The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/1750-6166.htm

Does citizens' participation moderate the relationship between the built environment and their quality of life in Indian smart cities?

Ajitabh Dash
Xavier School of Commerce, XIM University, Bhubaneswar, India

Received 22 June 2023
Revised 27 July 2023
Accepted 7 August 2023

Abstract

Purpose – This study aims to investigate the influence of the built environment of smart cities on citizens' quality of life in a developing country like India, focusing on the role of citizens' participation as a moderator.

Design/methodology/approach – This study used partial least square-based structural equation modelling to test the hypotheses using data from 542 sample respondents residing in five smart cities of India.

Findings – The findings of this study confirmed that the smart city-built environment dimensions of smart governance, smart economy, smart mobility, smart environment and smart living positively relate to citizen quality of life, except for the smart people dimension. This study also confirmed that citizen participation moderates the relationship between all six dimensions of the smart city-built environment and citizens' quality of life.

Originality/value – This study investigates the relationship between the built environment of smart cities and residents' quality of life and the moderating effect of citizen participation on this relationship.

Keywords Built environment, Smart city, Citizen participation, Quality of life

Paper type Research paper

1. Introduction

Over half of the global population currently resides in urban areas, with projections indicating a 1.5-fold increase to 6 billion by 2045 (World Bank, 2019). Leaders and politicians must plan for population growth by providing infrastructure to improve the quality of life, attract people and investments and promote growth and development (Maurya and Biswas, 2021). The smart city concept has emerged as a solution for urban development in recent decades, aimed at ensuring a more liveable future (Lee *et al.*, 2020; Dash, 2022). In January 2009, during a round table discussion, the Chief executive officer of the International Business Machines Corporation, Samuel J. Palmisano, proposed the concept of "smart cities" as part of the larger "smart earth" initiative (Prakash, 2019; Vadgama *et al.*, 2015). According to the World Bank, smart city development seeks to improve the relationship between citizens and governments by using existing technologies. The central focus of smart city initiatives is to prioritise ICT while aiming to draw individuals and investments to these urban areas. This, in turn, establishes a positive cycle of development and expansion, as noted by Bhattacharya *et al.* (2015). Today, India's urban population exceeds 35%, indicating that the country is keeping pace with urbanisation (Awasthi, 2021). India's urbanisation is expected to increase, resulting in nearly 40% of the population being urbanised by 2030 (Mohanty, 2022). In response to the swift urbanisation, the Indian government

The author would like to thank the editor in chief, Associate editors and the anonymous reviewers for their valuable suggestions and inputs.

Transforming Government: People, Process and Policy
Vol. 17 No. 4, 2023
pp. 673-687

1750-6166
DOI 10.1108/TG-06-2023-0084

initiated the Smart Cities Mission (SCM) in June 2015 to address the associated challenges (Government of India, 2015). Under this mission, the Indian government aims to convert 100 cities into smart cities as part of its initiative (Praharaj and Han, 2019a). This multifaceted progression of smart city development has garnered the interest of scholars and researchers, prompting them to investigate these advancements. Over the past decade, several studies conducted in developed economies have suggested that while smart cities have been found to contribute to the economic development of nations, they do not necessarily improve the quality of life of their residents (Benevolo *et al.*, 2016; Wolniak and Jonek-Kowalska, 2021; Zhu *et al.*, 2022). Although developing nations like India have already embraced the idea of the Smart City, its effect on its residents' quality of life has yet to be fully explored. According to Cohen (2014), the foundation of a smart city's built environment is made up of six factors:

(1) smart economic development;
(2) smart environment;
(3) smart living;
(4) smart mobility;
(5) smart people; and
(6) smart governance.

Hence, the present study aims to investigate the impact of the smart city dimensions, as identified by Cohen (2014), on the quality of life of citizens residing in the top five smart cities across three distinct Indian states. These cities are Bhopal and Indore, situated in the state of Madhya Pradesh; Varanasi and Agra, located in the state of Uttar Pradesh; and Surat, situated in the state of Gujarat, have been spotted as the top performing smart cities in India in a recent report by Hindustan Times (2022).

Since smart city services are primarily aimed at citizens, participation can significantly influence the advancement of smart cities in developed and developing countries. Since the literature on smart city development is silent on this aspect, this study explores the mediating effect of citizen participation on the relationship between a smart city-built environment and residents' quality of life in a smart city. The research questions (*RQs*) for this study are as follows:

RQ1. What is the impact of the dimensions of the built environment in smart cities on the quality of life of citizens?

RQ2. Does citizen participation in the development of smart cities moderate the relationship between the built environment of smart cities and citizens' quality of life?

Findings of this study will aid policymakers and smart city planners in adopting a citizen-centric approach and developing more effective and practical plans for smart city development.

The remainder of the paper is structured as follows: Section 2 provides a literature review on smart cities, their built environment, citizen engagement and residents' well-being. Section 3 outlines the methodology used in this study, while Section 4 presents the analysis results. Section 5 presents the study's findings, while Section 6 discusses the theoretical and practical implications. Section 7 presents the limitations and scope for future research.

