, are not included in the lists of inclusion and exclusion criteria.

Using the aforementioned sampling procedure, a total of 75 participants were contacted for participation in the study, but only 40 participants completed the survey, indicating a response rate of 53%. All the responses obtained were complete and included in the analysis [105].

4. Results

The data was collected from participants to understand their level of understanding regarding smart cities. The data was gathered through a survey questionnaire covering questions on the respondents' demographic characteristics, as well as research-related questions which were further subdivided into categories of opinion towards smart cities. The survey was conducted from August to September 2022. The designed survey questionnaire was sent to participants through google survey. A total of 40 responses were obtained. It is important to note that the present research presents the results of a pilot study, undertaken as a part of a more extensive research into the topical research problem related to smart cities in the context of Qatar. The sample size is limited, and the sample distribution does not allow gaining research results representative of the Qatari population. Nevertheless, this research outlines preliminary findings that are laying the foundation needed for understanding the attitudes of the Qatari citizens and their readiness to accept smart cities.

4.1. Sample Demographics

The demographic characteristics of the participants are as shown in Table 2 below:

Table 2. Demographic Characteristics of Participants.

Demographic Characteristics	Options	Frequency	% Response
Gender	Male	26	65%
	Female	14	35%
	Prefer Not to Share	0	0%
Age	18–25	7	18%
	26–34	14	35%
	35–45	10	25%
	More than 45	9	22%
Marital Status	Single	9	23%
	Married	27	67%
	Divorced	2	5%
	Other	2	5%
How many people live in the household?	1	4	10%
	2	10	25%
	3	2	5%
	More 3	24	60%
How many children live in the household?	0	12	30%
	1	15	37%
	2	9	23%
	3	2	5%
	More than 3	2	5%
Have you ever lived in a smart city?	Yes	15	37%
	No	25	63%

It is observed that there is a good demographic mix in terms of the parameters of age, marital status, number of people in household, and number of children in household. However, the sample distribution is skewed towards male gender which is 77% of the

total sample. Another key observation is that out of 40 responses, only 15 have had a prior experience of living in a smart city.

It is observed that there is a good demographic mix in terms of the parameters of age, marital status, number of people in a household, and number of children in a household. However, the sample distribution is skewed towards male gender which is 77% of the total sample. Another key observation is that out of 30 responses, only 11 have had a prior experience of living in a smart city.

Out of the 11 participants with experience of living in a smart city, it is observed that they are currently living in a smart city, with over 54% of the participants having lived there for more than 1 year. This information is depicted in Table 3.

Table 3. Demographic Characteristics of Participants–Living in Smart City.

Demographic Characteristics	Options	Frequency	% Response
How Long have you lived in a smart city?	Less than 1 year	8	53%
	1–3 years	7	47%
Do you currently live in a smart city?	Yes	11	100%
	No	0	-

4.2. Survey Analysis

The analysis of the survey results with prevailing opinions in the positive spectrum for all the questions in this section of the survey, which is presented in the following subsection, uncovers the beneficial attitudes of the respondents towards different aspects of the smart cities as well as their readiness to accept the smart city concept.

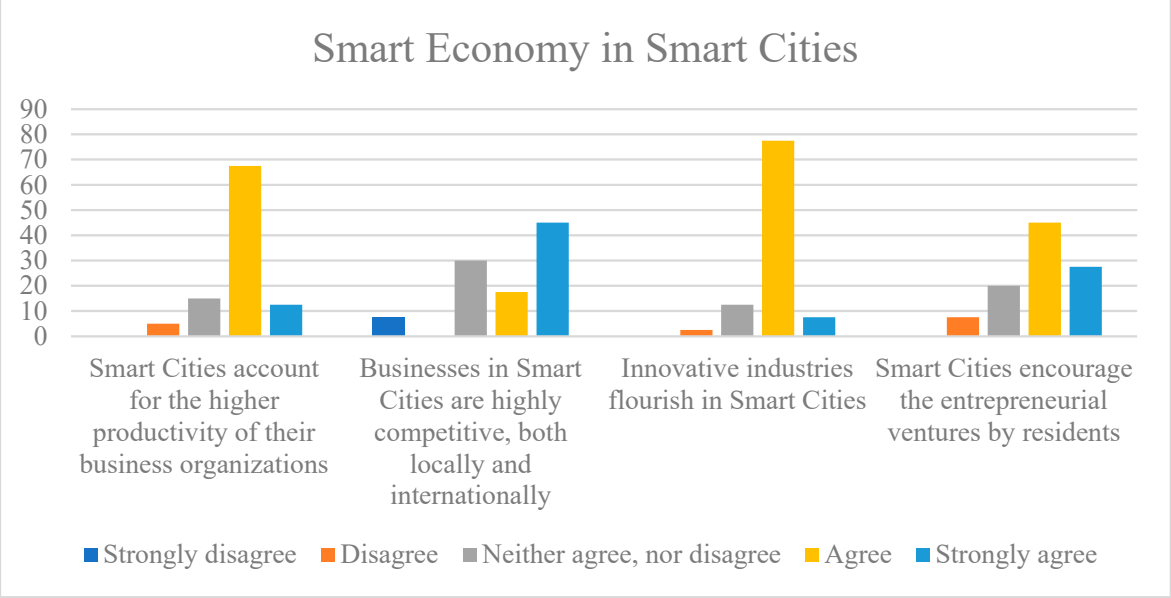
4.2.1. Smart Economy in Smart Cities

The response obtained with respect to the smart economy offering in smart cities is acknowledged in the areas of high productivity, innovative industries, entrepreneurial ventures, boosting economic image, and networking with business partners are presented in Figure 6. In particular, this figure illustrates the proportion of research participants (%) over the eight aspects of smart economy. The survey results show that the majority of the research participants agree that smart cities account for higher productivity (67.5%). Smart cities are seen as abundant ground where innovative industries can flourish by 77.5% of the respondents. Equal proportions of 62.5% of the research participants believe that smart cities can be used as a trademark and a foundation of the development of fruitful connections with international business partners. In this way, smart cities are recognized as a cornerstone of the effective international trade. Regardless of the prevailing responses in the positive spectrum of the scale, a relatively high proportion of 30% of the respondents do not have a clear opinion regarding the local and international competitiveness of businesses being run in smart cities. Of the research participants, 30% are not convinced about the employee-friendly nature of the business organizations in smart cities and the career opportunities provided by them. This evidences that even though smart cities are perceived as beneficial environment for running business, these positive effects do not necessarily spread over the whole spectrum of stakeholders.

4.2.2. Smart People in Smart Cities

The results obtained from the research participants evidence that smart people are a critical cornerstone of the smart cities in Qatar. Figure 7 presents the proportion of responses (in %) over the 5 components of the smart people scale–opportunities for qualification enhancement, life-long learning, diversity, open-mindedness, and ability of the smart cities to enhance the creativity of the citizens. The majority of the respondents agree that smart cities offer support for enhancing their residents' qualifications and life-long learning opportunities. Over three-quarters (78%) of the participants report their positive perceptions of the open-mindedness of smart city residents. Furthermore, more than half

of the respondents (55%) strongly agree that diversity is a leading characteristic of smart people living in smart cities. However, one interesting result is the rather neutral view related to the ability of smart cities to enhance the creativity of their residents.



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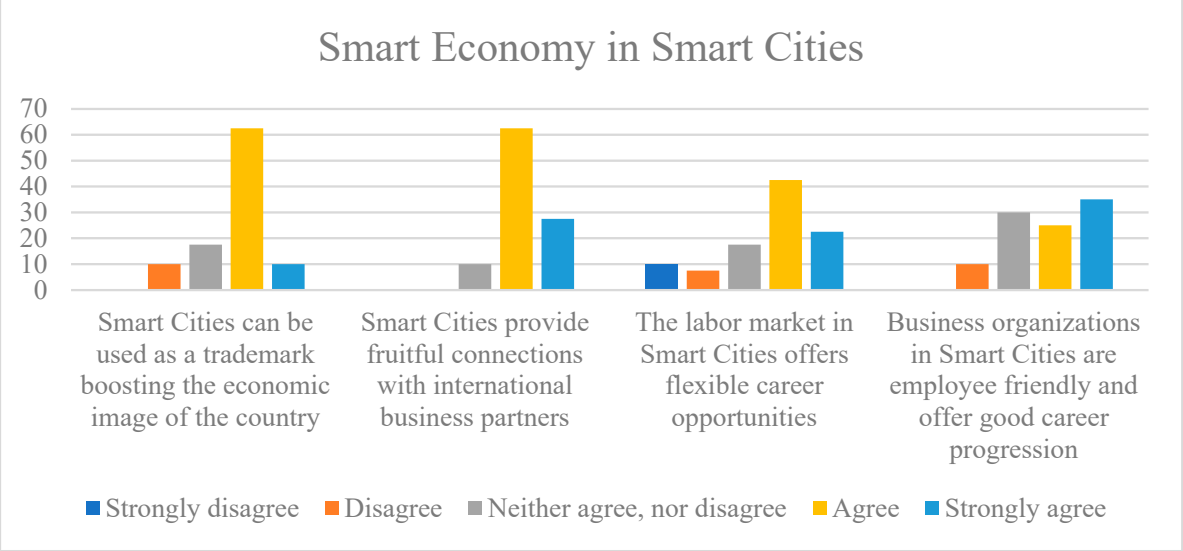

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Figure 6. Survey results (frequency distribution %)–Smart Economy in Smart Cities. (**a**) business organizations' effectiveness, international business competitiveness, innovative industries, citizens' entrepreneurial ventures encouragement; (**b**) trademark, international business connections, flexible career opportunities, employee friendly organizations.

4.2.3. Smart Governance

Figure 8 below illustrates the proportion of research participants (in %) distributed over the investigated aspects of smart governance–effective regulatory mechanisms, equitable policies, equity among the residents, and enhanced citizens and government engagement. The responses from the research participants indicate that governance is one of the major aspects of the smart city ecosystem. Even though the majority of respondents believe that smart cities provide effective regulatory mechanism, the results show that the prevailing

views are leaning to the rather neutral opinion of the respondents on the ability of smart cities' governance to provide equitable policies, equity among residents, and enhanced citizen and government engagement.

