Importance performance analysis for smart city implementation in Surabaya, Indonesia

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Abstract. This paper presents a study to measure the implementation of smart city initiatives in Indonesia that has been applied by the city government in various city scales. Various benefits are believed to be gained by applying a smart city concept that emphasizes on the use of information and communication technology. However it depends on the readiness of the city government and its citizens in implementing the smart city concept. Importance Performance Analysis is used to measure the differences between public perception and the real conditions of the smart city implementation. Surabaya city, which was granted as one of the five winners of smart city awards in Indonesia for big city category, is used as a case study. The implementation of smart city’s attributes is compared with the expectation of the citizens. The result of the research shows that the concept of smart city, which is used and implemented by the city government in providing services for its society is not always understood similarly to the societies’ point of view. Involving the community in determining the priority of which attributes and dimensions of smartness in the provision of public services is very important to improve the level of implementation of smart city.

1. Introduction

The discourses of smart cities are getting more and more attention in the media, which show how in the future, the concept of ‘smartness’ can be applied in cities. According to Cohen [1], there are 3 generations of smart cities i.e smart city 1.0 which is technology driven, smart city 2.0 which is technology enabled and city led, and smart 3.0 which is citizen co-creation models. In the last several years the concept of smart city is no longer a discourse but has been applied by the city government including in Indonesia in various city scale either in big city, medium city or small town.

This paper discusses the implementation of the smart city initiatives in Indonesia particularly in a big city scale. Since 2015, the Indonesian Government in cooperation with a consortium has been trying to set out the smart city index for cities in Indonesia. In addition a roadmap for policy and strategy of urban development have been set up by The National Planning Bureau by introducing ‘liveable’, ‘green’, and ‘smart’ keywords [2]. It is generally believed that implementation of smart city will bring benefits for the urban residents in many ways.

Beside of that, good planning is a planning that is able to meet the needs of the urban residents. In this smart city planning, the demand of each urban resident need will be different among cities. It is
based on the preferences of the people who live in it, so that the direct perception of the urban residents on their city conditions becomes an important process. A previous study has been done to measure the friendliness level for the medium city and small town in Indonesia like Yogyakarta and Magelang [3]. Nevertheless a study of the implementation of the smart city for the big city has not been done yet. Therefore Surabaya, one of the big cities in Indonesia is used as a study case. Surabaya is one of city in Indonesia, which is granted in a competition held by Kompas daily in collaboration with ITB and PGN as ‘smart city’ for the category of big cities with a population of more than 1 million. Apart from being a smart city, Surabaya also won an award as a smart city in the environmental category [4].

2. Methods

2.1. Importance Performance Analysis
The Importance Performance Analysis (IPA) introduced by Martilla and James [5] was used to measure the differences between public perception related to the attributes of smart city dimensions (attribute’s importance) and the real conditions of the smart city implementation in the field (attribute’s performance). The results of IPA are expected to provide an overview of the gap between aspects of real community needs (importance) and services supplied from the city/government that can be assessed (performance) in the implementation of smart city. The real condition in the field shows how each attribute of this smart city dimension is perceived by its citizens as have already been applied by the city government in providing services for the community. The results are compared with the smart city dimension’s attributes expected by citizens to be applied in the city in the future. The differences between performance and importance of the smart city’s attributes reveal the implementation of the smart city concept. The attributes of smart city’s dimensions are structured in a Likert Scale model’s questionnaire (level 1-7).

2.2. Smart city dimensions and attributes
According to Cohen [6] there were 6 dimensions of smart city used to measure the smart city implementation i.e. (1) smart economy, (2) smart mobility, (3) smart environment, (4) smart people, (5) smart living, and (6) smart governance. The smart disaster management was added to fit to the context of Indonesia. Each smart city dimensions is divided into 6 attributes as below:

| Table 1. Dimensions and attributes of smart city |
|-----------------------------------------------|
| **SMART ECONOMY (SE)** | **SMART LIVING (SL)** |
| SE-1 New startups | SL-1 Housing sufficiency |
| SE-2 Internet-based full employment | SL-2 Gini Index |
| SE-3 Innovative in business processing | SL-3 Investment in culture |
| SE-4 ICT-based business license | SL-4 Smart crime prevention |
| SE-5 Online transaction between institutions | SL-5 Accessible health and education services |
| SE-6 Business information availability | SL-6 Life expectancy |
| **SMART MOBILITY (SM)** | **SMART GOVERNANCE (SG)** |
| SM-1 Clean-energy transport such as bicycle | SG-1 Online government services |
| SM-2 Innovative and modern parking system | SG-2 Electronic benefit payments |
| SM-3 Integrated multi-modal transit system | SG-3 WiFi coverage at public space |
| SM-4 Real time public transport information services | SG-4 Sensor coverage |
| SM-5 Smart cards for public transportation | SG-5 Integrated health and safety services |
| SM-6 Online transportation apps | SG-6 Open data and apps |
| SMART ENVIRONMENT (SN) | SMART DISASTER MANAGEMENT (SDM) |
|------------------------|----------------------------------|
| SN-1 Smart homes       | SDM-1 Emergency warning system   |
| SN-2 Energy saving house| SDM-2 Responsive mitigation planning |
| SN-3 Public building automation system | SDM-3 Sensor for monitoring disaster |
| SN-4 Certified green buildings | SDM-4 Evacuation and rescue training |
| SN-5 Solid waste and waste water treatment | SDM-5 Emergency information |
| SN-6 Green open space  | SDM-6 Disaster relief assistance |