2. Conceptual background and hypotheses development

2.1 Smart city and it's built environment

The term "smart city" refers to integrating human-technology-urban elements to optimise resource utilisation. This is achieved by using information and communication technology

(ICT) to enhance efficiency, facilitate communication with citizens and improve governance quality (Praharaj and Han, 2019b). The concept of a "smart city" encompasses various urban aspects such as urban planning, economic development, environment, technology interventions and social involvement (Chan *et al.*, 2019). Cohen (2014) defines a smart city as one that monitors and integrates critical infrastructures, including roads, bridges, tunnels, rails and significant buildings. This is done to optimise resources, plan preventive maintenance activities, monitor security aspects and maximise services to citizens. Hall (2000) defines the smart city as a relationship between technological, human and institutional components. Understanding the social and physical infrastructure of a city's built environment is crucial for implementing smart cities, despite the central role of ICT (Rodríguez Bolívar, 2021). Giffinger and Gudrun (2010) identified six key dimensions of a smart city's built environment:

(1) smart economy;

(2) smart environment;

(3) smart mobility;

(4) smart people;

(5) smart governance; and

(6) smart living.

The smart economy includes economic growth, productivity and domestic and international market integration (Giffinger and Gudrun, 2010; Lytras *et al.*, 2021). Rodríguez Bolívar (2021) argues that creating a conducive environment for economic growth through the use of ICT services is crucial for the success of a smart city. The study focuses on using ICT integration to develop new products and services, which can create growth opportunities for the economy's manufacturing and service sectors (Neirotti *et al.*, 2014). Kogan and Lee (2014) defined a smart environment as environmentally protective initiatives using green technology and minimising waste. Smart cities aim to improve sustainability by using technology for environmental protection and natural resource management (Neirotti *et al.*, 2014). Smart mobility in smart cities pertains to modern, sustainable transportation systems using ICT (Rodríguez Bolívar, 2021). Neirotti *et al.* (2014) proposed innovative methods for enhancing mobility in smart cities, such as using eco-friendly fuels in vehicles, implementing multi-modal public transport systems and using ICT infrastructures for traffic monitoring to optimise time and energy usage. Kogan and Lee (2014) characterised intelligent individuals based on their educational attainment, social network quality and receptiveness to external stimuli. Praharaj and Han (2019b) advocated for citizen participation in the governance and management of smart cities. Smart cities aim to enhance their citizens' education and engagement through ICT applications and services (Albino *et al.*, 2015). The smart city concept can benefit significantly from the advancement of e-skills and digital education (Abusaada and Elshater, 2021). Smart city governance involves using ICT-enabled platforms to efficiently deliver public utility services, promote transparency and encourage citizen participation in decision-making (Abusaada and Elshater, 2021; Razmjoo *et al.*, 2021). It facilitates public access to government services. Smart living encompasses various dimensions, such as health, safety, housing and tourism (Chan *et al.*, 2019). Smart cities use telecommunications and information technology to facilitate the equitable distribution of public uses among all residents (Vázquez *et al.*, 2018). Prior research has identified sustainable building technologies as crucial components of smart living, which enhance energy efficiency, security, accessibility and usability (Chan *et al.*, 2019).

Smart cities seek to tackle social challenges related to citizen growth, inclusion and quality of life by engaging stakeholders such as government, people, enterprises and associations across six dimensions (Mohanty, 2022). Smart cities use ICT in an interactive built environment to provide innovative services to citizens, thereby improving their quality of life (Vázquez *et al.*, 2018). Vinod Kumar and Dahiya (2017) define a smart city as achieving inclusive economic development and decent quality of life through investments in six dimensions. Neirotti *et al.* (2014) and Vázquez *et al.* (2018) found that the success of smart services depends on their ability to enhance citizens' quality of life (Macke *et al.*, 2018). This study aims to analyse the impact of six dimensions of a smart city-built environment on the quality of life of its residents.

2.2 Smart city built environment and citizen's quality of life

According to Fahey *et al.* (2003), quality of life refers to the overall well-being of individuals, which encompasses their living conditions, control over resources and emotional responses across various life domains. Quality of life is becoming increasingly important in urban management and administration, especially for smart cities (Macke *et al.*, 2018; Lam and Yang, 2019). Metropolitan regions compete for cross-border investment and skilled labour, leading policymakers to prioritise the quality of life (Macke *et al.*, 2018). Razmjoo *et al.* (2021) concluded that a smart city is characterised by the contribution of its human and social capital and communication infrastructure to economic growth and improved quality of life. Rodríguez Bolívar (2021) and Vázquez *et al.* (2018) found that the built environment of smart cities in European countries significantly impacts residents' quality of life. According to Rodríguez Bolívar (2021), investigating the relationship between the built environment of smart cities and residents' quality of life is crucial for urban planning. This is because residents' experiences are closely connected to the concept of smart cities (Chen and Chan, 2022). Accordingly, this study proposed following hypotheses to be investigated in a developing nation like India:

H1a. The smart environment dimension of a smart city's built environment significantly influences the resident's quality of life.

H1b. The smart economic development dimension of a smart city's built environment significantly influences the resident's quality of life.

H1c. The smart governance dimension of a smart city's built environment significantly influences the resident's quality of life.

H1d. The smart living dimension of a smart city's built environment significantly influences the resident's quality of life.

H1e. The smart mobility dimension of a smart city's built environment significantly influences the resident's quality of life.

H1f. The smart people dimension of a smart city's built environment significantly influences the resident's quality of life.

2.3 Citizen's participation and it's moderating effect

Citizen participation (CP) refers to the involvement of individuals and communities in decision-making processes and activities that impact their lives (Hu *et al.*, 2016). Citizen participation is essential for inclusive and democratic governance through information sharing, input seeking, collaboration and co-creation (Huang *et al.*, 2022). As citizen participation empowers individuals and aligns technological advancements with people's requirements, it is crucial in shaping the dimensions of smart city built environment (Xu and Zhu, 2021). According to Simonofski *et al.* (2021), the involvement of citizens in the decision-making process regarding the development of smart cities can lead to the generation of superior solutions (Chen and Chan, 2023). The integration of citizens in the planning and development of smart cities can serve as a means to reconcile the dichotomy between technological progress and human-centred development, thereby improving citizens' quality of life. In light of the above discussion, the following hypothesis were proposed:

H2a. Citizen participation in smart city development moderates the relationship between the smart living dimension of a smart city-built environment and citizens' quality of life.

