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Digital Readiness and Business Engagement in Smart City Co-Creation: Insights from Poland's West Pomeranian Region

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Abstract:

Purpose: *The paper aims to examine the relationship between firms' digital readiness and their involvement in Smart City co-creation within the West Pomeranian region in Poland. It addresses a research gap concerning the limited empirical studies that link companies' digital maturity with their participation in collaborative innovation processes in urban areas environments.*
Design/Methodology/Approach: *The study uses a quantitative research design based on CATI and CAWI surveys conducted among firms operating in two major cities of the Polish region – Szczecin and Koszalin. The data were analysed using non-parametric statistical tests, including chi-square tests of independence and reliability analysis (Cronbach's Alpha).*
Findings: *The results show that firms' involvement in Smart City co-creation is partly linked to the use of specific digital tools, especially security applications and smart meters, indicating that greater digital readiness may enable more active collaboration with municipal stakeholders. The findings also highlight differences between companies in their levels of digital adoption across various areas of smart city infrastructure.*
Practical implications: *The study emphasises the importance of improving firms' digital competencies to strengthen their role as active co-creators of urban innovation. The results may guide policymakers and local authorities in developing strategies that encourage business participation in smart city ecosystems.*
Originality/Value: *This research contributes to the literature on Smart City and public management by providing new empirical evidence on the relationship between digital readiness and business co-creation in regional development. It also highlights a lack of validated measurement tools to systematically evaluate this relationship, emphasising the need for further methodological progress.*

Keywords: *Companies, co-creation, smart city, new technology.*

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1. Introduction

The modern development of digital technologies significantly influences the transformation of city management, as seen in the concept of the Smart City. By introducing innovative tools and systems, digitalisation enables better management of urban resources, enhances residents' quality of life, and promotes greater public engagement in decision-making (Hämäläinen, 2021; Pereira, Parycek, Falco, and Kleinhans, 2018).

In the context of smart governance, research indicates that the active participation of both residents and businesses in developing smart cities is crucial for attaining sustainable development, administrative efficiency, and innovation (Jiang, Geertman, and Witte, 2019; Vujković, Ravšelj, Umek, and Aristovnik, 2022). In response to global challenges such as urbanisation, digitalisation, and rapid social change, this topic is becoming increasingly relevant, compelling cities to adapt to modern conditions and enhance service quality through new technologies (Kitchin, 2014; Grima *et al.,* 2023; Tyagi *et al.,* 2023).

Previous research also indicates that companies are crucial partners in implementing technological solutions in smart cities, which will determine the success of the projects undertaken. (Helkkula, Kowalkowski, and Tronvoll, 2018). Their role is not only to use modern technologies as city users but also to develop new solutions. For this reason, this collaboration will determine further development and engagement (Carpentiere, Mancuso, Albino, Petruzzelli, and Panniello, 2023; Senyo, Liu, and Effah, 2019).

The literature is dominated by the perspective of citizens rather than businesses, which is why it is important to carry out analyses that include aspects of co-creating innovation in smart cities with businesses (Israilidis, Odusanya, and Mazhar, 2021; Pratama, 2025; Zwick and Spicer, 2024). Research tends to focus more on citizens and less on businesses.

Therefore, there is a gap in understanding the role that businesses play in the process of digitisation and co-creation of smart cities (Galvagno and Dalli, 2014; Menezes and Mateus, 2020). This also contributes to the limited number of studies analysing the relationship between companies' digital readiness and their involvement in co-creation in the Polish regional context.

This article aims to examine how the digital readiness level of enterprises in the West Pomeranian region affects their attitudes and experiences in co-creating a Smart City. The study investigates the relationship between companies' digital preparedness and their participation in Smart City co-creation.

To achieve this, it explores questions such as: To what extent does digital readiness influence companies' willingness to co-create smart cities? Does digital preparedness correlate with actual co-creation experience?

Data was collected from firms operating in two key cities within the West Pomeranian region—Szczecin and Koszalin—using CATI and CAWI methods.