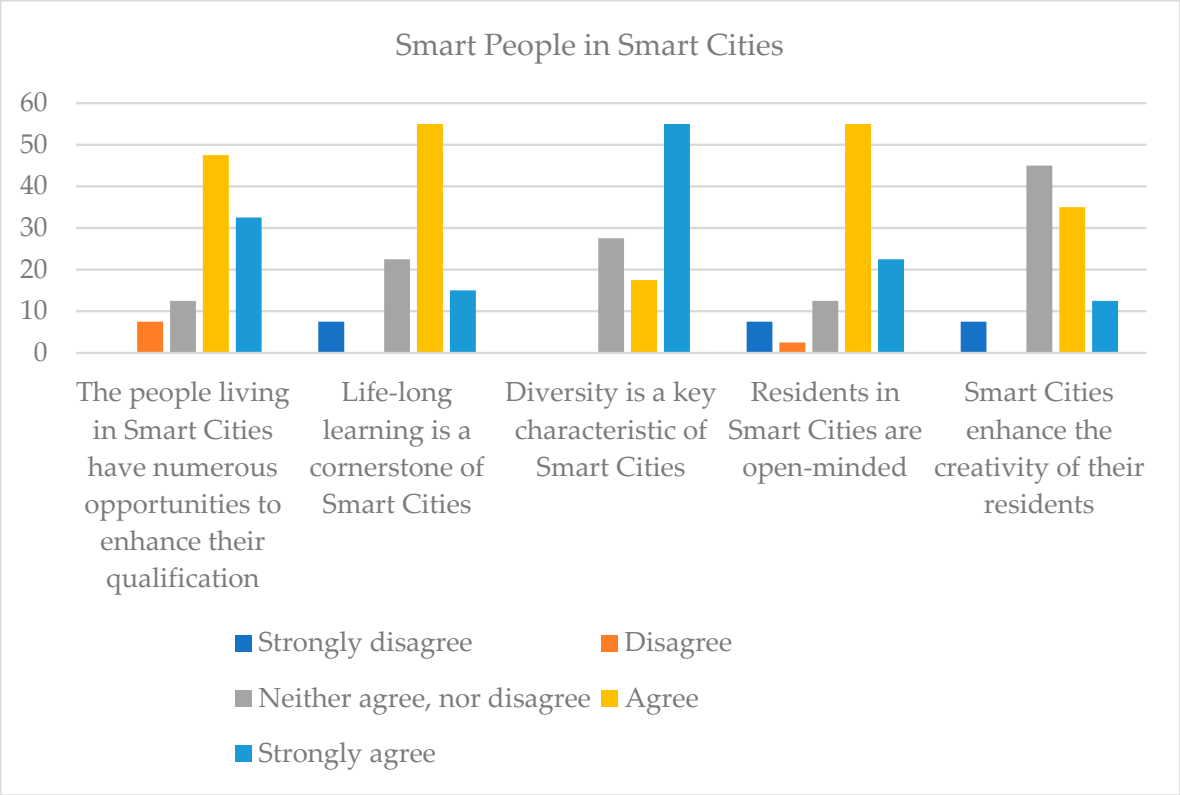


Figure 7. Survey results (frequency distribution %)–Smart People in Smart Cities (opportunities, life-long learning, diversity, open-mindedness, creativity).

4.2.4. Smart Mobility

The responses regarding the different aspects of smart mobility in smart cities in terms of frequency distribution of the responses (in %) are depicted in Figure 9. These results also demonstrate the positive perceptions of the participants in this study. The largest proportion–83% of the participants– agree that smart cities provide easy-to-use public transportation as well as supporting services such as payment. At the same time, 63% of the sample (25 respondents out of 40) emphasize that the transportation systems in smart cities offer easier commutes and improved traffic safety. The prevailing proportions of the survey respondents agree that smart mobility is offering benefits like reduction in travel time, energy efficient transport and improvement in traffic flow. However, regardless of the prevailing replies in the positive spectrum, 15% of the respondents strongly believe that smart mobility in smart cities does not eliminate the need for personal vehicles for the citizens.

4.2.5. Smart Environment

The distribution of responses (in %) related to the components of the smart environment in smart cities are depicted in Figure 10 below. The majority of the sample (92%) agrees that the infrastructure in smart cities is sustainable and eco-friendly, while 75% of the respondents support the view that smart cities can effectively address the challenges posed by climate change and environmental issues.

Even though 90% of the sample provides a positive reply to the question related to the awareness of smart city citizens of the environmentally friendly concept and the long-term

effect of the carbon footprint, 16% of the respondents replied in the negative spectrum, while 13% of them do not report a clear opinion.

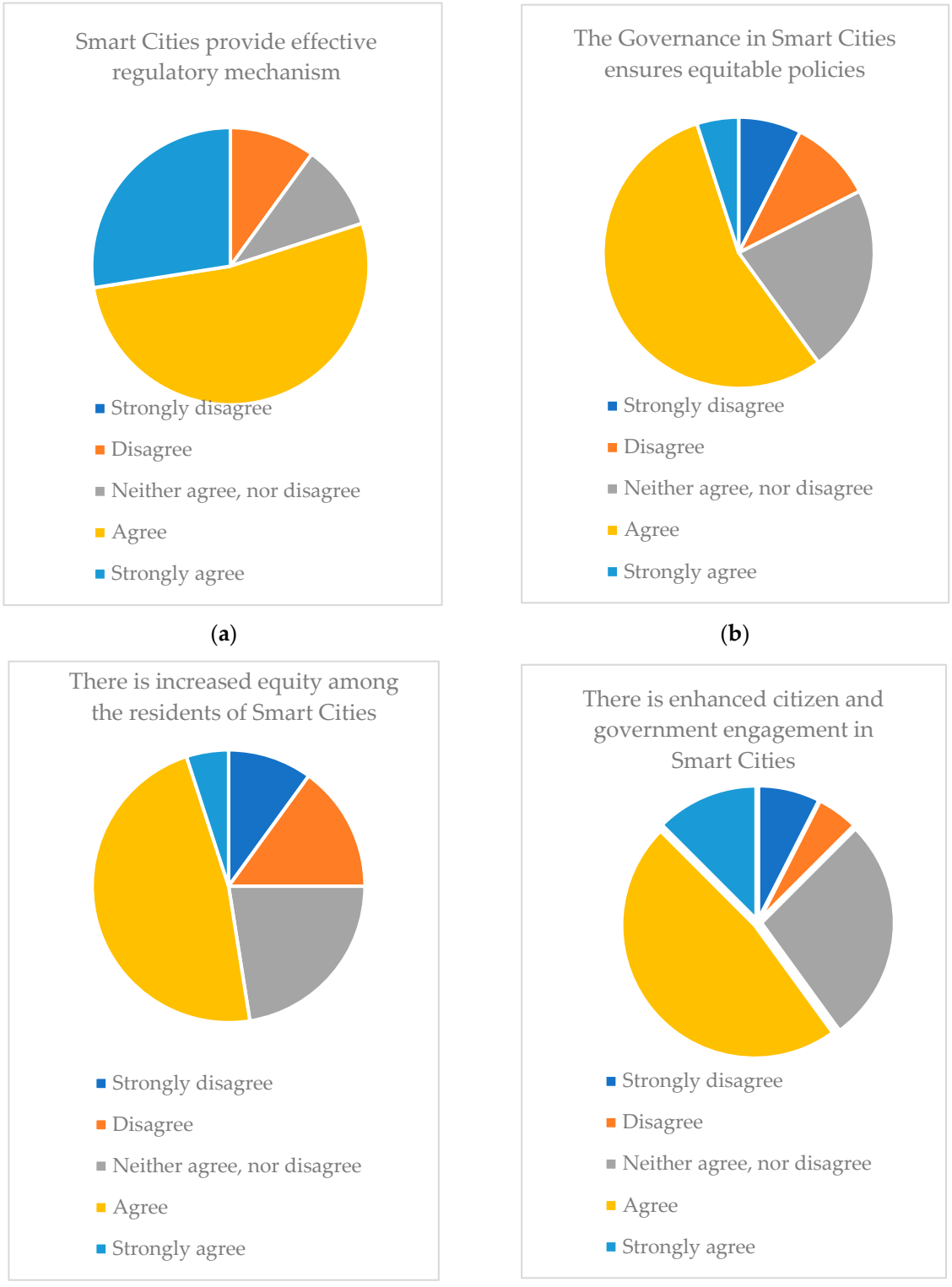
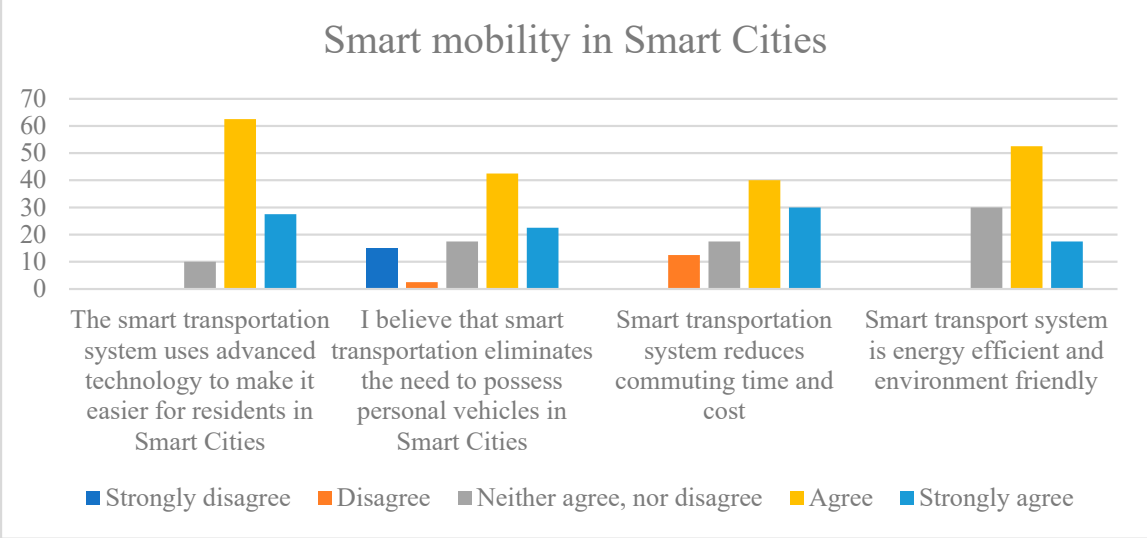


Figure 8. Survey results (frequency distribution %)–Smart Governance in Smart Cities: (**a**) effective regulatory mechanisms; (**b**) equitable policies; (**c**) equity among residents; (**d**) enhanced citizens and government engagement with smart cities.