H2b. Citizen participation in smart city development moderates the relationship between the smart people dimension of a smart city-built environment and citizens' quality of life.

H2c. Citizen participation in smart city development moderates the relationship between the smart governance dimension of a smart city-built environment and citizens' quality of life.

H2d. Citizen participation in smart city development moderates the relationship between the smart mobility dimension of a smart city-built environment and citizens' quality of life.

H2e. Citizen participation in smart city development moderates the relationship between the smart environment dimension of a smart city-built environment and citizens' quality of life.

H2f. Citizen participation in smart city development moderates the relationship between the smart economic development dimension of a smart city-built environment and citizens' quality of life.

The conceptual model presented below as Figure 1, summarizes the hypotheses proposed for this study.

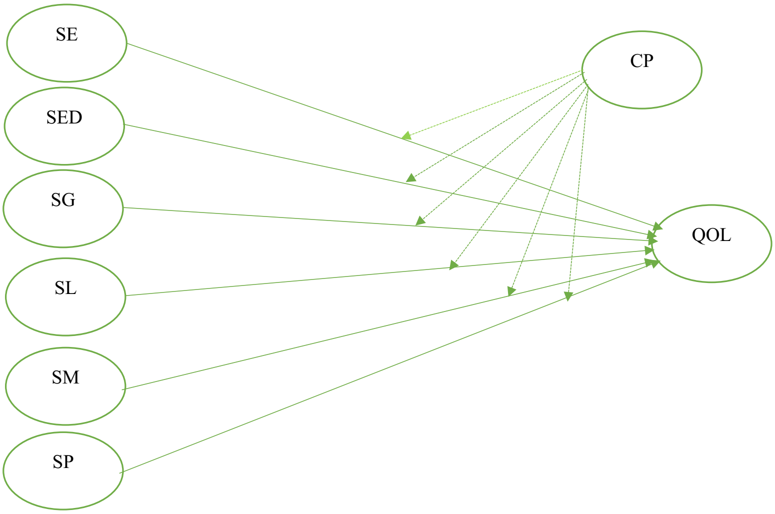
3. Research method

3.1 The context

India's diverse urban landscape, government initiatives such as the Smart Cities Mission, and rapid urbanisation make it a suitable location for this study. A study conducted in India's multifaceted cultural landscape and complex socio-economic factors can enrich the knowledge on smart city progression and shape the future of smart cities globally. Thus, the Indian citizens' opinion on the built environment of smart cities can significantly contribute to the worldwide community engaged in implementing smart city initiatives.

3.2 Data collection

This research used a quantitative methodology with a cross-sectional, face-to-face survey approach. The unit of the analysis for this study was the resident of smart cities who had recently used any of the smart city services. The selection of residents as the unit of analysis is based on the premise that they are the principal recipients of the smart city programme. Convenience sampling technique was used to survey 873 residents from the top five smart cities across three Indian states between January and April 2023. To overcome the historical



Source: Author's own creation

Figure 1.
Conceptual model

trend of low research engagement and reluctance to participate in telephone or internet surveys in India (Sahi *et al.*, 2022), we conducted a pen and paper based face-to-face survey. Since the study was voluntary in nature, the participants had the option to opt out of the study without any negative consequences, as their involvement was voluntary. Unique codes were assigned to each participant to ensure anonymity and confidentiality. The researcher anonymised participant data to protect confidentiality when presenting the results. The smart cities are Bhopal and Indore in Madhya Pradesh, Varanasi and Agra in Uttar Pradesh and Surat in Gujarat. Of the 873 citizens contacted, 565 agreed to participate in this study. Out of the 565 responses, 23 were excluded from the study due to having more than 50% of their data missing. The remaining 542 responses were used for further investigation. A sample-to-variable ratio of 10:1 is recommended by Hair *et al.* (2010). The study used 29 variables and a sample size of 542, which was deemed adequate (Hair *et al.*, 2010).

The study's socio-demographic profile analysis showed that 36% of the sample respondents were aged 30–45, 35% were less than 30 years old and only 29% were over 45. The gender distribution of the sample respondents showed that 53.7% were male and 46.3% were female. The data indicates that 41.5% of the sample respondents earn an annual income between 5 and 10 lakhs, while 30.5% earn less than five lakhs and 28% earn more than 10 lakhs Indian national rupees. The respondents were also asked about their frequency of smart-city service usage. The results revealed that most respondents (61.9%) reported using smart-city services less than three times per week, indicating light to moderate usage. However, a significant minority of respondents (39.1%) reported heavy usage, using smart-city services four or more times per week.

The study used variables derived from prior research, which were subsequently modified to suit the present inquiry. Four items modified from Hu *et al.* (2016) were used to measure citizen participation in smart city development. Three items modified from Lytras *et al.* (2021) were used to measure the resident's quality of life in smart cities. Twenty-two items assessing six dimensions of the built environment in smart cities were adapted from

Chan *et al.*'s (2019) research. The items were scaled using a seven-point Likert scale, ranging from 1 to 5, where one represents "strongly disagree" and seven represents "strongly agree".

