

COMPANIES' ENGAGEMENT IN THE CO-CREATION OF SMART CITY – AN EMPIRICAL STUDY

Małgorzata WIŚCICKA-FERNANDO

University of Szczecin, Management Institute; malgorzata.wiscicka-fernando@usz.edu.pl,
ORCID: 0000-0001-9928-3335

Purpose: This article aims to present an empirical analysis of companies' attitudes towards co-creation within the Smart City concept, with particular attention to the role of managers' gender in the regional context of Western Pomerania.

Design/methodology/approach: The survey was conducted using CATI and CAWI methods among companies operating in two cities of the West Pomeranian region, Szczecin and Koszalin. The aim of the analysis was to assess business entities' willingness to co-create the smart city concept in the West Pomeranian Voivodeship. Ten Smart City dimensions were evaluated, and two hypotheses were formulated: (H01) there is no difference between female and male decision-makers in the combined importance ratings of willingness to co-create Smart City variables (A–J), and (H02) there is no difference between female and male decision-makers in the combined importance ratings of co-creation experience variables (A–J). Quantitative data were analysed using Cronbach's alpha, MANOVA, post hoc ANOVA, and Pearson's chi-squared test.

Findings: The results indicate that managers' gender does not influence firms' willingness or experience in smart city co-creation in the West Pomeranian region. Accordingly, hypotheses H01 and H02 were not rejected.

Research limitations/implications: The main limitation is that only the two largest cities in the West Pomeranian region were analysed, and the research was pilot in nature. Regional specificity also limits the ability to generalise the results.

Practical implications: The study's results, gathered from the surveyed companies, may be helpful for managers as they show that cooperation between municipal institutions and local entrepreneurs does not need to depend on gender. Municipal institutions can also plan collaborations with companies without considering gender, based on the company's size and industry.

Social implications: Considering gender perspectives in Smart City planning can support more inclusive and informed decision-making, build public trust, and ensure that innovation and co-creation initiatives are grounded in skills rather than gender stereotypes. Although gender was not a differentiating factor in this study, acknowledging gender perspectives remains essential for fostering inclusivity in urban development.

Originality/value: This study contributes to the smart city literature by providing empirical evidence on companies' engagement in smart city co-creation, with a particular focus on the role of gender as an explanatory variable. By analysing firms operating in the West Pomeranian region, the study offers a regional perspective that is rarely examined in existing research.

The findings indicate that gender does not significantly influence firms' willingness or experience in co-creation, thereby challenging common assumptions about gender-based differences in business engagement with smart city initiatives.

Keywords: Smart City, co-creation, company, gender, business engagement, urban innovation.

Category of the paper: Research paper.

1. Introduction

The concept of Smart City, which has been discussed since the 1980s, has evolved from viewing the city as a technological system to seeing it as a space co-created by residents, businesses, government, and science. The absence of a universally accepted definition means that Smart Cities are understood differently across technological, urban, managerial, and social perspectives (Albino et al., 2015; Mora et al., 2017).

This evolution is visible across generations, from City 1.0 to City 5.0. Each new generation has been influenced by digital and technological transformations and major trends like globalisation, urbanisation, climate change, and sustainable development (Höjer, Wangel, 2015; Masik, Studzińska, 2018). It is worth noting that future Smart City concepts focus less on technology and more on building relationships and cooperation with stakeholders. Therefore, the city management model is shifting from a passive to an active approach, where residents and businesses are not only recipients of services but also creators of new solutions. The role of residents in the Smart City concept is well explained, especially in improving their quality of life. However, the role of companies remains less explored. There is a lack of studies highlighting the role of companies not only as users of Smart City services, but also as co-creators of Smart City solutions and services. Special attention will be given to companies and their dual roles in Smart Cities. The Polish context is fascinating because the development of the Smart City concept here involves strong participation of local authorities, while the role of companies is not sufficiently recognised.

Previous studies have mainly focused on residents and their quality of life, while the role of businesses in co-creating smart cities remains underrecognised. Meanwhile, as infrastructure users and innovative solutions providers, companies significantly influence shaping the urban ecosystem and its adaptation capacity. Addressing this gap is crucial to understanding how the Smart City development works (Letkiewicz et al., 2024).