The aim was to collect opinions on areas of the Smart City project, analysing six dimensions of digitalisation, with empirical data subjected to statistical analysis. The study highlights the role of companies in shaping smart cities, emphasising digital readiness as a crucial factor in co-creation. It offers a new perspective on the role of businesses in co-creating smart cities. The data, focused on a regional context rarely explored in existing literature, provides valuable insights.

Limitations stem from the pilot nature of the study and its focus on only two cities in the region. Nonetheless, the results lay the groundwork for deeper future investigations.

The article is organised into five sections. The first section, Introduction, introduces the topic and provides the study's context. The second section, Literature Review, offers an overview of relevant research. The Methodology section then explains the research design and procedures used. In the Results and Discussion section, the findings from the analyses are presented and discussed. Finally, the article concludes with a summary that highlights recommendations and directions for future research.

2. Literature Review

The Smart City concept has evolved from a primarily technology-based approach using information and communication technologies (ICT) to improve city operations into a participatory model in which social engagement and collaboration among different stakeholder groups form the foundation of the current Smart City idea. (Meijer and Bolívar, 2016; Misiak-Kwit, 2025; Weingaertner and Moberg, 2014). This approach signifies a move away from the technological focus of Smart Cities towards the social aspect of urban innovation.

Human capital, where co-creation becomes a vital element of Smart City solutions, is playing an increasingly significant role. Smart City co-creation emphasises involving residents and various partners in planning, maintaining, and developing cities to fully utilise local social capital and technology, thereby creating more sustainable and adaptable urban ecosystems (Cortés-Cediel, Cantador, and Bolívar, 2019; Puerari *et al.,* 2018).

Engaging residents is defined as a participatory process that enhances their shared sense of responsibility for urban space (Di Bernardo, Cosimato, and Carrubbo, 2023). Consequently, this fosters social dialogue aimed at improving quality of life (Webster and Leleux, 2018).

The literature shows a shift in the logic of city management from the traditional model of governance based on hierarchy and control to a collaborative innovation approach (Sørensen, 2012; Torfing, 2012). This shift is part of a wider strategy for collaborative governance, which involves the joint creation of public value by actors from various sectors, including public, private, and civic (Ansell and Torfing, 2021; Torfing and Triantafillou, 2016). It is within this model that space for an active role for business emerges.

The new approach stresses the importance of cross-sector collaboration and shared responsibility in fostering urban innovation. The city is no longer viewed as a top-down hierarchy but begins to operate as a network of interconnected stakeholders involved in decision-making and implementation processes. In this framework, public authorities act as facilitators and catalysts of cooperation, while companies, residents, and social organisations become co-creators of public value.

Therefore, co-creation in a Smart City is a practical aspect of the logic of collaborative innovation, where solutions are developed through the synergy of skills and resources among various actors within the urban ecosystem (Jukić, Pevcin, Benčina, Dečman, and Vrbek, 2019).

The modern approach to city management increasingly relies on stakeholder theory (Freeman, 2010), which considers a city as a system of interconnected actors, including public institutions, residents, non-governmental organisations, and businesses that collaboratively generate public value. In this perspective, enterprises are not just economic entities but essential participants in the urban ecosystem who, through their technological and organisational resources, actively contribute to creating public value (Agranoff, 2012; Caragliu and Del Bo, 2019).

In the context of developing the Smart City concept, this theory helps to better understand that the effectiveness of actions does not depend solely on the decisions of municipal authorities, but on the level of cooperation and commitment of all parties. Companies, with their technological and organisational resources, become key partners in this system, combining economic goals with the social needs of the

city (Agranoff, 2012). From a public management point of view, this involves shifting from a hierarchical administrative model to a network-based approach centred on shared responsibility and co-creation of innovative solutions (Torfing, 2019).

In practice, models concerning cooperation between residents-citizens or so-called urban models are utilised (Masik, Sagan, and Scott, 2021; Tartia and Hämäläinen, 2024). The literature includes works that explore engaging residents in the co-creation of Smart City (Aflaki, 2021; Biercewicz, Fernando, Misiak-Kwit, and Wiścicka-Fernando, 2024)).

However, the role of companies as active partners in producing public value is less frequently discussed (Di Bernardo *et al.,* 2023). The open innovation approach – participatory – requires co-creation and co-production not only with citizens but also with businesses (Jukić *et al.,* 2019).

