

Stakeholders and smart city creation

Kelaniyage Shihan Dilruk Fernando,
Małgorzata Wiścicka – Fernando and Sandra Misiak-Kwit
Institute of Management, University of Szczecin, Szczecin, Poland

International
Journal of
Organizational
Analysis

1431

Abstract

Purpose – This pilot study aimed to examine the factor structure of the Stakeholders' Engagement in the Smart City Development Process (SESCDP) and validate its reliability. The objective was to develop a robust tool for future applications, including cross-validation and generalization to broader contexts, such as emerging markets.

Design/methodology/approach – In 2021, a survey was conducted in Szczecin, Poland, using CATI (computer-assisted telephone interviewing) and CAWI (computer-assisted web interviewing) methods. A random sample of 225 citizens and 120 companies provided primary data via a structured questionnaire. Quantitative analysis employed Cronbach's alpha, confirmatory factor analysis (CFA), Pearson correlation and descriptive statistics using R (packages "lavaan" and "Hmisc") and Microsoft Excel.

Findings – The SESCDP scale demonstrated high reliability, with Cronbach's alpha confirming internal consistency across three items: public institutions, local businesses and citizens' engagement in smart city development. CFA supported a unidimensional structure and validated the scale's reliability and generalizability. Consistent fit indices across samples underscored the scale's utility in measuring stakeholders' engagement.

Research limitations/implications – Limitations include the small sample size and focus on one city. Future research should expand to larger populations and diverse contexts to enhance cross-validation and explore stakeholder perspectives further.

Practical implications – The validated SESCDP scale can guide stakeholder engagement practices in Smart City initiatives, with potential for application in emerging markets and varying socio-economic contexts.

Originality/value – This study confirms the SESCDP scale's reliability and offers a practical tool for evaluating stakeholder roles in Smart City development globally.

Keywords Engagement, Smart city, Smart city development process, Stakeholders, Citizens, Companies

Paper type Research paper

Received 27 December 2024
Revised 5 February 2025
Accepted 2 April 2025

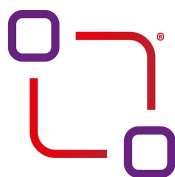
© Kelaniyage Shihan Dilruk Fernando, Małgorzata Wiścicka – Fernando and Sandra Misiak-Kwit. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licences/by/4.0/legalcode>

JEL classification – M31, O30, R11

The project is co-financed by the Minister of Science under the "Regional Excellence Initiative".



Ministry of Science and Higher Education
Republic of Poland



Regionalna
Inicjatywa
Doskonałości

Conflicts of interest: The authors declared no conflict of interest.



International Journal of
Organizational Analysis
Vol. 34 No. 4, 2026
pp. 1431-1452
Emerald Publishing Limited
1934-8835

DOI 10.1108/UOA-12-2024-5109

1. Introduction

With the rise of the smart city and the development of the concept itself, a holistic approach is increasingly emphasized (Caragliu *et al.*, 2011). Such a broad view requires taking into account not only the technology used or the efficiency of the city's operation (Mora *et al.*, 2017) but also the satisfaction of the needs of all stakeholders. The process of satisfying needs requires not only their identification but often also the engagement of all parties in the smart city development process. Therefore, it is fundamental to understand the perspectives of stakeholders (Kummitha and Crutzen, 2017) and focus on adopting a more inclusive approach, particularly in emerging markets (Michelotto and Joia, 2023).

The engagement of stakeholders requires the co-creation of a smart city together with the private sector, civil society and government (Wiścicka-Fernando, 2024). The literature indicates that by abandoning the typically classic profit-maximizing approach and implementing new strategies that are also geared toward environmental and social development, companies contribute to the co-creation of sustainable smart cities (Garri, 2022). From this point of view, the concept of social entrepreneurship is particularly important (Gupta *et al.*, 2020; Rivera-Santos *et al.*, 2015). Citizens, through their engagement, can also co-create their cities and make them smarter and more sustainable (Khanna and Khanra, 2023). Smart city governance, with a special focus on the relationship between smart city initiatives and governance (for example tourism governance) is also highly discussed in the literature (Ivars-Baidal *et al.*, 2023). According to Meijer and Bolívar (2016), smart city governance integrates collaborative governance, technology and human capital. Therefore, the development of a smart city should focus rather on that approach than on technology. It is also worth emphasizing that education, which is inclusive of all stakeholders, is crucial to the development of smart and sustainable cities (Hassan, 2020; Roslan *et al.*, 2022).

For successful smart city creation, an integrated strategy is needed, which includes collaboration, knowledge-sharing, innovativeness, sustainability and participation (Angelidou, 2015; Bibri and Krogstie, 2017a; Fernandez-Anez *et al.*, 2018; Ivars-Baidal *et al.*, 2023; Kramers *et al.*, 2014; Mora *et al.*, 2019). The development of a smart city is a long-term process, where synergies, challenges and opportunities should be taken into consideration (Marchesani and Masciarelli, 2024; Schachtner and Baumann, 2024). This process is a continuous set of interrelated and interdependent activities.

Stakeholder engagement is a critical component in the development of smart cities, as it facilitates collaboration among various entities, including government agencies, private sector organizations and the community (Bibri and Krogstie, 2017b). Recent literature emphasizes the necessity of involving diverse stakeholders to ensure that smart city initiatives align with the needs and expectations of the populace, thereby enhancing the overall effectiveness and sustainability of these projects. Especially when it comes to emerging markets where city management is more challenging and engagement requires a solid framework (Anand and Navío-Marco, 2018). In conclusion, the literature on stakeholder engagement in smart city development highlights its multifaceted nature, emphasizing the importance of collaboration, inclusivity, education and responsiveness to community needs (Hörisch *et al.*, 2014). As cities continue to evolve into smart environments, the integration of diverse stakeholder perspectives will be vital for achieving sustainable and effective urban governance. The development, also in the area of social entrepreneurship, is dependent on the role of a supportive institutional environment (Salimath and Cullen, 2010). This approach will facilitate the advancement of emerging markets and contribute to the attainment of Sustainable Development Goals (van Zanten and

van Tulder, 2021). Moreover, it is not only important whether stakeholders are involved, but also whether this involvement is recognized by other parties. It is this subjective assessment of stakeholder involvement in smart city development that is analyzed in this paper.

The existing literature indicates a lack of empirical validation of scales that assess stakeholder engagement in the smart city development process. In this paper, the authors attempt to fill this research gap by validating the scale in specific urban settings. The use of this scale provides an opportunity to further apply it to different cultural and socio-economic contexts in emerging markets. To the authors' knowledge, in the literature, there has been insufficient validation of a scale that assesses stakeholder engagement in smart city development in emerging markets (Anand and Navío-Marco, 2018; Ray and Miller, 2017). As a pilot study, the primary objective was to examine the factor structure of the Stakeholders' Engagement in the Smart City Development Process (SESCDP) scale. The intent was to validate the factor model, allowing for its application in future analyses, either through cross-validation or generalization to broader contexts, so that it could be used in other markets, including emerging markets.

The paper is structured as follows. In the "Literature Review" section, theoretical constructs regarding the smart city and stakeholders' engagement are presented. The "Materials and Methods" section is devoted to research objectives, research questions, hypotheses and conceptual model. The "Results" section is divided into four subsections, in which Descriptive Analysis, Internal consistency of the SESCO scale, Factor structure of SESCO and Correlation Analysis are described. In the "Discussion" section, special focus is placed on cross-validation metrics, and the generalization of the created model is highlighted. Next, the authors identified "Implications of the study," followed by "Conclusions" and "Limitations and Future Research Suggestions."

2. Literature review

The concept of the smart city has been a topic of interest for over a century, with a growing number of people engaged with it. Initially, the focus was on urban planning and improved governance (Shelton *et al.*, 2015). As time has marched on, new technological challenges have emerged, including the Internet of Things (IoT), big data and artificial intelligence (AI). These have begun to dominate the discussion of smart cities (Hämäläinen, 2020; Thakker *et al.*, 2020; Zanella *et al.*, 2014). Nevertheless, this is not the only appropriate direction for the development of smart cities (Trivellato, 2017). It is imperative to consider not only technological advancement and managerial efficiency but also to address the social and cultural urban challenges that arise (Allam and Newman, 2018). It has been demonstrated that there is a requirement to redefine how cities are governed. This should entail a shift in focus away from the neoclassical approach to the management of public institutions and toward a greater emphasis on transparency and accountability (Gamayanto and Nurhindarto, 2020; Kitchin, 2016; Lalicic and Önder, 2018). An approach that incorporates economic, cultural and social aspects can ensure the effectiveness of implemented measures while meeting the needs of different stakeholders in a more optimal manner.

The literature indicates that the optimal operational model for a smart city should be situated at the intersection of social and technological dimensions (Anand and Navío-Marco, 2018). This is confirmed by the Sustainable Development Goals (SDGs) set by the United Nations (Tarek, 2023). The development of technology and the rise of sustainability are precipitating a transformation in the roles of cities, which are consequently being redefined (Silva *et al.*, 2020). It would appear that the most logical and responsible course of action would be to integrate all of the relevant areas, thereby combining governance, sustainability, technology and socio-economic issues.

Nevertheless, critics have identified a number of potential risks associated with the smart city concept. These include concerns related to urban planning, ethical issues surrounding the utilization of data and privacy, as well as challenges related to disparities in access to education and skills, and the failure to adequately address the needs of smaller communities. Additionally, there are cultural and historical aspects of cities that must be considered (Ivanova and Ganzha, 2017; Shelton *et al.*, 2015; Williamson, 2015).

