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Citizens' Perceptions of the Smart City Distribution Strategy and Its Impact on Quality of Life: A Generational Perspective

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Abstract

Purpose: This study aims to explore the citizens' perceptions of the smart city distribution strategy and its impact on quality of life, classifying generations into two groups: Generation X with Baby Boomers, and Millennials with Generation Z. This study formulated research questions to explore how both generational groups perceive the impact of smart city experience, government's role, technology development, economic, social, and environmental factors, and institutional improvement on quality of life. Additionally, this study explored the influence of quality of life on city evaluation, life satisfaction, and the expected growth of the city. **Research design, data and methodology:** This study employed an online survey conducted by well-known research organization. This study utilized factor and regression analysis for data analysis. **Results:** This study revealed that the impact of smart city experience, technology development and social value on quality of life demonstrated significance in both generational groups. Additionally, the study identified significant results regarding the influence of quality of life on city evaluation, life satisfaction, and the expected growth of the city. **Conclusions:** The findings suggest that, for the development of smart cities, stakeholders should particularly consider economic value and environment aspects, as these factors ultimately impact on quality of life.

Keywords: Smart City, Quality of Life, Generational Perspecive, Distribution Strategy

JEL Classification Code: M10, M30, M38, J17

1. Introduction

With the onset of advanced technology, especially during the era of the fourth industrial evolution, cities are undergoing development through the application of cutting-edge technologies aimed at enhancing the living environment for citizens. In the information age, as highlighted by Wang (2022), national science and technology continue to advance, promising increased convenience in our daily lives. Javed et al. (2022) underscored that the development of technology plays a significant role in bringing ease and innovation into daily human life.

In the study by Nath et al. (2023), smart cities have been identified as a crucial element in urban planning and policy, utilizing technology and data analytics to enhance the quality of life for citizens. Chourabi et al. (2012) emphasized that smart cities represent an intricate web of interconnected systems, fostering a symbiotic relationship among individuals, institutions, technologies, organizations,

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environments, and physical infrastructure. Specifically, Information and Communication Technology (ICT) plays a pivotal role in urban areas, serving as a key enabler to intelligently address challenges such as traffic, housing, energy, and environmental issues (Batty, 2013; Manville, 2014). Furthermore, from political and social standpoints, the evolution of smart cities aims to strengthen the ecological equity and integrity of urban areas (Nam & Prado, 2011; Deakin, 2014). This is achieved by enhancing the city's problem-solving capacity through a robust community platform, bridging the information gap between citizens, and transcending a narrow focus solely on technological intelligence (Nam & Prado, 2011; Deakin, 2014). Nam and Pardo (2011) delved into the influence of governance on citizen participation in smart city projects, shedding light on different typologies of citizen engagement. Winkowska et al. (2019) emphasized the need for a foresight methodology in planning the future of smart cities, wherein citizens play dual roles as users and co-creators of the urban environment.

Nam and Pardo (2011) explored the criteria for classifying a city as "smart" examining three key dimensions: technology, people, and institutions. Wahab et al. (2020) explored the idea that a smart city represents a novel framework for the future, integrating diverse information and communication technologies to address urban challenges, while simultaneously enhancing the quality of life for its citizens. Mohanasundaram et al. (2018) underscored the pivotal role of a smart solution in optimizing a city-wide water distribution network. Mohanasundaram et al. (2018) also suggested using an Internet of Things (IoT)-based technological solution to improve the quality of water delivered to consumers. Pandya et al. (2018) introduced a novel concept on the distribution side, focusing on the design of a smart power distribution network for a more efficient approach to urbanization. Capra (2016) argued that although smart cities are often associated with modern technology and infrastructure, they have the potential to significantly enhance citizen involvement and contribution to urban development. Bakici et al. (2013) argued that smart cities, anchored in new ICT technology, aim to cultivate a superior urban environment and elevate citizens' quality of life through enhanced competitiveness and innovation. Nath et al. (2023) assessed the evolution of smart cities with a focus on neighborhoods, offering insights into dimensions and sectors. Hoffman (2020) emphasized the increasing popularity of the concept of smart cities among professionals and academics in diverse interconnected networks that span various fields. Wang and Zhou (2023) investigated three indicators to measure subjective quality of life including life satisfaction, frequency of happy emotions, and frequency of depressed emotions.