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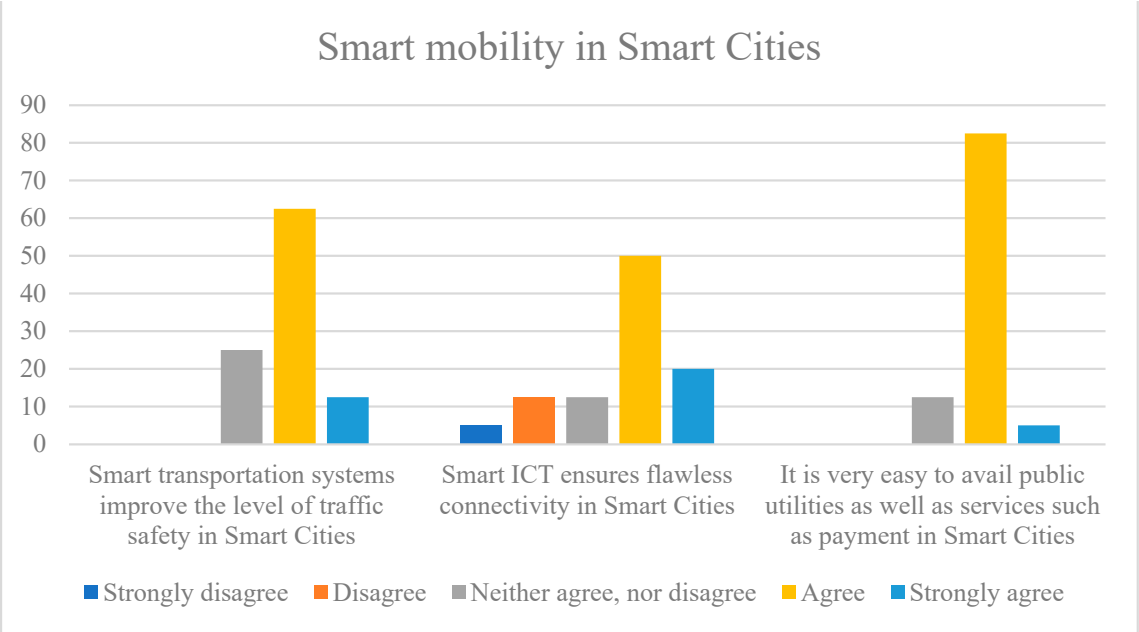

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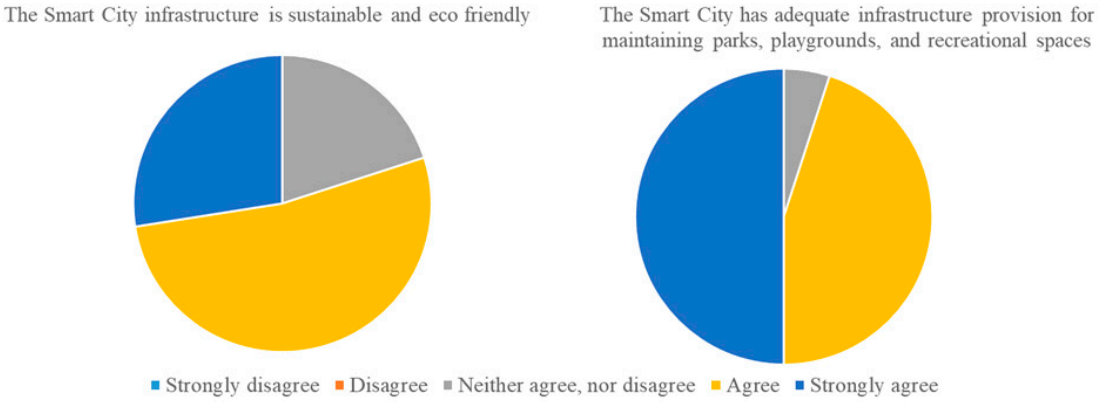
Figure 9. Survey results (frequency distribution %)–Smart Mobility in Smart Cities. (**a**) smart transportation's advanced technology, eliminating the need for personal vehicles, reducing commuting time and cost, energy efficiency; (**b**) improved traffic safety, flawless connectivity through ICT, easily available public utilities.

4.2.6. Smart Living

The next dimension of smart cities is smart living. The distribution of responses (in %) over the 7 aspects of smart living are illustrated in Figure 11 below. Similar to the other aspects of smart cities, the attitude toward smart living is majorly positive among the sampled research respondents. A considerable proportion of 92.5% of the sample shows positive opinion of the comfortable shopping options offered by the retail facilities in smart cities. Though, the replies show that 23% of the respondents have concerns about the privacy and security of smart city residents. In addition to that, a quarter of the respondents are not convinced (including the options "strongly disagree", "disagree", and "neither agree, nor disagree") in the superior quality of the smart cities' housing compared to the conventional one. Furthermore, 16 respondents equal to 40% of the sample do not support

the view that the use of technology in healthcare contributes to better health of the residents of smart cities. This evidences that when critical cornerstones of life such as health and housing are concerned, the respondents tend to question the superiority of smart cities, regardless of the modern technologies and infrastructure.



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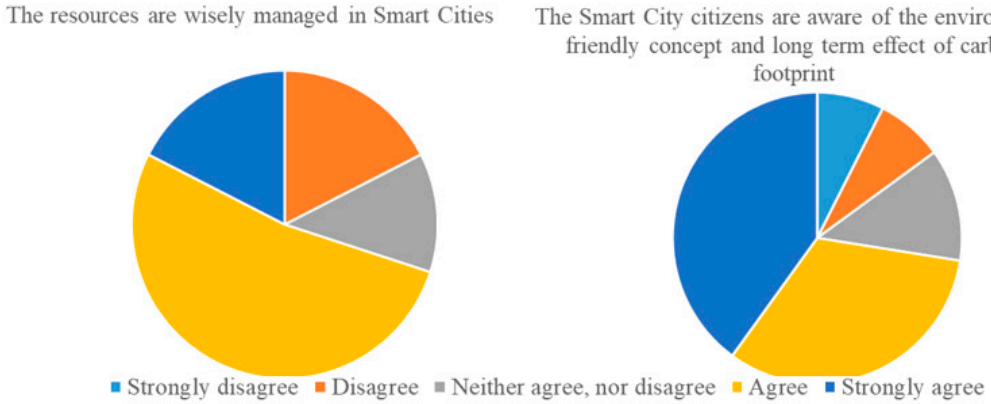

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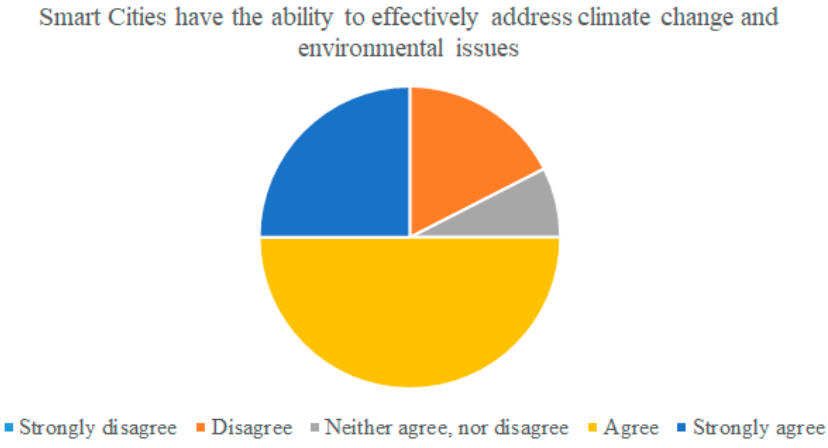
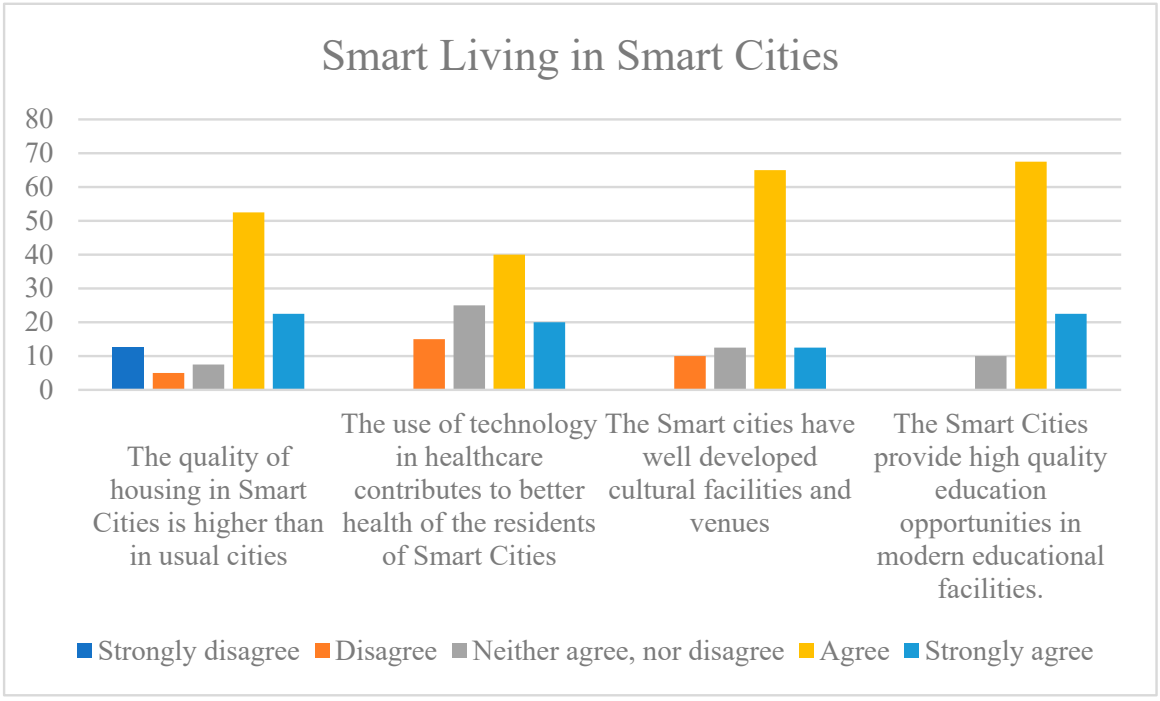


(**c**)

Figure 10. Survey results (frequency distribution %)–Smart Mobility in Smart. (**a**) sustainable eco-friendly infrastructure, and adequate infrastructure providing parks, playgrounds and recreational spaces; (**b**) wise resource management and citizens' awareness of the environment friendly concept and the long term effect of carbon footprint; (**c**) ability to effectively address climate change and environmental issues.