The contemporary approach to collaboration between a city and its stakeholders is heavily influenced by the level of digital readiness. Digital readiness is a crucial factor in determining the ability to participate in co-creating the Smart City concept. It is vital to foster a culture of continuous learning and openness to change (Wang, Gao, Cao, Li, and Wang, 2023), which supports effective management in today's knowledge-based economy (Mittal, Khan, Romero, and Wuest, 2018).

The level of digital maturity varies among organisations, affecting their willingness to collaborate within the Smart City model (Bharadwaj, El Sawy, Pavlou, and Venkatraman, 2013; Khin and Ho, 2018). More digitally advanced companies are more inclined to engage in urban projects, showing greater openness to cooperation with public institutions. It is also important to recognise that the degree of digital transformation influences the level of engagement with the public sector (Aflaki, 2021).

Another factor that differentiates digital readiness is geographical location, i.e., the region where the company operates. In Poland, there are still considerable disparities in infrastructure and digital development depending on the area (Misiak-Kwit *et al.,* 2025). In regions such as West Pomerania, the varying levels of digitisation among companies influence their actual readiness to co-create and co-manage Smart City projects (Grupa PFR, 2025).

Companies with a higher level of digitisation are more likely to engage in co-creation processes and are therefore more receptive to cooperation, which promotes interaction with urban platforms, applications, and data systems.

The significant interest in the concept of smart cities within the literature continues to primarily focus on residents (Joo, 2019) and the deployment of modern technologies to develop digital infrastructure (Rodriguez Müller, Casiano Flores,

Albrecht, Steen, and Crompvoets, 2021). Simultaneously, issues related to partnerships with companies and their digital maturity remain underexplored (Jukić *et al.,* 2019).

There are studies that examine the role of partnerships and readiness for co-creation in general (Giordino, Troise, Vanhaverbeke, and Culasso, 2025), but empirical research insufficiently investigates the connection between companies' digital preparedness and their involvement in co-creating the Smart City concept (Dai, Hasanefendic, and Bossink, 2024).

One reason for this is the tendency to focus research on residents as users of digital solutions and the fragmentation of studies across multiple disciplines, such as computer science, urban planning, and management. Furthermore, there is a lack of validated measurement tools to assess companies' digital readiness and their participation in Smart City co-creation processes (Fernando, Wiścicka – Fernando, and Misiak-Kwit, 2025; Jakubcinova, Štefčíková, and Poruban, 2023). The identified gap highlights the need to develop and validate a research instrument that allows for systematic measurement and comparison across different regional contexts.

3. Research Methodology

In 2021, the primary data were administered using the CATI and CAWI methods. The CATI and CAWI methods were chosen due to their effectiveness in reaching business respondents and ensuring a higher response rate among managers, particularly when investigating attitudes toward technology and collaboration in urban innovation contexts (Bryman, 2016; Dillman, Smyth, and Christian, 2014).

Accordingly, the study's sample size was randomly selected from 221 companies in the West Pomeranian region, Poland (Misiak-Kwit and Wiścicka-Fernando, 2024).

The study is cross-sectional and quantitative in nature, aiming to explore relationships between variables. According to the methodology employed in the regional research, the chosen sample is deemed representative (Bazarnik, Grabiński, Kąciak, Mynarski, and Sagan, 1992). Due to the nature of the primary data that belongs to the nominal and ordinal categories, the research study design applies non-parametric statistics to test the formulated hypotheses.

Furthermore, the authors applied the chi-square test of independence to determine the relationship between the categorical variables. Moreover, sample proportions were calculated with 95% confidence intervals to display the descriptive nature of the dataset. Cronbach's Alpha was calculated to determine the internal consistency of the six-item research instrument. Statistical analyses (Chi-square tests) were conducted to verify relationships between selected variables.

The authors used RStudio R version 4.2.2 and Microsoft Excel to calculate and run the hypothesis testing. Table 1 shows the selected Smart City variables, and the authors created symbols that demonstrated the digital readiness and business engagement in Smart City co-creation. While the study provides valuable insights into the digital readiness of firms in the West Pomeranian region, its pilot nature and regional focus limit the generalizability of findings.

