ANALYSIS OF FACTORS INFLUENCING THE SUSTAINABILITY OF SMART CITIES: A CASE STUDY IN BINJAI CITY

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ABSTRACT

The concept of a smart city is not only implemented in developed countries but is also being adopted in developing nations. It is not limited to large cities, as even smaller cities are starting to embrace it, including Binjai City in North Sumatra Province. However, not all smart city innovations implemented in Binjai City have been successful, and some applications are found to be unsustainable. This research aims to analyze the factors influencing the sustainability of smart city innovations in Binjai City, which was chosen as the first city in North Sumatra to implement the smart city concept in its medium-term development agenda. The research method used in this study is a mixed-method sequential exploratory approach, combining qualitative methods to formulate hypotheses and quantitative methods to analyze them. The qualitative informants consist of policymakers in Binjai City, while the quantitative respondents are civil servants involved in smart city innovations. The findings reveal three factors—political support, resources, and institutions—that have a positive and significant impact on innovation sustainability. In contrast, the other two hypotheses, community participation, and effects/impacts, are rejected as they show a negative and insignificant influence on innovation sustainability. The research results are expected to provide policy recommendations for local governments, especially in small cities with various limitations that are currently implementing smart city initiatives.

Keywords: *Innovation, Innovation sustainability, Smart City, Binjai City.*

A. INTRODUCTION

The Sustainable Development Goals (SDGs) place urban areas as a substantial aspect of managing sustainable living. Urban issues are accompanied by an increase in the urban population. In 2020, approximately 57% of Indonesia's population resided in urban areas, a significant rise compared to the 2010 figure of 49.7%. Moreover, the Central Statistics Agency (*BPS*) projects that the percentage of the urban population will continue to grow to 66.6% by

2035. The World Bank also estimates that by 2045, around 220 million Indonesians, or approximately 70% of the total population, will be living in urban areas. These projections emphasize the importance of addressing urban challenges and developing sustainable urban development strategies to accommodate the ongoing growth of the urban population. (Bappenas, 2020; Rizaty, 2021).

To address the issues arising from urban population density and achieve the success of the SDGs program, a sustainable urban governance strategy for the future is required. One of the strategies is the implementation of the smart city concept. A smart city is a city capable of managing its diverse resource potentials by integrating technology to enhance the quality of services and the performance of urban communities. The utilization of technologies such as the Internet of Things (IoT), 5G, and digital services within the smart city concept becomes essential, particularly for urban areas. (Curran, 2021; Pashchenko, 2021)

Smart cities have been implemented in various cities worldwide, with advanced cities competing to become the best in implementing smart city initiatives as a result of technology utilization, environmental sustainability, and resident comfort. Studies on smart city policies indicate that city governments in different countries adopt smart city strategies to address various urban issues (Micozzi & Yigitcanlar, 2022).

In Indonesia, the government continues to encourage regions to innovate and implement smart city initiatives, including through the "100 Smart Cities Program" initiated by the Ministry of Communication and Informatics in collaboration with seven other ministries/institutions. However, even before the launch of this program, the Binjai City Government had already embraced the smart city concept as part of its city development, as stated in the Binjai City Medium-Term Development Plan (*RPJMD*) for the period 2016-2021, with a vision of creating a smart, liveable, competitive, and environmentally conscious city, towards a prosperous Binjai City (*Pemerintah Kota* Binjai, 2016).

The development of smart city initiatives in Binjai City can be observed through the implementation of various applications, particularly in the e-government dimension. At least 32 applications have been launched since 2017, bringing digital-based innovations to public services in Binjai City. However, ironically, out of the 32 applications, only 8 are still actively used, and many others have been discontinued for various reasons. This raises concerns, especially considering the COVID-19 pandemic in 2020, which should have been an opportunity to encourage the public to adapt to digital services due to limitations in social interactions.