The indicated disparity in the conceptualization of the smart city concept illustrates the lack of consensus on the definition of a smart city (Biercewicz *et al.*, 2024) and the significance of the involvement of stakeholders.

As urban areas develop into smart cities, it is vital to integrate the views of a variety of stakeholders. It is essential to highlight that collaboration, integration and responsiveness to community needs will result from stakeholder engagement. Adopting this approach will also facilitate the development of emerging markets.

The essential premise for collaboration with stakeholders is their sense of responsibility and engagement. One such area is the perception of residents and their involvement in urban development, which is derived from the quality of life that a smart city offers (Chen and Chan, 2022; Del-Real *et al.*, 2023).

Additionally, the implementation of modern technologies has the potential to foster a closer relationship between residents and the city, thereby enhancing their involvement in public affairs, including smart city projects. It is also important to note that the utilization of public funds requires a greater degree of involvement from residents (Goodman *et al.*, 2020).

The implementation of transparent and clearly defined governance structures, together with a willingness to engage with stakeholders, will be crucial to the successful realization of initiatives such as living labs (Park and Fujii, 2023). The same is true concerning the engagement of residents in the process of achieving sustainable goals (Dash, 2023).

The engagement process should not neglect the significance of social communication, which can be facilitated by the utilization of modern technologies, such as e-communication and e-participation (Legutko-Kobus, 2021; Lim and Yigitcanlar, 2022; Mutiarin and Lawelai, 2023; Neupane *et al.*, 2021).

A second key stakeholder in the city is the private sector, comprising companies. In this context, the specific role of companies is that they are, on the one hand, stakeholders who benefit from smart city solutions. Conversely, they also function as suppliers of products and services pertaining to the development of smart cities. The dual role of companies in this context makes it challenging to clearly define their involvement in the development of the smart city concept.

The most frequently observed form of collaboration between corporate entities and local governments is the public-private partnership (PPP). Such partnerships enable companies to apply their expertise and investment capabilities to the improvement of urban development while meeting public needs (Nederhand and Klijn, 2019). They are linked to the concept of the smart city, in that they facilitate access to technology, accelerate the implementation of innovation and increase efficiency (Almarri, 2022; Lam and Yang, 2020). Nevertheless, it is possible that PPP collaborations may not be the most appropriate model for smart city ventures. The research indicates the necessity for the creation of more flexible institutional frameworks between public and private actors, based on the integration of technological innovations (Cruz and Sarmiento, 2017; Mostafa, 2020; Pianezzi *et al.*, 2023). The implementation of smart city concepts in collaboration with PPP may give rise to challenges pertaining to the transparency of operations and delineation of responsibilities (Calzada, 2020). It should be regarded as a flexible solution based on the implementation of

technological innovations in the delivery of services (Selim and ElGohary, 2020) and the engagement of stakeholders (Jayasena *et al.*, 2022).

A significant aspect of engagement is the establishment of trust, which is a key factor for both residents and businesses alike (Dameri, 2012). The participation of both residents and companies is of vital importance to the creation of a smart city. If the trust placed in leaders and their leadership has a direct impact on the commitment of teams to projects, then, by analogy, the trust of residents and local businesses in the city government and its vision for smart city development is of great consequence (Sontiwanich *et al.*, 2022).

A crucial aspect of the evolution of the smart city concept is the collaboration between various stakeholders, including government institutions, the private sector and local communities. Consequently, the participation of a diverse range of stakeholders enhances the effectiveness and sustainability of the projects in question (Neupane *et al.*, 2021).

The selection of appropriate tools is of paramount importance in engagement research, particularly in the assessment of the involvement of residents, local entrepreneurs and municipal institutions. This is a crucial factor in determining the success and effective implementation of smart city projects (Goodman *et al.*, 2020; Jayasena *et al.*, 2019; Sontiwanich *et al.*, 2022).

The research findings also indicate that the involvement of local companies and private sector partners has an impact on the development of the smart city concept (Cardullo and Kitchin, 2019; Tran Thi Hoang *et al.*, 2019). Nevertheless, it is of the utmost importance to guarantee that the private sector's actions do not impose the smart city concept from above and that citizens are granted the opportunity to play an active role in its development (Capdevila and Zarlenga, 2015). The results of the study on engagement demonstrate that the role of residents is not the sole factor that should be taken into account; the community also plays a significant part in this process (Allahar, 2020).

The published research findings indicate a need to increase stakeholder engagement (Engelbert *et al.*, 2022; Wirsinna *et al.*, 2023). Despite the existence of research examining the phenomenon of resident engagement (Chantry, 2023; Del-Real *et al.*, 2023; Hoogen *et al.*, 2022; Jayasena *et al.*, 2019; Remr, 2023; Senior *et al.*, 2023), as well as research investigating company engagement (Cleveland and Cleveland, 2018; Jun and Kim, 2021; Lende and Ambadkar, 2024; Surminski and Eldridge, 2015), there is currently no research that has yielded validated tools for measuring engagement. Nevertheless, research on engagement does exist (Allahar, 2020; Cardullo and Kitchin, 2019; Jayasena *et al.*, 2019; Sontiwanich *et al.*, 2022). Yet, there is a lack of standardized measurement tools to evaluate the nature and extent of such engagement. Likewise, the role of local companies and private sector partners in the smart city development process has been highlighted (Cardullo and Kitchin, 2019; Cleveland and Cleveland, 2018; Tran Thi Hoang *et al.*, 2019). However, there is limited empirical research on how to efficiently measure the level of contribution and involvement. The preparation of a tool and the validation of comprehensive stakeholder engagement scales would enable its use in different settings and markets, including emerging markets. Furthermore, it would facilitate a more transparent, inclusive, and tailored stakeholder engagement survey.

In conclusion, the key research gap is the lack of empirically validated measurement instruments to assess stakeholder engagement in smart city development. This should encompass the perspectives of city institutions, local businesses, and the local community. Filling this gap would be a valuable contribution to the development of smart city research, providing a tool that can be applied to different types of cities and markets. The research identifies a significant gap in the empirical validation of scales that measure stakeholder engagement in smart city development. Specifically, there is a need for validated tools to

assess the involvement of city institutions, local businesses, and the community. While literature emphasizes the importance of stakeholder engagement for successful smart city initiatives, there is a lack of standardized measurement instruments. Addressing this gap would enhance understanding and improve the inclusivity and effectiveness of smart city projects.

Stakeholder engagement is widely recognized as a critical success factor in smart city development. However, existing literature lacks empirically validated scales to measure stakeholder engagement, particularly concerning city institutions, local businesses, and community participation. While theoretical frameworks highlight the importance of inclusivity and active involvement, the absence of standardized and validated tools limits the ability to assess and improve stakeholder engagement effectively. This gap impedes the ability of researchers and policymakers to measure the impact of stakeholder dynamics on the success of smart city initiatives. Addressing this issue is essential to foster inclusivity, optimize collaboration and enhance the overall effectiveness of smart city projects.

3. Materials and methods

In the year 2021, a preliminary survey was conducted using both CATI (computer-assisted telephone interviewing) and CAWI (computer-assisted web interviewing) methods on a random sample comprising 225 citizens and 120 companies from Szczecin, the regional capital of the West Pomeranian region in Poland. Both samples can be considered as representative in the terms of regional research process (Bazarnik *et al.*, 1992). The study employed a primarily quantitative approach. Confirmatory factor analysis (CFA) was used to examine the factor structure of SESCDP. Cronbach’s alpha was calculated to evaluate the internal consistency of the Stakeholders’ Engagement in the Smart City Development Process (SESCDP) scale, which consisted of three items (Table 1).

Three observed variables in the SESCDP scale are the engagement of the city institutions (c1), local businesses (c2) and local community (c3) in developing a smart city. A graphical representation of the hypothesized model is shown in Figure 1.

The primary objective of the paper was to examine the factor structure of the SESCDP. The intent was to validate the factor model, allowing for its application in future analyses, either through cross-validation or generalization to broader contexts, so that it could be used in other markets, including emerging markets. In the course of the study, the authors formulated two research objectives:

- (1) RO1. The objective is to determine whether the proposed model structure aligns with the observed data from the sample of citizens, assessing the significance and

Table 1. The stakeholders’ engagement in the smart city development process (SESCDP) – description of variables

Variable definition	Latent variable	Observed variables		
	Stakeholders’ engagement in the smart city development process	The engagement of the city institutions in developing smart city	The engagement of local businesses in developing smart city	The engagement of the local community in developing smart city
Symbol	SESCDP	c1	c2	c3

Source(s): Field survey 2021

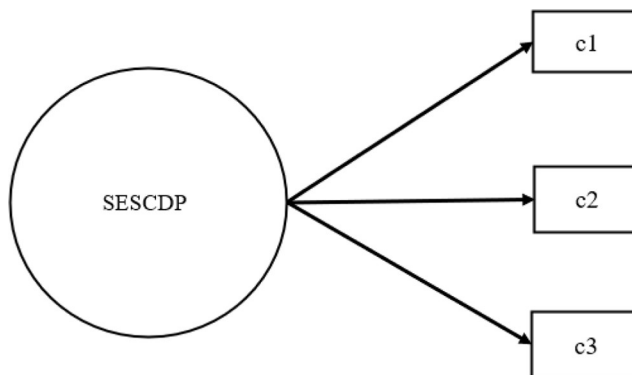


Figure 1. Hypothesized model of the study
Source: Own study

consistency of identified factors within the stakeholders' engagement in the smart city development process.

- (2) RO2. The objective is to determine whether the proposed model structure aligns with the observed data from the sample of companies, assessing the significance and consistency of identified factors within the stakeholders' engagement in the smart city development process.