Participation in the co-creation process presents a new challenge for city managers and companies. The core of co-creation has evolved since the early 2000s, when it was recognised that engaging customers in the development of products and services is vital to enhancing a company's value (Prahalad, Ramaswamy, 2000, 2004). By becoming an active participant in the creation process, the customer establishes a new link in communication and knowledge exchange. The Dialogue – Access – Risk assessment – Transparency model (DART) proposed

by Prahalad and Ramaswamy, which emphasises dialogue, accessibility, risk assessment, and transparency, has started to be implemented in various business sectors, including city management (Popescul et al., 2024; Rodríguez Bolívar, 2018; Schulders, 2022).

It is worth noting that co-creation involves not only value but also the co-creation of the product and the experience. A significant trend in integrating co-creation into Smart City development was the movement toward individualisation and mass personalisation that emerged in business (Cardullo, Kitchin, 2019; Cohen, Karatzimas, 2022; Preston et al., 2020). The concepts of co-creation, developed in business literature, were later adopted by urban research, where cooperation among various stakeholders became a crucial element in the development of Smart Cities.

The idea of co-creation originated in business literature and was subsequently transferred to urban research, where collaboration among stakeholders became a central part of developing Smart Cities. Today, a key focus in Smart City development is not solely on technology and rankings but also on various aspects of quality of life, including stakeholder experiences and how social needs are addressed within the city.

Today, an essential aspect of Smart City development is not just technology and rankings, but also various dimensions of quality of life, including stakeholder experiences and ways to meet social needs in the city. The Quadruple Helix Innovation Model demonstrates the stakeholder cooperation, emphasising four main actor groups: government, civil society, business, and academic institutions (Carayannis et al., 2012). This model stresses the importance of collaboration and participation among diverse stakeholders in developing the Smart City concept, highlighting the core social needs and sustainable urban growth (Cai, Lattu, 2021).

The innovation ecosystem perspective can further enrich the Quadruple Helix concept by emphasising the actors involved, their relationships, and value exchanges. In ecosystem terms, the city acts as a complex network of interdependencies where companies play a crucial role—both as recipients of public services and as creators of innovative solutions (Jacobides et al., 2018).

In the context of Smart Cities, companies serve a dual role. They benefit from city solutions, such as digitised administrative services, data access, infrastructure, and improved business processes. On the other hand, they develop innovative solutions, such as mobile apps, IoT systems, or smart energy networks, that can be implemented city-wide or across different organisations.

Given this dual role, it is essential to refer to the concept of Public Value Co-Creation, which suggests that public value is generated not only through residents' involvement but also through the active participation of local businesses (Bryson et al., 2014, 2017). The core idea of this concept is the joint creation of social value and innovation that influences residents' quality of life. One institutional mechanism supporting co-creation is Public-Private Partnership (PPP) (Cohen, Karatzimas, 2022).

Understanding how companies co-create within Smart Cities requires examining their attitudes and experiences within a specific urban context. This article aims to present an empirical analysis of companies' attitudes and experiences related to collaboration in the Smart City concept, considering the gender of the decision-maker. The aim of the analysis was to assess business entities' willingness to co-create the smart city concept in the West Pomeranian Voivodeship. The study provides insights into the potential and limitations of cooperation in the two most significant urban centres in the West Pomeranian region.

2. Methods

In 2021, a pilot survey was conducted using CATI (computer-assisted telephone interviewing) and CAWI (computer-assisted web interviewing) techniques on a random sample of 221 companies from the West Pomeranian region in Poland. The study was based on self-reported data collected through a cross-sectional survey approach. Consequently, the results reflect respondents' subjective evaluations at a single moment and do not permit causal inference or analysis of changes in firms' engagement over time.

The study adopted a quantitative approach, employing descriptive statistics, Cronbach's alpha, MANOVA, post-hoc ANOVA, and Pearson's Chi-squared test to analyse the primary data. The research questionnaire consists of two main sections. The first section addressed collecting ratio-scale data from 0 to 100, where 0 indicates no willingness to co-create Smart Cities related to the company, and 100 indicates maximum willingness to co-create. The second section focused on collecting ratio scale data from 0 to 100, where 0 signifies no experience in co-creation by the company, and 100 represents maximum expertise in co-creating Smart Cities by the company. Cronbach's alpha was calculated to assess the internal consistency of the company's scale for willingness to co-create Smart Cities, which includes 10 items: attractiveness of infrastructure (A), cultural events (B), green areas (C), e-office (D), healthcare (E), education (F), environmental protection (G), local labour market (H), safe city (I), and attractiveness of the property (J). It also evaluated the company's co-creation experience with the same 10 items: attractiveness of infrastructure (A), cultural events (B), green areas (C), e-office (D), healthcare (E), education (F), environmental protection (G), local labour market (H), safe city (I), and attractiveness of the property (J) (table 1).