Table 1. *Variables demonstrate digital readiness and business engagement in Smart City co-creation.*

Variable	Symbol
Smart payment systems (e-payment)	D1
E-government	D2
Security applications	D3
Smart meters (IoT)	D4
Hotspot / free Wi-Fi in the city	D5
Transport applications / smart parking	D6

Source: *Author's calculations.*

According to Table 1, Cronbach's Alpha, $\alpha = 0.70$ and according to the threshold: > 0.70 (acceptable), > 0.80 (good), > 0.90 (excellent). Thus, the 6-item scale shows acceptable internal consistency. The study's authors formulated 12 null hypotheses. \

H_{01}: There is a relationship between using an innovative payment system and being willing to co-create to develop a Smart City.
H_{02}: There is a relationship between using an e-government facility and being willing to co-create to develop a Smart City.
H_{03}: There is a relationship between using security applications and being willing to co-create to develop a Smart City.
H_{04}: There is a relationship between using smart meters and being willing to co-create to develop a Smart City.
H_{05}: Providing free Wi-Fi facilities and being willing to co-create to develop a Smart City are related.
H_{06}: There is a relationship between using innovative parking applications and being willing to co-create to develop a Smart City.
H_{07}: There is a relationship between using an innovative payment system and experience in co-creation to develop a Smart City.
H_{08}: There is a relationship between using an e-government facility and experience in co-creation to develop a Smart City.
H_{09}: There is a relationship between using security applications and experience in co-creation to develop a Smart City.
H_{010}: There is a relationship between using smart meters and experience in co-creation to develop a Smart City.
H_{011}: Providing free Wi-Fi facilities and experience in co-creation to develop a Smart City are related.

H_{012}: There is a relationship between using smart parking applications and experience in co-creation to develop a Smart City.

4. Research Results and Discussion

The analysis aimed to examine whether digital readiness influences companies' engagement and co-creation experiences in the context of smart cities. The results of multiple statistical tests consistently indicate that such dependencies occur only for selected variables.

The authors calculated proportions and 95% confidence intervals for the population proportion for each selected variable. Table 2 displays the overall sample proportion and the estimated population proportions calculation. It presents the digital variables of the selected smart cities and their usage under the options 'use', 'do not use', and 'willing to use'.

***Table 2**. Usage of the selected smart cities' digital variables*

Variable	Option	Frequency	Sample proportion (n = 221)	95% CI Estimation for the population proportion
Smart payment systems (e-payment)	Use	205	0.93	$0.89 \leq p \leq 0.96$
	Do not use	12	0.05	$0.02 \leq p \leq 0.08$
	Willing to use	4	0.02	$0.00 \leq p \leq 0.04$
E-government	Use	195	0.88	$0.84 \leq p \leq 0.92$
	Do not use	13	0.06	$0.03 \leq p \leq 0.09$
	Willing to use	13	0.06	$0.03 \leq p \leq 0.09$
Security applications	Use	84	0.38	$0.32 \leq p \leq 0.44$
	Do not use	91	0.41	$0.35 \leq p \leq 0.48$
	Willing to use	46	0.21	$0.15 \leq p \leq 0.26$
Smart meters (IoT)	Use	79	0.36	$0.29 \leq p \leq 0.42$
	Do not use	66	0.30	$0.24 \leq p \leq 0.36$
	Willing to use	76	0.34	$0.28 \leq p \leq 0.41$
Hotspot / free Wi-Fi in the city	Use	86	0.39	$0.32 \leq p \leq 0.45$
	Do not use	94	0.43	$0.36 \leq p \leq 0.49$
	Willing to use	41	0.19	$0.13 \leq p \leq 0.24$
Transport applications / smart parking	Use	92	0.42	$0.35 \leq p \leq 0.48$
	Do not use	72	0.33	$0.26 \leq p \leq 0.39$
	Willing to use	57	0.26	$0.20 \leq p \leq 0.32$

***Source:** Authors' calculations.*

Table 2 included six variables. Accordingly, 93% of the companies selected the option 'use' regarding the variable of smart payment systems, *95% [0.89, 0.96]*, 5% of the companies selected the option 'do not use' regarding the variable of smart payment systems, *95% [0.02, 0.08]*, and 2% of the companies selected the option 'willing to use' regarding the variable of smart payment systems, *95% [0.00, 0.04]*.