Next, the authors formulated two research questions:

- RQ1. Does the proposed model structure of the stakeholders' engagement in the smart city development process align with the observed data from the sample of citizens?
- RQ2. Does the proposed model structure of the stakeholders' engagement in the smart city development process align with the observed data from the sample of companies?

The formulated statistical hypotheses are as follows:

- H1. The proposed factor structure of the stakeholders' engagement in the smart city development process adequately fits the data from a sample of citizens.
- H1a. The proposed factor structure of the stakeholders' engagement in the smart city development process does not adequately fit the data from a sample of citizens.
- H2. The proposed factor structure of the stakeholders' engagement in the smart city development process adequately fits the data from a sample of companies.
- H2a. The proposed factor structure of the stakeholders' engagement in the smart city development process does not adequately fit the data from a sample of companies.

Additionally, Pearson correlation analysis was performed to explore the relationships between variables c1, c2 and c3 among the surveyed citizens and companies. Primary data were collected using a structured questionnaire designed to gather ratio-scale data (Stevens, 1946). Responses were recorded on a scale from 0 to 100, where 0 indicated no engagement

IJOA
34,4

in the Smart City Development Process, and 100 represented full engagement. Data analysis was constructed using package “lavaan” (Rosseel et al., 2024) and package “Hmisc” (Harrell and Dupont, 2024) in R (RStudio R version 4.2.2) combined with Microsoft Excel. Moreover, descriptive statistical analysis was conducted by using the Microsoft Excel data analysis tools (Microsoft Support-ToolPak, 2024).

1438

4. Results

4.1 Descriptive analysis

During the course of the study, the respondents were asked to assess the perceived engagement of city institutions (c1), local businesses (c2) and local community (c3). The results of descriptive analysis among citizens are presented in Table 2.

The median assessment of stakeholders’ engagement ranged from 59 for local businesses to 61 for city institutions. Analysis of the data allows the conclusion to be drawn that citizens rate stakeholder engagement at a very similar level.

The results of descriptive analysis regarding stakeholders’ engagement among companies are presented in Table 3.

The companies’ assessment of stakeholder engagement shows a little more disparity. Companies rated the engagement of city institutions (Median = 42.5) at a lower level than other parties (local businesses: Median = 50; local community: Median = 50).

4.2 Internal consistency of the Stakeholders’ Engagement in the Smart City Development Process scale

Cronbach’s alpha was calculated to measure the internal consistency of the SESCDP scale with three items (Table 1: c1, c2 and c3). The sample, consisting of 225 citizens from the Polish city of Szczecin, used to calculate the SESCDP scale, demonstrates excellent consistency with a Cronbach’s alpha of 0.93, indicating a high level of reliability for the three items. Moreover, the sample consisting of 120 companies from the Polish city of Szczecin, used to calculate SESCDP scale also demonstrates excellent consistency with a Cronbach’s alpha of 0.82, indicating that the three items have high reliability.

Table 2. Results of descriptive analysis – citizens (n = 225)

Citizens (n = 225)	Mean	Standard error	Median	Mode	SD	Sample variance
c1	57.77	1.67	61.00	50.00	25.08	629.09
c2	57.56	1.60	59.00	50.00	23.96	574.16
c3	58.21	1.55	60.00	50.00	23.26	541.15

Source(s): Field survey 2021

Table 3. Results of descriptive analysis – companies (n = 120)

Companies (n = 120)	Mean	Standard error	Median	Mode	SD	Sample variance
c1	45.01	2.04	42.50	40.00	22.31	497.94
c2	48.48	1.94	50.00	50.00	21.24	451.24
c3	49.78	2.01	50.00	60.00	22.00	483.91

Source(s): Field survey 2021

4.3 Factor structure of Stakeholders' Engagement in the Smart City Development Process

A CFA was conducted to examine the factor structure of the SESCO with a sample size of 225 citizens from the Polish city of Szczecin and the hypothesized model specified a single factor with three items loading onto this factor (Table 4, Figure 2). To determine whether the model fits, the $H1$ and $H1a$ were formulated. According to the Chi-Square test, the CFA results indicated an inadequate fit of the model to the data [$\chi^2(3) = 555.86, p < 0.005$]. However, the other results indicated an adequate fit of the model to the data including CFI = 1.0, TLI = 1.0, RMSEA = 0.00 and SRMR = 0.00. According to accepted thresholds (CFI and TLI > 0.90, RMSEA < 0.08, SRMR < 0.08), these indices suggest that the model fits the data well. Moreover, the standardized factor loadings for the items ranged from 0.863 to 0.938, and c1, c2 and c3 were statistically significant ($p < 0.005$) (Table 4). Thus, the CFA supported the unidimensional structure of the SESCO, confirming its reliability.

Based on the results of the survey on citizens, the authors created the Hypothesized Reflective Model for the Stakeholders' Engagement in the Smart City Development Process, which is presented in Figure 2.

Moreover, a CFA was conducted to examine the factor structure of the SESCO with a sample size of 120 companies from the Polish city of Szczecin and the hypothesized model specified a single factor with three items loading onto this factor (Table 5, Figure 3). To determine whether the model fits, the $H2$ and $H2a$ were formulated. According to the Chi-Square test, the CFA results indicated an inadequate fit of the model to the data [$\chi^2(3) = 130.55, p < 0.005$]. However, the other results indicated an adequate fit of the model to the data including CFI = 1.0, TLI = 1.0, RMSEA = 0.00, and SRMR = 0.00. According to accepted thresholds (CFI and TLI > 0.90, RMSEA < 0.08, SRMR < 0.08), these indices

Table 4. Standardized factor loadings for the SESCO – citizens ($n = 225$)

Item	Factor loading
Item 1 (c1)	0.863
Item 2 (c2)	0.938
Item 3 (c3)	0.910

Source(s): Field survey 2021

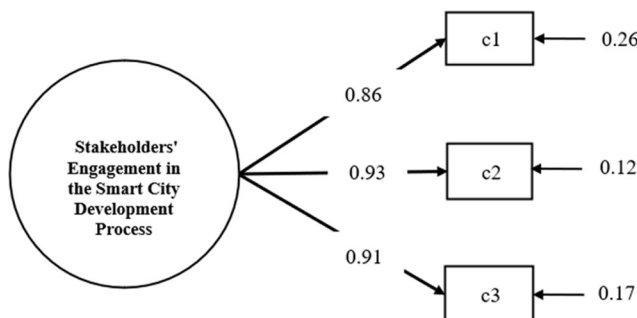


Figure 2. The hypothesized reflective model for the stakeholders' engagement in the smart city development process – citizens ($n = 225$)

Source: Own confirmatory factor analysis (CFA) based on the field data 2021

Table 5. Standardized factor loadings for the SESCDP – companies (*n* = 120)

Item	Factor loading
Item 1 (c1)	0.70
Item 2 (c2)	0.727
Item 3 (c3)	0.899

Source(s): Field survey 2021

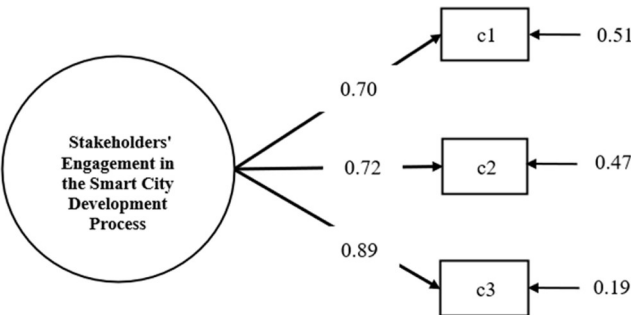


Figure 3. The hypothesized reflective model for the stakeholders' engagement in the smart city development process – companies (*n* = 120)
Source: Own CFA based on the field data 2021

suggest that the model fits the data well. Moreover, the standardized factor loadings for the items ranged from 0.70 to 0.89, and c1, c2 and c3 were statistically significant ($p < 0.005$) (Table 5). Thus, the CFA supported the unidimensional structure of the SESCDP, confirming its reliability.

Based on the results of the survey on companies, the authors created the Hypothesized Reflective Model for the Stakeholders' Engagement in the Smart City Development Process, which is presented in Figure 3.

4.4 Correlation analysis

A Pearson correlation analysis was conducted to examine the relationships between variables c1, c2 and c3 based on a sample size of 225 citizens from the Polish city of Szczecin (Table 6).

The results showed a significant positive correlation between c1 and c2, $r(3) = 0.80$, $p = 0.000$. Similarly, c1 and c3 were significantly correlated, $r(3) = 0.78$, $p = 0.000$. Further, the results showed a significant positive correlation between c2 and c3, $r(3) = 0.85$, $p = 0.000$.

A Pearson correlation analysis was also conducted to examine the relationships between variables c1, c2 and c3 based on a sample size of 120 companies from the Polish city of Szczecin (Table 7).

The results showed a significant positive correlation between c1 and c2, $r(3) = 0.50$, $p = 0.000$. Similarly, c1 and c3 were significantly correlated, $r(3) = 0.62$, $p = 0.000$. Further, the results showed a significant positive correlation between c2 and c3, $r(3) = 0.65$, $p = 0.000$.