Table 1.*Description of the variables and symbolic representations*

Name of the variable	Symbolic representation	Measurement scale
Attractiveness of infrastructure	A	Ratio scale (0-100, 0 means no willingness or no experience in co-creation, 100 means maximum willingness or maximum experience in the co-creation of smart cities)
Cultural events	B	
Green areas	C	
E-office	D	
Healthcare	E	
Education	F	
Environmental protection	G	
Local labour market	H	
Safe City	I	
Attractiveness of the property	J	

Source: own.

The selection of the ten Smart City dimensions (A–J) was guided by established smart city frameworks and aimed at capturing areas that are particularly relevant from the perspective of companies as both users of urban services and active partners in urban development processes. The dimensions reflect key domains identified in widely recognised models, including the Smart City Wheel (Cohen, 2012, 2015), which emphasises the interconnectedness of governance, economy, environment, mobility, and quality of life, as well as Giffinger's smart city model, which offers a structured classification of urban functions linked to economic performance, innovation, and labour markets (Giffinger et al., 2007).

Additionally, the selection was guided by models that explicitly incorporate sustainability, governance capacity, and stakeholder collaboration, such as IBM's Smarter Cities framework and the Smart Cities Maturity Model developed by the Scottish Cities Alliance. These approaches broaden the smart city concept beyond technological infrastructure by emphasising the importance of digital public services, data-driven governance, environmental responsibility, and cross-sector cooperation in improving urban management and citizen participation (Harrison et al., 2010; Scottish Cities Alliance, 2021).

Taken together, these frameworks support including dimensions related to infrastructure attractiveness, digital public services, environmental protection, labour markets, safety, and the quality of the urban environment. These are areas where companies directly interact with cities and contribute to value creation, making them particularly relevant for analysing business engagement in smart city co-creation. This operationalisation allows an empirical examination of smart city development focused on business participation and collaborative governance rather than only on technological solutions.

The study used self-reported data collected via a cross-sectional survey. As a result, the findings reflect respondents' subjective assessments at a single point in time and do not permit causal inference or the analysis of changes in firms' engagement over time. A reliability analysis indicated the ten-item company's willingness to co-create smart cities scale had acceptable internal consistency, Cronbach's $\alpha = .773$, 95% BCa CI [.698, .825] with a sample of 122 companies (Table 2), and the ten-item the company's co-creation experience of the Smart

Cities scale had good internal consistency, Cronbach's $\alpha = .828$, 95% BCa CI [.740, .887], with a sample of 66 companies (Table 3). RStudio and Microsoft Excel were used to analyse the primary data, and the results were reported in accordance with APA standards.

The conceptual framework of this study comprises a classification variable, specifically gender. The classification or treatment levels indicate whether women or men made decisions. Additionally, the model identifies dependent variables, encompassing ten areas of Smart Cities (A-J) (see Table 1). These ten variables were evaluated under two scenarios: willingness to participate in co-creating a Smart City and experience in co-creating one (Figure 1).

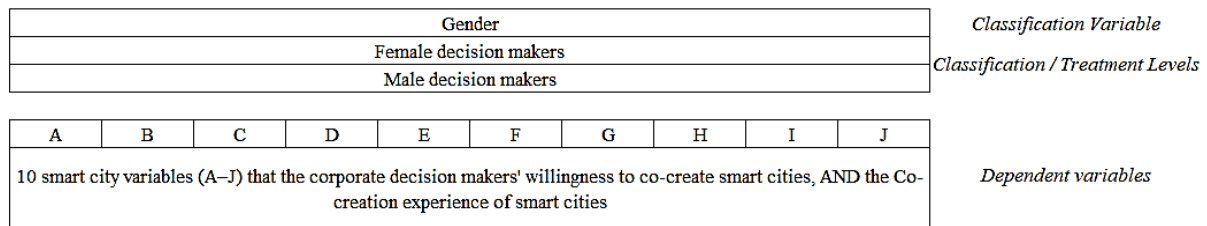


Figure 1. Conceptual framework of the study.