About 88% of the companies selected the option ‘use’ regarding the variable of e-government, *95% [0.84, 0.92]*, 6% of the companies selected the option ‘do not use’ regarding the variable of e-government, *95% [0.03, 0.09]*, and 6% of the companies selected the option ‘willing to use’ regarding the variable of e-government, *95% [0.03, 0.09]*.

About 38% of the companies selected the option ‘use’ regarding the variable of security applications, *95% [0.32, 0.44]*, 41% of the companies selected the option ‘do not use’ regarding the variable of security applications, *95% [0.35, 0.48]*, and 21% of the companies selected the option ‘willing to use’ regarding the variable of security applications, *95% [0.15, 0.26]*.

About 36% of the companies selected the option ‘use’ regarding the variable of smart meters, *95% [0.29, 0.42]*, 30% of the companies selected the option ‘do not use’ regarding the variable of smart meters, *95% [0.24, 0.36]*, and 34% of the companies selected the option ‘willing to use’ regarding the variable of smart meters, *95% [0.28, 0.41]*.

About 39% of the companies selected the option ‘use’ regarding the variable of free Wi-Fi, *95% [0.32, 0.45]*, 43% of the companies selected the option ‘do not use’ regarding the variable of free Wi-Fi, *95% [0.36, 0.49]*, and 19% of the companies selected the option ‘willing to use’ regarding the variable of free Wi-Fi, *95% [0.13, 0.24]*.

About 42% of the companies selected the option ‘use’ regarding the variable of smart parking applications, *95% [0.35, 0.48]*, 33% of the companies selected the option ‘do not use’ regarding the variable of smart parking applications, *95% [0.26, 0.39]*, and 26% of the companies selected the option ‘willing to use’ regarding the variable of smart parking applications, *95% [0.20, 0.32]*.

The majority of firms reported actively using smart payment systems (93%) and e-government services (88%), while usage of security applications, smart meters, free Wi-Fi, and smart parking was more varied, with substantial shares of firms either not using these services or indicating willingness to adopt them.

This variation suggests that engagement in certain Smart City services is uneven, reflecting differences in perceived relevance, technological readiness, and potential benefits across service types.

Further, the authors test the formulated hypotheses under two scenarios. The first scenario is connected to the selected digital variable usage (Table 1) and companies' ‘willingness to co-create’ to develop a Smart City (Table 3). The second scenario is connected to the selected digital variable usage (Table 1) and companies' experience in co-creation to develop a Smart City (Table 4).

Table 3. *Testing Hypotheses – Scenario 1*

		Does your company want to get involved in the development of your city?		**Chi-square test**						
Variable	Option	Yes	No	Hypotheses	Chi-square test statistic	df	α	p-value	Observation	Decision
Smart payment systems (e-payment)	Use Do not use Willing to use	115 5 2	90 7 2	H_{01}	0.999	2	0.05	0.6068	p-value > 0.05	Not to reject the null
E-government	Use Do not use Willing to use	109 6 7	86 7 6	H_{02}	0.47818	2	0.05	0.7873	p-value > 0.05	Not to reject the null
Security applications	Use Do not use Willing to use	48 47 27	36 44 19	H_{03}	0.8197	2	0.05	0.6637	p-value > 0.05	Not to reject the null
Smart meters (IoT)	Use Do not use Willing to use	43 32 47	36 34 29	H_{04}	2.5783	2	0.05	0.2755	p-value > 0.05	Not to reject the null
Hotspot / free Wi-Fi in the city	Use Do not use Willing to use	54 44 24	32 50 17	H_{05}	4.865	2	0.05	0.08782	p-value > 0.05	Not to reject the null
Transport applications / smart parking	Use Do not use Willing to use	52 36 34	40 36 23	H_{06}	1.3085	2	0.05	0.5198	p-value > 0.05	Not to reject the null

Source: *Authors' calculations.*

According to Table 3, a series of Chi-square tests of independence were conducted to examine the relationships between the use of various Smart City services and companies' willingness to co-create in the development of a Smart City. Each test was conducted with two degrees of freedom (*df* = 2). The results are presented below. For H_{01}, which examined the relationship between using a smart payment system and being willing to co-create to develop a Smart City, the Chi-square test was not significant, $\chi 2$ (2, N = 221) = 0.999, p = .607.