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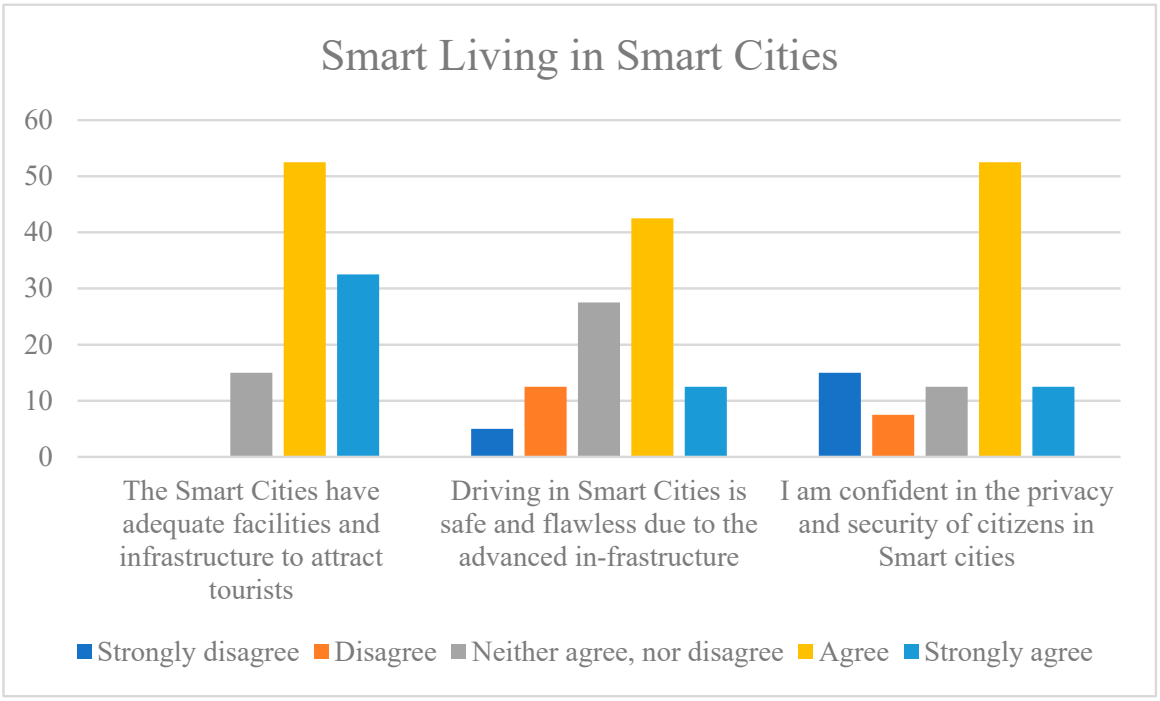

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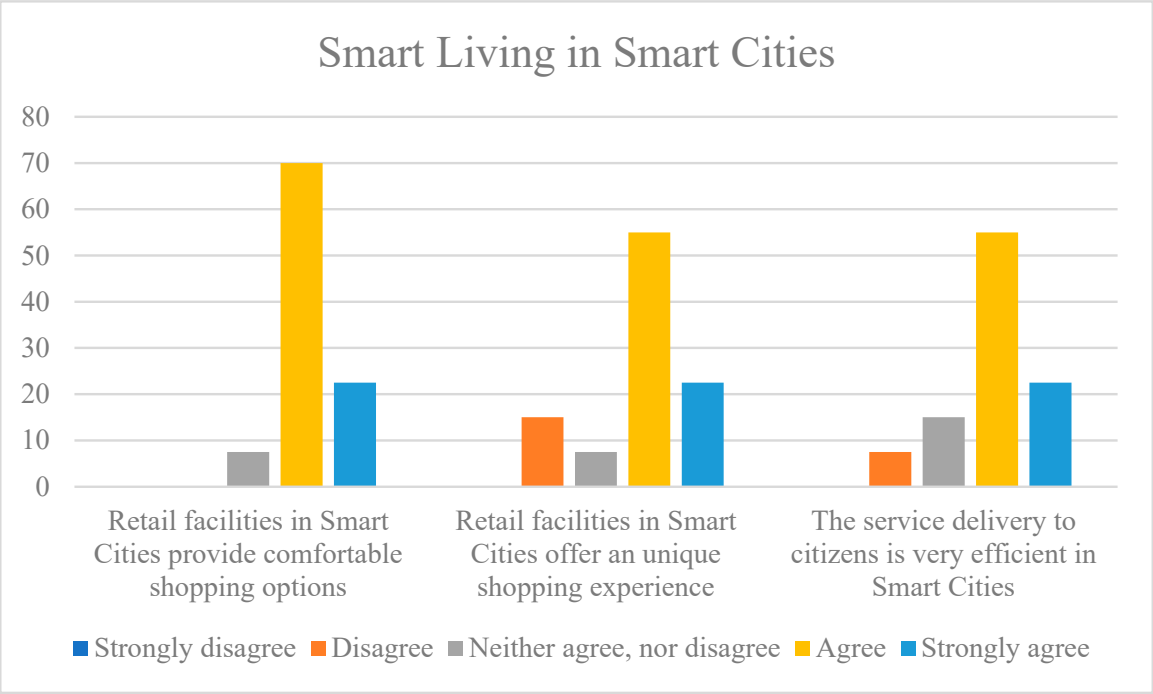
Figure 11. *Cont*.



(**c**)

Figure 11. Survey results (frequency distribution %)–Smart Mobility in Smart. (**a**) higher housing quality, technology-based healthcare, well-developed cultural facilities, high-quality education; (**b**) adequate facilities and infrastructure to attract tourists, safe and flawless driving, citizens' privacy and security; (**c**) comfortable shopping options, unique shopping experience, efficient service delivery.

4.2.7. Citizen Readiness

Figure 12 illustrates the frequency distribution of respondents' answers (%) regarding their readiness to accept different aspects of smart cities, including living in a smart city, starting a business in a smart city, engaging in life-long learning, taking part in the public incentives and governance of smart cities, as well as their willingness to accept the smart mobility system and smart housing, to shift to environmentally friendly habits which are fundamental to the smart city concept, and to use the cultural facilities and technology enabled healthcare facilities provided by the smart cities. Citizens' readiness is assessed using a 5-point scale ranging from 1–to a limited extent, to 5–to a significant extent.

Again, the responses are majorly in the positive spectrum of the scale which evidences that the higher proportion of survey respondents are willing to accept different aspects of the smart cities. Half of the research participants demonstrate significant readiness to gain an experience living in smart cities. In contrast, only 15% of the respondents are reluctant to try the experience of living in such city. The majority of the research participants, represented by 65% of them, are ready to a significant extent to shift to environmentally friendly habits. Though, it is found that the readiness of the respondents to engage in the governance and the public incentive in smart cities is questionable. Even though 70% of the sample are ready to different extent to start a new business in a smart city, a proportion of 15% are not ready for such a step. In correspondence to the above attitudes towards smart cities, the majority of the surveyed respondents are willing to accept the smart housing, but 15% of the respondents show limited readiness to embrace this aspect of smart cities.