3.3 Data analysis

The content validation for the study was done using Yusoff (2019)'s method. In order to assess the variables under scrutiny in this research, the authors formed a panel of experts comprising six members, consisting of three academicians and three professionals who specialise in smart cities and technology. These experts were provided with a content validation form for evaluation. The content validation process necessitates the establishment of clear definitions for both constructs and variables. The feedback prompted us to modify the questionnaire's specific phrases and sentence structures. In addition, a pre-test was conducted on the questionnaire with a sample of 37 participants for research purposes. Consistent with the research objective, the respondents evaluated the suitability and organisation of the survey instrument. The suggested modifications made to the questionnaire order were a result of pre-testing.

Partially least squares-based Structural Equation Modeling (PLS-SEM) was used due to its statistical reliability in examining the association between constructs (Hair *et al.*, 2019). The SmartPLS 4 software was used in the study. The study commences with a review of the measurement model, followed by a structural model assessment, as outlined by Hair *et al.* (2019). The measurement model assesses construct validity, whereas the structural model tests hypotheses.

4. Results

4.1 Assessment of common method variance

Since the data for this study was obtained through a self-administered questionnaire, it is imperative to assess common method variance (CMV) before conducting multivariate data analysis. Through Harman's single-factor test, this study has excluded the possibility of CMV, as a single factor accounted for only 37.63% of the observed variation. The study used Kock's (2015) method to evaluate CMV through a complete collinearity assessment. The study confirmed that CMV is not a concern as all items considered had VIF values less than 3.3 (Kock, 2015).

4.2 Assessment of the measurement model

The CFA was used to evaluate the reliability and validity of the measuring scale in the measurement model. Item reliability was assessed by analysing variable factor loadings with their respective latent factors. Hair *et al.* (2019) stipulated that a factor-loading score of 0.7 or higher is necessary. Twenty-seven items out of 29 met the criterion in the study. The study's reliability was established by computing the composite reliability (CR) value of all latent factors, which were found to be greater than 0.7 (Nunnally and Bernstein, 1994). After conducting a reliability analysis, the measurement model's convergent validity was evaluated via the average variance extracted (AVE) score. The AVE should be greater than 0.5, as Fornell and Larcker (1981) recommended. The AVE score of each latent factor is greater than 0.5. Table 1 presents the factor loading, CR and AVE scores for the latent factors examined in the study.

The discriminant validity of the study was evaluated using the Fornell–Larcker criterion (1981). To evaluate discriminant validity, the square root of AVE for each latent construct should exceed the correlations of all other latent constructs. The data presented in Table 2 shows that the discriminant validity was confirmed, as the square roots of AVE values for all constructs exceeded the correlations of other latent constructs. This aligns with Fornell and Larcker's (1981) criteria. The Heterotrait–Monotrait (HTMT) ratio calculation was also

Constructs	Item code	Outer loadings	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Citizen participation (CP)	CP-1	0.724	0.867	0.977	0.862	0.681
	CP-2	0.738				
	CP-4	0.988				
Quality of life (QOL)	QOL-1	0.813	0.798	0.797	0.881	0.712
	QOL-2	0.873				
	QOL-3	0.845				
Smart environment (SE)	SE-1	0.88	0.889	0.935	0.921	0.746
	SE-2	0.835				
	SE-3	0.889				
	SE-4	0.85				
Smart economic development (SED)	SED-1	0.836	0.869	0.871	0.905	0.656
	SED-2	0.829				
	SED-3	0.79				
	SED-4	0.801				
	SED-5	0.793				
Smart governance (SG)	SG-1	0.873	0.846	0.939	0.891	0.672
	SG-2	0.787				
	SG-3	0.747				
	SG-4	0.866				
Smart living (SL)	SL-1	0.868	0.773	0.828	0.896	0.812
	SL-3	0.932				
Smart mobility (SM)	SM-1	0.836	0.84	0.84	0.904	0.758
	SM-2	0.893				
	SM-3	0.882				
Smart people (SP)	SP-1	0.918	0.817	0.973	0.881	0.716
	SP-2	0.945				
	SP-3	0.742				

Source: Author's own calculation

Table 1. Results of measurement model assessment

Constructs	CP	QOL	SE	SED	SG	SL	SM	SP
CP	0.825							
QOL	0.042	0.844						
SE	0.571	0.073	0.863					
SED	0.055	0.546	0.006	0.81				
SG	0.479	0.088	0.626	0.046	0.82			
SL	0.642	0.051	0.578	0.122	0.493	0.901		
SM	0.113	0.465	0.144	0.559	0.087	0.198	0.871	
SP	0.073	0.098	0.029	0.168	0.01	0.141	0.104	0.846

Source: Author's own calculation

Table 2. Fornell–Larcker criterion

computed in this study to evaluate discriminant validity. The study found that the HTMT values were below the recommended threshold of 0.85 (Henseler *et al.*, 2015), supporting the discriminant validity (Table 3).

4.3 Assessment of the structural model

Hair *et al.* (2019) advised evaluating multi-collinearity and confirming the value of variance inflation factor (VIF) of less than three in the structural model before performing the path analysis. The investigation did not encounter multi-collinearity, as the VIF value was below the predetermined threshold. Assessing model fit using the standardised root mean residual (SRMR) criterion is crucial before examining the structural model, as suggested by Hu and Bentler (1998). The study exhibited a satisfactory model fit with an SRMR value of 0.064, below the threshold limit of 0.08 proposed by Hu and Bentler (1998). The proposed hypotheses were evaluated using a bootstrap-corrected accelerated method with 5,000 subsamples. The process included calculating path coefficients, *t*-statistics and associated *p*-values. Table 4 and Figure 2 presents the evaluation of the structural model.

