

GUIDELINES FOR DEVELOPING URBAN HOUSING PROJECTS WITH A SMART CITY APPROACH

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Abstract

The migration of population from rural to urban causes rapid urban expansion and housing demand. Smart cities are utilized as guidelines for the development of urban housing projects to enhance the quality of life and not destroy the environment. The objectives of this research were to: 1) study the level of governance, infrastructure, technology management, stakeholder engagement, and successfulness of urban housing project development; 2) examine the influence of causal factors, i.e., governance, infrastructure, technology management, stakeholder engagement and successfulness of urban housing project development, and 3) propose development guidelines on urban housing projects following the smart city approach. This research employed the mixed methods of quantitative and qualitative research methods. For quantitative research, the sample consisted of 360 residents in smart projects by using systematic sampling. For qualitative research, in-depth interviews were conducted with 16 key informants. The results indicated that: 1) governance, infrastructure, technology management, stakeholder engagement, and success of urban housing project development were at high levels; 2) Governance, infrastructure, technology management, and stakeholder engagement, collectively exerted significant effects on the success of urban housing project development, yielding impact values of 0.87, 0.44, 0.41, and 0.29 respectively, at a significance level of 0.01; 3) Guidelines for developing urban housing projects with a smart city approach were as follows: (1) the management of connectivity between the inside and outside the housing projects with modern technology to ensure easy and swift access and resident's safety and privacy; (2) Developing infrastructure especially the transportation system within the housing projects to establish effective connections with the external environment; (3) Participatory governance in which residents are involved in managing the various systems of the projects (4) communicating information and educating residents about water pollution and waste management to reduce the impact on the environment in the housing project; And (5) arranging spaces within the housing project for activities that both and individuals from outside the community can participate in fostering interactions among project managers, residents and community members, ultimately helping reduce potential conflicts Therefore, the success of smart city development in housing projects would require cooperation from the government sector, private sector and communities, especially stakeholders.

Keywords: Smart City/ Urban Housing Projects Development /Successfulness of Housing Development

INTRODUCTION

Thailand's economic structure has shifted from agrarian intensive to manufacturing. As a result, national income in 2017 increased by 6.4% (National Economic and Social Development Council, 2019). But people's incomes vary between urban and rural people, especially the gap between the rich and the poorest, 25.2 times wider. In addition to income inequality, there is also inequality in expenditure, Education, Public Health, Social Welfare, Arable Land, Access to capital and infrastructure (Office of the National Economic and Social Development Board, 2018).

As a result, some people move to urban areas to create opportunities for themselves and their families. With the boom in urban infrastructure, Transportation, Education,

Employment and income are the main attraction for people to move more from rural areas to cities (Research Group, Institute of Population and Social Research, 2019). The proportion of people living in Thailand's urban areas is steadily increasing, Urban urbanization continues to accelerate (Institute of Population and Social Research, Mahidol University, 2019). The government develops cities under the concept of "Smart City" through the utilization of modern and intelligent technology and innovation to enhance city management (Ministry of Digital Economy and Society, 2019).

Thailand's private sector has applied smart city concepts, such as the One Bangkok project. Modern technologies and innovations are applied in the project. Access to all points of the project, as well as convenient public transport connections, there is an intelligent traffic management system that makes internal traffic flow easy. The main roads within the project are clear and safe for pedestrians, The walkway in the project is shaded by large trees along the road, making walking outside in Bangkok's weather more comfortable.

The indoor space will have an energy-saving air conditioning system (Clark, 2020). Large real estate development companies are also adopting smart city approaches, focus on improving the quality of life of people in urban areas, especially in Bangkok's central business district (CBD). Providing a full range of facilities such as managing technology to facilitate residents, Optimum and environmentally friendly energy consumption, Various forms of project management to create project highlights and position in today's competitive market (Krungsri Research, 2021) The limitation is that the land price is very high, so it is developed by making it a high-rise condo. (High Rise) with outstanding location next to the main road, near public transportation lines, it has many common areas and facilities. But there are also many problems and obstacles such as failure of building design, lack of maintenance (Azian, Yusof & Kamal, 2020).