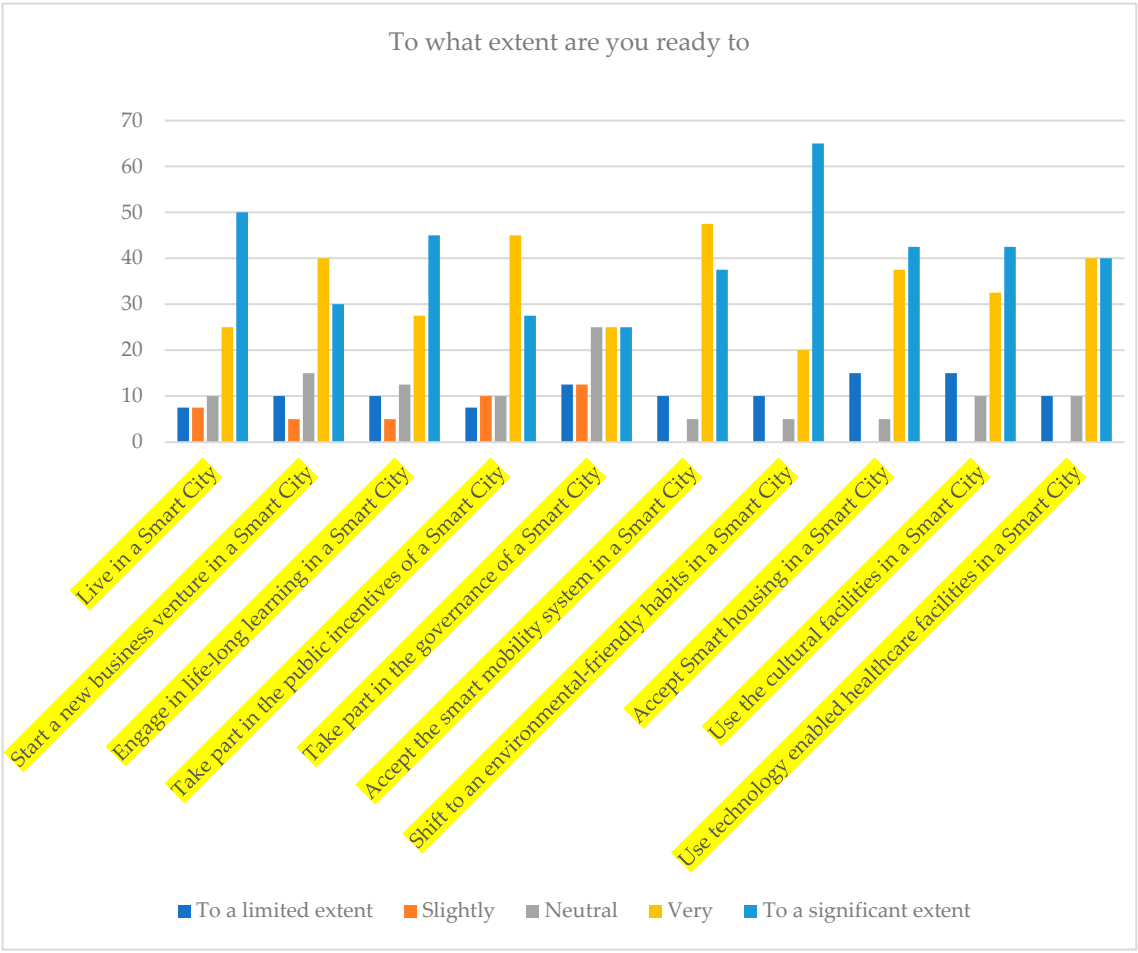


Figure 12. Survey results (frequency distribution %)–Citizen Readiness to accept smart cities.

5. Discussion

This study presents new findings related to the attitudes of Qatari citizens towards smart cities and their readiness to accept them. The findings are based on quantitative primary research employing survey questionnaire. The key findings uncover the prevailing positive attitude of the respondents to smart cities and their high readiness to accept most aspects of this unconventional city alternative. Though, it is discovered that the respondents are reluctant to engage in the governance of smart cities. In addition to that, the current study justifies the multi-dimensional nature of the smart cities depicted. Major findings of the study are discussed in the following lines.

The present study has uncovered that the smart economy is an important aspect of smart cities while the respondents see diverse economic benefits of the smart cities. The findings of the present study correspond to past views highlighting the importance of facilitating trade, and other economic indicators for conceptualizing a smart city [19]. Similar view is also reported by other scholars who emphasized on the socio-economic context and innovation as an inherent part of smart cities [21], a data point which is also supported in the findings of this study.

However, one interesting finding obtained is that participants do not categorically view businesses as highly competitive at local or international level. This could be explained based on the argument that businesses need to establish themselves in the smart cities before they can become capable of generating sufficient revenues, though the results show that the survey respondents value the opportunities for connections with international business partners provided by the smart cities. Another interesting finding was related to the career opportunities for the workforce where participants replied that there was

a lack of flexible career opportunities. This aspect is also explained based on the nature of businesses that have been established in smart cities and whether the labor force can develop their skills to meet the changing business dynamics and the smart city ecosystem. The finding is also supported by other scholars [35], who argued that even though the role of ICT in smart cities is important, it is not a sufficient condition for the transformation of a conventional city into a smart city.

In addition to that, smart cities are seen as a cradle of the learning, diversity, and open-mindedness, while their role for enhancing the creativity of their residents is not acknowledged in the results of the present study. In this respect, it is pointed out that the exchange of valuable information and responses through the collection of feedback data and data patterns via digital mediums is one of the key success factors of smart cities [79]. The lack of interaction and the adoption of digital services by the residents of the smart cities could be a factor that could explain the lack of creativity. Furthermore, since many of the participants have been living in smart cities for a limited period, they may not be fully aware of the capabilities that can help in enhancing the creativity of the residents.

Smart governance is also perceived as a key aspect of smart cities in the present study. The importance of governance and engagement of citizens towards the success of smart cities ecosystem has also been acknowledged in academic literature [35,43]. The importance of smart governance is also emphasized as a critical success factor based on a case study of 15 cities in Indonesia [46]. Additionally, the participants agreed that smart city ecosystem has the potential to provide effective regulatory mechanism.

Further, mobility in smart cities is considered one of the strengths which is facilitated by the use of information and communication technologies [65]. This is also supported by the participants' responses where it has been pointed out that smart transportation provides easier commutes, reduction in travel time, energy efficient transport, improvement in traffic flow, and easy-to-use public transportation, as well as supporting services such as payments. Nevertheless, contradiction between the survey results is detected by whether or not smart mobility can eliminate the need for the citizens to use their personal vehicles. This can be explained based on the argument that since many participants have been living for a shorter duration in the smart cities, they may not have had adequate time to adopt public transportation.

Smart environment pertains to the environmentally friendly ecosystem which is sustainable and also addresses climate and environmental issues [28]. The response from the participants provided support with respect to the parameters of sustainable and eco-friendly materials, and provision for public spaces such as parks and recreational spaces. However, regardless of the prevailing positive perceptions on these aspects, a mixed response was obtained with respect to parameters of citizen's awareness of the environmentally friendly concept. This can be attributed to the lack of social networks or awareness programs which delays the acceptance of smart cities and its ecosystem [5]. Furthermore, policy environment and political readiness also play a crucial role in the adoption of smart cities [68]. In the context of Qatar, the concept of smart cities is new, and therefore, delay in formulating appropriate policies and political readiness to create such an ecosystem could be a factor that resulted in a mixed response by the participants.

Smart living entails the overall experience of the residents in a smart city. The responses from the survey participants indicate support for well-developed cultural facilities, high quality education opportunities, facilities, and infrastructure to attract tourists, retail outlets for the citizens, and enhanced quality of service delivery (Figure 11). This is also acknowledged in academic literature where the convergence of technology with the daily lives of the citizens is considered as an integral part of smart city ecosystem [47]. However, an interesting finding with respect to healthcare facilities and quality of housing requires further investigation as the housing and healthcare are also integral to a smart city ecosystem [15,16]. Another important aspect that was highlighted by the participants is the concern for privacy and security of personal information, which is also supported in academic literature [29,86].

Citizen readiness refers to the extent to which citizens are willing to proactively accept the changes in their lifestyle when exposed to the smart city ecosystem [49]. The responses provided by the participants indicated a willingness to live in a smart city, adopt an eco-friendly lifestyle, start a business venture, participate in public incentives, use smart mobility, and accept smart housing, cultural facilities, and advanced healthcare (Figure 12). However, one of the major issues is that the participants were reluctant to take part in the governance of the smart city. This could be due to the lack of knowledge of social interaction in a smart city environment or due to lack of awareness by the local government towards the need for citizen-government interaction to make a smart city a success [36].

The model in Figure 13 below is developed based on the results of the performed analysis. It combines the attitudes of the citizens on the six components of a smart city known from previous research [48] with the readiness of to accept smart cities. This model will be employed in the next stage of the empirical research aimed at smart cities in the context of Qatar. Even though the causal interconnections between the components of the model have not been established, the present model presents a system perspective to the smart city and the readiness of the citizens to embrace this concept. In a way, it can be considered a living lab, combining diverse aspects and stakeholders [53,54].

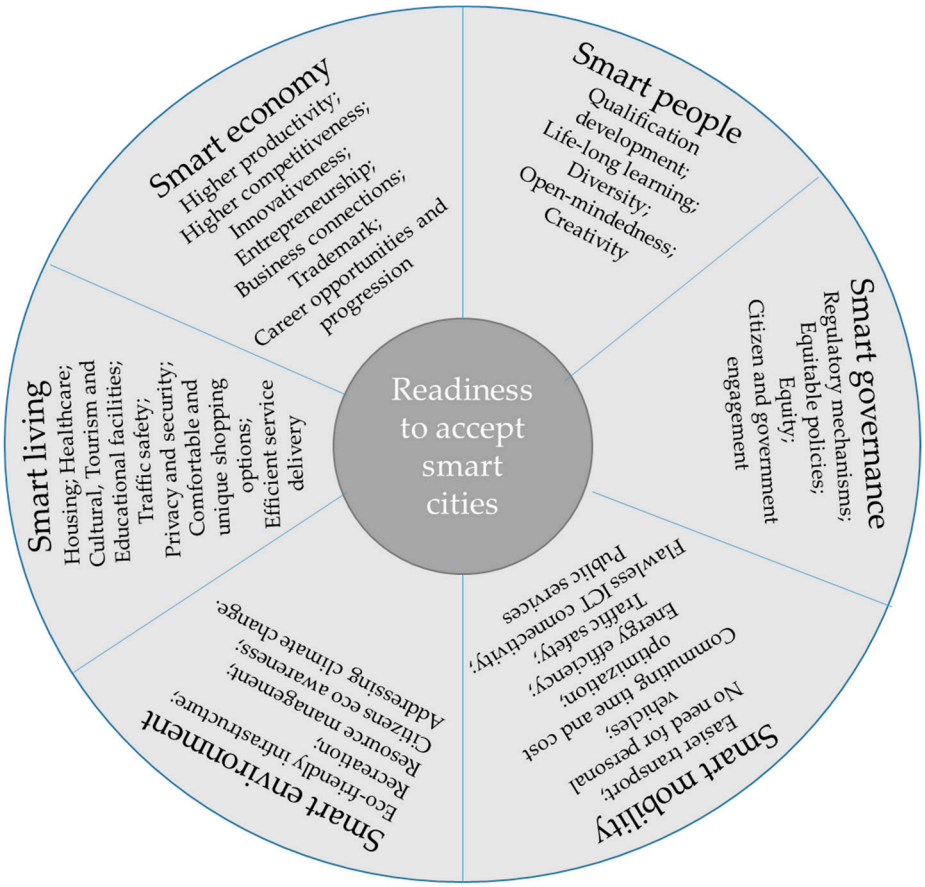


Figure 13. Smart cities conceptual model.

