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SMART SECURITY AND SAFETY INDEX MEASUREMENT: A CASE STUDY IN BANDUNG INDONESIA

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Abstract

Purpose: Nowadays, the development of technology is very fast and increasingly sophisticated; no doubt all the problems in a city can be solved quickly and well. Hence, facing a huge number of the urban population, the city must adopt the strategy of smart city so that the standard of life can be improved. Some of the cities in the world have applied the concept of smart city. One of the dimensions in smart city concept is smart security and safety. This study aims to know the indicators and index level of smart security and safety in Bandung city of Indonesia. This research explores the indicators and measures the index level of smart security and safety in Bandung.

Methodology: The research method characteristics applied in this study is the exploratory sequential mixed method.

Main Findings: This study finds that there are 20 indicators to measure the index level of smart security and safety. The smart security and safety level of Bandung city is 72% which is considered that on average the measured indicators are already good enough and satisfied, but there are some indicators that should be improved. The variable that should be improved is variable of Awareness and Understanding which has score of 49%.

Implications/Applications: It is suggested by this study that the socialization of smart security and safety program such as Panic Button Application, LAPOR! The website should be more effective through making socialization more targeted and real.

Keywords: *Smart City, Bandung, smart surveillance, smart security and safety, quadruple helix.*

INTRODUCTION

Bandung is the capital city of West Java in Indonesia. It is situated at 768m overhead sea level. In 1800 it was basically developed as resort city by the government of Dutch Indies, because of its filthy natural location and comfortable climate (Voskuil, 2007). In the recent decade Bandung city has gained a lot of attraction for all types of industry and has a lot of chances for higher economic growth (Firman, 2009). However, In west Java it has the highest growth rate and it is higher more than its national growth that has main contribution in total GDP of the country (Tarigan et al., 2016). In the field of academic Bandung has about 80 universities that will give birth to human resources experts in each field.

There are some problems faced by some big cities such as Bandung, Jakarta, and Surabaya. The problems occurred because the population is increasing time by time and caused by a high urbanization rate. The amount of city and village population that will occur until 2045 is not balanced, the population in the city will increase but the amount of villager or suburban population will decrease (Mohamad, 2017). The problems of the city will become more complex. One of the big city, Bandung is the example. Bandung becomes the tourism objects, it becomes the culinary, cultural, and shopping destinations, there are some tourists from outside Bandung come and experience the tourism objects in Bandung. These functions of Bandung beside create good income for Bandung but also create city problems. These city problems should be managed and solved by using smart city concept.

Nowadays in Bandung city, the information technology systems have been implemented by the government. Information technology began to be used for urban services in order to implement the smart city concept. One dimension of smart city is smart security and safety. Programs that are run from Bandung city government to realize smart security and safety of Bandung were already socialized. One of the programs is launching a panic button mobile application to provide security for the people in the city. Panic button application was officially launched in Bandung on July 10th 2015 by Ridwan Kamil as a Major of Bandung city at that time (Bohang, 2015). The second program of Bandung city government is launching new application which is called as E-PunTen. The application is provided especially for migrant residents who live temporarily in the city of Bandung without changing the identity card. By using this application, the government can easily identify the migrant resident who is not Bandung resident. This is important especially to prevent a newcomer who has a bad objective or willingness to do negative things such as doing terrorism (Ramdhani, 2017).

This study aims to find out the related indicators of smart security and safety and measure smart security and safety index level for the city of Bandung, which has already made some efforts to become a smart city. Data collection tool used is the first in-depth interview to know the indicators to measure smart safety and security, and second using questionnaires to measure the index. The study took 16 selected samples from the population-based on the Quadruple Helix namely governments, academicians, business players, and civil society.

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LITERATURE REVIEW

Smart safety and security is a dimension of a smart city. Before discussing the model and definition of smart security and safety, it is better to know the definition of smart city. There are many definitions of smart cities. The smart city is usually defined or related to the integration of technology and natural environment to increase the effectiveness of processes in every field of a city. The smart city is implemented in order to achieve sustainable development, safety and health of inhabitants with the aim for increasing the quality of life of citizens, near communities and environments. Smart city is usually using intensive and advanced technology that connects people, information and city elements in order to create a sustainable, greener city, competitive and innovative commerce, and an increased life quality (Bakıcı, Almirall, & Wareham, 2012; Paireepinas, Dhiravisit, & Grisanaputi, 2017; Bernik, Azis, Kartini, & Harsanto, 2015; Varsani, 2018; Malinda, 2018; Humaidi, Shahrom, & Abdullah, 2018; Rerkklang, 2018). From the various literatures that are already reviewed, smart city is expected to answer at least 3 important things from a city. First, the cities can autonomously sense of the city's problems. Second, the city can learn from the problem (city learning) and become more and more understanding about the city problem, and the last, the city can take action on the problems that arise as the result of city learning.