The smart city concept, as an innovation in urban governance, should be a solution to urban issues and has proven successful in many countries. However, the reality is that there are still cities implementing the smart city concept but facing challenges in its implementation. Many innovations are not sustainable, raising questions about the factors that influence the sustainability of smart city innovations. This research aims to identify and analyze the factors that affect the sustainability of smart city innovations, focusing on Binjai City as the research

locus.

B. LITERATURE REVIEW

The smart city is a concept of an intelligent city that utilizes big data analysis to identify issues from the early stages and recommend appropriate policies for collaborative development. By leveraging information technology, a smart city integrates information into existing infrastructure, enhancing the quality of urban life, providing services that align with the real needs of the community, and managing the city in an effective and efficient manner. At the core of the smart city concept lays the intelligent effort to transform the structure of governance, society, and businesses, while facilitating broader interactions among the community with clearer, more effective, efficient, and responsive technologies. (Sari & Salahuddin, 2021; UNECE & ITU, 2015).

According to the Ministry of Communication and Informatics (*KOMINFO*), a smart city is an alternative development strategy for districts and municipalities that effectively and efficiently integrate information technology for the common good. There are several elements within the concept of a smart city that need to be developed, one of which is smart government. Additionally, Rauf defines a smart city as a complex city governance concept that implements technology to meet various urban community needs. (*Direktorat Jenderal Aplikasi Informatika*, 2021; Rauf, 2016).

One successful example of a city implementing the smart city concept is New York City (NYC), United States, which was even awarded as the best smart city in the world in 2016. As the most populous city in the United States, with a population of 8,398,748 in 2018, the implementation of the smart city concept has successfully overcome challenges and various urban issues while providing benefits to people's lives, such as waste management, air quality control, improved security, advanced smart lighting systems, digital infrastructure provision, and more. (Shah et al., 2019).

The purpose of implementing the smart city concept is to gather integrated information for urban management. This integration is achieved through synergy among various dimensions of urban life, including resources, environment, economy, social aspects, and others, all interconnected through the city's digital geographic network. IBM, as the pioneer advocating smart city in Los Angeles, United States, divides the concept into six dimensions: smart economy, smart mobility, smart governance, smart people, smart living, and smart environment. (Rauf, 2016; Widiyastuti, ST., MT et al., 2021).

Innovation is seen as the conception and implementation of significant service improvements, involving new ideas or methods to renew existing policies, with risks as possible consequences. Innovation can also refer to renewed or perceived new ideas, practices, or objects. According to Rogers, there are at least three factors that influence innovation. First, political impetus, such as the developmental vision of newly elected local leaders who aim to realize their campaign promises; Second, economic pressure and increased efficiency; Third, pressure to improve services. These conditions often serve as drivers for innovation, as public demands for easier access to services push governments to

innovate in public service delivery. These three factors play a dominant role in innovation, particularly in the public sector. (Glor, 2018; Rogers, 2003).

The sustainability of innovation is closely related to sustainable innovation itself. The best strategy for achieving smart city sustainability is to ensure that the created innovations can continue over time and to continuously improve existing innovations. Continuous improvement is the key to sustainable innovation, and sustainable innovation is a strategy for smart city sustainability. (Cole, 2000).

According to Glor, there are six factors that contribute to the sustainability of innovation: economic factors, resources, external support, the impact generated, political factors, and ideology. Glor believes that political factors and ideology play a crucial role in determining whether an innovation will end or continue. On the other hand, the factors that support innovation sustainability include resources, economic aspects, external support, and the effects generated by the innovation. (Glor, 2018).

This research adopts Glor's theory to measure the sustainability of smart city innovation. However, due to contextual differences between the United States with its federal system of government and Indonesia with its republican system, not all variables used by Glor are relevant to this study. Therefore, this research will focus on measuring four main factors: politics, resources, effects/impacts, and community participation. The political factor will involve an explanation of politics and ideology, which will be tailored to the support of local leaders, regional legislative councils (*DPRD*), and the central government. The resource factory will delve into three aspects: human resources, budgetary resources, and technological infrastructure resources. External support will be linked to public participation, while the economic aspect will be a part of the effects/impacts resulting from innovation programs.