The performed research provides interesting insights into the opinions of Qatari citizens– residents and non-residents of smart cities– about different components of the smart city concept and their readiness to accept them. The findings presented in this paper offer novel insights into the topical research problem of smart cities in the specific context of Qatar. While the findings present a preliminary stage in the research process, it uncovers the need for a more detailed investigation of the differences between the opinions of people with and without personal experience living in a smart city, as well as the factors

shaping their opinion. The readiness of Qatari people to embrace the smart city concept also provides vast opportunities for further research.

6. Conclusions

The analysis of the data presents useful insights with respect to adoption of smart cities. The findings covered the different components of smart cities such as smart economy, smart people, smart government, smart mobility, smart environment, and overall smart living. It also assessed the readiness of the citizens to live in smart cities. It is observed that the success of the smart city is dependent on the extent of adoption by the citizens and businesses as well as government. Even though citizens may be experiencing a lifestyle in smart cities, lack of proper governance may still make the experience and capabilities incomplete. The findings also indicated that even though people are living in smart cities, it may take them some time to get used to the ecosystem, as is evident in the preference for personal vehicles, understanding of the rules and regulations of smart cities, and concerns about privacy and security of data. This also ascertains the argument that even though the role of ICT in smart cities is important, it is not a sufficient condition for the transformation of a conventional into a smart city.

The findings of the study present useful insights on the different factors which contribute towards conceptualization and implementation of smart cities by studying the views of the participants in Qatar. The findings of the study cover important factors such as governance, mobility, environment, social life, and citizen readiness, all of which are crucial for the adoption of smart cities. The study complements the earlier findings of [11,36,47], with emphasis on a smart city ecosystem comprising the infrastructure, economic, social, and environmental aspects. An important theoretical contribution of this study is the perception of citizen readiness to adopt the smart city ecosystem, which was positive to a large extent, indicating that people in Qatar are open to the idea of living in smart cities.

The main practical implications that can be derived from this study are threefold. Firstly, the findings can be used to conceptualize the smart city ecosystem from the social, economic, and environmental perspectives to ensure successful habitation at the smart cities. The findings of the study can be combined with leading practices of smart cities across the world for effective implementation. Prior studies conducted in smart cities across different areas also highlight the initiative and goal of smart city development [37] which can be combined with the findings of this study. Secondly, the response of the citizens related to smart city ecosystems such as governance, mobility, business environment, and living standards form useful inputs for strategic planning for a sustainable smart city. Based on the findings of this study, brainstorming and prioritization of services can be carried out in line with the vision of the smart city and its core ideology. This finding can also be viewed in conjunction with the smart city success factors framework proposed by [11] to understand the factors which shape the conditions for smart city success. Finally, the findings related to the citizen readiness can help in understanding the psychology of the citizens and the factors which contribute towards participation of citizens and their willingness to proactively accept the changes in their lifestyles. This aspect is also supported in literature where [43] and [44] highlighted the importance of the human factor as users of the technologies and agents of change enabling the shift towards smart cities.

The presented conceptual framework is valuable for the specific elements included in each of the smart city dimensions which are considered viable for the Qatari case, though the present study does not provide clarity regarding the interconnections and causality between the components in the model.

While this study has generated useful insights which have helped in the application of design thinking framework for understanding the smart city ecosystem, the study is also characterized by a number of limitations. First of all, the findings outlined in this paper are drawn from the research performed at the pilot stage of an extensive investigation on the topical research problem related to smart cities in the selected specific socio-economic context–the State of Qatar. The research employs a sample limited to 40 respondents.

This limited sample size limits the possibility to draw results representative to the Qatari population. Though, the research presents quantitative research in its qualitative aspect which provides a solid foundation for further research aimed at the detailed investigation of smart cities in the design thinking context.

Secondly, the study only briefly discusses briefly the security and privacy issues related to smart city infrastructure. Several researchers have highlighted concerns related to safety, security, and privacy of citizens when it comes to using an all connected technological infrastructure [95,97,98]. In addition, concerns related to totalism have also attracted significant attention in the literature [99,102] and need to be visited in greater depth when designing smart city ecosystems.

Finally, the study is based on the findings of a small sample based on purposive sampling technique. This strategy has the potential to limit generalization of findings, thereby confining the study to the specific context.

The concept of smart city design and implementation contains many research areas which can be further examined. Firstly, the study can explore the influence of citizen engagement and identify ways to encourage citizens in decision making process in smart cities. Considering the inhibitions of the citizens in smart city governance as observed in the findings of this study, this area presents promising research opportunities. Secondly, the scope of the study can be enhanced by carrying out a causal investigation of the influence of privacy and security issues on the extent of smart city adoption by the citizens and their readiness to proactively accept the ecosystem in light of these issues. Such an investigation can be carried out using quantitative methods of regression in order to establish objective findings which can be generalized to a larger population. For this purpose, a larger sample size can be identified to increase the validity and reliability of the study. Finally, future research can also focus upon the challenges and possibilities of using internet of things and mobile technologies to assess the satisfaction of citizens with respect to the services offered in a smart city ecosystem. This study can be combined with the use of Living Labs for the development of more inclusive smart cities' projects with focus on open innovation. These areas of research offer the potential of useful insights which can cover the entire smart city ecosystem to improve life for citizens in such a set up.

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References

1. Silva, B.N.; Khan, M.; Han, K. Towards sustainable smart cities: A review of trends, architectures, components, and open challenges in smart cities. *Sustain. Cities Soc.* **2018**, *38*, 697–713. [CrossRef]
2. Yin, C.; Xiong, Z.; Chen, H.; Wang, J.; Cooper, D.; David, B. A literature survey on smart cities. *Sci. China Inf. Sci.* **2015**, *58*, 1–18. [CrossRef]

3. Suzuki, L.R. Smart cities IoT: Enablers and technology road map. In *Smart City Networks*; Springer: Cham, Switzerland, 2017; pp. 167–190.
4. Syed, A.; Sierra-Sosa, D.; Kumar, A.; Elmaghraby, A. IoT in Smart Cities: A Survey of Technologies, Practices and Challenges. *Smart Cities* **2021**, *4*, 429–475. [CrossRef]
5. Baltac, V. Smart Cities—A View of Societal Aspects. *Smart Cities* **2019**, *2*, 538–548. [CrossRef]
6. Moura, F.; Silva, J.d.A.e. Smart Cities: Definitions, evolution of the concept and examples of initiatives. In *Industry, Innovation and Infrastructure, Encyclopedia of the UN Sustainable Development Goals*; Filho, W., Ed.; Springer: Cham, Switzerland, 2019; pp. 123–131.
7. Höjer, M.; Wangel, J. Smart Sustainable Cities: Definition and Challenges. *Adv. Intell. Syst. Comput.* **2014**, *310*, 333–349. [CrossRef]
8. Howard, E. *Garden Cities of Tomorrow*; Swan Sonnenschein & Co.: London, UK, 1998.
9. JJarrah, H. Smart Cities and Their Impact on Human Civilization Behavior "Abu Dhabi City Model". *J. Eng. Appl. Sci.* **2019**, *14*, 50–61. [CrossRef]
10. Hajduk, S. The concept of a Smart City in urban management. *Bus. Manag. Educ.* **2016**, *14*, 34–49. [CrossRef]
11. Chourabi, H.; Nam, T.; Walker, S.; Gil-Garcia, J.R. Understanding Smart Cities: An Integrative Framework. In Proceedings of the 2012 45th Hawaii International Conference on System Sciences, Maui, HI, USA, 4–7 January 2012; pp. 2289–2297. [CrossRef]
12. Barth, J.; Gremm, J.; Hartmann, S.; Fietkiewicz, K. Informational Urbanism. A conceptual framework of Smart Cities. In Proceedings of the 50th Hawaii International Conference on System Sciences, Maui, HI, USA, 4–7 January 2017.
13. Nam, T.; Pardo, T.A. Smart city as urban innovation: Focusing on management, policy, and context. ICEGOV 2011. In Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance, Tallinn, Estonia, 26–28 October 2011.
14. Mora, L.; Deakin, M.; Aina, Y.; Appio, F. Smart City Development: ICT innovation for urban sustainability. In *Encyclopedia of the UN Sustainable Development Goals: Sustainable Cities and Communities*; Filho, W., Ed.; Springer: Cham, Switzerland, 2020; pp. 83–97.
15. Harrison, C.; Donelly, I. A theory of Smart Cities. In Proceedings of the 55th Annual Meeting of the ISSS-2011, Hull, UK, 11–22 July 2011.
16. Dameri, R.P. Searching for Smart City definition: A comprehensive proposal. *Int. J. Comput. Technol.* **2013**, *11*, 2544–2551. [CrossRef]
17. Biloria, N. Smart Cities: A Socio-technical perspective. In Proceedings of the International Conference on the 4th Game Set and Match, Doha, Qatar, 6–7 February 2019.
18. Lombardi, P.; Giordano, S.; Farouh, H.; Yousef, W. Modelling the smart city performance. *Innov. Eur. J. Soc. Sci. Res.* **2012**, *25*, 137–149. [CrossRef]
19. Orbok, A. Challenges and risks in the Smart Cities. In Proceedings of the 12th PhD Conference 'New Approaches to the National Security', Brno, Czech Republic, 14 February 2016.
20. Arkaraprasertkul, N.; Rabitaille, R.P. Why do we need Smart(er) Cities and how to build one the Smart City primer. *Urbanism 4.0: Data Design and Digitalisation*. 2022. Available online: https://doi.org/10.13140/RG.2.2.32168.44800 (accessed on 22 October 2022).
21. Neirotti, P.; De Marco, A.; Cagliano, A.C.; Mangano, G.; Scorrano, F. Current trends in Smart City initiatives: Some stylised facts. *Cities* **2014**, *38*, 25–36. [CrossRef]
22. Eleutheriou, V.; Depiné, Á.; Azevedo, I.D.; Azevedo, I. Smart Cities and Design Thinking: Sustainable development from the citisen's perspective. In Proceedings of the IV Regional Planning Conference, Aveiro, Portugal, 23 February 2017.
23. Stimmel, C.L. *Building Smart Cities: Analytics, ICT, and Design Thinking*; Routledge: London, UK, 2015.
24. Buchanan, R. Wicked Problems in Design Thinking. *Des. Issues* **1992**, *8*, 5–21.
25. Schilwa, G. Smart Cities by design? Interrogating design thinking for citisen participation. In *The Right to the Smart City*; Cardullo, P., Di Feliciantonio, C., Kitchin, R., Eds.; Emerald Publishing: Bingley, UK, 2019; pp. 151–164.
26. Baer, D.; Gohari, S. The potential of design thinking for tackling the "Wicked Problems" of the Smart City. In Proceedings of the 24th International Conference on Urban Planning and Regional Development in the Information Society GeoMultimedia, Karlsruhe, Germany, 2–4 April 2019.
27. Hanzl, M.; Młynarczyk, A.; Tessier, A.; Munoz, M.M. Smart City—A Quest for Innovation within the EPS Framework. In Proceedings of the REAL CORP 2014 Tagungsband, Vienna, Austria, 21–23 May 2014.
28. Wang, Z. Research on Smart City Environment Design and Planning Based on Internet of Things. *J. Sensors* **2022**, *2022*, 1–9. [CrossRef]
29. Badran, A. Developing Smart Cities: Regulatory and Policy Implications for the State of Qatar. *Int. J. Public Adm.* **2021**, 1–14. Available online: https://www.tandfonline.com/doi/full/10.1080/01900692.2021.2003811 (accessed on 28 September 2022). [CrossRef]
30. Al Sharif, R.A.; Pokharel, S. Smart City Perspectives in the Context of Qatar. In *Sustainable Smart Cities and Territories International Conference*; Springer: Cham, Switzerland, 2021; pp. 103–113.
31. Mensonen, A.; Halstron, A.A. Designing cities? The use of design thinking in urban planning in Finland. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *588*, 1–8. [CrossRef]
32. Alrikabi, H.T.S.; Jasim, N.A. Design and Implementation of Smart City Applications Based on the Internet of Things. *Int. J. Interact. Mob. Technol.* **2021**, *15*, 4–15. [CrossRef]
33. Komninos, N.; Kakderi, C.; Tsarchopoulos, P. New services design for smart cities: A planning roadmap for user-driven innovation. In Proceedings of the 2014 ACM International Workshop on Wireless and Mobile Technologies for Smart Cities—WiMobCity '14, Philadelphia, PA, USA, 11 August 2014.