The results of a path analysis are displayed in Table 4, wherein the investigation of direct and moderated relationships among variables is the primary focus. We adhered to the criteria proposed by Hair *et al.* (2019) to ensure the statistical significance of the beta values. Hair *et al.* (2019) found that the *p*-value for the path coefficients should be less than 0.05, and the 95% confidence interval should not contain zero. The study proposed hypotheses *H1a* to *H1f* to examine the direct relation between the various aspects of the built environment in smart cities and the overall quality of life experienced by citizens. The findings indicate that smart economic development ($b = 0.441$, $t = 6.181$, $p < 0.001$) exerts the most substantial and favourable impact on citizens' quality of life. The study also found a significant and positive relationship between the quality of life of citizens living in smart cities of India and various factors such as smart mobility ($b = 0.218$, $t = 4.001$, $p < 0.001$), smart environment

Constructs	CP	QOL	SE	SED	SG	SL	SM	SP
CP								
QOL	0.078							
SE	0.751	0.088						
SED	0.061	0.654	0.054					
SG	0.577	0.09	0.696	0.074				
SL	0.799	0.063	0.698	0.143	0.607			
SM	0.134	0.564	0.154	0.656	0.094	0.244		
SP	0.099	0.113	0.073	0.18	0.078	0.186	0.105	

Source: Author's own calculation

Table 3. Heterotrait–Monotrait ratio

Hypotheses	Path	Path coefficient	*t*-statistics	*p*-values	BCI-LL	BCI-UL
H1a	SE → QOL	0.127	3.057	0.003	0.192	0.232
H1b	SED → QOL	0.441	6.181	0.001	0.343	0.579
H1c	SG → QOL	0.071	2.789	0.009	0.108	0.193
H1d	SL → QOL	0.123	2.44	0.024	0.137	0.297
H1e	SM → QOL	0.218	4.001	0.001	0.086	0.323
H1f	SP → QOL	0.012	0.009	0.236	−0.077	0.116
H2a	CP × SL → QOL	0.027	2.372	0.003	0.107	0.131
H2b	CP × SP → QOL	0.115	3.417	0.001	0.04	0.276
H2c	CP × SG → QOL	0.008	2.111	0.006	0.076	0.147
H2d	CP × SM → QOL	0.025	3.232	0.008	0.176	0.315
H2e	CP × SE → QOL	0.172	4.661	0.001	0.19	0.278
H2f	CP × SED → QOL	0.037	3.342	0.006	0.089	0.166

Notes: BCI-LL = biased corrected confidence interval-lower limit; BCI-UL = biased corrected confidence interval-upper limit
Source: Author's calculation