C. METHOD

The researcher utilized a mixed methods research approach in this study. Mixed methods research is a methodology that combines both qualitative and quantitative methods to be used together in a single research endeavor, resulting in more comprehensive, valid, reliable, and objective data (Sugiyono, 2020).

The model employed in this mixed methods research is the sequential exploratory design. The sequential exploratory design is a mixed methods research approach that sequentially combines qualitative and quantitative research methods, where the first stage of research employs qualitative methods, followed using quantitative methods in the second stage (Creswell, 2014). This model was chosen as the primary research approach to explore which variables are most suitable for influencing the sustainability of smart city innovations in Binjai City. Subsequently, the identified variables will be tested for hypotheses on a broader population at the implementation level.

The study selected Binjai City as the research locus for the sustainability of smart city innovations. Binjai City was chosen because it was the first area in North Sumatra to implement the smart city concept. The relatively long-time span was deemed appropriate for measuring sustainability. Additionally, Binjai City is also part of the national program "100 Cities Towards Smart City"

initiated by the Central Government.

In the qualitative research phase, the researcher will analyze four variables that influence smart city sustainability: political support, resources, community participation, and effects/impacts. The hypotheses for the research will be formulated based on the findings from the qualitative research. Qualitative data will be obtained through in-depth interviews with ten selected credible informants to address the research questions. The chosen informants include the Secretary of Binjai City, the Head of the Department of Communication and Informatics of Binjai City, the Head of the Planning and Development Agency of Binjai City, the Head of the Civil Service and Human Resources Development Agency of Binjai City, the Head of the Cooperative and SME Agency of Binjai City, the Head of the Smart City Support Team of Binjai City, the Chairperson of Al Fityah Foundation of Binjai City, the Chairperson of the KNPI Regional Board of Binjai City, the Chairperson of the SME Community of Binjai City, and a Member of the Regional People's Representative Council (*DPRD*) of Binjai City.

The qualitative data analysis will be conducted using data analysis techniques from Miles and Huberman. The analysis will take place simultaneously with the data collection process and after completing a specific data collection period. The qualitative data analysis consists of three stages: data reduction, data display, and conclusion drawing or verification. Before concluding, the researcher will conduct triangulation and negative case analysis to ensure the validity and credibility of the findings.

The results of the qualitative research will be used to form hypotheses that will be tested in the quantitative research phase. The quantitative research will be conducted on the population involved in the implementation of smart city innovations, namely civil servants within the Binjai City government. From a total population of 2,651, a sample size of 340 will be determined and distributed proportionally among the 34 administrative units of Binjai City. Quantitative data will be collected by administering questionnaires through the Google Form application. The questionnaire will employ Likert scales to measure five exogenous variables and one endogenous variable, with a total of 40 statement indicators to measure the six variables.

The quantitative data analysis will be performed using the Structural Equation Modelling (SEM) Partial Least Square (PLS) method with the assistance of the smartPLS 3.0 application. The analysis of quantitative data using smartPLS encompasses two stages: instrument testing and structural model analysis or inner model testing. Instrument testing includes validity testing and reliability testing. Meanwhile, the analysis of the structural model comprises R Square, Q Square, and Path Coefficient analyses. (Ghozali & Latan, 2015).

D. EXPLANATION

Binjai City is one of the cities in North Sumatra Province, located approximately 22 kilometres from the city canter of Medan (about a 30-minute journey). The outermost boundary of Binjai City is only about 8 kilometres away

from Medan. Binjai City has a total area of 9,023.62 hectares (approximately 90.23 square kilometres) consisting of five districts and thirty-seven sub-districts.

The population of Binjai City reaches 279,361 people, consisting of 147,664 males and 147,697 females, with a population density of 3,095 people per square kilometre and an average of 4 people per household. The residents of Binjai come from various ethnic groups, including Malay, Batak Toba, Mandailing, Karo, Simalungun, Javanese, Banten, Minang, Acehnese, Chinese, and Indian, with the majority practicing Islam as their religion. (*BPS* Kota Binjai, 2022).