Therefore, the null hypothesis was retained, indicating that there is no significant association between the use of smart payment systems and willingness to co-create.

For H_{02}, testing the relationship between using an e-government facility and willingness to co-create, the result was also not significant, $\chi 2$ (2, N = 221) = 0.478, p = .787. Thus, the null hypothesis was retained, suggesting no statistically significant relationship between these variables.

For H_{03}, examining the association between using security applications and willingness to co-create, the result was not significant. $\chi 2$ (2, N = 221) = 0.820, p = .664. Consequently, the null hypothesis was retained.

For H_{04}, which tested the relationship between using smart meters and willingness to co-create, the Chi-square test was not significant, $\chi 2$ (2, N = 221) = 2.578, p = .276. Therefore, the null hypothesis was retained.

For H_{05}, which explored the relationship between providing free Wi-Fi facilities and willingness to co-create, the result approached significance but did not reach the conventional threshold of $p < .05$, $\chi 2$ (2, N = 221) = 4.865, p = .088. Hence, the null hypothesis was retained, although the result suggests a potential trend worth further investigation.

Finally, H_{06} examined the relationship between using smart parking applications and willingness to co-create. The test result was not significant, $\chi 2$ (2, N = 221) = 1.309, p = .520, leading to the retention of the null hypothesis. Overall, none of the Chi-square tests revealed statistically significant associations between the use of Smart City services and citizens' willingness to co-create.

However, the near-significant finding for free Wi-Fi facilities (H_{05}) may warrant further exploration with a larger sample size or additional variables. This finding indicates a relatively uniform perception across firms regardless of willingness to co-create various digital areas. The next section (Table 4) shows the results of testing the hypotheses for scenario 2.

According to Table 4, a series of Chi-square tests of independence were conducted to examine the relationships between the use of various Smart City services and companies' experience in co-creating a Smart City. Each test was conducted with two degrees of freedom (df = 2), using a sample of N = 221.

The results are summarised below. For H_{07}, which examined the relationship between using a smart payment system and experience in co-creation, the Chi-square test was not significant, $\chi 2$ (2, N = 221) = 0.115, p = .944. Therefore, the null hypothesis was retained, indicating no significant association between smart payment system usage and co-creation experience.

Table 4. *Testing Hypotheses – Scenario 2*

		Has your company been involved in developing your city in the past?		**Chi-square test**					
Variable	Option	Yes	No	Hypotheses	Chi-square test statistic	df	α	p-value	Observation	Decision
Smart payment systems (e-payment)	Use Do not use Willing to use	61 4 1	144 8 3	H_{07}	0.115	2	0.05	0.944	p-value > 0.05	Not to reject the null
E-government	Use Do not use Willing to use	59 4 3	136 9 10	H_{08}	0.30532	2	0.05	0.8584	p-value > 0.05	Not to reject the null
Security applications	Use Do not use Willing to use	33 20 13	51 71 33	H_{09}	6.3183	2	0.05	0.04246	p-value < 0.05	Reject null
Smart meters (IoT)	Use Do not use Willing to use	32 12 22	47 54 54	H_{010}	8.6026	2	0.05	0.01355	p-value < 0.05	Reject null
Hotspot / free Wi-Fi in the city	Use Do not use Willing to use	29 24 13	57 70 28	H_{011}	1.5195	2	0.05	0.4678	p-value > 0.05	Not to reject the null
Transport applications / smart parking	Use Do not use Willing to use	30 18 18	62 54 39	H_{012}	1.2242	2	0.05	0.5422	p-value > 0.05	Not to reject the null

Source: *Authors' calculations.*

For H_{08}, testing the relationship between using an e-government facility and experience in co-creation, the result was also not significant, $\chi 2$ (2, N = 221) = 0.305, p = .858. Thus, the null hypothesis was retained, suggesting no statistically significant relationship between these variables.