Based on the consideration, this research aims to investigate citizen perception of smart cities and its distribution strategy, utilizing a comprehensive framework that encompasses smart city experiences, the role of government, technology development, economic value, social value, environmental value, and institutional improvements. Quantitative research, specifically measuring citizens' perception, has been rarely conducted in previous studies within the field of smart cities. By categorizing generations into two groups – Generation X with Baby Boomers, and Millennials with Generation Z – this study seeks to analyze how the aforementioned factors influence the quality of life that lacks in previous studies. This study categorizes generations into those older than Millennials including Generation X and Baby Boomers by considering similarities between Millennials and Generation Z as a group within the context of the Internet environment and their shared perceptions of advanced technologies. This study formulated the following research questions: i) how does the perceived smart city experience impact quality of life? ii) how does the perceived role of government influence the quality of life?; iii) in what ways does the perceived technology development affect the quality of life?; iv) what is the impact of perceived economic value on the quality of life?; v) how does perceived social value contribute to the quality of life?; vi) to what extent does perceived environmental value influence the quality of life?; vii) what role does perceived institutional improvement play in sharing the quality of life?; and viii) how does the perceived quality of life related to city evaluation, life satisfaction, and the anticipated growth of the city?

2. Literature Review

2.1. Smart City

Pira (2021) highlighted that the concept of smart cities originated in the 1970s, with its roots traced to a digital configuration based on technology and non-material structures integrated into urban physical spaces. Vishnivetskaya and Alexandrova (2019) emphasized that the smart city concept manifests through the creation of an advanced urban environment. Vishnivetskaya and Alexandrova (2019) also stated that this transformative initiative began to gain momentum in the 1990's. Pira (2021)'s study highlighted that globalization trends and the emergence of new technologies are increasingly influencing urban and regional environments. Li and Wu (2023) investigated the current situation and future prospects of smart cities in China by analyzing the distribution of smart city initiatives across regions.

Albino et al. (2015) noted the existence of numerous definitions of smart cities, accompanied by a variety of conceptual variants that involve replacing 'smart' with adjectives such as intelligent or digital. Early attempts focused on leveraging information technology to manage diverse city functions, while recent research has expanded its scope to encompass outcomes and perspectives, including quality of life and citizen services (Hara et al., 2016; Ahvenniemi et al., 2017). In the realm of information technology, the majority of researchers often narrow their definitions of smart cities to the electronic functions provided to citizens, frequently overlooking broader outcomes such as quality of life, equity, livability, and resilience (Ramaprasad et al., 2017). Smart cities are regarded as a specific intellectual capability that addresses innovative socio-technical and socio-economic aspects of growth (Zygiaris, 2013). Moura and e Silva (2019) stated that a smart city as an urban area that utilizes electronic data collection sensors embedded in infrastructures, building, vehicles, institutions, and devices such as the Internet of Things (IoT). According to Kozlowski and Suwar (2021), a smart city is a modern concept addressing contemporary problems in urban life. Mora and Bolici (2016) asserted that smart cities are urban areas where information and communication technologies are applied to address specific challenges and promote development in social, economic, and environmental dimensions. Singh et al. (2022) posited that a smart city is an innovative urban center leveraging information and communication technologies (ICTs) and other tools to enhance the quality of life, optimize urban operations and services, and boost competitiveness. This is achieved while ensuring it addresses the needs of present and future generations across economic, social, and environmental dimensions (Singh et al., 2022). Wang et al. (2022) emphasized that the intelligent distribution of products in smart cities can effectively guarantee product quality, improve distribution efficiency, reduce distribution costs, and increase customer satisfaction. Nam and Pardo (2011) underscored the growing global popularity of the smart city concept and noted the emergence of conceptual variants created by substituting 'smart' with different adjectives.

Javed et al. (2022) highlighted that smart cities integrate information and communication technologies (ICT) and the Internet of Things (IoT) to enhance operational efficiency. Their overarching goals include improving the quality of government services, enhancing citizen welfare, and promoting development practices to meet the ever-growing demands of citizens (Javed et al., 2022). Attaran et al. (2022) emphazised the categorization of the smart city structure into six main components by previous researchers: smart people, smart government, smart environment, smart transportation, smart economy, and smart life. Further, Khanderia and Patel (2023) delved into the quality of life theory, illustrating its multidimensional nature and emphasized a broad spectrum of factors including societal changes, cultural values, and individual perceptions in relation to their environment. Meadow et al. (1992) explored the judgment theories of life satisfaction, proposing that the degree of life satisfaction an individual experiences at any given moment is directly influenced by a cognitive comparison between established standards and their current conditions.