The Smart City concept has been implemented in Binjai City since 2016 as the main program of the Mayor and Vice Mayor of Binjai for the 2016-2021 periods. The Development Vision of Binjai City for the 2016-2021 period is "Realizing a Smart City that is Liveable, Competitive, and Environmentally Conscious towards a Prosperous Binjai."

The Development Mission of Binjai City for the 2016-2021 period includes the development of smart governance, the development of quality human resources, the optimization of community mobility, the improvement of the city's economy through sustainable natural resource management, and the development of skilled, creative, innovative, and productive human resources, as well as the improvement of living standards. (Pemerintah Kota Binjai, 2016).

Based on the development mission of Binjai City for the 2016-2021 periods, the Smart City concept is elaborated through the Smart City development map of Binjai City, which is included in the Smart City development plan in Binjai City for the 2016-2021 periods.

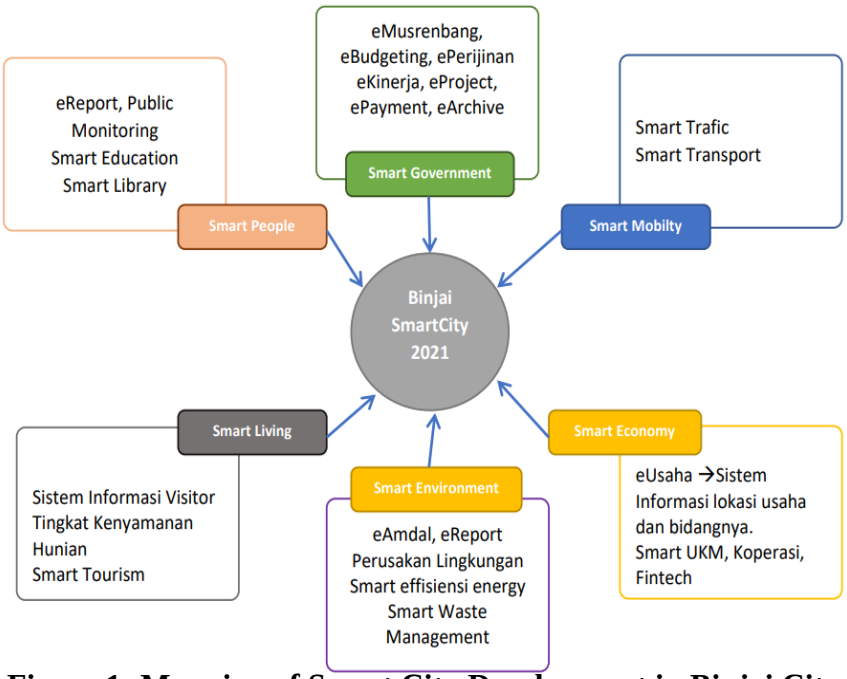

Figure 1: Mapping of Smart City Development in Binjai City
(*Diskominfo Kota* Binjai, 2016)

Results of Qualitative Research.

The qualitative research findings have identified factors that influence the sustainability of smart city innovation in Binjai City. Four factors were analyzed, namely political support, resources, community participation, and effects/impacts, which influence innovation sustainability. In addition to these four factors, the researchers also identified another factor that affects smart city sustainability, namely the institutional factor. These findings are based on qualitative data analysis, where all informants provided information related to institutional factors that influence smart city sustainability in Binjai City. The following are the qualitative analysis results for each influencing factor:

Firstly, political support has three aspects: support from the mayor, the role of the Regional People's Representative Council (*DPRD*), and support from the Central Government. The change in local leadership has resulted in a shift in development program priorities. Smart City, which was the flagship program of the mayor from 2016 to 2021, is no longer a priority for the next Mayor. This is due to political promises that need to be fulfilled and adjustments to medium-term regional development plans. The lack of sustainability in smart city innovation is also caused by less-than-ideal implementation, leading the implementers to be reluctant in completing the innovation program. Apart from the Mayor's support, the role of the *DPRD* also affects innovation sustainability. As part of the local government administration, the *DPRD* has significant authority in supporting development programs. Smart city innovation becomes unsustainable when the *DPRD* does not fully understand the ongoing innovation, resulting in inadequate oversight and budgeting functions. Moreover, the *DPRD* always communicates with the community through aspiration programs, recess, and regulation socialization. Given their duties and authority, the role of the *DPRD* significantly influences smart city sustainability in terms of political support. Another aspect of the political factor is the support from the Central Government. Although the "100 Smart Cities" program has been implemented, the support from the Central Government, especially in terms of budget, is still considered suboptimal. Smart city innovation carried out by the local government with limited fiscal resources will have difficulty sustaining without guidance and financial support from the Central Government. Currently, budget support is only provided to winners of regional innovation competitions.

Secondly, resources are examined in three aspects: human resources, budget resources, and infrastructure/technology resources. Human resources involve the implementers of smart city innovation, particularly civil servants. The implementation strategy of the smart city in Binjai City, which introduces numerous applications, has not adequately prepared the implementers' competencies. The implementers lack technical and managerial competencies in implementing the smart city concept. During the previous Mayor's tenure, development was handed over to third parties, and the implementers merely acted as application operators. When the smart city team changes without technology transfer and knowledge sharing, it also hampers sustainability. Additionally, budget support also influences the sustainability of smart city innovation. The

budget should not only focus on acquiring advanced technology because Binjai City already has adequate infrastructure to support the smart city innovation program. However, the budget is also needed to prepare the innovators with the necessary competencies to successfully implement the innovation program, including providing additional income for those who successfully implement the innovation. The insufficient budget also hampers the optimal socialization of innovation programs.

Thirdly, community participation, the involvement of the community and various community groups in the smart city innovation program in Binjai City, both in planning, implementation, and evaluation, is still suboptimal. Limited budget constraints hinder the maximum implementation of socialization programs, resulting in the ongoing innovation program being widely unknown to the public. In terms of competency, the residents of Binjai City have good digital skills, especially those under the age of 40. However, in terms of culture, since Binjai City is not geographically vast, the community prefers face-to-face services over the provided digital services.

Fourthly, effects and impacts, the smart city innovation program in Binjai City has not had significant impacts on economic growth and increasing local revenue. Several innovations introduced to the community have not provided significant economic benefits. However, smart city innovation has had a positive impact on improved governance. Additionally, bureaucratic performance has also improved. It is not only the applications created by the Binjai City government but also applications from the central government that have had an impact on improving bureaucratic performance.

Lastly, organization, in addition to the four mentioned factors, the researchers identified another variable that influences smart city innovation sustainability in Binjai City, namely the organizational variable. All informants provided information regarding this variable, including clarity in the direction of smart city innovation development, organizational design, task distribution, and functions in each regional organization. Most importantly, having strong regulations to develop smart city innovation. The organizational factor plays a significant role in smart city innovation sustainability. If it can be implemented properly and supported by all the necessary components for development, the smart city innovation program will be sustainable. Without these factors, policy evaluations will not be conducted optimally, and the lack of comprehensive evaluations will make the Binjai Smart City program unsustainable. As an innovation ecosystem, a smart city needs to be optimally evaluated to ensure continuous innovation. The discontinuation of innovation will automatically lead to the end of the smart city concept. The sustainability of innovation is a follow-up action from comprehensive evaluations.

Based on the presented qualitative research findings, five research hypotheses were identified. Firstly, political support has a positive and significant influence on innovation sustainability. Secondly, resources have a positive and significant influence on innovation sustainability. Thirdly, community participation has a positive and significant influence on innovation sustainability. Fourthly, effects/impacts have a positive and significant influence on innovation

sustainability. Lastly, the organization has a positive and significant influence on innovation sustainability.