Table 6. Correlation matrix – citizens' evaluation ($n = 225$)

	<i>c1</i>	<i>c2</i>	<i>c3</i>
<i>c1</i>	–	0.80* (0.000)	0.78* (0.000)
<i>c2</i>	0.80* (0.000)	–	0.85* (0.000)
<i>c3</i>	0.78* (0.000)	0.85* (0.000)	–

Note(s): $p < 0.05$ are marked with an asterisk (*)**Source(s):** Field survey 2021**Table 7.** Correlation matrix – companies' evaluation ($n = 120$)

	<i>c1</i>	<i>c2</i>	<i>c3</i>
<i>c1</i>	–	0.50* (0.000)	0.62* (0.000)
<i>c2</i>	0.50* (0.000)	–	0.65* (0.000)
<i>c3</i>	0.62* (0.000)	0.65* (0.000)	–

Note(s): $p < 0.05$ are marked with an asterisk (*)**Source(s):** Field survey 2021

5. Discussion

The authors compared the fit indices across the two models (based on the citizens' responses and companies' responses) to assess the cross-validation of the hypothesized single-factor model for the SESCDP (Table 8).

In both models, the Chi-Square statistic indicates a significant difference between the model-implied and observed covariance matrices ($p < 0.005$), suggesting inadequate fit. However, The Chi-Square is extremely sensitive to sample size, often leading to over-rejection of models in large samples or under-rejection in small samples. Thus, depending on alternative fit indices such as CFI, TLI, RMSEA, SRMR and factor loadings is necessary. The Comparative Fit Index CFI value of 1.0 in both models demonstrates an excellent fit of the model in both citizen and company samples, exceeding the threshold of 0.90. This indicates that the model effectively explains the variance-covariance structure relative to a null (independence) model. Likewise, the Tucker-Lewis Index TLI value of 1.0 in both models also reflect a perfect fit. Like the CFI, this suggests the model is parsimonious and

Table 8. Cross-validation metrics

Metric	Threshold for good fit	Model based on the citizens response	Model based on the companies' response
Chi-square (χ^2)	Nonsignificant ($p > 0.05$)	$\chi^2 (3) = 555.86$, $p < 0.005$	$\chi^2 (3) = 130.55$, $p < 0.005$
CFI	> 0.90	1.0	1.0
TLI	> 0.90	1.0	1.0
RMSEA	< 0.08	0.00	0.00
SRMR	< 0.08	0.00	0.00
Factor loadings	≥ 0.70	0.863–0.938	0.70–0.89

Source(s): Field survey 2021

well-suited for both samples. Moreover, Root Mean Square Error of Approximation RMSEA values of 0.00 in both models indicate an excellent fit. Values below 0.08 are considered acceptable, however, the observed values signify the absence of a significant misfit in the data for both samples. Further, Standardized Root Mean Square Residual SRMR values of 0.00 in both models reinforce the excellent fit. Values below 0.08 confirm that the discrepancies between the observed and predicted correlations are negligible. Finally, factor loadings in both models meet or exceed the acceptable threshold of 0.70. For citizens, the range (0.863–0.938) indicates strong item contributions to the latent construct. For companies, while slightly lower (0.70–0.89), the loadings are still adequate and support the model's reliability.

According to the conducted research, citizens rate stakeholder engagement at a very similar level, where the median ranged from 59 to 61. To compare, the assessment of stakeholder engagement made by companies is not that high. The median for local businesses and local communities was 50, and for city institutions 42.5. This shows that companies do not fully recognize or are not necessarily satisfied with stakeholder engagement, particularly city institutions. The lower ratings of stakeholder engagement by companies, particularly city institutions, may stem from a combination of opportunistic engagement practices (Manetti, 2011), inadequate governance structures (Spitzeck and Hansen, 2010), perceiving the institutions of the city, as being slower to respond to social needs (Ardiana, 2021) and a lack of genuine inclusivity in stakeholder interactions (Concannon *et al.*, 2014). This situation highlights the need for city institutions to reassess their engagement strategies to align more closely with the community's expectations and perceptions. This is particularly important in highly socially diverse emerging markets, where empirical frameworks can guide these engagements (Ruess and Lindner, 2023).

Examining the relationship between analyzed variables, research results indicated positive and significant correlations between all of them. For both samples (citizens and companies), their assessment of the engagement of the city institutions is positively correlated with the engagement of local businesses and the engagement of the local community. Similarly, the assessment of the engagement of local businesses is positively correlated with the engagement of the local community in developing a smart city. It is also worth noting that the correlations among citizens' assessment of stakeholder engagement are stronger than those among companies.

The significance of stakeholder engagement in the context of data-driven smart cities is also highlighted in the literature. (Bibri and Krogstie, 2017b) focus on the integration of innovative solutions and propose a framework that enables the identification and categorization of stakeholders. The basis for such division is the contribution to smart city initiatives. In contrast, other findings on stakeholder engagement link it to trust in the government and the perceived benefits of initiatives supporting smart city development (Hamamurad *et al.*, 2022).

The literature on models of stakeholder engagement is relatively limited. One alternative is the concept of living labs as a model for citizen engagement in smart cities (Park and Fujii, 2023). Keh *et al.* also propose models of the Ethical Smart City Framework, where community engagement is fundamental and should occur from the beginning of project development (Keh *et al.*, 2021). Additionally, there is a proposed model in which the integration of social media and ICT tools creates an area for increased citizen engagement (Pereira *et al.*, 2018). Moreover, a collaborative governance model involves various stakeholders in the planning and implementation of smart city policies. Ongoing research in other areas suggests a dual process model that includes different aspects, such as behavioral,

cognitive and secondary engagement. This model emphasizes that the satisfaction of needs, like autonomy, is central to students' engagement in learning (Bong, 2023).

Moreover, the vision of future smart cities is linked rather with sustainability and quality of life than the usage of new technologies (Del-Real *et al.*, 2023). In this regard, concepts such as Corporate Sustainability, Corporate Citizenship and Corporate Social Responsibility should be taken into consideration (Lee, 2021; Schaltegger *et al.*, 2022). Implementation of sustainable, green behavior is challenging (Miah *et al.*, 2024), and gamification can be a way to motivate employees and increase their commitment to such initiatives (Haque *et al.*, 2024). Another way to achieve sustainable behavior in various stakeholders is education through designing training programs and combating cultural hesitations (Arslan *et al.*, 2023).

5.1 Generalization of the model

Despite differences in sample characteristics (citizens versus companies), the fit indices (CFI, TLI, RMSEA and SRMR) are consistently excellent in both data sets, suggesting that the unidimensional structure of the SESCDP scale is robust and generalizable. Thus, model consistency across samples is visible. Studies presented in the literature indicate that it is important to use alternative fit indices such as TLI, CFI, SRMR and RMSEA as they provide a better assessment of model fit. This is important when stakeholder engagement is examined (Forsythe *et al.*, 2016; Ray and Miller, 2017). Even though the Chi-Square test results should not undermine the model fit, alternative indices strongly indicate a good fit. This discrepancy is common when relying on Chi-Square in real-world data applications, particularly with varying sample sizes (Concannon *et al.*, 2014). The Chi-Square statistic is widely recognized for its sensitivity to sample size, which can lead to misleading conclusions regarding model fit. In large samples, even trivial discrepancies between observed and model-implied covariance matrices can result in significant Chi-Square values, leading to the rejection of models that may otherwise be acceptable. Conversely, in smaller samples, the Chi-Square may not detect genuine misfits (Concannon *et al.*, 2014). However, the Confirmatory Factor Analysis CFA results confirm that the SESCDP performs well across different populations (citizens and companies) in the Polish city of Szczecin. The consistent fit indices across samples demonstrate that the scale is reliable, valid and generalizable, making it a strong tool for measuring stakeholders' engagement in smart city development processes. Thereby, this tool can be also used in other cities, also on emerging markets. This aligns with the findings of Nunkoo *et al.*, who emphasize the importance of advanced statistical techniques, including confirmatory factor analysis (CFA), in establishing the reliability of measurement instruments in contemporary research (Nunkoo *et al.*, 2017).

A review of the literature indicates that to successfully build a smart city, stakeholder involvement is crucial and contributes significantly to the success of the initiatives undertaken (Jayasena *et al.*, 2019). Taking this into account, the research described in the paper gains importance. Smart cities, according to the literature review, have a positive and significant influence on sustainable development (Dogan, 2024). Thus, it is worth building them.

6. Implications of the study

The research conducted takes stakeholders into account and can be adopted as good practice in the area of smart city development processes, which constitutes added value to this paper. The created model is, according to the authors, simple to use and easy to understand. Therefore, it can constitute as a base model and a solid approach to any further studies related to the stakeholders' engagement in the smart city development process. This is consistent with the notion that a validated scale to measure stakeholder engagement can enable urban planners and decision-makers to make informed, data-driven decisions (Papagiannakis *et al.*, 2019).

Since emerging markets need a solid framework for managing sustainable cities (Ruess and Lindner, 2023), the use of the model and its further validation can prove to be an effective tool. This allows for the application of scale in emerging markets and its further validation in different cultural and socio-economic contexts. The more researchers use the scale, the more this will influence future validation. Also, it will influence the acquisition of data to assess engagement in different cities geographically.

Taking into consideration the fact that companies in Szczecin do not fully recognize or are not necessarily satisfied with stakeholder engagement, particularly city institutions, it is worth intensifying smart and sustainable initiatives and promoting the current ones. City institutions in Szczecin, from the point of view of research results, should also focus on the communication process and promote activities and innovations that are implemented. Although the citizens' assessment of the engagement of city institutions is higher than that of the companies, it still cannot be considered very high. The implication from the conducted research for all parties is that stakeholder engagement is rated at a medium level.

The results of the research presented in this paper might be significant for regional policymakers in Szczecin. The first step in implementing recommendations is to conduct in-depth qualitative research to identify stakeholder needs. The second step involves analyzing and selecting alternatives. In this stage, it is essential to invite stakeholders to consult, analyze, and choose alternatives. The third step focuses on the implementation of the selected activities, where co-creation plays a key role. The final step is to evaluate satisfaction. Moreover, other cities, interested in implementing smart and sustainable initiatives, can also benefit from the content of the paper. Researchers interested in the topic of smart and sustainable city development and stakeholders' engagement might also find the content of this paper useful. The topic of the paper is gaining importance among various stakeholders; therefore, it is worth sharing the knowledge and practical and social implications presented in the paper. Theoretical considerations highlighted the role of all key stakeholders, emphasizing not only the importance of their engagement but also its recognition by other parties.