Environmental management issues, Residents' comfort and energy savings (Rahmawati et al., 2020). So, if there is a clear development line of urban housing projects based on smart city concepts, will be empirical data that government executives, The private sector and real estate development companies can be used to formulate policies, Strategies to develop urban housing to be modern, convenient, comfortable, Safe and environmentally friendly, It contributes to the good quality of life of urban residents.

RESEARCH OBJECTIVES

1. Study the level of governance, infrastructure, technology management, stakeholder engagement, and successfulness of urban housing project development.
2. examine the influence of causal factors, i.e., governance, infrastructure, technology management, stakeholder engagement and successfulness of urban housing project development.
3. Propose development guidelines on urban housing projects following the smart city approach.

Research Hypotheses

- Hypothesis 1: Governance directly affects the development success of smart urban housing projects.
- Hypothesis 2: Infrastructure directly affects the development success of smart urban housing projects.
- Hypothesis 3: Technology management directly affects the development success of smart urban housing projects.
- Hypothesis 4: Stakeholder involvement directly affects the development success of smart city housing projects.

LITERATURE REVIEW

Success of Smart City Development

The success of smart cities has been studied by academics as follows: Giffinger et al. (2007) studied medium-sized smart cities in Europe. (Medium-sized smart cities) of 77 cities and classifying the elements that indicate the “smartness” of cities leads to the classification of smart city elements into 6 areas, as follows: (1) smart public administration (2) Smart Citizenship (3) Smart Transportation (4) Smart Living (5) Smart Economy and (6) environmental intelligence Yu & Xu (2018). Samil (2019) states that smart cities consist of 6 aspects: (1) smart environment (2) Smart economy, (3) Smart transportation, (4) Smart public administration, (5) Smart living, and (6) Smart citizens. Shafiullah et al. (2023) identify the six areas of smart cities. Importantly, smart systems in energy production and storage, are a challenge for every country that wants to develop cities towards smart cities. According to Attaran, Kheibari & Bahrepour (2022), the success of smart cities consists of six areas of intelligence: (1) smart environment, (2) smart economy (3) smart transportation, (4) smart public administration, (5) smart living, and (6) smart citizens. And The Office of Smart Cities Thailand (2019) stated that smart cities are in line with past academics. There are 6 aspects and 1 type of smart energy has been added, meaning that cities can manage energy efficiently, balancing local production and energy consumption to ensure energy security and reduce dependence on energy from the main power grid

Governance

Smart city development is a management process in order for urban development to achieve the specified goals. Odendaal (2003) identifies governance as a legal system, administrative rules and practices related to stakeholder relationships are one of the key factors for the success or failure of smart city development projects. Chourabi et al. (2012) state that governance consists of: Cooperation, Leadership, Participation, Effective communication, Information Exchange, Services, Responsibility and transparency that affect smart city development. In addition, Rana et al. (2018) study found that if project managers are unable to implement the cooperation, Governance will hinder urban development and political stability. Mangla et al. (2017) study found that governance is a success factor in smart city development. Jayasena, Mallawaarachchi & Waidyasekara (2019) study found that governance consists of accountability, effective communication, and transparency. And Ngatikoh, Kumorotomo & Retnandari (2019) argue that a key component of governance is transparency. Being clear and to the point is essential for building public trust. According to Kholmi (2020), transparency is an important

component of governance that business operators must focus on in order to make their operations successful.