Table 4. Results of path analysis

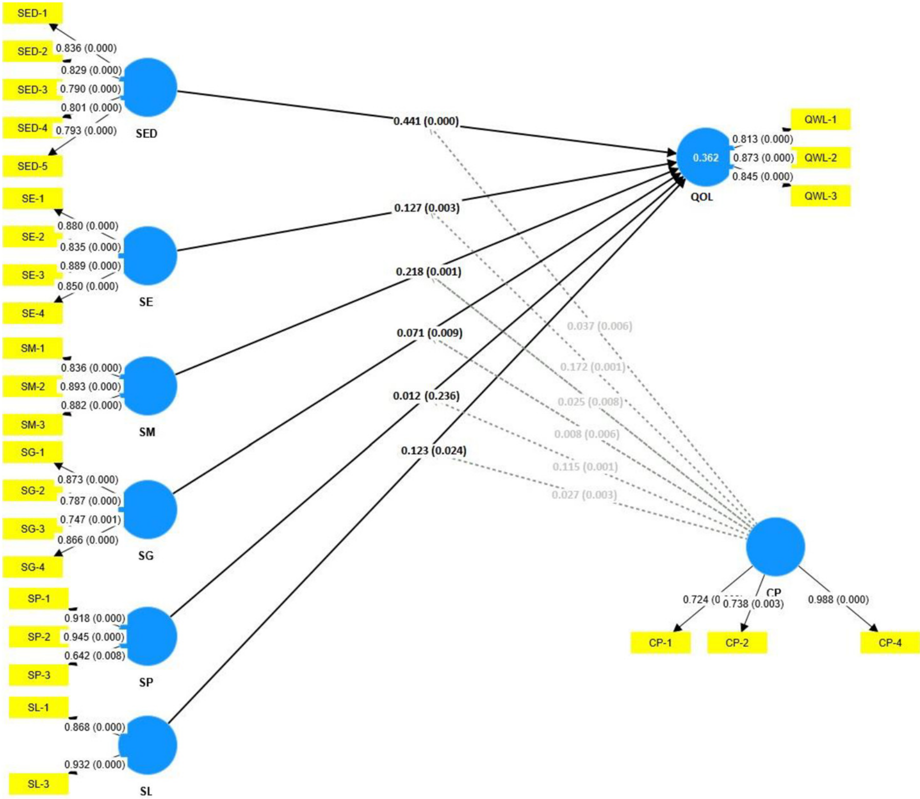


Figure 2.
The structural model

Source: Output of SmartPLS4

(b = 0.127, t = 3.057, p = 0.003), smart living (b = 0.123, t = 2.44, p = 0.025) and smart governance (b = 0.441, t = 6.181, p = 0.009). The results also indicate that followed by smart economic development, smart mobility has the most substantial effect on citizens' quality of life, followed by smart environment, smart living and the smart governance. These findings suggest that the implementation of smart city initiatives can have a positive impact on the quality of life of the citizens residing in the smart cities in India. Simultaneously, the dimension of intelligent individuals within the constructed environment of smart cities in India (b = 0.012, t = 0.009, p = 0.236) does not exhibit a statistically significant impact on the standard of living of its inhabitants. The study's proposed hypotheses, *H1a* through *H1e*, were accepted, while *H1f* was not accepted. Finally, Table 4 also depicts the interaction effect of a smart city-built environment and citizen's participation in the quality of life of citizens living in the smart cities of India. The findings related to the interaction variables posited in hypotheses *H2a* to *H2f* exhibit a statistically significant and favourable effect on citizens' quality of life in smart cities in India. Additionally, incorporating interaction effects into the model yielded a rise in the R^2 value from 0.362 to 0.413. According to Hair *et al.* (2019), the significance of the R^2 change cannot be disregarded, even if it is moderate. Accordingly, the study's proposed hypotheses, *H2a* through *H2f*, were accepted.

5. Discussion

Smart cities are linked to urban planning's goal of enhancing citizens' quality of life, prioritising their benefit as the primary focus. Incorporating citizens' opinions on built environment features can enhance their quality of life. This study aimed to examine how six components of a smart city (smart economic development, smart people, smart governance, smart mobility, smart environment and smart living) affect citizens' quality of life in smart cities. The results of this study found that smart economic development is the primary factor affecting the citizen's quality of life, with a path coefficient value of 0.441. The study suggests that digital infrastructure, innovation ecosystems, entrepreneurship support and business-friendly policies are essential for smart city development in developing economies like India. The relationship between smart governance, smart mobility, smart living and smart environment are also statistically significant: with a path coefficient value of 0.071, 0.218, 0.123 and 0.127, respectively. Chen and Chan (2022) and Macke *et al.* (2018) reported similar results in their study conducted in developed economies in the Western Hemisphere. Thus, while building a smart city, it is crucial to consider these characteristics, which can enhance residents' quality of life. However, contrary to past studies, the results of this study failed to prove the association between the smart people dimension of a smart city and the citizen's quality of life. Bhattacharya *et al.* (2015) found that inadequate citizen participation mechanisms, limited access to information and decision-making processes, disengagement of residents and initiatives not addressing community-specific needs and aspirations can lead to this outcome. Therefore, while examining the relationship between the interaction effect of smart people and citizen participation on the citizen's quality of life, the authors found a significant positive relationship. This indicates that more citizen participation in smart city development can help the relationship between the smart people dimension of smart cities and citizens' quality of life.

Furthermore, the present study's current findings suggest that citizen participation is a significant moderator in the correlation between a smart city's built environment and the quality of life experienced by its citizens. This corroborates the findings reported in the study of De Guimarães *et al.* (2020), Chen and Chan (2022) and Lytras *et al.* (2021) . Hence, incorporating citizen participation can confer decision-making authority for developing smart cities to the citizens, ensuring that urban progress aligns with the citizens. In addition, the development of smart cities is a collaborative effort among various stakeholders, including citizens, businesses, institutions and government entities, as noted by Chen and Chan (2022). Thus, promoting citizen participation can effectively enhance citizens' quality of life, thereby contributing to the holistic advancement of smart cities.

6. Implications

This study holds significance for the smart city field's theoretical and managerial aspects. This study adds to the existing literature on smart cities, specifically in the context of emerging economies such as India. This study aims to investigate how citizen participation moderates the relationship between a smart city's built environment and its citizens' quality of life, addressing a gap in the literature. This study confirms the correlation between the built environment characteristics of a smart city and citizen participation as a moderator. This finding extends previous research by indicating that citizen participation can enhance the well-being of inhabitants in smart cities. This study used PLS-SEM, a widely accepted research method in social science, to validate a conceptual framework based on prior research findings. This study pioneers accurate estimation of smart city dimensions and their effect on citizens' quality of life, moderated by citizen participation.

This study also offers managerial insights for policymakers and organisations to improve the smart city-built environment and enhance residents' quality of life. The results indicate that emphasising smart economic development and smart mobility is crucial when developing smart cities. Developing digital infrastructure, innovation ecosystems, entrepreneurship support and business-friendly policies can boost the smart economic development aspect of smart city-built environment development in developing economies like India. Similarly, smart mobility is crucial to a smart city's built environment. A multimodal public transport system and the integration of ICT can promote smart mobility for its residents. Apart from this, enhancing citizen participation in planning and decision-making can contribute to the success of smart city missions in developing nations such as India.

7. Conclusion

This study emphasizes the goal of smart cities to enhance citizens' quality of life by considering their input on built environment features. Smart economic development was found to be the primary factor influencing citizens' quality of life, with crucial elements such as digital infrastructure, innovation ecosystems, entrepreneurship support and business-friendly policies. Similarly, smart governance, smart mobility, smart living and smart environment significantly influence the citizens' quality of life, consistent with prior research in developed economies. Surprisingly, the study did not establish a direct relation between the "smart people" dimension and citizens' quality of life. However, when citizen participation was considered as a moderator, a significant and positive relationship emerged, highlighting the importance of involving the public in smart city development. Thus, by empowering citizens with decision-making authority, urban progress can align better with their needs and aspirations, fostering a holistic advancement of smart cities. To achieve this, collaboration among citizens, businesses, institutions and governments is essential for building smart cities that truly enhance residents' quality of life.