These five hypotheses will be tested using quantitative methods to measure the extent to which each variable influences the sustainability of smart city innovation in Binjai City. The quantitative research will provide a clearer understanding of the significance and magnitude of each variable's influence on innovation sustainability.

Results of Quantitative Research

In this study, questionnaires were distributed to the respondents who served as the research sample, namely civil servants within the Binjai City Government, using the Google Forms application from June 1 to June 6, 2023. There were 340 respondents proportionally distributed among 34 regional organizations. A total of 40 questions or indicators were used to measure the five exogenous variables and one endogenous variable. The data obtained were then processed using the smartPLS 3.0 application. The following is the SEM-PLS model diagram using the smartPLS application:

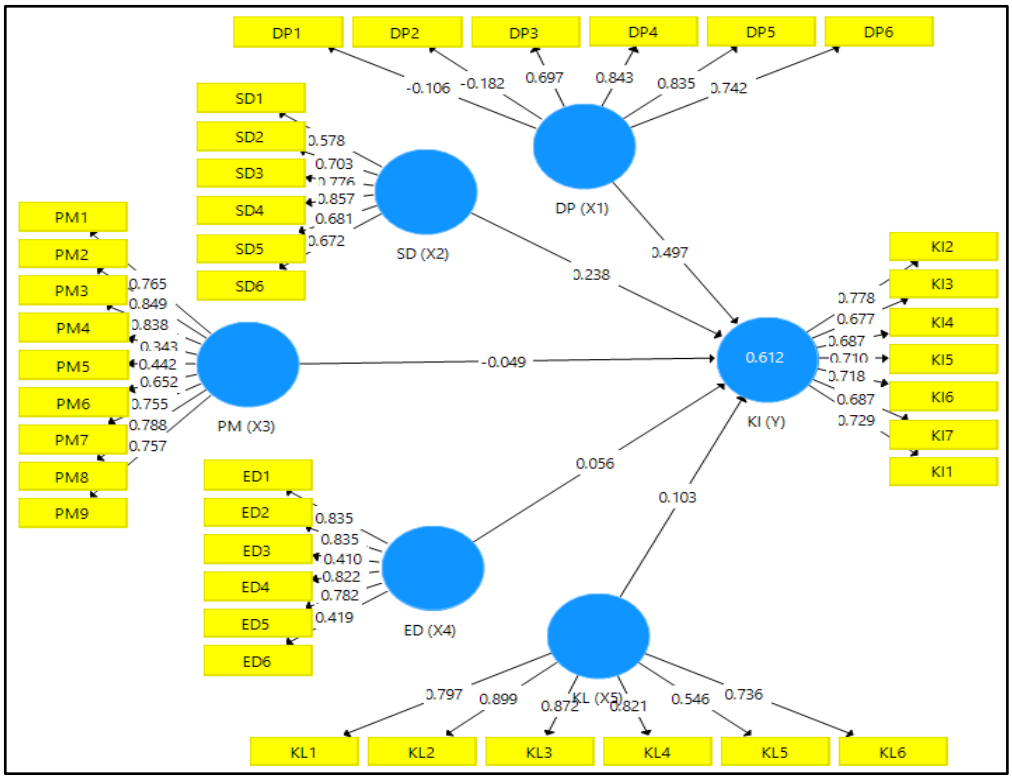

Figure 2: SEM PLS Model Analysis. (Source: processed primary data)

The initial stage of quantitative data analysis involved testing the validity and reliability of the research instrument. The results of the convergent validity test, calculated by examining the outer loading values, revealed that six out of the 40 indicators used were invalid. The invalid indicators were subsequently eliminated, followed by discriminant validity testing and instrument reliability

testing through the calculation of Average Variance Extracted (AVE), Composite Reliability, and Cronbach's Alpha values. The results of these tests are presented in Table 1 below."