When developing a smart city, it is also important to consider its broader societal impact. The basic concept of a smart city is quality of life, which should be improved not only for the present generation but also for future generations. Consciously co-creating a smart city with stakeholders also requires education in this regard. Public education plays a key role in this process.

Various recommendations for emerging markets can arise from the research results. First and foremost, the adoption and further validation of the model. Next, awareness should also be placed on the significance of recognition of engagement in the smart city development process by different stakeholders. Policymakers need to build relationships with other stakeholders and create a communication plan that would promote initiatives related to the development of a smart city. Undertaking such activities is crucial and should always be a first step, together with understanding the needs of all stakeholders, but without knowledge sharing, relationship building, and co-creation, awareness, and then assessment will not be very high. A key recommendation that arises from the literature review and research results while developing a smart city is to include all significant stakeholders. Finally, the authors also recommend including a sustainable approach during smart city planning.

7. Conclusions

This pilot study successfully confirmed the reliability of the SESCDP scale in measuring stakeholder engagement in smart city development. Thus, according to the analytical results of the alternative fit indices, the researchers have robust evidence to accept the null

hypotheses (*H1* and *H2*) formulated in this research study. The scale's unidimensional structure was validated, making it a useful tool for assessing the role of public institutions, companies, and citizens in other cities, including emerging markets. This has to take into account the fact that residents of emerging markets are characterized by unequal access to technology, which is one of the determinants of the social inequalities found in these markets (Michelotto and Joia, 2023). It is therefore worthwhile using different practices to engage citizens (Johnson *et al.*, 2020).

In the paper, Pearson correlation analysis was also conducted. Citizens and companies were asked to assess the engagement of three stakeholders – city institutions, local businesses and the local community. Research results indicated that all variables are positively and significantly correlated. Yet, the correlations among citizens' assessments of stakeholder engagement are stronger than those among companies.

The research contributes to the growing field of smart city studies by providing empirically validated measurement tools for stakeholder engagement. It addresses a critical gap in the literature by developing and testing a model structure for stakeholders' involvement, offering a foundation for future empirical studies and theory-building in this domain. Further, by validating a scale to measure stakeholder engagement, the study equips city planners, policymakers, and urban developers with reliable tools to assess and enhance engagement practices.

As emphasized by Papagiannakis *et al.*, effective stakeholder engagement is pivotal for effective environmental management and innovation (Papagiannakis *et al.*, 2019). It is suggested that effective stakeholder engagement can yield improved outcomes in a variety of contexts, including urban development. This can lead to more inclusive, data-driven decision-making processes, ensuring that smart city initiatives cater to the needs and expectations of diverse stakeholders, including citizens and businesses. The literature also describes how different stakeholder engagement strategies can affect the quality of disclosure and decision-making in a corporate context. It is indicated that tailored engagement approaches are necessary to meet the diverse needs of stakeholders (Moratis and Brandt, 2017). Moreover, enhanced stakeholder engagement contributes to the inclusivity and sustainability of smart city projects. This is a key action, especially when producing sustainability reports, as it leads to a more inclusive city (Kaur and Lodhia, 2014). Communication at all stages of smart city development is also of strategic importance, as it ensures that all stakeholder needs are taken into account (Erkul *et al.*, 2019).

The findings of the pilot study described in this paper promote the active participation of citizens, local businesses, and institutions, fostering collaboration and trust. This ensures that smart city initiatives are not only technologically advanced but also socially equitable and responsive to community needs, which is particularly relevant in emerging markets.

8. Limitations and future research suggestions

The pilot study had some limitations, primarily the small sample size and the focus on just one city, which may limit the broader applicability of the findings. Future research should expand to larger, more diverse populations to cross-validate the scale and gather deeper insights into the varying perspectives of different stakeholder groups. More qualitative research could also help in a better understanding of the nuances of stakeholder engagement in the smart city development process. Notwithstanding these limitations, both study samples are representative of the city of Szczecin. As a result, the conclusions of the research can serve as a basis for the institutions of Szczecin in building a further strategy for the development of the smart city. The comparative approach, in turn, has the potential to

facilitate a more profound comprehension of the distinctive challenges confronting emerging markets in their endeavors to engage stakeholders effectively.

The data presented in the article refers to the assessment of stakeholder engagement by other parties. Further analysis could provide data that takes into account the actual involvement of specific parties. Such an approach would allow a multi-faceted comparison of real engagement and its assessment and perception by key stakeholders.

From the point of view of the average level of stakeholder engagement assessment, it is also worth deepening the research on this aspect. A research question that could be posed would concern the reasons for such an assessment. Is it due to such low involvement? Or rather, is it due to a lack of activities to inform and promote them, which in turn affects the rather low rating of stakeholder engagement, particularly city institutions by companies?

Future research should continue to explore the implications of these findings in the context of stakeholder engagement practices, potentially leading to enhanced strategies for effective engagement. If the validated scale is used for research in other cities, then interested parties will have access to more data for analysis. This would allow an indication of how different cultural, economic, or political environments affect stakeholder engagement practices in emerging markets. It would also enable the identification of best practices and strategies. A validated scale would also save time and financial resources, which may be particularly important in emerging markets. In the future, it would also be interesting to conduct a comparative study with other empirical studies and competing models to identify each model's strengths and weaknesses. This paper can serve as a solid foundation for addressing another research gap in the future – a comparison with other models or similar studies.

It would be interesting to undertake research that would broaden the understanding of the motivations and constraints to stakeholder engagement in smart city development. This would allow a better understanding of the reasons for reluctance to engage. The research process could also be extended to include qualitative research such as focus groups, to gain in-depth insights. Conducting research on engagement assessment will also be important for creating inclusive smart city development strategies.

References

- Allahar, H. (2020), "What are the challenges of building a smart city?", *Technology Innovation Management Review*, Vol. 10 No. 9, pp. 38-48.
- Allam, Z. and Newman, P. (2018), "Redefining the smart city: culture, metabolism and governance", *Smart Cities*, Vol. 1 No. 1, pp. 4-25, doi: [10.3390/smartcities1010002](https://doi.org/10.3390/smartcities1010002).
- Almarri, K. (2022), "The value for money factors and their interrelationships for smart city public-private partnerships projects", *Construction Innovation*, Vol. 23 No. 4, pp. 815-832, doi: [10.1108/CI-01-2022-0020](https://doi.org/10.1108/CI-01-2022-0020).
- Anand, P.B. and Navío-Marco, J. (2018), "Governance and economics of smart cities: opportunities and challenges", *Telecommunications Policy*, Vol. 42 No. 10, pp. 795-799, doi: [10.1016/j.telpol.2018.10.001](https://doi.org/10.1016/j.telpol.2018.10.001).
- Angelidou, M. (2015), "Smart cities: a conjuncture of four forces", *Cities*, Vol. 47, pp. 95-106, doi: [10.1016/j.cities.2015.05.004](https://doi.org/10.1016/j.cities.2015.05.004).
- Ardiana, P.A. (2021), "Stakeholder engagement in sustainability reporting by fortune global 500 companies: a call for embeddedness", *Meditari Accountancy Research*, Vol. 31 No. 2, doi: [10.1108/medar-12-2019-0666](https://doi.org/10.1108/medar-12-2019-0666).
- Arslan, A., Kharusi, S.A., Hussain, S.M. and Alo, O. (2023), "Sustainable entrepreneurship development in Oman: a multi-stakeholder qualitative study", *International Journal of Organizational Analysis*, Vol. 31 No. 8, pp. 35-59, doi: [10.1108/IJOA-11-2022-3497](https://doi.org/10.1108/IJOA-11-2022-3497).