8. Limitations and scope for future research

This study has both theoretical and practical implications, but it has limitations. This study is limited to the perspectives of 542 citizens residing in five smart cities in India. Future researchers may conduct a cross-national study incorporating diverse perspectives to enhance the present study's reliability and validity. A larger sample size in future investigations may enhance the generalizability of the present study's findings. This study solely focuses on citizen participation as a moderator. Further research could explore the influence of social capital, social awareness and other moderating factors on the relation between smart city built environment and quality of life. A longitudinal study is needed to establish the significance of all components over time, as this study's conclusions are based on a cross-sectional inquiry.

References

Abusaada, H. and Elshater, A. (2021), "Competitiveness, distinctiveness and singularity in urban design: a systematic review and framework for smart cities", *Sustainable Cities and Society*, Vol. 68 No. 1, p. 102782.

Albino, V., Berardi, U. and Dangelico, R. (2015), "Smart cities: definitions, dimensions, performance, and initiatives", *Journal of Urban Technology*, Vol. 22 No. 1, pp. 3-21.

Awasthi, S. (2021), "Hyper'-Urbanisation and migration: a security threat", *Cities*, Vol. 108 No. 1, p. 102965.

Benevolo, C., Dameri, R. and D'Auria, B. (2016), "Smart mobility in smart city", in Torre, T., Braccini, A. and Spinelli, R. (Eds), *Empowering Organizations. Lecture Notes in Information Systems and Organisation*, Springer, Cham, pp. 13-28.

Bhattacharya, S., Rathi, S., Patro, S. and Tepa, N. (2015), "Reconceptualising smart cities: a reference", available at: https://smartnet.niua.org/sites/default/files/resources/6b9cb2a72ca68b2c2ab3e98ba4c5e649.pdf (accessed 12 February, 2021).

Chan, C., Peters, M. and Pikkemaat, B. (2019), "Investigating visitors' perception of smart city dimensions for city branding in Hong Kong", *International Journal of Tourism Cities*, Vol. 5 No. 4, pp. 620-637.

Chen, Z. and Chan, I. (2022), "Smart cities and quality of life: a quantitative analysis of citizens' support for smart city development", *Information Technology and People*, Vol. 36 No. 1.

Chen, Z. and Chan, I.C.C. (2023), "Smart cities and quality of life: a quantitative analysis of citizens' support for smart city development", *Information Technology and People*, Vol. 36 No. 1, pp. 263-285.

Cohen, B. (2014), "The smartest cities in the world 2015: methodology", available at: www.fastcompany.com/3038818/the-smartest-cities-in-the-world-2015-methodology (accessed 12 January, 2021).

Dash, A. (2022), "Modeling the moderating effect of technology anxiety on the relationship between smart city–built environment and the quality of life of citizens", *Journal of Facilities Management*, doi: 10.1108/JFM-06-2022-0061.

De Guimarães, J.C.F., Severo, E.A., Júnior, L.A.F., Da Costa, W.P.L.B. and Salmoria, F.T. (2020), "Governance and quality of life in smart cities: towards sustainable development goals", *Journal of Cleaner Production*, Vol. 253, p. 119926.

Fahey, T., Nolan, B. and Whelan, C. (2003), "Monitoring quality of life in Europe", in Fahey, T. (Ed.), *European Foundation for the Improvement of Living and Working Conditions*, Office for Official Publications of the European Communities, UK, pp. 1-10.

Fornell, C. and Larcker, D. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Giffinger, R. and Gudrun, H. (2010), "Smart cities ranking: an effective instrument for the positioning of the cities?", *ACE: Architecture, City and Environment*, Vol. 4 No. 12, pp. 7-26.

Government of India (2015), "About smart cities", available at: https://smartcities.gov.in/about-the-mission (accessed 15 December 2022).

Hair, J., Black, W., Babin, B., Anderson, R. and Tatham, R. (2010), *Multivariate Data Analysis*, 7th ed., Prentice Hall, NJ.

Hair, J., Risher, J., Sarstedt, M. and Ringle, C. (2019), "When to use and how to report the results of PLS-SEM", *European Business Review*, Vol. 31 No. 1, pp. 2-24.

Hall, P. (2000), "Creative cities and economic development", *Urban Studies*, Vol. 37 No. 4, pp. 639-649.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modeling", *Journal of the Academy of Marketing Science*, Vol. 43 No. 1, pp. 115-135.

Hindustan Times (2022), "2022 Smart city ranking: Prayagraj jumps four places", available at: www.hindustantimes.com/cities/others/2022-smart-city-rankings-prayagraj-jumps-four-places-101648049807292.html (accessed 21 March 2022).

Hu, L. and Bentler, P. (1998), "Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification", *Psychological Methods*, Vol. 3 No. 4, p. 424.

Hu, M., Zhang, M. and Luo, N. (2016), "Understanding participation on video sharing communities: the role of self-construal and community interactivity", *Computers in Human Behavior*, Vol. 62, pp. 105-115.

Huang, G., Li, D., Yu, L., Yang, D. and Wang, Y. (2022), "Factors affecting sustainability of smart city services in China: from the perspective of citizens' sense of gain", *Habitat International*, Vol. 128, p. 102645.

Kock, N. (2015), "Common method bias in PLS-SEM: a full collinearity assessment approach", *International Journal of e-Collaboration (IJEC)*, Vol. 11 No. 4, pp. 1-10.

Kogan, N. and Lee, K. (2014), "Exploratory research on the success factors and challenges of smart city projects", *Asia Pacific Journal of Information Systems*, Vol. 24 No. 2, pp. 141-189.