Table 1: Results of Research Instrument Testing

Variable	AVE	Composite Reliability	Cronbach's Alpha	Keterangan
Political Support (X1)	0,613	0,863	0,789	Valid dan Reliable
Effects/Impacts (X4)	0,750	0,923	0,889	Valid dan Reliable
Innovation Sustainability (Y)	0,509	0,879	0,839	Valid dan Reliable
Organization (X5)	0,619	0,905	0,870	Valid dan Reliable
Community Participation (X3)	0,630	0,922	0,901	Valid dan Reliable
Resources (X2)	0,514	0,862	0,806	Valid dan Reliable

Source: processed primary data

From the table above, the AVE values of all variables are > 0.5, and the results of the composite reliability and Cronbach's alpha tests for all variables are > 0.7. This indicates that all variables in this study are valid and reliable. (Ghozali, 2016).

After confirming the validity and reliability of the research instruments, the analysis proceeds to the structural model analysis by calculating the coefficients of determination (R^2), predictive relevance (Q^2), and path coefficient values.

The coefficient of determination (R^2) is used to measure the influence of exogenous variables on the endogenous variable. The closer the value is to one, the stronger the influence of the exogenous variables on the endogenous variable. From the calculation results, an R^2 value of 0.622 is obtained. This indicates that the five exogenous variables, namely political support (X1), resources (X2), community participation (X3), effects/impacts (X4), and organization (X5), collectively account for 62.2% of the variance in innovation sustainability (Y) as the endogenous variable.

The analysis of predictive relevance (Q^2) is performed by calculating blindfolding in smart pls. If the Q^2 value is > 0.05, it can be concluded that the measurement model is relevant, meaning that the exogenous variables used to predict the endogenous variable are appropriate. The blindfolding calculation results in a Q^2 value of 0.303, indicating that Q^2 > 0.05. It can be concluded that all exogenous variables are appropriate and relevant as predictors of innovation sustainability.

The analysis of Path Coefficients using the bootstrapping technique will yield the values of the Original Sample (O), Sample Mean (M), Standard Deviation (STDEV), T Statistic (|O/STDEV|), and P-Value. The results of the path coefficient test are presented in the table below:

Table 2: The results of path coefficients with bootstrapping technique

Variable	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
DP (X1) -> KI (Y)	0,524	0,526	0,057	9,233	0,000
ED (X4) -> KI (Y)	-0,064	-0,067	0,066	0,963	0,336
KL (X5) -> KI (Y)	0,225	0,226	0,087	2,582	0,010
PM (X3) -> KI (Y)	-0,149	-0,149	0,077	1,925	0,055
SD (X2) -> KI (Y)	0,286	0,288	0,072	3,976	0,000

Source: processed primary data

1. DP (X1) -> KI (Y): The path coefficient between Political Support (X1) and Innovation Sustainability (Y) is 0.524. This value indicates a significant positive relationship between political support and innovation sustainability. The high T-statistic (9.233) demonstrates the statistical significance of this relationship ($P < 0.001$). Therefore, the hypothesis linking political support to innovation sustainability is accepted.
2. ED (X4) -> KI (Y): The path coefficient between Effects/Impacts (X4) and Innovation Sustainability (Y) is -0.064. This value indicates a weak negative relationship between effects/impacts and innovation sustainability. However, the low T-statistic (0.963) suggests that this relationship is not statistically significant ($P > 0.05$). Therefore, the hypothesis linking effects/impacts to innovation sustainability is not accepted.
3. KL (X5) -> KI (Y): The path coefficient between Organization (X5) and Innovation Sustainability (Y) is 0.225. This value indicates a moderate and significant positive relationship between organization and innovation sustainability. The relatively high T-statistic (2.582) indicates the statistical significance of this relationship ($P < 0.05$). Therefore, the hypothesis linking organization to innovation sustainability is accepted.
4. PM (X3) -> KI (Y): The path coefficient between Community Participation (X3) and Innovation Sustainability (Y) is -0.149. This value indicates a weak negative relationship between community participation and innovation sustainability. However, the relatively low T-statistic (1.925) suggests that this relationship is not statistically significant ($P > 0.05$). Therefore, the hypothesis linking community participation to innovation sustainability is not accepted.
5. SD (X2) -> KI (Y): The path coefficient between Resources (X2) and Innovation Sustainability (Y) is 0.286. This value indicates a moderate and significant positive relationship between resources and innovation sustainability. The high T-statistic (3.976) indicates the statistical significance of this relationship ($P < 0.001$). Therefore, the hypothesis linking resources to innovation sustainability is accepted.