34. Cvar, N.; Trilar, J.; Kos, A.; Volk, M.; Stojmenova Duh, E. The Use of IoT Technology in Smart Cities and Smart Villages: Similarities, Differences, and Future Prospects. *Sensors* **2020**, *20*, 3897. [CrossRef] [PubMed]
35. Kogan, N.; Lee, K.J. Exploratory Research on the Success Factors and Challenges of Smart City Projects. *Asia Pac. J. Inf. Syst.* **2014**, *24*, 141–189. [CrossRef]
36. Kim, C.; Kim, K.-A. The Institutional Change from E-Government toward Smarter City; Comparative Analysis between Royal Borough of Greenwich, UK, and Seongdong-gu, South Korea. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 42–75. [CrossRef]
37. Iamtrakul, P.; Klaylee, J. Lesson learns of success factors from 10 smart cities development: Thailand context. In Proceedings of the First International Conference on Smart Technology & Urban Development (STUD), Chiang Mai, Thailand, 13–14 December 2019.
38. Peters, B. *IBI Group Smart City Task Force Lead. Top 10 Smart City Strategy Success Factors*; IBI Group: Montréal, QC, Canada, 2017.
39. Chaiyasoonthorn, W.; Khalid, B.; Chaveesuk, S. Success of Smart Cities development with community's acceptance of new technologies. In Proceedings of the 9th International Conference on Information Communication and Management–ICICM, Prague, Czech Republic, 23–26 August 2019.
40. Krishnan, B.; Arumugam, S.; Maddulety, K. Critical success factors for the digitalization of smart cities. *Int. J. Technol. Manag. Sustain. Dev.* **2020**, *19*, 69–86. [CrossRef]
41. Fahim, R.; El-Gazzar, R.F. Smart cities, sustainable cities, or both?—A critical review and synthesis of success and failure factors. In Proceedings of the 6th International Conference on Smart Cities and Green ICT Systems (SMARTGREENS 2017), Port, Portugal, 22–24 April 2017.
42. Eremia, M.; Toma, L.; Sanduleac, M. The Smart City Concept in the 21st Century. *Procedia Eng.* **2017**, *181*, 12–19. [CrossRef]
43. Novita, D.; Supranoto, S. Smart city's success: The importance of stakeholder collaboration. *Int. Semin. Ser. Reg. Dyn. Proceeding* **2019**, *1*, 175–183. [CrossRef]
44. Bughin, J.; Chui, M.; Manyika, J. Clouds, big data, and smart assets: Ten tech-enabled business trends to watch. *McKinsey Q.* **2010**, *56*, 75–86.
45. Yigitcanlar, T.; Lee, S.H. Korean ubiquitous-eco-city: A smart-sustainable urban form or a branding hoax? *Technol. Forecast. Soc. Chang.* **2014**, *89*, 100–114. [CrossRef]
46. Anindra, F.; Supangkat, S.H.; Kosala, R.R. Smart governance as smart city critical success factor (case in 15 cities in Indonesia). In Proceedings of the International Conference on ICT for Smart Society (ICISS), Semarang, Indonesia, 10–11 October 2018.
47. Patel, M.; Dr., Pitroda, J.; Bhavsar, J. Success factor for smart infrastructure development through lean management: A review. In Proceedings of the 21st ISTE State Annual Faculty Convention and National Conference on "Emerging Trends in Engineering" at Tolani Foundation Gandhidham Polytechnic, Adipur, India, 27 December 2016.
48. Giffinger, D.; Gudrun, H. Smart cities ranking: An effective instrument for the positioning of the cities? *ACE* **2010**, *4*, 7–26. [CrossRef]
49. Tanda, A.; Marco, A.D.; Rosso, M. Evaluating the Impact of Smart City Initiatives—The Torino Living Lab Experience. In Proceedings of the 6th International Conference on Smart Cities and Green ICT Systems, Porto, Portugal, 22–24 April 2017.
50. Osipov, V.S.; Skryl, T.; Zeldner, A. Making the smart city: Technologies, experiences, and future perspectives. In Proceedings of the 2018 International Scientific Conference "Investment Construction, Real Estate: New Technologies and Special-Purpose Development Priorities" (ICRE 2018) , Online, 15 October 2018.
51. Kumar, V. (Ed.) *Smart Living for Smart Cities*; Springer: Cham, Switzerland, 2020.
52. Burguete, J.L.; Lanero, A.; Rodriguez, C.S.; Sahelices, C. The Contribution of Smart Cities to Quality of Life from the View of Citizens. In *Entrepreneurial, Innovative and Sustainable Ecosystems*; Leitão, J., Alves, H., Krueger, N., Park, J., Eds.; Springer: Cham, Switzerland, 2018; pp. 55–66.
53. Cosgrave, E.; Arbuthnot, K.; Tryfonas, T. Living Labs, Innovation Districts and Information Marketplaces: A Systems Approach for Smart Cities. *Procedia Comput. Sci.* **2013**, *16*, 668–677. [CrossRef]
54. Bifulco, F.; Tregua, M.; Amitrano, C.C. Co-Governing Smart Cities Through Living Labs. Top Evidences from EU. *Transylv. Rev. Adm. Sci.* **2017**, *2017*, 21–23. [CrossRef]
55. Biçer, S.; Halicioglu, F. A view of smart city strategies: Success factors from the perspective of building technology solutions. In Proceedings of the 6th International Project and Construction Management Conference (e-IPCMC2020), Istanbul Technical University, Istanbul, Turkey, 12–14 November 2021.
56. Achmad, K.; Nugroho, L.; Djunaedi, A.; Widyawan, W. Smart city readiness based on Smart City Council's Readiness Framework. *IJECE* **2018**, *8*, 271–279. [CrossRef]
57. Berst, J. *Smart Cities Readiness Guide–The Planning Manual for Building Tomorrow's Cities Today*; Smart Cities Council: Reston, VA, USA, 2014; Available online: http://smartcitiescouncil.com/system/files/premium_resources/SmartCitiesCouncil-READINESSGUIDEV1.5-7.17.14.pdf?file=1&type=node&id=615 (accessed on 5 August 2022).
58. Orlowski, A. Smart Cities Concept–Readiness of City Halls as a Measure of Reaching a Smart City Perception. *Cybern. Syst.* **2021**, *52*, 313–327. [CrossRef]
59. Yigitcanlar, T.; Degirmenci, K.; Butler, L.; Desouza, K.C. What are the key factors affecting smart city transformation readiness? Evidence from Australian cities. *Cities* **2021**, *120*, 103434. [CrossRef]
60. Arief, A.; Abbas, M.Y.; A Wahab, I.H.; A Latif, L.; Abdullah, S.D.; Sensuse, D.I. The Smart Islands Vision: Towards Smart City Readiness in Local Government of Archipelagos. *J. Phys. Conf. Ser.* **2020**, *1569*, 042006. [CrossRef]