For H_{09}, examining the association between using security applications and experience in co-creation, the result was statistically significant, $\chi 2$ (2, N = 221) = 6.318, p = .042. Therefore, the null hypothesis was rejected, indicating a significant association between the use of security applications and experience in co-creation to develop a Smart City.

For H_{010}, which tested the relationship between using smart meters and experience in co-creation, the Chi-square test was significant, $\chi 2$ (2, N = 221) = 8.603, p = .014.

Accordingly, the null hypothesis was rejected, suggesting that individuals who use smart meters differ significantly in their co-creation experience compared to those who do not.

For H_{011}, which explored the relationship between providing free Wi-Fi facilities and experience in co-creation, the result was not significant, $\chi 2$ (2, N = 221) = 1.520, p = .468. Hence, the null hypothesis was retained, indicating that there is no significant relationship between free Wi-Fi access and co-creation experience.

Finally, H_{012} examined the relationship between using smart parking applications and experience in co-creation. The test result was not significant, $\chi 2$ (2, N = 221) = 1.224, p = .542, leading to the retention of the null hypothesis.

Among hypotheses H_{06} to H_{012}, only H_{09} (security applications) and H_{010} (smart meters) showed significant associations with firms' engagement in Smart City co-creation, while the remaining hypotheses exhibited no statistically significant relationships.

Overall, the results indicate that while digital readiness levels vary among firms, this variation does not significantly influence their engagement in Smart City co-creation. Notably, while the majority of firms reported using smart payment systems and e-government services, these areas did not show significant associations with co-creation participation, reinforcing that digital readiness alone is insufficient to drive engagement.

Of the twelve hypotheses tested, only H_{09} (security applications) and H_{010} (smart meters) revealed significant relationships with citizens' experience in co-creation, while the remaining hypotheses showed no statistically significant associations.

Firms' participation in Smart City co-creation remains limited, with most activity focused on security and smart metering, suggesting that companies tend to engage where technological and economic benefits are most direct and tangible. In contrast, areas requiring more extensive coordination, such as e-payments, mobility, or data-sharing platforms, exhibit weaker links with firms' digital readiness.

These patterns align with prior studies emphasising that co-creation with business actors often begins in infrastructure-related sectors—particularly energy, security, and utilities—where technological integration is clearer and risk-sharing mechanisms are more established *(Bibri, 2021; Meijer and Bolívar, 2016; Jukić et al.,* 2019).

Overall, the results highlight that digital readiness is a necessary but not sufficient condition for business engagement in Smart City initiatives, as institutional and collaborative factors remain equally critical.

5. Conclusions, Proposals, Recommendations

The study examined the relationship between firms' digital readiness and their engagement in Smart City co-creation. The results indicate that, despite variations in digital readiness levels among companies, these differences do not significantly influence their actual participation in co-creation initiatives.

Of the twelve hypotheses tested, only security applications (H_{09}) and smart meters (H_{010}) showed significant associations with citizens' co-creation experience. Notably, while the majority of firms reported using smart payment systems (93%) and e-government services (88%), these areas did not exhibit significant links with co-creation participation, reinforcing that digital readiness alone is insufficient to drive engagement.

These findings suggest that firms primarily engage in Smart City co-creation where technological integration is straightforward and economic benefits are direct and tangible. Institutional and collaborative factors—including the maturity of public–private partnerships and coordination mechanisms appear equally important in shaping firms' involvement.

The study has several methodological limitations. First, it relies on self-reported data, which may be biased due to subjective assessments of digital readiness and engagement. Second, the research was limited to two cities within a single region, reducing generalizability. Third, sector-specific differences were not considered, although they may influence digital maturity and co-creation potential.

Future research could adopt comparative designs across multiple regions and industries to further explore how digital readiness interacts with institutional and collaborative conditions to affect Smart City co-creation. In addition, qualitative studies involving representatives from specific sectors could provide deeper insights into the motivations, barriers, and context-specific challenges that shape business engagement in Smart City initiatives.

From a practical perspective, policymakers and city managers should not assume that higher digital readiness alone guarantees business engagement; targeted mechanisms to facilitate collaboration and reduce coordination barriers may be necessary to foster broader co-creation.

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