Based on the analysis of path coefficients, the variables of political support (X1), organization (X5), and resources (X2) have a positive and significant influence on innovation sustainability (Y). Thus, the hypotheses linking political support, organization, and resources to innovation sustainability are accepted. However, the variables of effects/impacts (X4) and community participation (X3) do not have a significant impact on innovation sustainability, and therefore, the hypotheses linking these variables to innovation sustainability are rejected.

This research reveals a discrepancy between the qualitative findings and quantitative data analysis. The factors of community participation (X3) and effects/impacts (X5) in this study demonstrate a weak and insignificant influence on innovation sustainability. However, in the qualitative research, both factors showed a positive and significant influence. The greater community involvement in the innovation program and the greater the perceived impact of the innovation, the more the innovation program is needed and sustained.

The findings from the quantitative data also contradict the results of smart city research conducted in New York City, United States. That research demonstrated that the success of the smart city program in New York City was attributed to effective two-way engagement between the government and the community. Community participation in the planning and implementation of the program facilitated the continuous development of the smart city and its benefits for both the community and the government. (Shah et al., 2019).

However, this study supports the findings of smart city research in South Korea. The success of Namyanju City in implementing a smart city began by equipping the implementers with the necessary technical and managerial capabilities to understand and apply the smart city concept effectively. Namyanju focused on educating and training its employees before engaging the wider community. On the other hand, Gimpo City started by providing advanced technological infrastructure and establishing extensive public-private partnerships. (Myeong et al., 2021).

The results of this study indicate that community participation can have a negative impact if the implementers of innovation lack adequate technical and managerial skills in implementing the innovation program, as observed in Gimpo City. However, community participation can have a positive impact on innovation when there is effective political support, institutional support, and available resources, as seen in New York City.

The factors influencing the sustainability of innovation, as proposed by Glor in previous research, do not directly affect the sustainability of an innovation. However, these factors run in parallel and mutually influence each other. The research findings indicate that the influence of community participation and effects/impacts is highly dependent on the availability of resources. This suggests the potential presence of intervening variables within the analyzed exogenous variables. The success of an innovation is determined by political, resource, and institutional factors. Meanwhile, the development and sustainability of successful innovations are influenced by community participation and the effects/impacts arising from those innovations.

E. CONCLUSION

The research findings reveal that political support, resources, and organization significantly and positively influence the sustainability of smart city innovation in Binjai City. On the other hand, community participation and effects/impacts have a non-significant and negative influence on the sustainability of smart city initiatives in Binjai City. The lack of impact from community participation and effects/impacts on innovation sustainability is attributed to the limited resources that have not reached an ideal capacity for implementing innovations. The study highlights the potential for intervening variables within the analyzed exogenous variables.

Based on the research findings, two recommendations are provided. Firstly, from a practical perspective, the local government of Binjai City needs to consider three crucial factors to achieve the sustainability of smart city innovation: political support from local authorities, legislative bodies, and the central government; support in terms of human resources, budgetary resources, and technology; and the design of an ideal organizational structure along with the provision of necessary organizational tools to support smart city sustainability. Secondly, from an academic standpoint, further in-depth studies are recommended to explore the factors of community participation and effects/impacts. The differences between qualitative and quantitative research findings in this study are intriguing and warrant further investigation. Future research should analyze the potential of intervening variables within the analyzed exogenous variables and involve the wider community as research respondents, beyond civil servants.

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