Infrastructure

Infrastructure At the core of a smart city is an internet connection that bridges the gap of access to information and communication technology (ICT) (bridging the digital divides) so everyone can access the internet. By bringing information and communication technology (ICT) systems to use in the city, it is necessary to have various devices that can be used with the Internet network properly (IAI-Hader & Rodizi, 2019). According to Myeong, Jung & Lee (2018), the predictive factors for smart city development include technological infrastructure that will require the development of digital devices and internet networks to be effective. Wireless Communications and Personal Infrastructure is that people have equipment related to technology, Knowledge and ability to make the most of various equipment. According to Albino, Berardi & Dangelico (2015), information and communication technology systems are at the heart of smart city development. Smart city development success is to build or improve cities using advanced technology, focus on information and communication technology systems related to modern infrastructure in the city. In line with Mangla et al. (2017) study, it was found that infrastructure is one of the success factors in the smart city development, India. Similar to Chourabi et al (2012), it states that the key infrastructure is the availability and quality of information and communication technologies and wireless communications. In line with Siuryte & Davidaviciene (2016), Infrastructure is identified as having information and communication technology (ICT), especially wireless networks.

Technology Management

Technology Management is an important factor in the smart city development, but the impact of technology may be less. If human infrastructure is not yet able to implement technology cost-effectively. Technology will be useless. Therefore, it is necessary to educate the people living in the city to make effective use of modern technology. (Myeong, Jung & Lee, 2018). In line with Buckley, Seerya, Power & Phelan (2019), technology is an educational challenge. Due to the increasing use of educational technology nowadays, learners must have knowledge and understanding about technology according to the level of technology used in teaching. So that students can use technology effectively. According to Asim & Sorooshian (2019), technology can affect R&D if users of knowledge technology aligned with core resources can drive R&D. Technology is fundamental to the success of smart city development because it is used to manage and solve problems, especially security and privacy issues of users (Mangla et al., 2017). The benefits of information technology are numerous, connected systems lead to unprecedented convenience. A better life, but the challenge is security and privacy. (Elmaghraby, 2013). According to Abosaq (2019), smart cities have big data communication connections between different devices. There is a risk of being sold, information to criminals or violate the privacy of data users, so there must be access control to treatment, Confidentiality, Reliability and Security

Stakeholder Engagement

Stakeholder Engagement is important and a driver of success in smart city development, with academics studying Stakeholder Engagement and Smart City Development such as Pezzutto, Fazeli & De Felice (2016) studying, finding that stakeholder engagement in data perception and urban development planning is a key strength in driving smart city projects in Europe. According to Siuryte & Davidaviciene (2016) study, one of the key

factors in smart city development is citizens' participation in urban development. Beyond that, Graniera & Kudo (2016) stated. When the Smart City or Smart Community project is implemented in four cities in Japan, the government's objective is to focus on the participation of all groups of people and behavior change through smart city lifestyles. According to Borsekova, Vanova & Vitalisova (2016), a good smart city development plan requires stakeholder engagement in data awareness. Participation in the impact of development and participation in decision-making. According to Jayasena, Waidyasekara, Mallawaarachchi & Periris (2021), smart cities are ecosystems of multiple stakeholders. Participation in integration planning. Therefore, effective decision-making of stakeholders is an important factor for the success of smart city project development.

RESEARCH METHODOLOGY

Participants

Participants are residents of high-rise condominiums developed by real estate development companies. In Bangkok A total of 360 participants was randomized through a multi-step systematic process.

Research Instruments

The research instrument is 1 questionnaire divided into 2 parts. (1) Questionnaire Personal factors Participants include gender, age, Education Level, Status and number of years of residence in smart condo projects, 5 items and (2) regulatory factor questionnaire, Infrastructure, Technology, Stakeholder recognition and development success of smart city housing projects, 90 items. 5-level approximation (minimum-maximum)

Instrument quality check is a questionnaire consisting of (1) content validity by Index of Item -Objective Congruence (IOC) method, obtaining IOC values between 0.60-1.00. And (2) reliability determination by Cronbach's Alpha Coefficiency. The total text is .950 and the questionnaire sentiment is valued. As follows

Sides	Confidence Value
Governance	0.903
Infrastructure	0.920
Technology Management	0.912
Stakeholder Engagement	0.917
Successful development of the Smart City Housing Project	0.857

Collection of Information

Data collection through coordination with high-rise condo managers and submit the questionnaire via a Google form. Check the integrity of every questionnaire and use the complete questionnaire for further analysis.