61. Kamolov, S.; Kandalintseva, Y. Defining the readiness for Smart City Concept: Russian municipalities study. In *Post-Industrial society: The Choice between Innovation and Tradition*; Kovalchuk, J., Ed.; Palgrave McMillian: London, UK, 2021; pp. 211–221.
62. Enwereji, P.; Uwizeyimana, D. Smart city readiness in South African municipalities: A qualitative study. *HOLISTICA JBPA* **2022**, *13*, 93–109. [CrossRef]
63. Chatterjee, S.; Kar, A. *Readiness of Smart City: Emerging Economy Perspective' In Emerging Markets from a Multidisciplinary Perspective*; Dwivedi, Y., Rana, N.P., Slade, E.L., Shareef, M.A., Clement, M.A., Simintiras, C., Lal, B., Eds.; Springer: Berlin, Germany, 2018; pp. 221–232.
64. Susanti, R.; Soetomo, S.; Buchori, I.; Brotosunaryo, P. Smart Growth, Smart City and Density: In Search of The Appropriate Indicator for Residential Density in Indonesia. *Procedia Soc. Behav. Sci.* **2016**, *227*, 194–201. [CrossRef]
65. Yigitcanlar, T. Kamruzzaman Smart Cities and Mobility: Does the Smartness of Australian Cities Lead to Sustainable Commuting Patterns? *J. Urban Technol.* **2017**, *26*, 21–46. [CrossRef]
66. Ivars-Baidal, J.A.; Celdrán-Bernabeu, M.A.; Femenia-Serra, F.; Perles-Ribes, J.F.; Giner-Sánchez, D. Measuring the progress of smart destinations: The use of indicators as a management tool. *J. Destin. Mark. Manag.* **2020**, *19*, 100531. [CrossRef]
67. Richter, C.; Kraus, S.; Syrjä, P. The Smart City as an opportunity for entrepreneurship. *Int. J. Entrep. Ventur.* **2015**, *7*, 211. [CrossRef]
68. Noori, N.; De Jong, M.; Hoppe, T. Towards an Integrated Framework to Measure Smart City Readiness: The Case of Iranian Cities. *Smart Cities* **2020**, *3*, 676–704. [CrossRef]
69. Ibrahim, M.; El-Zaart, A.; Adams, C. Smart sustainable cities roadmap: Readiness for transformation towards urban sustainability. *Sustain. Cities Soc.* **2018**, *37*, 530–540. [CrossRef]
70. Wieczorek, A.J. Sustainability transitions in developing countries: Major insights and their implications for research and policy. *Environ. Sci. Policy* **2018**, *84*, 204–216. [CrossRef]
71. Setijadi, E.; Darmawan, A.K.; Mardiyanto, R.; Santosa, I.; Hoiriyah; Kristanto, T. A Model for Evaluation Smart City Readiness using Structural Equation Modelling: A Citizen's Perspective. In Proceedings of the 2019 Fourth International Conference on Informatics and Computing (ICIC), Semarang, Indonesia, 16-17 October 2019; pp. 1–7. [CrossRef]
72. Surendran, P. Technology acceptance model: A survey of literature. *Int. J. Bus. Soc. Res.* **2012**, *2*, 175–178. [CrossRef]
73. Khansari, N.; Mostashari, A.; Mansouri, M. Impacting Sustainable Behavior and Planning in Smart City. *Int. J. Sustain. Land Use Urban Plan.* **2014**, *1*, 46–61. [CrossRef]
74. Al Sharif, R.; Pokharel, S. Smart City Dimensions and Associated Risks: Review of literature. *Sustain. Cities Soc.* **2021**, *77*, 103542. [CrossRef]
75. Turovskiy, A.A.; Aseev, A.D.; Sokolov, N.E. Social and political factors of smart city administration in the context of digitalization. In *Socio-Economic Systems: Paradigms for the Future*; Popkova, E.G., Ostrovskaya, V., Bogoviz, A., Eds.; Springer: Cham, Switzerland, 2021; pp. 1729–1736.
76. Gandy Jr, O.H.; Nemorin, S. Toward a political economy of nudge: Smart city variations. *Inf. Commun. Soc.* **2019**, *22*, 2112–2126.
77. Dameri, R.P.; Benevolo, C. Governing smart cities: An empirical analysis. *Soc. Sci. Comput. Rev.* **2016**, *34*, 693–707. [CrossRef]
78. Paiva, S.; Ahad, M.A.; Tripathi, G.; Feroz, N.; Casalino, G. Enabling Technologies for Urban Smart Mobility: Recent Trends, Opportunities and Challenges. *Sensors* **2021**, *21*, 2143. [CrossRef] [PubMed]
79. Zhao, Z.; Zhang, Y. Impact of Smart City Planning and Construction on Economic and Social Benefits Based on Big Data Analysis. *Complexity* **2020**, *2020*, 1–11. [CrossRef]
80. Arroub, A.; Zahi, B.; Sabir, E.; Sadik, M. A literature review on Smart Cities: Paradigms, opportunities and open problems. In Proceedings of the 2016 International Conference on Wireless Networks and Mobile Communications WICOM, Fez, Morocco, 26–29 October 2016.
81. Routray, S.; Sarangi, S.; Javali, A. Smart Cities: The Hopes and Hypes. *EESP* **2019**, *7*, 1–5. [CrossRef]
82. Vanlı, T.; Marşap, A. Smart Cities, Smarter Management: Developing a Smart Framework for Smart Cities Management in Europe. *GE-IJMR* **2018**, *6*, 41–73.
83. Lam, P.; Yang, W. A Study of the Costs and Benefits of Smart City Projects Including the Scenario of Public-Private Partnerships. *IJUCE* **2017**, *11*, 600–605. [CrossRef]
84. Bjørner, T. The advantages of and barriers to being smart in a smart city: The perceptions of project managers within a smart city cluster project in Greater Copenhagen. *Cities* **2021**, *114*, 103187. [CrossRef]
85. Bawa, M.; Cagáňová, D.; Szilva, I.; Spirkova, D. Importance of Internet of Things and Big Data in Building Smart City and What Would Be Its Challenges. In *Smart City 360°*; Springer: Cham, Switzerland, 2016; pp. 605–616. [CrossRef]
86. Al Nuaimi, E.; Al Neyadi, H.; Mohamed, N.; Al-Jaroodi, J. Applications of big data to smart cities. *J. Internet Serv. Appl.* **2015**, *6*, 25. [CrossRef]
87. Phan, A.; Qureshi, S.T. *5G Impact on Smart Cities*. 5GCJ 2017. Available online: https://www.researchgate.net/publication/315804922_5G_impact_On_Smart_Cities (accessed on 12 November 2022).
88. MOTC. Sustainable Smart Cities: Improving Quality of Life. Available online: https://www.motc.gov.qa/sites/default/files/sustainable_smart_cities_-_improving_quality_of_life.pdf (accessed on 6 June 2022).
89. Maru, P. Smart Cities Initiative Supercharges Qatar's Diversified Economy. 2019. Available online: https://techherald.in/news-analysis/smart-cities-initiative-supercharges-qatars-diversified-economy/ (accessed on 6 June 2022).
90. Pinochet, L.H.C.; Romani, G.F.; de Souza, C.A.; Rodríguez-Abitia, G. Intention to live in a smart city based on its characteristics in the perception by the young public. *RdG* **2018**, *26*, 1–21. [CrossRef]

91. Myeong, S.; Park, J.; Lee, M. Research Models and Methodologies on the Smart City: A Systematic Literature Review. *Sustainability* **2022**, *14*, 1687. [CrossRef]
92. Glasmeier, A.; Christopherson, S. Thinking about smart cities. *Camb. J. Reg. Econ. Soc.* **2015**, *8*, 3–12. [CrossRef]
93. Ningrum, T.P. Smart City: The main assist factor for smart cities. *Int. J. Innov. Enterp. Syst.* **2021**, *5*, 46–54. [CrossRef]
94. Elmaghraby, A.S.; Losavio, M.M. Cyber security challenges in Smart Cities: Safety, security and privacy. *J. Adv. Res.* **2014**, *5*, 491–497. [CrossRef]
95. Chen, N.; Chen, Y. Smart city surveillance at the network edge in the era of IoT: Opportunities and challenges. In *Smart Cities*; Springer: Cham, Switzerland, 2018; pp. 153–176.
96. Braun, T.; Fung, B.C.; Iqbal, F.; Shah, B. Security and privacy challenges in smart cities. *Sustain. Cities Soc.* **2018**, *39*, 499–507. [CrossRef]
97. Hernandez-Ramos, J.L.; Martinez, J.A.; Savarino, V.; Angelini, M.; Napolitano, V.; Skarmeta, A.F.; Baldini, G. Security and Privacy in Internet of Things-Enabled Smart Cities: Challenges and Future Directions. *IEEE Secur. Priv.* **2020**, *19*, 12–23. [CrossRef]
98. Cui, L.; Xie, G.; Qu, Y.; Gao, L.; Yang, Y. Security and Privacy in Smart Cities: Challenges and Opportunities. *IEEE Access* **2018**, *6*, 46134–46145. [CrossRef]
99. Pali, B.; Schuilenburg, M. Fear and Fantasy in the Smart City. *Crit. Criminol.* **2019**, *28*, 775–788. [CrossRef]
100. Edwards, L. Privacy, security and data protection in smart cities: A critical EU law perspective. *Eur. Data Prot. Law Rev.* **2016**, *2*, 28–58. [CrossRef]
101. Ismagilova, E.; Hughes, L.; Rana, N.P.; Dwivedi, Y.K. Security, Privacy and Risks Within Smart Cities: Literature Review and Development of a Smart City Interaction Framework. *Inf. Syst. Front.* **2020**, *24*, 393–414. [CrossRef] [PubMed]
102. Kalinin, M.; Krundyshev, V.; Zegzhda, P. Cybersecurity Risk Assessment in Smart City Infrastructures. *Machines* **2021**, *9*, 78. [CrossRef]
103. Bonett, D.G.; Wright, T.A. Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *J. Organ. Behav.* **2014**, *36*, 3–15. [CrossRef]
104. Andrade, C. The Limitations of Online Surveys. *Indian J. Psychol. Med.* **2020**, *42*, 575–576. [CrossRef] [PubMed]
105. Etikan, I.; Musa, S.A.; Alkassim, R.S. Comparison of Convenience Sampling and Purposive Sampling. *Am. J. Theor. Appl. Stat.* **2016**, *5*, 1–4. [CrossRef]