Source: own study.

The research objective

RO1: The first research objective was to test whether female and male decision-makers differ in how they rate willingness to co-create smart cities across 10 Smart City variables (A–J).

RO2: The second research objective was to test whether female and male decision-makers differ in how they rate the co-creation experience of Smart Cities across 10 Smart City variables (A–J).

Main research hypotheses

(H01): There is no difference between female and male decision-makers in the combined importance ratings of willingness to co-create Smart Cities variables (A to J).

(H02): There is no difference between female and male decision-makers in the combined importance ratings of the co-creation experience of Smart Cities variables (A to J).

Post-hoc ANOVA hypotheses (willingness to co-create Smart Cities variables A-J)

Ha10: Mean willingness to co-create Smart Cities variable rating of variable A is equal across females and males.

Hb10: Mean willingness to co-create Smart Cities variable rating of variable B is equal across females and males.

Hc10: Mean willingness to co-create Smart Cities variable rating of variable C is equal across females and males.

Hd10: Mean willingness to co-create Smart Cities variable rating of variable D is equal across females and males.

He10: Mean willingness to co-create Smart Cities variable rating of variable E is equal across females and males.

Hf10: Mean willingness to co-create Smart Cities variable rating of variable F is equal across females and males.

Hg10: Mean willingness to co-create Smart Cities variable rating of variable G is equal across females and males.

Hh10: Mean willingness to co-create Smart Cities variable rating of variable H is equal across females and males.

Hi10: Mean willingness to co-create Smart Cities variable rating of variable I is equal across females and males.

Hj10: Mean willingness to co-create Smart Cities variable rating of variable J is equal across females and males.

Post-hoc ANOVA hypotheses (Co-creation experience of Smart Cities variables A-J)

Ha20: Mean co-creation experience of Smart Cities variable rating of variable A is equal across females and males.

Hb20: Mean co-creation experience of Smart Cities variable rating of variable B is equal across females and males.

Hc20: Mean co-creation experience of Smart Cities variable rating of variable C is equal across females and males.

Hd20: Mean co-creation experience of Smart Cities variable rating of variable D is equal across females and males.

He20: Mean co-creation experience of Smart Cities variable rating of variable E is equal across females and males.

Hf20: Mean co-creation experience of Smart Cities variable rating of variable F is equal across females and males.

Hg20: Mean co-creation experience of Smart Cities variable rating of variable G is equal across females and males.

Hh20: Mean co-creation experience of Smart Cities variable rating of variable H is equal across females and males.

Hi20: Mean co-creation experience of Smart Cities variable rating of variable I is equal across females and males.

Hj20: Mean co-creation experience of Smart Cities variable rating of variable J is equal across females and males.

3. Results

The research was a pilot study and was conducted in companies from the two largest cities in the West Pomeranian Province, Szczecin and Koszalin. The sample included 120 companies from Szczecin and 101 from Koszalin. The regional study focused on companies in the West

Pomeranian Province to ensure the sample accurately represented the structure of companies in the area. Carefully selected sampling criteria were applied to improve the results' reliability and enable generalisations about the population of companies operating in the province. This approach is essential for accurately understanding the opinions and experiences of companies in this specific region (Bazarnik et al., 1992).

Table 2.

Chi-square test of independence - willingness to co-create Smart Cities

Gender	Willing to co-create	
	Yes	No
Female	47 / 21%	43 / 19%
Male	75 / 34%	56 / 25%

Source: field data 2021.

The contingency table shows the distribution of responses across two groups: women and men. The results show that 21% of women and 34% of men expressed willingness to co-create a Smart City (Table 2).

A Chi-square test of independence was conducted to examine the association between the decision maker's gender (female vs. male) and responses (Willing to co-create—Yes vs. Willing to co-create—No). The association was not statistically significant, $\chi^2(1, N = 221) = 0.36$, $p = .548$, indicating that yes/no responses did not differ by the company's decision-maker's gender.

Table 3.

Chi-square test of independence - experience to co-create Smart Cities

Gender	Co-creation experience	
	Yes	No
Female	23 / 10%	67 / 30%
Male	43 / 19%	88 / 40%

Source: field data 2021.