2.2. Generations

Latkovikj and Popovska (2020) highlighted that the scientific exploration of generational differences can be traced back to the 1950s. As noted by Berkup (2014), the generation born after World War II, commonly referred to as 'Baby Boomers,' comprises individuals born between 1946-1964, while the generation born between 1965-1979 is known as the 'X Generation'. Berkup (2014), further categorizes generations, noting that individuals born between 1980-2001 are commonly referred to as the 'Millennials' or 'Y Generation,' while those born between 2000-2020 are recognized as the technology-driven 'Z Generation'. Investigating generational demographics, Dimock (2019) defined Millennials as individuals born between 1981 and 1996, and noted that anyone born from 1997 onward is part of a new generation. Dimock (2019) also highlighted that Generation Z is the dominant group in online searches for information on the post-Millennials generation. Latkovikj and Popovska (2020) emphasized that technology is commonly recognized as a key driver shaping generational characteristics. Millennials and Generation Z share similarities, often being referred to as the Internet generation due to their exposure to computers from a young age. Mohanty et al. (2016) explored the idea that a smart city aims to meet the needs of both present and future generations, concerning economic, social, and environmental dimensions. In contrast, Kozlowski and Suwar (2021) emphasized that smart initiatives specifically focus on promoting an eco-friendly environment in cities and the empowerment of elderly and disabled people.

3. Hypotheses Development

3.1. Effects of Smart City Experience on Quality of Life

This study proposed the experience of a smart city is a factor influencing the quality of life, examining how citizens interact with and perceive smart city initiatives. Citizens residing in smart cities encounter public services with smart

features, including AI-driven traffic lights, travel information, safety information, and more. In various instances of smart city, citizen participation through experiential engagement is acknowledged as a factor capable of shaping citizen governance, enhancing quality of life. It is deemed one of the most critical elements in the functioning and advancement of smart cities. Margerum (2002) asserts that effective planning and enforcement of urban policies are vital for improved urban development. The significance of these policies lies in their reflection of citizens' experiences and necessitates their active participation (Margerum, 2002). In emphasizing participation that places value on citizen experience in the development of smart cities, Edge et al. (2020) emphasized the importance of gaining a deeper understanding of the diverse lived experiences of community members and local voices of the smart city, with the aim of facilitating both physical and social change. Therefore, this study hypothesized the impact of smart city experience on quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H1a: The impact of perceived smart city experience on quality of life in Generation X and Baby Boomers.

H1b: The impact of perceived smart city experience on quality of life in Millennials and Generation Z.

3.2. Effects of Role of Government on Quality of Life

This study proposed evaluating the impact of governmental involvement in shaping the smart city landscape. Kozlowski and Suwar (2021) emphasized that the success of smart initiatives is heavily influenced by local factors. The challenge for city authorities lies in selecting the most optimal city development strategy within the prevailing economic, technological, and social conditions (Kozlowski & Suwar, 2021). Indeed, as highlighted in numerous studies, the deficiencies of smart cities encompass budgetary constraints, inadequate planning, and challenges in attracting residents and capital (Shwayri, 2013). Moreover, in advancing a smart city, substantial efforts are essential to orchestrate and regulate the intricate ecosystem of people, institutions, and stakeholders, requiring systematic strategies to enhance the intelligence of existing infrastructure (Bélissent, 2010). In Capra's (2016) investigation, the focus was on exploring the relationships between governance characteristics and citizen participation typologies within a specific smart city program. In the end, the capability of the central government emerges as a crucial driving force in addressing challenges such as budgetary constraints, the implementation of technological infrastructure, and the coordination of stakeholders, including citizens (Tan & Taeihagh, 2020). These aspects have been identified as significant shortcomings in smart city development (Tan & Taeihagh, 2020). Therefore, this study hypothesized the impact of role of government on quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H2a: The impact of role of government on quality of life in Generation X and Baby Boomers.

H2b: The impact of role of government on quality of life in Millennials and Generation Z.

3.3. Effects of Technology Development on Quality of Life

Kozlowski and Suwar (2021) addressed that one of definitions that link the city includes technology orientation involving the use of technological infrastructure, information communication technology to improve the quality of life in the city. Winkowska et al. (2019) emphasized the role of technology in defining smart cities, particularly highlighting smart technology as a cluster encompassing advanced technologies used in urban settings. Essentially, as smart cities have evolved from cutting-edge technologies such as ICT, big data, IoT, and AI, technological advancement for smart cities is widely regarded as both a competitive asset and an essential element. Continuous research has been dedicated to smart technologies, encompassing digital services and internet networks (Taylor Buck & While, 2015). This effort has led to a myriad of innovations and services that were initially developed independently and subsequently interconnected (Taylor Buck & While, 2015). In essence, the primary objective of constructing smart cities has been to address urban challenges through ICT (Toporkoff, 2012). The advancement of digital technology has consequently influenced multiple sectors within the city, and the substantial volume of data generated by ICT systems stands out as a major factor in the development of smart cities (Toporkoff, 2012). Therefore, this study hypothesized how to assess the influence of technological advancements on quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H3a: The impact of technology development on quality of life in Generation X and Baby Boomers.