Data Analysis

Data analysis as follows: (1) Descriptive statistics: To describe the personal data of the 400 study participants. It describes the scale of 20 observable variables with frequency (f), percentage (%), mean (\bar{X}), standard deviation (S.D.) of the data and (2) statistics, Structural Equation Model (SEM) analysis to model structural equations to test the relationship between latent variables and observers and found between the latent variables studied.

Findings

Present the research results to answer all 3 objectives as follows:

1. Level of factors Governance Infrastructure, Technology Management, Stakeholder Engagement and Successful development of the Smart City Housing Project found that governance was the 1st most average, followed by Technology Management, Infrastructure, Successful development of the Smart City Housing Project, and Stakeholder Engagement respectively as shown in Table 1.

Table 1: Mean, standard deviation and level of the factors studied

Factors	Mean	St. Dev.	Interpret the results	Order
Governance	3.90	0.44	High	1
Infrastructure	3.84	0.47	High	3
Technology Management	3.88	0.47	High	2
Stakeholder Engagement	3.75	0.53	High	5
Successful development of the Smart City Housing Project	3.78	0.47	High	4

2. To study the influence of Governance Infrastructure Technology Management, Stakeholder engagement affecting the Successful development of the Smart City Housing Project uses structural equation analysis to find the influence of the studied variables influencing the Successful development of the Smart City Housing Project. Therefore, we presented a sequence of analysis steps. These are (1) the results of the analysis of the relationship structure model that is modeled according to the hypothesis, (2) the results of the analysis of the relationship structure model that is an alternative model, (3) the results of the comparison of the hypothesis and alternative models, and (4) the results OF THE hypothesis test result, respectively as follows:

The results of the analysis of the relationship structure model that is modeled according to the hypothesis

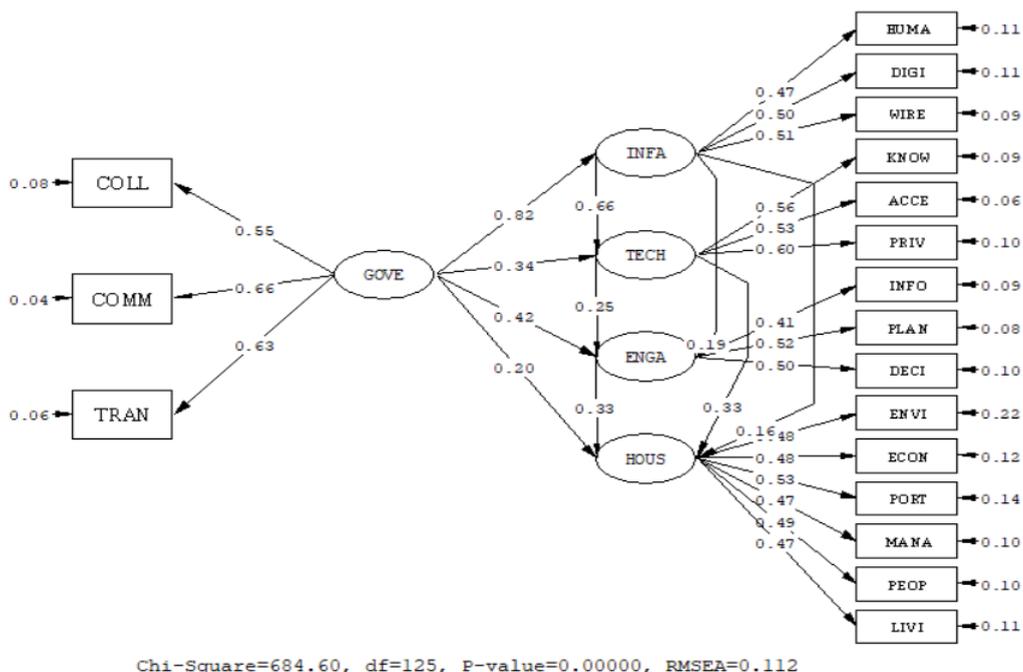


Figure 1: Modelling based on assumptions

The results of the analysis of the relationship structure model that is an alternative model