Smart security is also defined vary just like smart city, but one of the definitions which are considered clear enough has come from Frost and Sullivan. Frost and Sullivan defines smart security and safety is about technology and solutions such as video surveillance, public safety LTE, and managed security services that are designed to protect people, property, and information (Frost & Sullivan, 2013; Sharma et al., 2017; Osra, 2017; Fan & Fujimoto, 2018; Paireepinas, Dhiravisit, & Grisanaputi, 2017).

Smart safety and security in Bandung city are related with smart living, one of eight dimensions of smart city of Bandung, namely Smart Economy, Smart People, Smart Government, Smart Mobility, Smart Environment, and Smart Living. Smart living refers to a good quality of life. The residents are expected to live properly and free from threats and criminality.

There are eight variables of smart security and safety, namely regulation/policy, awareness/understanding, expert, monitoring & controlling system, emergency system, preventive system, and recovery system as shown in Figure 1 (Indrawati, Ariffianto, & Amani, 2018).

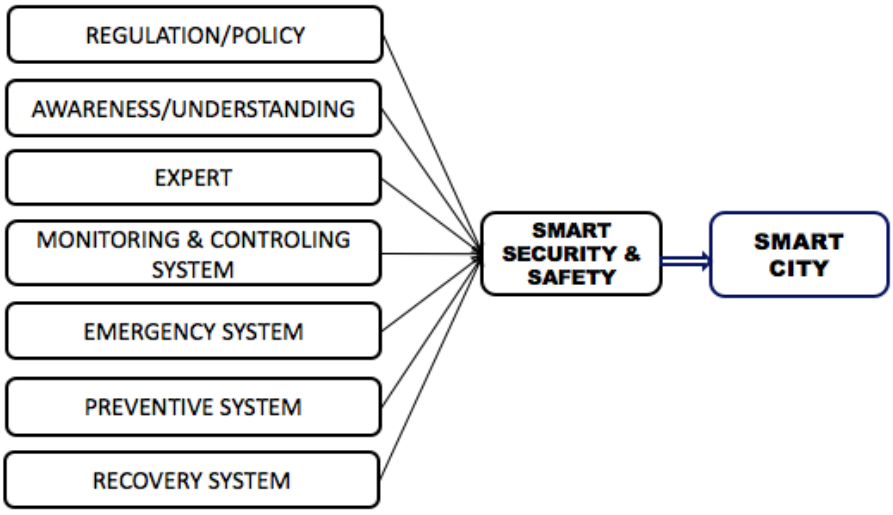

Figure 1: Smart Security and Safety Model (Source: Indrawati et al., 2018).

Policy or regulation means that the existence of regulations/policies is complete and clear when the existence of policy or regulation is clear and complete then the existence and implementation of smart safety & security solutions in a city will be better.

Awareness means that the high level of awareness and understanding of the citizen when the level of awareness and understanding of the citizen is high, the existence and implementation of smart safety & security solutions in a city will be better.

Expert means that the high level of readiness of experts in the field of Information and Communication Technology (ICT), when the existence of readiness experts in the field of ICT high, the implementation of safety and security solutions in the city will be better.

Monitoring & Controlling means that with the existence of the monitor system and effective management control hence the implementation of smart safety & security solution in a city will get better.

Emergency System means that when the emergency response system is fast and accurate then the application and implementation of smart safety & security solutions in a city will be better.

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Preventive System means that with the existence of the prevention system against potential crime or effective disaster hence the implementation of smart safety & security solution in a city will get better.

Recovery System means that with the existence of the effective system of recovery for the impact of accidents, crime or disaster then the implementation of smart safety & security solutions in a city will be better.

RESEARCH METHODOLOGY

The research method characteristics applied in this study is an exploratory sequential mixed method. The exploratory sequential mixed method is a design in which the researcher first begins by exploring with qualitative data and analysis and then used the findings of the first step to do a second step which is a quantitative method, as shown in Figure 2 (Creswell, 2014).