H3b: The impact of technology development on quality of life in Millennials and Generation Z.

3.4. Effects of Economic Factor on Quality of Life

This study proposed investigating the economic benefits perceived by citizens in smart city environments. Previous studies (e.g., Hoffman, 2020) have emphasized that the smart economy, a key aspect of both the smart city and the new industrial revolution, is also regarded as a knowledge

economy and a shared economy. Pira (2021) asserted that a city attains smart status when investments in human and social capital, combined with both traditional and modern connectivity networks, contribute to economic growth and a high quality of life through participatory mechanisms. The primary positive outcomes of smart city development are identified as promoting economic development and enhancing efficiency (Capdevila & Zarlenga, 2015). Specifically, economic development encompasses the generation of jobs and the creation of new business opportunities (Capdevila & Zarlenga, 2015). Wang et al. (2022) explored the optimization goal of intelligent distribution in a smart city aiming to minimize the distribution costs while maximizing customer satisfaction. The economic implications of smart cities have been posited to exert a substantial influence on nurturing creative industries (Kraus et al., 2015), transitioning towards a service-oriented economy (Ménascé et al., 2017), and enhancing competitiveness in the global market (Dameri & D'Auria, 2014). Therefore, this study hypothesized the impact of economic factor on the quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H4a: The impact of economic factor on quality of life in Generation X and Baby Boomers.

H4b: The impact of economic factor on quality of life in Millennials and Generation Z.

3.4. Effects of Social Factor on Quality of Life

This study contends that a smart city aims to examine societal advantages and the impact on community well-being arising from its innovative approach. Alizadeh and Sharifi (2023) introduced the concept of societal smart city, seamlessly integrating social rights and democratic values with technological innovations. This is achieved by addressing key aspects such as citizen-centeredness, e-democracy, social justice, and more (Alizadeh & Sharifi, 2023). Specifically, concerning the positive social value of smart cities, they cultivate an open social environment and encourage citizen participation (Navarro et al., 2017). Moreover, Mora and Bolici (2016) define a smart city as one that advances a better society through the utilization of information and communication technology, emphasizing that the ultimate goal of cutting-edge technology is to enhance the quality of life in the cities where citizens reside. Singh et al. (2022) contend that a smart city is an innovative urban center leveraging ICT technology to enhance the quality of life, optimize city operations and services, and meet the needs of present and future generations across economic, social, and environmental dimensions. Ultimately, Sajhau (2017) asserts that social development through smart cities plays a crucial role in achieving an egalitarian and just society for all citizens. Therefore, this study hypothesized the impact of social factor on the quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H5a: The impact of social factor on quality of life in Generation X and Baby Boomers.

H5b: The impact of social factor on quality of life in Millennials and Generation Z.

3.5. Effects of Environment Factor on Attitude

This study proposed gauging citizen perceptions regarding the environment concerns of smart cities. Aletà et al. (2016) focused on the role of cities in development and proposed smart city projects, encompassing clusters such as mobility, environment, government, economy, people, and living. Kozlowski and Suwar (2021) asserted that the adoption of the smart concept entails fostering innovative and urban development that aligns harmoniously with the natural environment. Wang (2022) emphasized that environmental protection stands as a core element within the framework of a smart city. In their review, Winkowska et al. (2019) assessed the smart environment based on factors such as the attractiveness of the natural environment, pollution levels, environmental protection activities, and methods employed for resource management. In terms of environmental concerns, Snow et al. (2016) assert that safeguarding the environment involves mitigating CO_2 emissions and reducing energy consumption. Amsterdam, a representative European city, is actively pursuing its 2040 Smart City Strategy, focusing on reducing greenhouse gases, expanding renewable energy, and improving energy efficiency to achieve its vision of becoming an eco-friendly city (Manville et al., 2014). It is undeniable that the inception of smart cities arose from the recognition of the urgent need to create better environment in the face of the global survival crisis posed by climate change and resource depletion, transcending geographical boundaries encompassing European and Asian nations. Therefore, this study hypothesized the impact of environment factors on the quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H6a: The impact of environment factor on quality of life in Generation X and Baby Boomers.

H6b: The impact of environment factor on quality of life in Millennials and Generation Z.