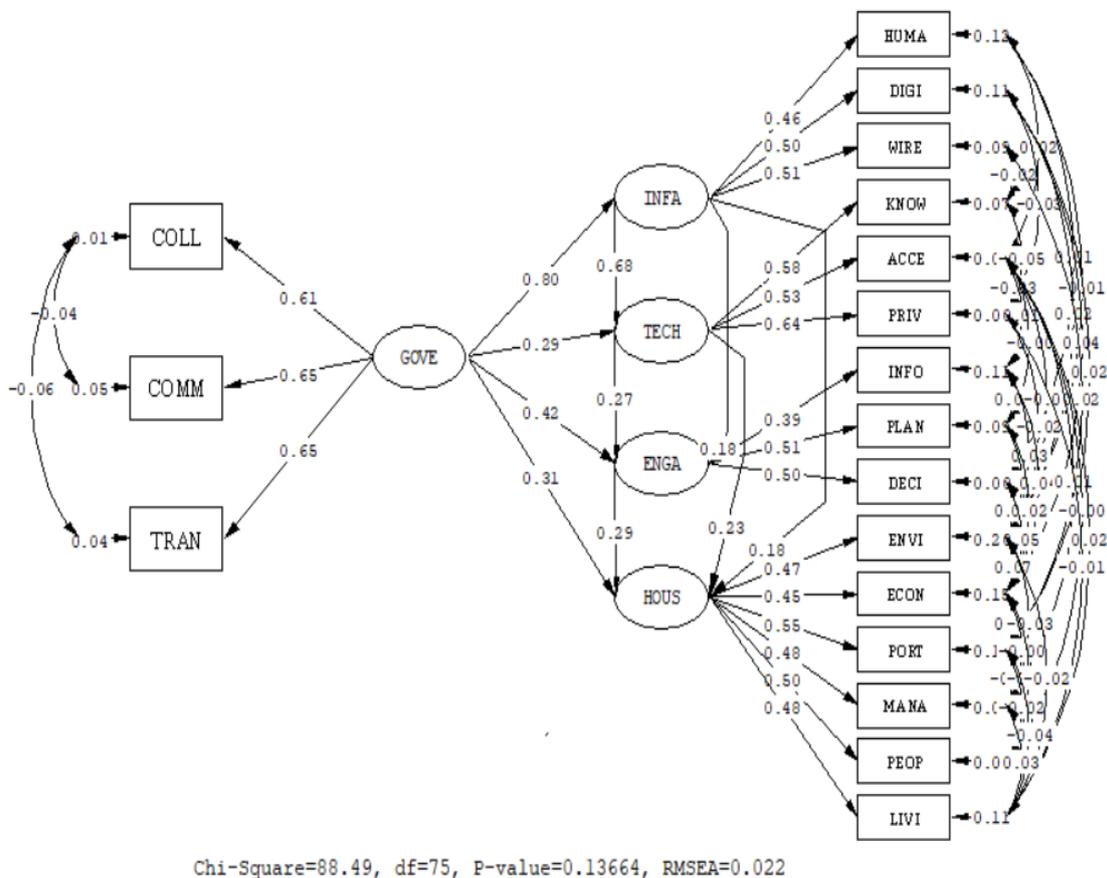


Figure 2: Alternative relationship structure model

The results of comparing models based on research hypotheses with alternative models

Presents the results of comparing hypothetical-based models and alternative models, it shows that alternative models are more suitable and can be put to good use. By checking the straightness structurally, by examining the harmony between hypothetical models and empirical data, and alternative models with empirical data as shown in table 2.