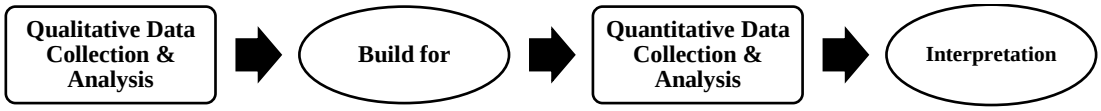

Figure 2: Exploratory Sequential Mixed Method

This research is supported by the descriptive purpose of study. Descriptive research is done when researchers already know the factor or variable to measure an object of the study but not yet know the relationship between factors or variables. Researchers only describe the factors or variables, without seeing or testing relationships or influence between factors or variables (Sekaran & Bougie, 2010). This study is also categorized as non-contrived setting means that this study is conducted in a normal environment, which usually occurs or is called natural and in non-contrived research setting, the researcher does not manipulate or making any intervention (Sekaran & Bougie, 2010). Data collection is done in one period of time, the data are processed, analyzed, and used to drawn conclusion in a period of time, hence this study is also a cross-sectional study (Sekaran & Bougie, 2010).

The first stage of research is findings and reviewing the indicators of smart security and safety from the existing literatures which can be used to measure the 7 variables of smart security and safety (Indrawati et al, 2018). The second stage is finding secondary data based on the indicators, the secondary data means that the facts and the action that has already been implemented in Bandung city regarding smart security and safety programs to realize Bandung as Smart City. The third stage is finding data from best practices in the world. This is done by reviewing the other cities that already have implemented the smart security and safety programs to realize a Smart City. The fourth stage is interviewing informants who are selected based on Quadruple Helix Model. This model suggests to include collaboration of people who come from sectors, namely Government, Civil Society, Academician, and Business Player. In choosing the informant for each sector this study purposive sampling technique is used and the informant is nominated after informer is restricted to very specific type of people who can provide information very easily, in case they are the only one who has that information or they are fulfilling some criteria through which that information can be obtained (Wahyuni, 2012). The list of informants is shown in Table 1.

Table 1: List of Informants

Category	Organizations, Institutions or Jobs of Respondents	Number
Government	Dept. of Communication and Information Bandung City	1
	POLICE	2
	Dept. of Fire and Rescue Bandung City	1
Academician	Telkom University Smart City Research Group	1
	Lecturer at Telkom University	1
	Lecturer at Bandung State Polytechnic	1
	Lecturer at Police Academy – University of Police Science	1
Business Player	PT. Telekomunikasi Indonesia	3
	PT. Neuron	1
Civil Society	Citizen in Bandung City	4
Total		16

The fifth stage is measuring the indicators of smart security and safety. The respondents who are already chosen based on Quadruple Helix Model are asked to give the score to each indicators.

In the process of giving the score to each indicator, the informant should consider and compare the existing data from Bandung with the data derived from best practice (data from cities that are already considered as smart cities), the informant should also give score based on their living experience and knowledge related with the indicators. The informants should give score ranging from 1 to 5 for each indicator. The scores are categorized as follows:

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Score '1' as 'Very Poor'.

Score '2' as 'Poor'.

Score '3, as 'Neutral'.

Score '4' as 'Good'.

Score '5' as 'Very Good'.

The scores given are calculated to get the indicator index by using the following formula:

Indicator Index=Σx/Σy x 100% (Equation 1)

Σx = Total score of an indicator given by respondents.

Σy = Total respondent who give the score for an indicator.

DATA ANALYSIS AND RESULT

In order to achieve the aims of this study, this study collected data by using an in-depth interview. The in-depth interview was conducted in Bandung between December 8, 2017 and December 22, 2017. The in-depth interview was conducted first to find the indicators related to existing variables from Indrawati et al., (2018), then the second steps is to find score of each indicator to generate the index of smart security and safety.

After conducting in-depth interviews with the respondents, this study found some indicators related to the existing variables in the model. As shown in Table 2.