3.6. Effects of Institutional Development Factor on Quality of Life

This study proposed analyzing the role of institutional changes in enhancing the overall smart city experience. Advocating for a smart city is inherently complex, as it

necessitates navigating diverse laws and systems related to both cities and technology, in addition to engaging with various stakeholders. Nam and Pardo (2012) posited that at the core of a smart city is the coordination and enhancement of public and private institutions. Utilizing IT infrastructure this fosters tolerance for class, racial, and cultural differences among city residents and thereby expanding the usability of urban spaces (Nam & Pardo, 2012). Despite the central government's vigorous promotion of smart cities through innovative policies, conflicts with local governments' self-governing laws or regulations are not uncommon (Myeong et al., 2018). In the establishment of a smart city, the imperative and expeditious revision of related laws, the enhancement of regulations, and the pace of technological advancement must be acknowledged as significantly crucial factors in achieving the stability of the city. Therefore, this study hypothesized the impact of institutional development factor on quality of life in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H7a: The impact of institutional development on quality of life in Generation X and Baby Boomers.

H7b: The impact of institutional development on quality of life in Millennials and Generation Z.

3.7. Effects of Quality of Life on City Evaluation, Life Satisfaction, & Expected Growth of the City

Winkowska et al. (2019) emphasized that the transformations of metropolises into smart cities is a pivotal factor in enhancing the living conditions of their inhabitants. Mohanty et al. (2016) addressed the concept of a smart city as an innovative urban center that leverages information and communication technologies, among other tools, to enhance both the quality of life and the efficiency of urban operations and services, ultimately fostering competitiveness. Alizadeh and Sharifi (2023) investigated that smart cities are anticipated to tackle global challenges and enhance the quality of life. Edge et al. (2020) highlighted the smart city's objective of enhancing the efficiency and effectiveness of municipal services, fostering urban development, and elevating the quality of life though investments in information and communication technologies. Pira (2021) asserted that the smart city component known as smart living is intricately linked to the quality of life experienced by citizens. A study conducted by Novianti et al. (2020) explored the role of quality of life as a predictor of both life satisfaction and happiness. Therefore, this study hypothesized the impact of the quality of life on city evaluation, life satisfaction, and expected growth of the city in both groups of Generation X with Baby Boomers and Millennials with Generation Z.

H8a: The impact of quality of life on city evaluation in Generation X and Baby Boomers.

H8b: The impact of quality of life on city evaluation in Millennials and Generation Z.

H9a: The impact of quality of life on life satisfaction in Generation X and Baby Boomers.

H9b: The impact of quality of life on life satisfaction in Millennials and Generation Z.

H10a: The impact of quality of life on expected growth of the city in Generation X and Baby Boomers.

H10b: The impact of quality of life on expected growth of the city in Millennials and Generation Z.

4. Methodology

This study conducted an online survey with the assistance of a well-known survey agency. The survey started with warm up questions by asking awareness, major questions related to proposed variables, and demographic questions. Proposed variables in this study include smart city experience, role of government, technology development, economic, social, and environmental value, institutional improvement, and quality of life. Further, this study also proposed effects of quality of life on smart city evaluation, satisfaction, and expected growth of the city. The study will apply 5-point Likert scales for major proposed items (1 – strongly disagree, 5 – strongly agree). This study collected 400 responses including 180 responses from generations older than MZ including Generation X and Baby Boomers and 220 responses from millennials and Generation Z. This study applied a study by Nicolas (2015) who defined the Millennials are individuals born between 1980 and 2000, while there slightly different definitions on generations based on previous studies. This study categorizes generations into those older than Millennials including Generation X and Baby Boomers. Millennials and Generation Z are grouped together due to their similar characteristics in context of the Internet environment and their shared perceptions of advanced technologies. Generation Z and Millennials spend more time in virtual worlds such as social network system, online games, etc. (Eyada, 2023). Dimock (2019) explored that generation cohorts serve as a valuable tool for researchers, enabling the analysis of changes in views over time and provide a means to understand how various formative experiences, including technological, economic, and social shifts interact with the life-cycle.

The survey employed stratified sampling, taking into accounts factors such as residential area, age, gender, etc. With a focus on citizens' awareness of smart cities, the survey was distributed across major provinces in South Korea. Hence, the population for this study comprises

residents of major provinces in South Korea. Considering the application process of smart city development across regions, this study allocated a larger proportion of the sample size to leading cities including Seoul, Incheon, Busan, and Sejong. In terms of g gender distribution, an equal representation of 50% female and 50% male participants completed the survey in both groups of generations. Regarding educational backgrounds in the Generation X and Baby Boomers, 23.9% held a high school degree, 10.6% attended college, 49.4% obtained a bachelor's degree, and 14.4% held a graduate degree. In the Millennials and Generation Z group, 20.5% held a high school degree, 10.9% attended college, 61.4% held a bachelor's degree, and 7.3% held a graduate degree.