Table 2: Compares Models Based on Research Hypotheses with Alternative Models.

List	Statistics	Hypothetical Models	Alternative Models	Value Interpretation
1. Chi-square (χ^2)	*Low Near 0	684.60	88.49	Suitable
	*Equal df	125	75	Suitable
Relative Chi-square	Quotient (χ^2 / df) < 2.00	5.48	1.78	Suitable
2. GFI	> 0.90	0.83	0.97	Suitable
3. AGFI	> 0.90	0.76	0.94	Suitable
4. RMR	Approach 0.00	0.016	0.006	Suitable
5. RMSEA	< 0.05	0.112	0.022	Suitable
6. CFI	*0.00-1.00	0.98	1.00	Suitable
7. CN	> 200	95.78	423.38	Suitable

Hypothesis Test Results

From the research hypotheses that define the 4 hypotheses, it was found that:

- 1) Governance (GOVE) has a direct influence on the successful development of the Smart City Housing Project (HOUS). It has a direct influence value of 0.31, according to the hypothesis.
- 2) Infrastructure (INFA) has a direct influence on the Successful development of the Smart City Housing Project (HOUS). It has a direct influence value of 0.18, according to the hypothesis.
- 3) Technology Management (TECH) has a direct influence on the successful development of the Smart City Housing Project (HOUS). It has a direct influence value of 0.23 according to the hypothesis.
- 4) Stakeholder Engagement (ENGA) has a direct influence on the successful development of the Smart City Housing Project (HOUS). It has a direct influence value of 0.29, according to the hypothesis.

Presenting hypothesis test results as shown in Table 3.

Table 3: Hypothesis test results

Research Hypotheses	Route Coefficient	t statistics	Result
Hypothesis 1: Governance directly affects the successful development of the Smart City Housing Project (GOVE --> HOUS)	0.31**	6.11	Support
Hypothesis 2: Infrastructure directly affects the successful development of the Smart City Housing Project (INFA --> HOUS)	0.18*	1.96	Support
Hypothesis 3: Technology Management directly affects the successful development of the Smart City Housing Project (TECH --> HOUS)	0.23*	2.52	Support
Hypothesis 4: Stakeholder Engagement Successful development of the Smart City Housing Project (ENGA --> HOUS)	0.29**	5.08	Support

Present guidelines for the development of urban housing projects in accordance with smart city guidelines. The researchers analyzed, synthesized, and compared the mean values of each latent variable and the direct influence obtained from hypothesis testing to summarize and present as guidelines for the development of urban housing projects in accordance with smart city guidelines. As follows

- 1) The management of connectivity between the inside and outside the housing Projects with modern technology to ensure easy and swift access and resident's safety and privacy
- 2) Developing infrastructure especially the transportation system within the housing Projects to establish effective connections with the external environment
- 3) Participatory governance in which residents are involved in managing the various Systems of the projects
- 4) Communicating information and educating residents about water pollution and waste Management to reduce the impact on the environment in the housing project
- 5) Arranging spaces within the housing project for activities that both and individuals

From outside the community can participate in fostering interactions among project managers, residents and community members, ultimately helping reduce potential conflicts.