The contingency table presents the distribution of responses between two respondent groups: women and men. The results show that 30% of women and 40% of men reported having no co-creation experience (Table 3). A chi-square test of independence was conducted to examine the association between the decision maker's gender (female vs. male) and responses (Co-creation experience of smart cities = Yes vs. Co-creation experience of smart cities = No). The findings indicated that the association was not statistically significant, $\chi^2(1, N = 221) = 1.02$, $p = .312$, indicating that the yes/no responses did not vary according to the company's decision-maker's gender.

MANOVA analysis of the effect of the gender of the decision maker on willingness to co-create Smart Cities. A one-way multivariate analysis of variance was conducted to examine whether the decision-maker's gender (female vs. male) influenced willingness to co-create across 10 dimensions of smart cities (A–J). The results of the multivariate tests were not statistically significant. Specifically, **Pillai's Trace was .13, $F(10, 111) = 1.65$, $p = .102$;**

Wilks' Lambda was .87, $F(10, 111) = 1.65$, $p = .102$; Hotelling–Lawley trace was .15, $F(10, 111) = 1.65$, $p = .102$, and Roy's Largest Root was .15, $F(10, 111) = 1.65$, $p = .102$. These results indicate that, when considered jointly, there were no statistically significant differences between female and male decision makers in their willingness to co-create across the ten measured Smart City dimensions (A-J) (Table 4).

Table 4.

Multivariate test summary of the gender on willingness to co-create Smart Cities

Test Statistic	Value	F	Hypothesis df	Error df	p value
Pillai's Trace	.13	1.65	10	111	.102
Wilks' Lambda	.87	1.65	10	111	.102
Hotelling–Lawley	.15	1.65	10	111	.102
Roy's Largest Root	.15	1.65	10	111	.102

Note: The independent variable is the decision maker's gender (female or male). The dependent variables are A-J (willingness to co-create dimension of smart cities).

Source: Field data 2021.

Accordingly, none of the dependent variables from A-J (willing to co-create smart cities) show a statistically significant difference between female and male decision-makers.

Analysis - MANOVA - the effect of gender on experience in co-creating Smart Cities. MANOVA was conducted to examine whether the gender of the decision maker (female vs. male) influenced experience in co-creating Smart City dimensions (A–J) (Table 5).

Table 5.

Analysis - Post-hoc ANOVAs (Univariate tests summary of the gender on willingness to co-create smart cities)

Variable	F-value	p-value	Interpretation
A	3.11	.080	Not significant
B	1.40	.287	Not significant
C	1.04	.309	Not significant
D	0	.995	Not significant
E	1	.139	Not significant
F	.68	.410	Not significant
G	1.33	.250	Not significant
H	.47	.491	Not significant
I	3.85	.060	Not significant
J	.08	.771	Not significant

Source: Field data 2021.

The multivariate effect of gender was not statistically significant. Specifically, **Pillai's Trace = .12, $F(10, 55) = 0.77$, $p = .660$; Wilks' Lambda = .88, $F(10, 55) = 0.77$, $p = .660$; Hotelling–Lawley trace = .14, $F(10, 55) = 0.77$, $p = .660$; and Roy's Largest Root = .14, $F(10, 55) = 0.77$, $p = .660$.** These results indicate that female and male decision makers did not differ significantly in their co-creation experience when considering the ten dimensions jointly (Table 6).

Table 6.*Multivariate test summary of the gender on the co-creation experience of Smart Cities*

Test Statistic	Value	F	Hypothesis df	Error df	p value
Pillai's Trace	.12	.77	10	55	.660
Wilks' Lambda	.88	.77	10	55	.660
Hotelling–Lawley	.14	.77	10	55	.660
Roy's Largest Root	.14	.77	10	55	.660

Note: The independent variable is the gender of the decision maker (female or male). Dependent variables: A–J (Co-creation experience of Smart Cities).

Source: Field data 2021,

Based on the results presented in Table 7, none of the variables examined (A–J) differentiate participants' experiences in Smart City projects.

Table 7.*Analysis - Post-hoc ANOVAs (Univariate tests summary of the experience in co-creation of Smart Cities)*

Variable	F-value	p-value	Interpretation
A	.01	.920	Not significant
B	1.13	.291	Not significant
C	.00	.948	Not significant
D	.010	.917	Not significant
E	.79	.377	Not significant
F	.57	.451	Not significant
G	.16	.685	Not significant
H	.51	.474	Not significant
I	1.24	.269	Not significant
J	.10	.749	Not significant

Source: Field data 2021.