This study utilized factor analysis, ANOVA, and multiple regression analysis to examine the proposed hypotheses. This study assessed reliability by examining Cronbach alpha. The Cronbach's alpha results for Generation X and Baby Boomers are summarized as follows: 0.838 for smart city experience, 0.853 for role of government, 0.842 for technology development, 0.837 for economic factor, 0.833 for social factor, 0.832 for environment factor, 0.817 for institutional improvement, and 0.830 for quality of life. Further, the Cronbach's alpha results for Millennials and Generation Z are summarized as follows: 0.705 for smart city experience, 0.761 for role of government, 0.808 for technology development, 0.800 for economic factor, 0.772 for social factor, 0.776 for environment factor, 0.804 for institutional improvement, and 0.779 for quality of life.

Table 1: Demographics of Respondents

		Older than MZ # (%)	MZ # (%)
Gender	Male	90 (50.0)	110 (50.0)
	Female	90 (50.0)	110 (50.0)
Age	20-24 years old	-	34 (15.5)
	25-29 years old	-	52 (23.6)
	30-34 years old	-	52 (23.6)
	35-39 years old	-	50 (22.7)
	40-44 years old	-	32 (14.5)
	45-49 years old	44 (24.4)	-
	50-54 years old	46 (25.6)	-
	55-59 years old	32 (17.8)	-
	60-64 years old	32 (17.8)	-
	Elder than 65 years old	26 (14.4)	-
Education	Middle School	3 (1.7)	0 (0.0)
	High School	43 (23.9)	45 (20.5)
	In College	19 (10.6)	24 (10.9)
	Bachelor's Degree	89 (49.4)	135 (61.4)
	Graduate Degree	26 (14.4)	16 (7.3)
Annual Income	Below 10,000,000 KRW	49 (27.2)	57 (25.9)
	Between 10,000,000-20,000,000 KRW	9 (5.0)	5 (2.3)
	Between 20,000,000-30,000,000 KRW	23 (12.8)	36 (16.4)
	Between 30,000,000-40,000,000 KRW	24 (13.3)	58 (26.4)
	Between 40,000,000 -50,000,000 KRW	20 (11.1)	31 (14.1)
	Between 50,000,000-60,000,000 KRW	13 (7.2)	15 (6.8)
	Between 60,000,000-70,000,000 KRW	15 (8.3)	5
	More than 70,000,000 KRW	27 (15.0)	0.9
	Other	68	12.8
	TOTAL	180	220

5. Data Analysis

In this study, factor analysis was employed and scale items were extracted by applying factor analysis. Principal component analysis served as the method for extraction, with maximum iterations for convergence, and factors' eigenvalue was greater than 1 are extracted. VARIMAX with Kaiser Normalization was applied as the rotation method with maximum iterations for convergence. Table 2 presented a summarized component matrix, including factor loadings. In this study, the questionnaire items applied as follows: i) for smart city experience, questionnaire items applied in this study include how technology is utilized by smart cities to deliver public services, focusing on the citizens' firsthand experiences, How smart city can enhance their development through active citizen participation and feedback; ii) for the role of government, questionnaire items applied in this study include how the success of smart city depends on the responsibility of the government and the leading role of the government; iii) for technology development, questionnaire items applied in this study include how application of advanced technologies such as Internet of things, big data, information communication technology help enhance the development of smart city; iv) for economic value, questionnaire items applied in this study include how smart city impacts on the development of the local economy

driven by the active participation of businesses and the city's commitment to innovation; v) for social value, questionnaire items applied in this study include how smart city contributes the formation of better community through local urban regeneration; vi) for environment factor, questionnaire items applied in this study include how smart city contribute to creating better environment; and vii) for institutional development, questionnaire items applied in this study include how smart city contributes the improvement of the overall system of society, such as deregulation related to cities and industries.

Table 2: Component Matrix for Smart City Experience, Role of Government, Technology Development, Economic, Social, and Environmental value, and Institutional improvement (Case of Older Generations)

	Component						
	1	2	3	4	5	6	7
SE4	.86						
SE3	.83						
SE1	.82						
SE2	.77						
RO2		.85					
RO3		.83					
RO4		.82					
RO1		.82					
TD3			.85				
TD2			.83				
TD4			.83				
TD1			.78				
EV2				.84			
EV1				.83			
EV3				.82			
EV4				.79			
SV3					.83		
SV1					.82		
SV2					.81		
SV4					.80		
EV3						.84	
EV4						.82	
EV1						.81	
EV2						.78	
II3							.84
II2							.83
II4							.82
II1							.72

* SE: Smart City Experience; RG: Role of Government;
TD: Technology Development; EV: Economic Value;
SV: Social Value; EV: Environmental value,
II: Institutional Improvement