- Bazarnik, J., Grabiński, T., Kąciak, E., Mynarski, S. and Sagan, A. (1992), *Badania Marketingowe. Metody i Oprogramowanie Komputerowe*, Wyd. AE w Krakowie, Kraków.
- Bibri, S.E. and Krogstie, J. (2017a), "Smart sustainable cities of the future: an extensive interdisciplinary literature review", *Sustainable Cities and Society*, Vol. 31, pp. 183-212, doi: [10.1016/j.scs.2017.02.016](https://doi.org/10.1016/j.scs.2017.02.016).
- Bibri, S.E. and Krogstie, J. (2017b), "The core enabling technologies of big data analytics and context-aware computing for smart sustainable cities: a review and synthesis", *Journal of Big Data*, Vol. 4 No. 1, p. 38, doi: [10.1186/s40537-017-0091-6](https://doi.org/10.1186/s40537-017-0091-6).
- Biercewicz, K., Fernando, K.S.D., Misiak-Kwit, S. and Wiścicka-Fernando, M. (2024), "Experiences of residents in using smart city technologies", *Procedia Computer Science*, Vol. 246, pp. 5074-5083, doi: [10.1016/j.procs.2024.09.592](https://doi.org/10.1016/j.procs.2024.09.592).
- Bong, J. (2023), "A dual-process motivation mediation model to explain female high school students' cognitive engagement and disengagement in emergency remote teaching and online learning in South Korea", *British Journal of Educational Technology*, Vol. 55 No. 3, pp. 1020-1040, doi: [10.1111/bjet.13415](https://doi.org/10.1111/bjet.13415).
- Calzada, I. (2020), "Democratising smart cities? Penta-helix multistakeholder social innovation framework", *Smart Cities*, Vol. 3 No. 4, pp. 1145-1172, doi: [10.3390/smartcities3040057](https://doi.org/10.3390/smartcities3040057).
- Capdevila, I. and Zarlenga, M. (2015), "Smart city or smart citizens? The Barcelona case", SSRN Scholarly Paper, Social Science Research Network, Rochester, New York, NY, doi: [10.2139/ssrn.2585682](https://doi.org/10.2139/ssrn.2585682).
- Caragliu, A., Del Bo, C. and Nijkamp, P. (2011), "Smart cities in Europe", *Journal of Urban Technology*, Vol. 18 No. 2, pp. 65-82, doi: [10.1080/10630732.2011.601117](https://doi.org/10.1080/10630732.2011.601117).
- Cardullo, P. and Kitchin, R. (2019), "Smart urbanism and smart citizenship: the neoliberal logic of 'citizen-focused' smart cities in Europe", *Environment and Planning C: Politics and Space*, Vol. 37 No. 5, pp. 813-830, doi: [10.1177/0263774X18806508](https://doi.org/10.1177/0263774X18806508).
- Chantry, W. (2023), "Built from the internet up': assessing citizen participation in smart city planning through the case study of Quayside, Toronto", *GeoJournal*, Vol. 88 No. 2, pp. 1619-1637, doi: [10.1007/s10708-022-10688-3](https://doi.org/10.1007/s10708-022-10688-3).
- Chen, Z. and Chan, I.C.C. (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, pp. 263-285, doi: [10.1108/ITP-07-2021-0577](https://doi.org/10.1108/ITP-07-2021-0577).
- Cleveland, M. and Cleveland, S. (2018), "Building engaged communities—a collaborative leadership approach", *Smart Cities*, Vol. 1 No. 1, pp. 155-162, doi: [10.3390/smartcities1010009](https://doi.org/10.3390/smartcities1010009).
- Concannon, T.W., Fuster, M., Saunders, T., Patel, K., Wong, J.B., Leslie, L.K. and Lau, J. (2014), "A systematic review of stakeholder engagement in comparative effectiveness and patient-centered outcomes research", *Journal of General Internal Medicine*, Vol. 29 No. 12, pp. 1692-1701, doi: [10.1007/s11606-014-2878-x](https://doi.org/10.1007/s11606-014-2878-x).
- Cruz, C.O. and Sarmiento, J.M. (2017), "Reforming traditional PPP models to cope with the challenges of smart cities", *Competition and Regulation in Network Industries*, Vol. 18 Nos 1/2, pp. 94-114, doi: [10.1177/1783591717734794](https://doi.org/10.1177/1783591717734794).
- Dameri, R.P. (2012), "Searching for smart city definition: a comprehensive proposal", *International Journal of Computers and Technology*, Vol. 11 No. 5.
- Dash, A. (2023), "Does citizens' participation moderate the relationship between the built environment and their quality of life in Indian smart cities?", *Transforming Government: People, Process and Policy*, Vol. 17 No. 4, pp. 673-687, doi: [10.1108/TG-06-2023-0084](https://doi.org/10.1108/TG-06-2023-0084).
- Del-Real, C., Ward, C. and Sartipi, M. (2023), "What do people want in a smart city? Exploring the stakeholders' opinions, priorities and perceived barriers in a medium-sized city in the United States", *International Journal of Urban Sciences*, Vol. 27 No. sup1, pp. 50-74.
- Dogan, B.O. (2024), "The role of smart cities in sustainable development: empirical evidence from Türkiye", *Economía*, Vol. 25 No. 3, pp. 422-438, doi: [10.1108/ECON-07-2023-0108](https://doi.org/10.1108/ECON-07-2023-0108).

- Engelbert, J., Ersoy, A., van Bueren, E. and van Zoonen, L. (2022), "Capitalizing on the 'public turn': new possibilities for citizens and civil servants in smart city-making", *Journal of Urban Technology*, Vol. 29 No. 3, pp. 3-17, doi: [10.1080/10630732.2021.1963647](https://doi.org/10.1080/10630732.2021.1963647).
- Erkul, M., Yitmen, I. and Celik, T. (2019), "Dynamics of stakeholder engagement in mega transport infrastructure projects", *International Journal of Managing Projects in Business*, Vol. 13 No. 7, pp. 1465-1495, doi: [10.1108/IJMPB-09-2018-0175](https://doi.org/10.1108/IJMPB-09-2018-0175).
- Fernandez-Anez, V., Fernández-Güell, J.M. and Giffinger, R. (2018), "Smart city implementation and discourses: an integrated conceptual model. The case of Vienna", *Cities*, Vol. 78, pp. 4-16, doi: [10.1016/j.cities.2017.12.004](https://doi.org/10.1016/j.cities.2017.12.004).
- Forsythe, L.P., Ellis, L.E., Edmundson, L., Sabharwal, R., Rein, A., Konopka, K. and Frank, L. (2016), "Patient and stakeholder engagement in the PCORI pilot projects: description and lessons learned", *Journal of General Internal Medicine*, Vol. 31 No. 1, pp. 13-21, doi: [10.1007/s11606-015-3450-z](https://doi.org/10.1007/s11606-015-3450-z).
- Gamayanto, I. and Nurhindarto, A. (2020), "Developing smart city 5.0 framework to produce competency", *Journal of Applied Intelligent System*, Vol. 5 No. 1, pp. 23-31, doi: [10.33633/jais.v5i1.4228](https://doi.org/10.33633/jais.v5i1.4228).
- Garri, M. (2022), "MNE's sustainability strategies in emerging and developing markets", *International Journal of Organizational Analysis*, Vol. 30 No. 3, pp. 743-759, doi: [10.1108/IJOA-03-2020-2111](https://doi.org/10.1108/IJOA-03-2020-2111).
- Goodman, N., Zwick, A., Spicer, Z. and Carlsen, N. (2020), "Public engagement in smart city development: lessons from communities in Canada's smart city challenge", *Canadian Geographies / Géographies Canadiennes*, Vol. 64 No. 3, pp. 416-432, doi: [10.1111/cag.12607](https://doi.org/10.1111/cag.12607).
- Gupta, P., Chauhan, S., Paul, J. and Jaiswal, M.P. (2020), "Social entrepreneurship research: a review and future research agenda", *Journal of Business Research*, Vol. 113, pp. 209-229, doi: [10.1016/j.jbusres.2020.03.032](https://doi.org/10.1016/j.jbusres.2020.03.032).
- Hämäläinen, M. (2020), "A framework for a smart city design: digital transformation in the Helsinki smart city", in Ratten, V. (Ed.), *Entrepreneurship and the Community: A Multidisciplinary Perspective on Creativity, Social Challenges, and Business*, Springer International Publishing, Cham, pp. 63-86, doi: [10.1007/978-3-030-23604-5_5](https://doi.org/10.1007/978-3-030-23604-5_5).
- Hamamurad, Q.H., Jusoh, N.M. and Ujang, U. (2022), "Factors affecting stakeholder acceptance of a Malaysian smart city", *Smart Cities*, Vol. 5 No. 4, pp. 1508-1535, doi: [10.3390/smartcities5040077](https://doi.org/10.3390/smartcities5040077).
- Haque, S., Panda, D. and Ghosh, A. (2024), "Gamifying sustainability with self-efficacy: motivating green behaviours in large industrial firms", *International Journal of Organizational Analysis*, Vol. 32 No. 11, pp. 74-93, doi: [10.1108/IJOA-08-2023-3951](https://doi.org/10.1108/IJOA-08-2023-3951).
- Harrell, F.E., Jr and Dupont, C. (2024), "HMISC: Harrell miscellaneous", available at: <https://cran.r-project.org/web/packages/Hmisc/index.html>
- Hassan, H.M.K. (2020), "Intention towards social entrepreneurship of university students in an emerging economy: the influence of entrepreneurial self-efficacy and entrepreneurship education", *On the Horizon*, Vol. 28 No. 3, pp. 133-151, doi: [10.1108/OTH-04-2020-0012](https://doi.org/10.1108/OTH-04-2020-0012).
- Hoogen, A.V.D., Scholtz, B. and Calitz, A.P. (2022), "Expert views on value alignment for stakeholders in smart cities", *Presented at the Proceedings – 3rd International Conference on Next Generation Computing Applications, NextComp 2022, Scopus*, doi: [10.1109/NextComp55567.2022.9932248](https://doi.org/10.1109/NextComp55567.2022.9932248).
- Hörisch, J., Freeman, R.E. and Schaltegger, S. (2014), "Applying stakeholder theory in sustainability management: links, similarities, dissimilarities, and a conceptual framework", *Organization and Environment*, Vol. 27 No. 4, pp. 328-346, doi: [10.1177/1086026614535786](https://doi.org/10.1177/1086026614535786).
- Ivanova, N. and Ganzha, O. (2017), "The methodological aspect of the landscape and ecological forming of a comfortable environment for the smart city", *MATEC Web of Conferences*, Vol. 106, p. 1002, doi: [10.1051/matecconf/201710601002](https://doi.org/10.1051/matecconf/201710601002).