Accordingly, none of the dependent variables from A–J (Experience in co-creating Smart Cities) show a statistically significant difference between female and male decision-makers.

4. Discussion

The analyses conducted show that in none of the areas studied was there a significant correlation between the gender of managers and their attitude towards co-creating a Smart City. The areas examined included: attractiveness of infrastructure (A), cultural events (B), green areas (C), e-office (D), healthcare (E), education (F), environmental protection (G), local labour market (H), safe city (I), and attractiveness of the property (J). The findings may suggest that gender does not play a significant role in the willingness to innovate, including in co-creating a Smart City (Expósito et al., 2023). However, when it comes to issues of security or trust in modern solutions, emotions are correlated with gender. However, these issues were not the subject of the research results presented in the article (Walczak et al., 2025).

Regarding experience in co-creating Smart City areas, no correlation was found between the manager's gender and their self-reported experience. This is different from research on CSR implementation and gender differences in attitudes (Lu et al., 2020).

However, studies in other markets indicate that gender issues should be taken into account at the planning stage. This is particularly true in regions where women play a lesser role in management, such as Asian countries (Wahyudi, Elanda, 2023).

Companies' gender does not seem to differentiate either willingness or experience in co-creating Smart City areas. Consequently, this may mean that in practice, when engaging companies from the West Pomeranian region, the willingness to participate in Smart City projects is independent of the gender of the management staff. This may suggest that, in the region under study, companies' approach to smart cities is shaped more by sectoral, technological, or economic factors than by managers' socio-demographic characteristics.

Some limitations may have influenced the research results. First, it is important to note that the study was pilot in nature. The relatively small sample size might not have identified subtle differences between gender groups across the examined variables. It should also be recognised that the sample included companies from a region with a specific sectoral structure, which may limit the broader applicability of the findings. Additionally, as the concept of co-creation is not yet widely integrated into the development of Smart Cities, this may have influenced respondents' assessments of both willingness to participate and actual experience.

The data were based on self-reported assessments, which may be affected by respondents' subjective perceptions and social desirability bias. Additionally, the cross-sectional design of the study does not permit tracking changes in firms' engagement over time or establishing causal links between gender and co-creation attitudes. Finally, the use of aggregated indicators may have restricted the ability to observe more detailed differences across specific dimensions of smart city co-creation.

Despite these limitations, the findings add to the existing literature, as empirical studies exploring business engagement in smart city co-creation within the Polish context remain limited, and gender does not appear as a major differentiating factor. In practice, this indicates that local governments planning collaboration with companies do not need to tailor their strategies for engaging firms based on the gender of the individual in charge. Therefore, the researcher recommends conducting similar studies with a larger sample covering the entire country of Poland as a future research direction. Additionally, future research could be designed to analyse the same phenomena across various sectors and industries to identify potential differences.

In summary, the literature on this topic shows mixed results. Some studies find no gender differences in the overall perception of Smart City co-creation. Conversely, others indicate that differences exist regarding specific aspects, such as trust in technology or environmental values.

5. Summary

The aim of the empirical analysis in this article was to evaluate business entities' willingness to participate in the co-creation of the smart city concept in the West Pomeranian Voivodeship, based on companies' attitudes and experiences, with gender as a factor explaining differences. The results indicate that managers' gender does not differentiate between companies' willingness to co-create Smart Cities or their experiences in this area. This means that, in practice, business involvement in such initiatives in the West Pomeranian region is gender-neutral.

These results significantly contribute to the discussion on co-creating Smart Cities, as they indicate that demographic factors - such as gender - do not necessarily determine business engagement. This suggests that other factors, such as industry, company size, level of innovation, or a company's degree of integration into the local ecosystem, may play a more significant role in shaping urban policies.

From a practical perspective, the results show that strategies for involving businesses in Smart City projects can be designed more universally without differentiating activities based on the management staff's gender. This allows local governments to focus on building cooperation platforms, making project access easier, and creating sectoral incentives that appeal to companies regardless of their demographic makeup.

However, it should be emphasised that the study was a pilot study and its scope was limited to the two largest urban centres in the West Pomeranian region. The small sample size might not have revealed subtle relationships that would be visible in a larger-scale study. Additionally, each region has its own sector-specific characteristics, which makes it difficult to generalise the results to other areas. Future analyses should consider the industry and size of companies, as well as cultural, technological, and organisational factors that may influence their readiness to co-create a Smart City.

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