Table 2: Indicators of Smart Security and Safety Based on Interview

Variables	Indicators	Concept
Policy / Regulation	The existence of regulations or policies related to safety & security	There are policies/regulations related security and safety: personal, digital, disaster.
	Level of completeness	Level of completeness for policies/regulations
	Level of explication	Level of explication for policies/regulations
Awareness / Understanding	The existence of a socialization program for citizen	There are socialization from the government to citizen about App that supports Smart Security and Safety
	The evaluation of program effectiveness	The level of effectiveness from socialization
Expert	Capacity or number of experts	Level of number of an expert in Bandung City: IT, Police, SAR, Cyber Security Team
	Capability or qualification of experts	The level capability of an expert
Monitoring & Controlling System	The existence of monitoring & controlling system	There are the smart office to monitor and control: Command Centre
	The high validity of data	The level of validity based on who parties in charge
	Speed of analysis	The level speed analysis of the system
	Accuracy of evaluation	The level accuracy of the system
Emergency System	The existence of the emergency system	There is an emergency system: via App or system
	Speed of response	Level speed of team emergency system
	Handling speed	Level speed of handle the accident after response by the system
Preventive System	The existence of a crime prevention system	There are the preventive system for crime
	The existence of the disaster prevention system	There is a preventive system to detect natural disaster
	The Existence of Closed-Circuit Televisions (CCTV)	There is CCTV in public place
	Effectiveness of the preventive system	Level effectiveness of the program
Recovery System	The existence of the recovery system from accident, destruction & disaster	There are recovery system after accident, destruction, and disaster
	Effectiveness of the recovery system	Level effectiveness of the program

Having finished identifying the indicators of each variable, this study makes confirmation whether the respondents agree or not with the indicators. This study found that almost all of the respondents agree with the identified indicators as shown in Table 3.

Table 3: Summary of Respondent's Agreement Regarding Indicators of Smart Security and Safety.

Indicators	Respondent's Code															
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16
P/R1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

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P/R2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
P/R3	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
A/U1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
A/U2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
E1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
E2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
MC1	√	√	√	√	√	√	√	√	O	√	√	√	√	√	√	√
MC2	√	√	√	√	√	√	√	√	O	√	√	√	√	√	√	√
MC 3	√	√	√	√	√	√	√	√	O	√	√	√	√	√	√	√
MC4	√	√	√	√	√	√	√	√	O	√	√	√	√	√	√	√
ES1	√	√	√	√	√	√	√	√	O	√	√	√	√	√	√	√
ES2	√	√	√	√	√	√	√	√	O	√	√	√	√	√	√	√
ES3	√	√	√	√	√	√	√	√	O	O	√	√	√	√	√	√
PS1	√	√	o	√	√	√	√	√	√	O	√	√	√	√	√	√
PS2	√	√	o	√	√	√	√	√	√	O	√	√	√	√	√	√
PS3	√	√	o	√	√	√	√	√	√	O	√	√	√	√	√	√
PS4	√	√	o	√	√	√	√	√	√	O	√	√	√	√	√	√
RS1	√	√	o	O	√	√	√	√	O	O	o	√	√	√	√	√
RS2	√	√	o	O	√	√	√	√	O	O	o	√	√	√	√	√

*P/R = Policy / Regulation
*A/U = Awareness / Understanding
*E = Expert
*MCS = Monitoring and Controlling System
*ES= Emergency System
*PS= Preventive System
*RS = Recovery System

Agree = √

Disagree = o

After confirming each indicator with the respondents, this study asked the respondents to give the score for each indicator which is important to derive smart security and safety index. During giving score, the respondents have to consider the data from best practice from other cities and the existing data from Bandung city related to each indicator. By comparing the data from best practices, existing data from Bandung city, and experience in living in Bandung, the respondents should fill up questionnaire with giving score rating from 1 (very poor) to 5 (very good).

This is the simulation of measuring index process:

For example to measure the existence of Closed-Circuit–Television as Indicator of Preventive Systems (P3). The researcher gives the informant the data of best practice in other countries and existing data in Bandung. This data should be used in the process of giving score for each indicator by every informant.

DATA BEST PRACTICES OTHER COUNTRIES

Beijing, London or Tokyo, they have ubiquitous CCTV deployments.
In Singapore, about 40,000 police cameras have been installed in over 7,000 Housing Development Board (HDB) blocks and multi-storey car parks (MSCPs) as of September 2015, as a key component of the Community Policing System (The Economist Intelligence Unit, 2017).

EXISTING DATA IN BANDUNG CITY

-There are 132 CCTVs installed at 40 dots at a crossroads in Bandung City. All of them are effective in recording every vehicle number data (IG: @infobdgcom / http://jabar.pojoksatu.id)

Through the process of considering the data from best practices, existing data from Bandung, and the experience during living in Bandung, the respondents give scores, the scores are tabulated as shown in Table 4.