- Ivars-Baidal, J.A., Casado-Díaz, A.B., Navarro-Ruiz, S. and Fuster-Uguet, M. (2023), "Smart tourism city governance: exploring the impact on stakeholder networks", *International Journal of Contemporary Hospitality Management*, Vol. 36 No. 2, pp. 582-601, doi: [10.1108/IJCHM-03-2022-0322](https://doi.org/10.1108/IJCHM-03-2022-0322).
- Ivars-Baidal, J.A., Celdrán-Bernabeu, M.A., Femenia-Serra, F., Perles-Ribes, J.F. and Vera-Rebollo, J. F. (2023), "Smart city and smart destination planning: examining instruments and perceived impacts in Spain", *Cities*, Vol. 137, p. 104266, doi: [10.1016/j.cities.2023.104266](https://doi.org/10.1016/j.cities.2023.104266).
- Jayasena, N.S., Chan, D.W.M., Kumaraswamy, M.M. and Saka, A.B. (2022), "Applicability of public-private partnerships in smart infrastructure development: the case of Hong Kong", *International Journal of Construction Management*, Vol. 23 No. 11, pp. 1932-1944.
- Jayasena, N.S., Mallaawarachchi, H. and Waidyasekara, K.G.A.S. (2019), "Stakeholder analysis for smart city development project: an extensive literature review", *MATEC Web of Conferences*, Vol. 266, p. 6012, doi: [10.1051/mateconf/201926606012](https://doi.org/10.1051/mateconf/201926606012).
- Johnson, P.A., Acedo, A. and Robinson, P.J. (2020), "Canadian smart cities: are we wiring new citizen-local government interactions?", *Canadian Geographies / Géographies Canadiennes*, Vol. 64 No. 3, pp. 402-415, doi: [10.1111/cag.12623](https://doi.org/10.1111/cag.12623).
- Jun, H. and Kim, M. (2021), "From stakeholder communication to engagement for the sustainable development goals (SDGs): a case study of LG electronics", *Sustainability*, Vol. 13 No. 15, p. 8624, doi: [10.3390/su13158624](https://doi.org/10.3390/su13158624).
- Kaur, A. and Lodhia, S.K. (2014), "The state of disclosures on stakeholder engagement in sustainability reporting in Australian local councils", *Pacific Accounting Review*, Vol. 26 Nos 1/2, pp. 54-74, doi: [10.1108/PAR-07-2013-0064](https://doi.org/10.1108/PAR-07-2013-0064).
- Keh, E., Lawrence, M., Sauz, R., Dadashi, N. and Homayounfar, N. (2021), "The ethical smart city framework & toolkit: an inclusive application of human-centered design and public engagement in smart city development", *Interaction Design and Architecture(s)*, No. 50, pp. 63-81, doi: [10.55612/s-5002-050-004](https://doi.org/10.55612/s-5002-050-004).
- Khanna, P. and Khanra, S. (2023), "Citizen empowerment through smart surveillance: evidence from Indian smart cities", *Digital Policy, Regulation and Governance*, Vol. 25 No. 4, pp. 385-401, doi: [10.1108/DPRG-11-2022-0141](https://doi.org/10.1108/DPRG-11-2022-0141).
- Kitchin, R. (2016), "The ethics of smart cities and urban science", *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, Vol. 374 No. 2083, p. 20160115, doi: [10.1098/rsta.2016.0115](https://doi.org/10.1098/rsta.2016.0115).
- Kramers, A., Höjer, M., Lövehagen, N. and Wangel, J. (2014), "Smart sustainable cities – exploring ICT solutions for reduced energy use in cities", *Environmental Modelling and Software*, Vol. 56, pp. 52-62, doi: [10.1016/j.envsoft.2013.12.019](https://doi.org/10.1016/j.envsoft.2013.12.019).
- Kummitha, R.K.R. and Crutzen, N. (2017), "How do we understand smart cities? An evolutionary perspective", *Cities*, Vol. 67, pp. 43-52, doi: [10.1016/j.cities.2017.04.010](https://doi.org/10.1016/j.cities.2017.04.010).
- Lalicic, L. and Önder, I. (2018), "Residents' involvement in urban tourism planning: opportunities from a smart city perspective", *Sustainability*, Vol. 10 No. 6, p. 1852, doi: [10.3390/su10061852](https://doi.org/10.3390/su10061852).
- Lam, P.T.I. and Yang, W. (2020), "Factors influencing the consideration of Public-Private Partnerships (PPP) for smart city projects: Evidence from Hong Kong", *Cities*, Vol. 99, p. 102606, doi: [10.1016/j.cities.2020.102606](https://doi.org/10.1016/j.cities.2020.102606).
- Lee, T.H. (2021), "How firms communicate their social roles through corporate social responsibility, corporate citizenship, and corporate sustainability: an institutional comparative analysis of firms' social reports", *International Journal of Strategic Communication*, Vol. 15 No. 3, pp. 214-230, doi: [10.1080/1553118X.2021.1877708](https://doi.org/10.1080/1553118X.2021.1877708).
- Legutko-Kobus, P. (2021), "E-partycypacja i ISO 37120 jako wyznacznik implementacji rozwoju zrównoważonego w smart city", *Studia Ecologiae et Bioethicae*, Vol. 19 No. 1, pp. 71-82, doi: [10.21697/seb.2021.19.1.06](https://doi.org/10.21697/seb.2021.19.1.06).

- Lende, P.K. and Ambadkar, S.D. (2024), "Public-Private partnerships for smart cities in India: survey findings and recommended strategies", *SSRG International Journal of Civil Engineering*, Vol. 11 No. 6, pp. 98-106, doi: [10.14445/23488352/IJCE-V11I6P111](https://doi.org/10.14445/23488352/IJCE-V11I6P111).
- Lim, S.B. and Yigitcanlar, T. (2022), "Participatory governance of smart cities: insights from e-participation of Putrajaya and Petaling Jaya, Malaysia", *Smart Cities*, Vol. 5 No. 1, pp. 71-89, doi: [10.3390/smartcities5010005](https://doi.org/10.3390/smartcities5010005).
- Manetti, G. (2011), "The quality of stakeholder engagement in sustainability reporting: empirical evidence and critical points", *Corporate Social Responsibility and Environmental Management*, Vol. 18 No. 2, pp. 110-122, doi: [10.1002/csr.255](https://doi.org/10.1002/csr.255).
- Marchesani, F. and Masciarelli, F. (2024), "Smart cities and economic development: synergies among technology, social forces and female entrepreneurship", *Journal of Small Business and Enterprise Development*, Vol. 31 No. 8, pp. 77-104, doi: [10.1108/JSBED-01-2023-0042](https://doi.org/10.1108/JSBED-01-2023-0042).
- Meijer, A. and Bolívar, M.P.R. (2016), "Governing the smart city: a review of the literature on smart urban governance", *International Review of Administrative Sciences*, Vol. 82 No. 2, pp. 392-408, doi: [10.1177/0020852314564308](https://doi.org/10.1177/0020852314564308).
- Miah, M., Rahman, S.M.M., Biswas, S., Szabó-Szentgróti, G. and Walter, V. (2024), "Effects of green human resource management practices on employee green behavior: the role of employee's environmental knowledge management and green self-efficacy for greening workplace", *International Journal of Organizational Analysis*, doi: [10.1108/IJOA-04-2024-4462](https://doi.org/10.1108/IJOA-04-2024-4462).
- Michelotto, F. and Joia, L.A. (2023), "Unveiling the smart city concept: perspectives from an emerging market via the social representation theory", *Sustainability*, Vol. 15 No. 10, p. 8155, doi: [10.3390/su15108155](https://doi.org/10.3390/su15108155).
- Microsoft Support-ToolPak (2024), available at: <https://support.microsoft.com/en-us/office/use-the-analysis-toolpak-to-perform-complex-data-analysis-6c67ccf0-f4a9-487c-8dec-bdb5a2cefab6>
- Mora, L., Bolici, R. and Deakin, M. (2017), "The first two decades of smart-city research: a bibliometric analysis", *Journal of Urban Technology*, Vol. 24 No. 1, pp. 3-27, doi: [10.1080/10630732.2017.1285123](https://doi.org/10.1080/10630732.2017.1285123).
- Mora, L., Deakin, M. and Reid, A. (2019), "Strategic principles for smart city development: a multiple case study analysis of European best practices", *Technological Forecasting and Social Change*, Vol. 142, pp. 70-97, doi: [10.1016/j.techfore.2018.07.035](https://doi.org/10.1016/j.techfore.2018.07.035).
- Moratis, L. and Brandt, S. (2017), "Corporate stakeholder responsiveness? Exploring the state and quality of GRI-based stakeholder engagement disclosures of European firms", *Corporate Social Responsibility and Environmental Management*, Vol. 24 No. 4, pp. 312-325, doi: [10.1002/csr.1408](https://doi.org/10.1002/csr.1408).
- Mostafa, S. (2020), "Emerging themes of public-private partnership application in developing smart city projects: a conceptual framework", Built Environment Project and Asset Management, available at: www.academia.edu/95496556/Emerging_themes_of_public_private_partnership_application_in_developing_smart_city_projects_a_conceptual_framework
- Mutiarin, D. and Lawelai, H. (2023), "Optimizing the role of ICT and citizen participation: Analysis of smart city governance implementation in Jakarta, Indonesia and Kuala Lumpur, Malaysia", *E3S Web of Conferences*, Vol. 440, p. 3027, doi: [10.1051/e3sconf/202344003027](https://doi.org/10.1051/e3sconf/202344003027).
- Nederhand, J. and Klijn, E.H. (2019), "Stakeholder involvement in public-private partnerships: its influence on the innovative character of projects and on project performance", *Administration and Society*, Vol. 51 No. 8, pp. 1200-1226, doi: [10.1177/0095399716684887](https://doi.org/10.1177/0095399716684887).
- Neupane, C., Wibowo, S., Grandhi, S. and Deng, H. (2021), "A trust-based model for the adoption of smart city technologies in Australian regional cities", *Sustainability*, Vol. 13 No. 16, p. 9316, doi: [10.3390/su13169316](https://doi.org/10.3390/su13169316).
- Nunkoo, R., Teeroovengadum, V., Thomas, P. and Leonard, L. (2017), "Integrating service quality as a second-order factor in a customer satisfaction and loyalty model", *International Journal of*