Lam, P. and Yang, W. (2019), "Application of technology to car parking facilities in Asian smart cities", *Journal of Facilities Management*, Vol. 17 No. 2, pp. 142-156.

Lee, P., Hunter, W.C. and Chung, N. (2020), "Smart tourism city: developments and transformations", *Sustainability*, Vol. 12 No. 10, pp. 1-15.

Lytras, M., Visvizi, A., Chopdar, P., Sarirete, A. and Alhalabi, W. (2021), "Information management in smart cities: turning end users' views into multi-item scale development, validation, and policy-making recommendations", *International Journal of Information Management*, Vol. 56 No. 1, p. 102146.

Macke, J., Casagrande, R., Sarate, J. and Silva, K. (2018), "Smart city and quality of life: citizens' perception in a Brazilian case study", *Journal of Cleaner Production*, Vol. 182 No. 3, pp. 717-726.

Maurya, K. and Biswas, A. (2021), "Performance assessment of governance in Indian smart city development", *Smart and Sustainable Built Environment*, Vol. 10 No. 4, pp. 653-680.

Mohanty, P. (2022), "Planning for urbanisation and economic growth: addressing urban and regional governance issues in India", in Kumar, A. and Meshram, D. (Eds), *Future of Cities*, Routledge India, Delhi, pp. 1-20.

Neirotti, P., De Marco, A., Cagliano, A., Mangano, G. and Scorrano, F. (2014), "Current trends in smart city initiatives: some stylised facts", *Cities*, Vol. 38 No. 1, pp. 25-36.

Nunnally, J. and Bernstein, I. (1994), *Psychometric Theory*, 3rd ed., McGraw-Hill, New York, NY.

Praharaj, S. and Han, H. (2019a), "Building a typology of the 100 smart cities in India", *Smart and Sustainable Built Environment*, Vol. 8 No. 5, pp. 400-414.

Praharaj, S. and Han, H. (2019b), "Cutting through the clutter of smart city definitions: a reading into the smart city perceptions in India", *City, Culture and Society*, Vol. 18 No. 3, p. 100289.

Prakash, A. (2019), "Smart cities mission in India: some definitions and considerations", *Smart and Sustainable Built Environment*, Vol. 8 No. 4, pp. 322-337.

Razmjoo, A., Østergaard, P., Denai, M., Nezhad, M. and Mirjalili, S. (2021), "Effective policies to overcome barriers in the development of smart cities", *Energy Research and Social Science*, Vol. 79 No. 1, p. 102175.

Rodríguez Bolívar, M. (2021), "Analyzing the influence of the smart dimensions on the citizens' quality of life in the European smart cities' context", in Estevez, E., Pardo, T. and Scholl, H. (Eds), *Smart Cities and Smart Governance*, Springer, Spain, pp. 239-256.

Sahi, G., Devi, R., Gupta, M. and Cheng, T. (2022), "Assessing co-creation based competitive advantage through consumers' need for differentiation", *Journal of Retailing and Consumer Services*, Vol. 66 No. 1, p. 102911, doi: 10.1016/j.jretconser.2022.102911.

Simonofski, A., Vallé, T., Serral, E. and Wautelet, Y. (2021), "Investigating context factors in citizen participation strategies: a comparative analysis of Swedish and Belgian smart cities", *International Journal of Information Management*, Vol. 56, p. 102011.

Vadgama, C., Khutwad, A., Damle, M. and Patil, S. (2015), "Smart funding options for developing smart cities: a proposal for India", *Indian Journal of Science and Technology*, Vol. 8 No. 1, pp. 1-12.

Vázquez, J., Lanero, A., Gutiérrez, P. and Sahelice, C. (2018), "The contribution of smart cities to quality of life from the view of citizens", in Leitão, J., Alves, H., Krueger, N. and Park, J. (Eds), *Entrepreneurial, Innovative and Sustainable Ecosystems. Applying Quality of Life Research*, Springer, Spain, pp. 55-66.

Vinod Kumar, T. and Dahiya, B. (2017), "Smart economy in smart cities", in Vinod Kumar, T. (Ed.), *Smart Economy in Smart Cities. Advances in 21st Century Human Settlements*, Springer, Singapore, pp. 3-76.

Wolniak, R. and Jonek-Kowalska, I. (2021), "The level of the quality of life in the city and its monitoring", *Innovation: The European Journal of Social Science Research*, Vol. 34 No. 3, pp. 376-398.

World Bank (2019), "Urban development", available at: www.worldbank.org/en/topic/urbandevelopment/overview#1 (accessed 12 December 2021).

Xu, H. and Zhu, W. (2021), "Evaluating the impact mechanism of citizen participation on citizen satisfaction in a smart city", *Environment and Planning B: Urban Analytics and City Science*, Vol. 48 No. 8, pp. 2466-2480.

Yusoff, M. (2019), "ABC of content validation and content validity index calculation", *Education in Medicine Journal*, Vol. 11 No. 2, pp. 49-54.

Zhu, H., Shen, L. and Ren, Y. (2022), "How can smart city shape a happier life? The mechanism for developing a happiness driven smart city", *Sustainable Cities and Society*, Vol. 80 No. 1, p. 103791.

Further reading

Gamil, Y. and Abd Rahman, I. (2021), "Studying the relationship between causes and effects of poor communication in construction projects using PLS-SEM approach", *Journal of Facilities Management*, Vol. 21 No. 1.

Grossnickle, J. (2001), *The Handbook of Online Marketing Research: knowing Your Customer Using the Net*, McGraw-Hill, New York, NY.

Corresponding author
Ajitabh Dash can be contacted at: ajitabh001@gmail.com