DISCUSSION

The hypothesis test results showed that the four latent variables were (1) governance, (2) infrastructure, (3) technology management, and (4) stakeholder engagement had a direct influence on the successful development of the Smart City Housing Project, as follows:

1. Governance has a direct influence on the successful development of the Smart City Housing Project. It has an influence value of 0.31, It argues that smart city development requires governance, Effective communication, transparency and cooperation from stakeholders. A study by Jayasena, Mallawaarachchi & Waidyasekara (2019) found that governance is one of the driving factors for smart city development. According to Mangla et al. (2017), a study found that good governance is one of the factors contributing to the success of smart city development, India. In line with a study by Myeong, Jung & Lee (2018), governance is a predicting factor for smart city development success. Other than that, Chourabi et al. (2012) A literature review related to smart cities has been conducted based on concepts, and scholars' studies have concluded. Governance Impact of smart city development Governance consist cooperation, leadership, participation, Effective communication, work Exchange information, Service & Application Integration, Accountability and Transparency. And Ngatikoh, Kumorotomo & Retnandari (2019) argue that the key element of governance is transparency by providing accurate information, being clear and to the point is essential to building trust from residents.

2. Infrastructure It has a direct influence on the Successful development of the Smart City Housing Project with an influence value of 0.18. It can be discussed that Infrastructure Importantly, in a smart city, internet connectivity is very important. Bridging the digital divides is needed to make the Internet accessible to all, especially in developing countries. The introduction of information and communication technology (ICT) systems in cities requires the proper use of equipment for the Internet network (Al-Hader & Rodizi, 2019). According to Myeong, Jung & Lee (2018) study, technology infrastructure can predict smart city development. Consistent with Albino, Berardi & Dangelico (2015), information and communication technology systems are at the heart of successful smart city development. Focus on giving importance to information technology and communication systems related to Infrastructure modern in the city. In line with Mangla et al. (2017) study of success factors in smart city development, India. It was found that technology infrastructure is the presence of network and communication technologies and services that can be systematically linked as one of the success factors in smart city development. According to Siuryte & Davidaviciene (2016), infrastructure is the presence of information and communication technology (ICT), especially wireless networks, affecting the success of smart city development.

3. Technology Management has a direct influence on the Successful development of the Smart City Housing Project with an influence value of 0.23. It can be discussed that Technology is an important factor in the smart cities. Smart city residents can put technology to good use by educating residents. In order to take advantage of the modern technology effect (Myeong, Jung & Lee, 2018). This is in line with Jayasena, Mallawaarachchi & Waidyasekara (2019) who stated that technology is a driving factor

for the development of smart cities, but technology is a challenge in developing smart cities, therefore there must be an appropriate Technology Management. Mangla et al. (2017) argue that technology is a success factor in the smart city development in managing and solving problems, especially security and user privacy issues. According to Abosaq (2019), smart cities have data communication connections between devices, which is a big data with a criminal risk of selling data to criminals or not maintaining the privacy of data users. Therefore, technology management is required to build confidence and trust for residents. And Vodak, Sulyova & Kubina (2021) argue that smart cities are adopting advanced technologies. It is important to have Technology Management so that residents can use advanced technology effectively.

4. Stakeholder participation has a direct influence on the success of smart city housing project development. With an influence value of 0.29, it can be discussed that Stakeholder participation is very important in local or community development. Participation is also a key factor in driving the success of smart city development. A study by Pezzutto, Fazeli & De Felice (2016) found that stakeholder engagement in information perception and urban development planning is a key strength in driving European smart city projects. According to the Siuryte & Davidaviciene (2016) study, one of the key factors in smart city development is stakeholder involvement in urban development. In addition to that, smart city development requires stakeholders to be informed. Participation in development impacts and decision-making implications for urban planning and development monitoring (Borsekova, Vanova & Vitalisova, 2016). Smart city development relies on information provision, Exchange of opinions and information from stakeholders to determine the direction of development so that all sectors can work together and succeed. (Ministry of Information and Communication Technology, 2014). And Jayasena et al. (2021) state that smart cities are ecosystems of multiple stakeholders, ensuring stakeholders' participation, planning, and effective decision-making are therefore critical factors for the success of smart city project development.

Suggestion

Public and private sector stakeholders on smart city development need to be aware of and pay attention to the regulatory factors that require building partnerships with smart city residents through effective communication and transparent and accountable governance.

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