- Papagiannakis, G., Voudouris, I., Lioukas, S. and Kassinis, G. (2019), "Environmental management systems and environmental product innovation: the role of stakeholder engagement", *Business Strategy and the Environment*, Vol. 28 No. 6, pp. 939-950, doi: [10.1002/bse.2293](https://doi.org/10.1002/bse.2293).
- Park, J. and Fujii, S. (2023), "Civic engagement in a citizen-led living lab for smart cities: evidence from South Korea", *Urban Planning*, Vol. 8 No. 2, pp. 93-107, doi: [10.17645/up.v8i2.6361](https://doi.org/10.17645/up.v8i2.6361).
- Pereira, G., Parycek, P., Falco, E. and Kleinhans, R. (2018), "Smart governance in the context of smart cities: a literature review", *Information Polity*, Vol. 23 No. 2, pp. 143-162, doi: [10.3233/ip-170067](https://doi.org/10.3233/ip-170067).
- Pianezzi, D., Mori, Y. and Uddin, S. (2023), "Public-private partnership in a smart city: a curious case in Japan", *International Review of Administrative Sciences*, Vol. 89 No. 3, pp. 632-647.
- Ray, K.N. and Miller, E. (2017), "Strengthening stakeholder-engaged research and research on stakeholder engagement", *Journal of Comparative Effectiveness Research*, Vol. 6 No. 4, pp. 375-389, doi: [10.2217/cer-2016-0096](https://doi.org/10.2217/cer-2016-0096).
- Remr, J. (2023), "Usefulness of a civic engagement scale for research on smart cities: Measuring attitudes and behavior", *Smart Cities*, Vol. 6 No. 6, pp. 3251-3265, doi: [10.3390/smartcities6060144](https://doi.org/10.3390/smartcities6060144).
- Rivera-Santos, M., Holt, D., Littlewood, D. and Kolk, A. (2015), "Social entrepreneurship in Sub-Saharan Africa", *Academy of Management Perspectives*, Vol. 29 No. 1, pp. 72-91.
- Roslan, M.H.H., Hamid, S., Ijab, M.T., Yusop, F.D. and Norman, A.A. (2022), "Social entrepreneurship in higher education: challenges and opportunities", *Asia Pacific Journal of Education*, Vol. 42 No. 3, pp. 588-604, doi: [10.1080/02188791.2020.1859354](https://doi.org/10.1080/02188791.2020.1859354).
- Rosseel, Y., Jorgensen, T.D., Wilde, L.D., Oberski, D., Byrnes, J., Vanbrabant, L. and Classe, F. (2024), "Lavaan: latent variable analysis", available at: <https://cran.r-project.org/web/packages/lavaan/index.html>
- Ruess, P. and Lindner, R. (2023), "Knowledge management for smart cities—standardization and replication as policy instruments to foster the implementation of smart city solutions", *Smart Cities*, Vol. 6 No. 4, pp. 2106-2124, doi: [10.3390/smartcities6040097](https://doi.org/10.3390/smartcities6040097).
- Salimath, M.S. and Cullen, J.B. (2010), "Formal and informal institutional effects on entrepreneurship: a synthesis of nation-level research", *International Journal of Organizational Analysis*, Vol. 18 No. 3, pp. 358-385, doi: [10.1108/19348831011062175](https://doi.org/10.1108/19348831011062175).
- Schachtner, C. and Baumann, N. (2024), "Accompanying study of the development process towards a smart city strategy-with a particular focus on social change", *Smart Cities and Regional Development (SCRD) Journal*, Vol. 8 No. 2, pp. 63-72, doi: [10.25019/cpe4t781](https://doi.org/10.25019/cpe4t781).
- Schaltegger, S., Christ, K.L., Wenzig, J. and Burritt, R.L. (2022), "Corporate sustainability management accounting and multi-level links for sustainability – a systematic review", *International Journal of Management Reviews*, Vol. 24 No. 4, pp. 480-500, doi: [10.1111/ijmr.12288](https://doi.org/10.1111/ijmr.12288).
- Selim, A.M. and ElGohary, A.S. (2020), "Public-private partnerships (PPPs) in smart infrastructure projects: the role of stakeholders", *HBRC Journal*, Vol. 16 No. 1, pp. 317-333, doi: [10.1080/16874048.2020.1825038](https://doi.org/10.1080/16874048.2020.1825038).
- Senior, C., Temeljotov Salaj, A., Johansen, A. and Lohne, J. (2023), "Evaluating the impact of public participation processes on participants in smart city development: a scoping review", *Buildings*, Vol. 13 No. 6, p. 1484, doi: [10.3390/buildings13061484](https://doi.org/10.3390/buildings13061484).
- Shelton, T., Zook, M. and Wiig, A. (2015), "The 'actually existing smart city'", *Cambridge Journal of Regions, Economy and Society*, Vol. 8 No. 1, pp. 13-25, doi: [10.1093/cjres/rsu026](https://doi.org/10.1093/cjres/rsu026).
- Silva, F.J.F., Câmara, G.F.M., Vieira, J.A.C. and Santos, C.A.S.M. (2020), "Is the spending behaviour of tourists affected by low-cost carriers' operation? Some empirical evidence", *Tourism Management Perspectives*, Vol. 33, doi: [10.1016/j.tmp.2019.100630](https://doi.org/10.1016/j.tmp.2019.100630).

- Sontiwanich, P., Boonchai, C. and Beeton, R.J.S. (2022), "An unsustainable smart city: lessons from uneven citizen education and engagement in Thailand", *Sustainability*, Vol. 14 No. 20, p. 13315, doi: [10.3390/su142013315](https://doi.org/10.3390/su142013315).
- Spitzeck, H. and Hansen, E.G. (2010), "Stakeholder governance: how stakeholders influence corporate decision making", Rochester, NY: Social Science Research Network, available at: <https://papers.ssrn.com/abstract=1440756>
- Stevens, S.S. (1946), "On the theory of scales of measurement", *Science*, Vol. 103 No. 2684, pp. 677-680, doi: [10.1126/science.103.2684.677](https://doi.org/10.1126/science.103.2684.677).
- Surminski, S. and Eldridge, J. (2015), "Observations on the role of the private sector in the UNFCCC's loss and damage of climate change work program", *International Journal of Global Warming*, Vol. 8 No. 2, pp. 213-230, doi: [10.1504/IJGW.2015.071955](https://doi.org/10.1504/IJGW.2015.071955).
- Tarek, S. (2023), "Smart eco-cities conceptual framework to achieve UN-SDGs: a case study application in Egypt", *Civil Engineering and Architecture*, Vol. 11 No. 3, pp. 1383-1406, doi: [10.13189/cea.2023.110322](https://doi.org/10.13189/cea.2023.110322).
- Thakker, D., Mishra, B.K., Abdullatif, A., Mazumdar, S. and Simpson, S. (2020), "Explainable artificial intelligence for developing smart cities solutions", *Smart Cities*, Vol. 3 No. 4, pp. 1353-1382, doi: [10.3390/smartcities3040065](https://doi.org/10.3390/smartcities3040065).
- Tran Thi Hoang, G., Dupont, L. and Camargo, M. (2019), "Application of decision-making methods in smart city projects: a systematic literature review", *Smart Cities*, Vol. 2 No. 3, pp. 433-452, doi: [10.3390/smartcities2030027](https://doi.org/10.3390/smartcities2030027).
- Trivellato, B. (2017), "How can 'smart' also be socially sustainable? Insights from the case of Milan", *European Urban and Regional Studies*, Vol. 24 No. 4, pp. 337-351, doi: [10.1177/0969776416661016](https://doi.org/10.1177/0969776416661016).
- van Zanten, J.A. and van Tulder, R. (2021), "Analyzing companies' interactions with the sustainable development goals through network analysis: four corporate sustainability imperatives", *Business Strategy and the Environment*, Vol. 30 No. 5, pp. 2396-2420, doi: [10.1002/bse.2753](https://doi.org/10.1002/bse.2753).
- Williamson, B. (2015), "Educating the smart city: schooling smart citizens through computational urbanism", *Big Data and Society*, Vol. 2 No. 2, p. 2053951715617783, doi: [10.1177/2053951715617783](https://doi.org/10.1177/2053951715617783).
- Wirsinna, A., Grega, L. and Juenger, M. (2023), "Assessing factors influencing citizens' behavioral intention towards smart city living", *Smart Cities*, Vol. 6 No. 6, pp. 3093-3111, doi: [10.3390/smartcities6060138](https://doi.org/10.3390/smartcities6060138).
- Wiścicka-Fernando, M. (2024), "Citizens' engagement in the co-creation of smart city—an empirical study", in Sörensson, A., Bogren, M., Grigore, G., Stancu, A. and Lundström, A. (Eds), *Creating New Roles for a Sustainable Economy: Digitalization, Green Enterprises and Organizational Challenges*, Springer Nature Switzerland, Cham, pp. 177-201, doi: [10.1007/978-3-031-61551-1_8](https://doi.org/10.1007/978-3-031-61551-1_8).
- Zanella, A., Bui, N., Castellani, A., Vangelista, L. and Zorzi, M. (2014), "Internet of things for smart cities", *IEEE Internet of Things Journal*, Vol. 1 No. 1, pp. 22-32, doi: [10.1109/JIOT.2014.2306328](https://doi.org/10.1109/JIOT.2014.2306328).

Corresponding author

Kelaniyage Shihan Dilruk Fernando can be contacted at: kelaniyage.fernando@phd.usz.edu.pl