Table 4: Scores from each Respondent for The existence of Closed-Circuit–Television as an Indicator of Preventive Systems (P3) indicator.

Respondent	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	Total
P3	3	4	4	4	4	3	3	3	3	4	2	2	2	3	3	3	50

The result of each respondent's score for each indicator is shown in Table 5. By using formula (1) as described in Part 3, the index levels of each indicator resulted from calculation are shown in the last column of Table 5.

The scores of each indicator are all above 50 except for indicators related to awareness which are 42 and 37. These scores indicate that the awareness of respondents is still very low. Having finished calculating the score for each indicator, hence

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this study intends to measure index level for total safety and security in Bandung by calculating the average score of all indicators. The result of the calculation is shown in the last column in Table 6.

Table 5: Respondents' Score for the Indicators of Smart Security and Safety

Indicators' Code	Respondents' Code																
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	Total Score of Each Indicator
PR1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	64
PR2	4	4	4	4	4	3	3	3	3	4	3	3	4	3	3	3	55
PR3	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4	3	61
A1	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	42
A2	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	37
E1	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	62
E2	4	3	4	3	4	4	4	4	4	3	4	4	4	4	3	3	59
M1	4	4	4	5	5	4	4	4	4	4	4	4	4	3	3	3	63
M2	4	4	4	5	5	4	4	4	4	3	4	4	4	4	4	4	65
M3	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	63
M4	4	4	4	4	4	3	3	3	3	4	3	3	4	3	3	3	55
EM1	4	4	4	4	4	4	4	3	3	3	3	2	3	3	2	3	53
EM2	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	70
EM3	4	4	4	4	4	3	3	3	2	3	4	4	4	4	4	4	58
P1	4	4	4	4	4	3	3	3	3	4	3	3	4	3	3	3	55
P2	3	5	5	5	4	4	4	3	3	3	3	3	3	3	3	3	57
P3	3	4	4	4	4	3	3	3	3	4	2	2	2	3	3	3	50
P4	4	4	4	4	4	3	3	4	4	3	4	5	3	4	3	4	60
R1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	64
R2	3	4	4	4	4	4	4	2	4	4	4	4	4	3	2	3	57

Table 6: Smart Security and Safety Index Level for Bandung City

Indicators	Percentage of Index
The existence of regulations or policies related to safety & security	80%
Level of completeness	68.75%
Level of explication	76.25%
The existence of a socialization program for citizen	52.5%
The evaluation of program effectiveness	46.25%
Capacity or number of experts	77.5%
Capability or qualification of experts	73.75%
The existence of monitoring & controlling system	78.75%
The high validity of data	81.25%
Speed of analysis	78.75%
Accuracy of evaluation	68.75%
The existence of the emergency system	66.25%
Speed of response	87.5%
Handling speed	72.5%
The existence of a crime prevention system	68.75%
The existence of the disaster prevention system	71.25%
The existence of Closed-Circuit Televisions (CCTV)	62.5%
Effectiveness of the preventive system	75%
The existence of the recovery system from accident, destruction & disaster	80%
Effectiveness of the recovery system	71.25%
Average	72%

Table 6 shows that the average score is 72% that is the indication that those indicators that can be measured are good enough and satisfied, however, some indicators should be improved. The indicators of *the existence of a socialization*

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program for citizen and *The evaluation of program effectiveness* are only 52.5% and 46.25% which are considered low. These indicators should be improved.

CONCLUSION AND SUGGESTION

Smart Security and Safety Indicators

Refers to interview results, there are 20 indicators of 7 variables that can be used to measure the index of smart security and safety level of a city. Therefore, this research suggested a model measure smart security and safety in Indonesia as presented in figure 3.