Table 3: Component Matrix for Smart City Experience, Role of Government, Technology Development, Economic, Social, and Environmental value, and Institutional improvement (Case of MZ)

	Component						
	1	2	3	4	5	6	7
SE2	.76						
SE1	.75						
SE4	.73						
SE3	.68						
RO1		.83					
RO4		.82					
RO2		.73					
RO3		.68					
TD1			.82				
TD3			.82				
TD2			.78				
TD4			.76				
EV1				.81			
EV2				.80			
EV4				.78			
EV3				.77			
SV2					.80		
SV1					.79		
SV4					.78		
SV3					.71		
EV3						.82	
EV2						.80	
EV4						.76	
EV1						.72	
II2							.84
II3							.80
II1							.77
II4							.76

* SE: Smart City Experience; RG: Role of Government;
TD: Technology Development; EV: Economic Value;
SV: Social Value; EV: Environmental value,
II: Institutional Improvement

In this study, multiple regression analysis was employed to test hypotheses incorporating factor scores utilized as variables in the analysis. In this study, the dependent variables included smart city experience, role of government, technology development, economic, social, and environmental value, and institutional improvement. The dependent variable assessed was the quality of life. The results of the ANOVA revealed that the overall model is significant with an F value of 44.725 at the 0.01% significance level and an R-square of 0.745 for generations older than MZ including Generation X and Boomers. For Millennials and Generation Z, the model was also significant with an F value of 37.924 at the 0.01% significance level and an R-square of 0.667. Table 4 illustrated that in this study, the effects of smart city experience, technology development, environmental value, and institutional development on quality of life were found to be significant at a 1% significance level and the effect of the social value factor on quality of life showed significance at a 5% level for generations older than MZ including Generation X and Baby Boomers. This study also revealed that the effects of smart city experience on quality of life were statistically significant at a 1% significance level and the impact of technology development and the social value factor on quality of life showed significance at a 5% level for Millennials and Generation Z. Therefore, H1a, 1b, 3a, 3b,

5a, 5b, 6a, and 7a were accepted. Among the significant factors, the study found that the effect size was highest for the smart city experience factor on quality of life followed by technology development, environment impact, institutional development, and social value for generations older than MZ including Generation X and Baby Boomers. Among the significant factors, the study found that the effect size was highest for the smart city experience factor on quality of life followed by technology development and social value for Millennials and Generation Z.

Table 4: Effects of Proposed Factors on Quality of Life

Independent Variables => Dependent variable	Standardized Coefficient (t-value/sig)	Standardized Coefficient (t-value/sig)
	Older than MZ	MZ
Smart City Experience => Quality of Life	.503 (7.559***)	.507 (8.201***)
Role of Government => Quality of Life	.081 (1.221)	.097 (1.642)
Technology Development => Quality of Life	.252 (2.708***)	.154 (1.988**)
Economic Value => Quality of Life	.010 (.129)	.056(.763)
Social Value => Quality of Life	.181 (2.266**)	.112 (1.927**)
Environmental Impact => Quality of Life	.234 (3.016***)	.022 (.318)
Institutional Improvement => Quality of Life	.232 (3.065***)	.085 (1.368)

***significant at 0.01%, ** significant at 0.05%

This study also conducted regression analyses to test the effect of quality of life on city evaluation, satisfaction, and expected growth of the city. For the effect of quality of life on city evaluation, the results of the ANOVA revealed that the overall model is significant with an *F* value of 76.343 at the 0.01% significance level and an *R*-square of 0.300, for the effect of quality of life on satisfaction, the results of the ANOVA revealed that the model was significant with an *F* value of 22.960 at the 0.01% significance level and an *R*-square of 0.114, and for the effect of quality of life on expected growth of the city, the results of the ANOVA revealed that the model was significant with an *F* value of 87.256 at the 0.01% significance level and an *R*-square of 0.329 for generations older than MZ including Generation X and Baby Boomers. For the effect of quality of life on city evaluation, the results of the ANOVA revealed that the model was significant with an *F* value of 61.314 at the 0.01% significance level and an *R*-square of 0.220, for the effect of quality of life on satisfaction, the results of the ANOVA revealed that the model was significant with an *F* value of 88.722 at the 0.01% significance level and an *R*-square of 0.289, and for the effect of quality of life on expected growth of the city, the results of the ANOVA revealed that the model was significant with an *F* value of 84.987 at the 0.01% significance level and an *R*-square of 0.280 for Millennials and Generation Z. Therefore, H8a, 8b, 9a, 9b, 10a, and 10b were accepted in both cases of generations older than MZ including Generation X and Baby Boomers and millennials and Generation Z (Table 5).