### SMART PEOPLE (SP)

| attributes                      | attributes                               |
|---------------------------------|------------------------------------------|
| SP-1 Accessible internet at home| SP-4 Voter participation in municipal election |
| SP-2 Smart phone penetration    | SP-5 Number of higher education degree   |
| SP-3 Civic engagement activities using ICT | SP-6 Creative industry jobs |

Source: Adapted from [7]

It is important to know that choosing priorities, directions, policies, and utilizing information and communication technology with automatic computerization intelligently is the key strategy for the smart city implementation. In addition, more than that consideration, the citizen centric approach, which facilitates active participation of the urban residents in the city management, is also important way to create a successful implementation of urban strategy like smart city, bringing closer interaction between citizens needs and local government responses.

3. Smart city implementation in Surabaya

There were about 120 respondents participated in the survey. Various information related to gender, age, education level, occupation and the area where respondents live have been gathered through the questionnaire. Respondents consist of 45% male and 55% female with level of education are 5% secondary school, 78% high school and 17% higher education level.

![Figure 1](image.png)

**Figure 1.** Expectation of smart dimensions according to gender

The importance of smart city attributes in Surabaya is perceived relatively the same between men and women. Nevertheless, female expect a little bit higher value for smart disaster management than male citizens, while other dimensions are in reversed (Figure 1)
Meanwhile education level influenced the perception of the smart city implementation in Surabaya. According to Surabaya citizens with primary education level the performance of the smart city’s attributes is low especially in dimension of mobility, environment, and disaster management (Figure 2-left). However, most of Surabaya citizens expect a high level implementation on all dimensions (Figure 2-right).

The result of the IPA of smart city implementation in Surabaya city can be seen from Figure 3. The figure represents the implementation of smart city initiatives in Surabaya city. The X-axis shows the performance of smart attributes implemented in the city while the Y-axis shows the importance of smart attributes perceived by the citizens. Each quadrant shows the gap between the performance and the importance of the attributes. Quadrant A shows high importance-low performance which can be interpreted that implementation is not as good as expected by the citizens. Quadrant B shows high importance - high performance. It means that the implementation is as good as expected by the citizens. Quadrant C shows low importance-low performance. It can be read that the attributes are as less important as city’s performance. Meanwhile quadrant D shows low importance-high performance meaning that the city has a good implementation in some attributes although the citizens perceived it as not quite important.

In Figure 3, quadrant A and B are important to be highlighted. Quadrant A reveals obligation from the government to improve their services in some attributes that the citizens think they are important. Meanwhile Quadrant B shows in which attributes the citizens are satisfied with the services.
Surabaya residents consider their city government is fairly good at implementing the concept of smart governance by providing an online system and utilizing ICT for health and security services (SG-1, SG-2, SG-3, SG-5, and SG-6). However, the community believes that Government needs to increase the use of sensors broadly to improve their services (SG-4).

In addition, the citizens are also pleased to the Government's effort in supporting smart living implementation by improving investment in culture (SL-3) and life expectancy (SL-6) and providing accessible health and education services (SL-5). However they have a highly expectation that the Government can provide sufficient housing (SL-1), good gini index (SL-2) and smart crime prevention SL-4) as pointed out in quadrant A in (Figure 3).

Surabaya's achievements in winning smart cities in the environmental category seem to be proven by the satisfaction of its residents to the availability of open green spaces (SN-6), good handling of solid waste and waste water treatment (SN-5), and government support for the use of bicycles as a clean energy transportation (SM-1). Green buildings (SN-4) and energy saving house (SN-2) are two attributes that needs to be improved continuously.

Nonetheless, problems in the transportation sector such as the provision of parking and integrated multi-modal transit system (SM-2, SM-3), and the provision of modern and sophisticated public transportation are urged to be resolved (SM-4, SM-5). Both Surabaya government and its citizens have the same opinion that internet-based employment, smart homes and building automation system, mitigation planning and evacuation training are attributes of smart city that get the last priority in their implementation.

4. Conclusion
The results show that about 64% attributes of smart cities were considered important by the residents of Surabaya to support community services. Among those attributes that are considered important, 48% of them have been implemented properly by the Government of Surabaya while 52% of others
need to be improved. Meanwhile 36% of other smart city’s attributes are considered not too urgent to be implemented in the city of Surabaya. However, from the number of attributes that are not too important, 70% of them are applied very well by the government, for example in the economic dimension like the use of internet and ICT in economic and business activities.

This shows that the concept of smart city, which is used and implemented by the city government in providing services for its society like Surabaya, is not always understood similarly to the societies’ point of view. Therefore involving the community in determining the priority of which attributes and dimensions of smartness in the provision of public services is very important to improve the level of implementation of smart city.

5. References

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