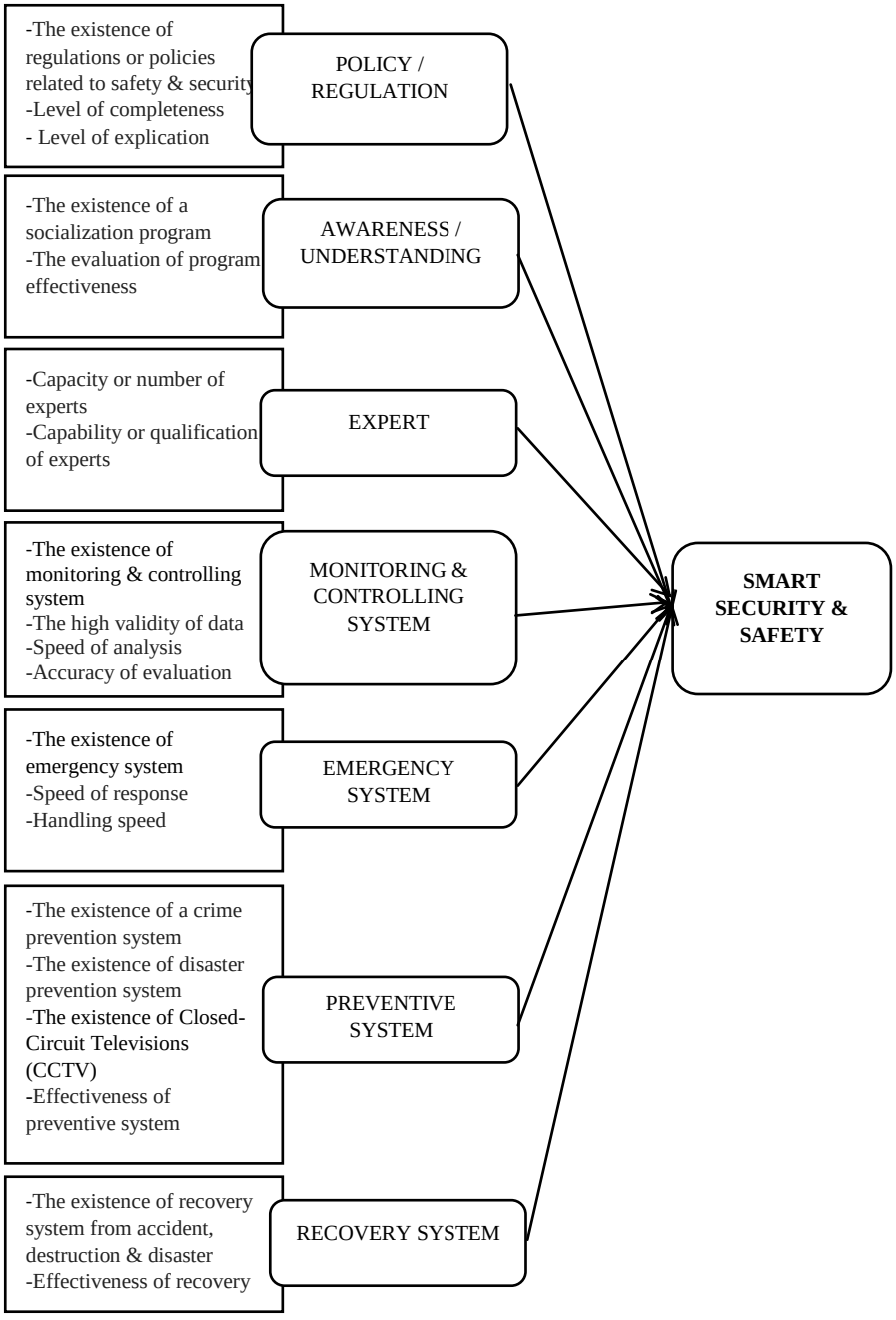

Figure 3: Smart Security and Safety Model

The study has shown that smart security and safety index of Bandung is 72% that is considered enough and satisfied, however, some indicators should be improved. The indicators of the existence of a socialization program for citizen and The evaluation of program effectiveness are only 52.5% and 46.25% which are considered low, hence these indicators should be improved. These findings showed that this study has filled the gap since the previous study (Indrawati et al., 2018) only find variables of smart security and Safety.

Suggestions

Socialization about smart security & safety programs such as Panic Button App, LAPOR!, etc. should be more effective, due to the fact that the score for the indicator of the evaluation of program effectiveness only reaches 46.25%. Socialization is very important to make the society of Bandung city aware of the programs. The in-depth interview result shows that some respondents do not know about the existing programs or application to maintain or increase security and safety services to the citizens of the Bandung.

The model founded is expected to be an information and knowledge regarding the smart city of Bandung City in security and safety dimension. The indicators of the model can be used to perform calculations related to the readiness index of the city in applying smart safety & security to another city.

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