Table 5: Effects on City Evaluation, Satisfaction, & Expected Growth of the City

Independent Variables => Dependent variable	Standardized Coefficient (t-value/sig)	Standardized Coefficient (t-value/sig)
	Older than MZ	MZ
Quality of Life => City Evaluation	. 548 (8.737***)	. 469 (7.830***)
Quality of Life => Satisfaction	.338 (4.792***)	.538 (9.419***)
Quality of Life => Expected Growth of the City	.574 (9.341***)	.530 (9.219***)

***significant at 0.01%, ** significant at 0.05%

6. Conclusion

6.1. Findings

This study investigates how citizens' perceptions of smart cities distribution strategy and their impact on quality of life. By categorizing into two groups – Generation X with Baby Boomers and Millennials with Generation Z – the research examined varying perceptions regarding the implementation of smart city technologies across different age groups. This study incorporated perceived smart city experience, government's role, technology development, economic, social considerations, environmental factors, and institutional development as independent variables. The dependent variable under examining was the quality of life. The study revealed significant impacts on the quality of life for Generation X and Baby Boomers in areas such as perceived smart city experience, technology development, social factor, environment factor, and institutional development. Similarly, for Millennials with Generation Z, the study identified significant in the impact of perceived smart city experience, technology development, and social factor on quality of life. Hence, the results of both groups – Generation X with Baby Boomers and Millennials with Generation Z – consistently demonstrated significant impacts of smart city experience, technology development, and social factor on quality of life. Nevertheless, while the impacts of environmental factors and institutional development were found to be significant for Generation X with Baby Boomers, these effects were not observed in the case of Millennials with Generation Z. Taking into account the effect size, the influence of perceived smart city experience on quality of life is the most pronounced for Generation X with Baby Boomers, followed by the impacts of technology development, environment factor,

institutional improvement, and social factor. Considering the effect size, the influence of perceived smart city experience on the quality of life is most prominent for Millennials with Generation Z, followed by the impacts of technology development and social factors. Consequently, for both generation groups, the effect size was higher for perceived smart city experience on quality of life, followed by the impact of technology development on quality of life. Furthermore, the results also indicated a significant influence on quality of life on the evaluation of the smart city, city satisfaction, and the expected growth of the smart city.

6.2. Managerial and Policy Implications

The results offer managerial and policy implications. Citizens, irrespective of their generation, recognize the significance of smart cities distribution value based on their experiences with public services. This is evident in the value placed on real-time traffic information services through applications, which is anticipated to contribute to an enhanced quality of life. Citizens also associate the concept of a smart city with the advancements in technology during the era of 4th industrial revolution. This includes technologies such as Internet of Things, virtual reality, augmented reality, artificial intelligence, information communication technologies. These innovations are perceived to contribute significantly to the success of the smart city and its distribution strategy. Both generational groups also share the perception that the smart city's impact on revitalizing social interactions and fostering better communities through local urban regeneration that will lead to an improved quality of life. However, Generation X with Baby Boomers perceive that the smart city and its distribution strategy contribute to creating better environment and addresses environmental problems caused by climate change. Consequently, they believe it will enhance quality of life. In contrast, the impact of environment on quality of life was not found to be significant in the case of Millennials with Generation Z. Moreover, Generation X with Baby Boomers perceive that the smart city will contribute to the enhancement of the overall societal system, including deregulation related to cities and industries, as well as the establishment of new laws aimed at improving quality of life. In contrast, the impact of institutional development on quality of life was not found to be significant in the case of Millennials with Generation Z. Hence, firms, governments and other stakeholders associated with the smart city should carefully consider the specific aspects that require attention for the smart city's development. Conversely, citizens in both generational groups perceive that the impact of government's role and its importance in related to the smart city on quality of life does not demonstrate significance. Hence, the government plays a pivotal role in spearheading the development of the smart city and its distribution strategy contributing to an enhanced quality of life for citizens in a society. Notably, citizens in both generational groups perceive that the impact of economic values, such as the development and revitalization of the local economy, on quality of life does not demonstrate significance. This study suggests that one of the reasons for the perceived lack of significance might be the citizens' lack of awareness regarding the smart city's impacts on economic value. Therefore, there is a need for the development of better policies aimed at fostering awareness of the economic benefits when a smart city is established in a society. The role of businesses also needs to be addressed through the creation of enhanced opportunities related to the smart city, contributing to an improvement in quality of life and citizen satisfaction.

6.3. Limitations and Future Research

This study has limitations and suggests avenues for future research. Subsequent studies could strengthen robustness by expanding the sample size. Future research may explore citizens' perceptions in other smart cities around the world. Moreover, a comprehensive understanding could be attained by comparing the perceptions of each generation cohort.

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