Implementation of Smart City Concept for Sustainable Development in Semarang Old Town Area

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Abstract. The Old Town Area of Semarang has become a 'Pilot Project' for developing the smart city concept in Semarang. On the other hand, this area is a cultural heritage area, so the implementation of the smart city concept should be able to support the preservation of buildings and the history of the area. The Covid-19 pandemic has affected the implementation of smart cities, considering that activities in the Old Town Area have decreased drastically. This study aims to identify the application of the smart city concept in the Old Town Area of Semarang. The study conducted was in 2020, when the Covid-19 pandemic was still occurring in the community. The study's initial stage was compiling the dimensions and indicators of smart cities as study variables and exploring smart city regulations in Semarang. In the second stage, to obtain information on the implementation of a smart city in the Old Town Area of Semarang, we conducted interviews with stakeholders from the government, cultural heritage activists, and communities related to the Old Town Area, and building occupants. As a result, we collected information regarding the implementation of smart city before and during the Covid-19 pandemic. The content analysis processed the result of the interview. Meanwhile, we used descriptive analysis techniques to study the dimensions and indicators and smart city regulations in Semarang. From the study results, the implementation of smart city in the Old Town of Semarang was organized into categories: appropriate, still not suitable and not suitable. The dimension of smart city that has appropriate is Smart Living. The dimensions that are still not suitable are Smart Governance, Smart Environment, Smart Economy and Smart Mobility. Meanwhile, the dimension that has not suitable is Smart People. Based on the six dimensions of smart city, there are 25 indicators, and the study results state that only 18 indicators are appropriate.

Keywords: old town area, smart city, sustainable development

1. Introduction
The concept of a smart city emerged several years ago as a combination of new ideas where information technology can improve the city's functioning [1]. The smart city concept is increasingly popular, and almost all cities in the world label their cities as smart cities [2]. Initially, this concept emerged as a response to the challenges of urbanization in the 21st century [3]. Planning and building smart urban districts is an aim of the smart city concept, where technology is integrated into infrastructure and used to control and manage city functions innovatively [4].
The concept of a smart city is one of the fashionable approaches to city development [2]. Currently, some smart cities are technologically advanced [5]. The concept of a smart city is becoming increasingly widespread, so this concept is very influential on city development policies [6]. The smart city concept applies in real life. The concept develops into a framework or model, and in the next step, some experts formulate and divide the concept into several dimensions. One of the smart city concepts divides into six dimensions: smart governance, smart economy, smart people, smart mobility, smart environment, smart living [7][8]. Another opinion divides the smart cities concept into seven dimensions: data, smart governance, smart economy, smart people, smart mobility, smart environment, smart living [9]. In addition to the above opinion, a smart city framework based on the Smart Cities Nine Pillar Model combines three main elements: management and planning, infrastructure, and people [10].

Several big cities in Indonesia have implemented the smart city concept, one of which is the city of Semarang. The Indonesian government targets that there will be one hundred smart city concept cities by 2045 [11]. The city of Semarang is one of the cities that began implementing the smart city concept in 2013 entitled "Semarang is Great". The Mayor of Semarang declared the Semarang Smart City (SSC) marked by the signing of the MoU with PT Telkom, namely the installation of 2,300 free wifi in public areas. The Semarang City government's effort to realize a smart city is to launch a website http://smartcity.semarangkota.go.id. The smart concept applied in various online service systems in the city of Semarang includes the concept of systemic (connected to the system), monitorable (can be monitored), accessible (easy to access), reliable (trustworthy), and time-bound (has a time limit) [12].

The Semarang City government is currently intensively developing the smart city concept, one of which is the Semarang City Government successfully revitalising the Old City as one of the smart city concept implementation programs. Its success has had a significant impact on the progress of the city of Semarang. Based on this, the Semarang City Government stated that the Semarang Old City Area became a 'Pilot Project' in developing the smart city concept in Semarang City. The Semarang City Communication and Informatics Service stated that the Old City area of Semarang is ideal for implementing the smart city concept. According to the RTRW of Semarang City in 2011-2031, Kota Lama is a strategic socio-cultural area. The Old Town area of Semarang has also become a tentative list of the World Heritage City by UNESCO. The Semarang city government, through Diskominfo, has carried out the ducting process and will continue the fibre optic (FO) installation process. This utility will later be helpful for the development of the smart city concept in the Old City of Semarang. Based on public services in the Old City of Semarang, the City Government provides free wifi in public areas, precisely in Srigunting Park. In addition, the Semarang City Government will develop CCTV that uses analytical sensors. The Semarang City Government has also launched the Wis Semar mobile application, making it easier for tourists to obtain tourist information. Then there is the "Old City Semarang" application which provides information about the history and cultural heritage buildings [13]. In addition, bicycle and motorbike rentals use the gowes application, and the payment system uses mBanking or T-cash [14].

The Semarang City Government will develop a smart service by using smart lighting to implement parking payments through electronic money (e-money) and street lighting. For food by implementing paying for food through an application system and installing tools in every restaurant and cafe to make it easier to calculate taxes. In addition, other facilities will also develop, namely the existence of a sensor that sounds at the command centre when there is full of garbage. Then there will be a notification at the command centre in the event of a parking violation so that the officer can remind via loudspeaker [15].

Based on this, the application of the smart city concept in the Old City of Semarang emphasizes the utility aspects related to the application. The smart city concept approach is broad and must be in good integration to be efficient and grow the economy. The application of the smart city concept in the Old City of Semarang must include the six dimensions of the smart city concept because the Old City is a 'Pilot Project' for the application of the smart city concept. Based on Local Government Regulation Number 2 of 2020 concerning the RTBL of the Old City of Semarang, the Old City of Semarang is a cultural heritage area, so implementing the smart city concept in the Old City of Semarang must support
the operations of the cultural heritage area. Therefore, a research question arises, "How is the application of the smart city concept in the Semarang Old City Area?".

2. Data and Methods
The research location is in the Old City of Semarang. Regional Regulation Number 2 of 2020 concerning the RTBL of the Old City Site has determined the delineation of the Semarang Old Town Area. The delineation area is 72,358 Ha, consisting of a core zone and a buffer zone. Figure 1 shows a delineation map of the study area.

This study uses a deductive approach with mixed analysis methods. A deductive approach is an approach to compiling research variables. The researcher starts by looking for the smart city concept literature along with its dimensions and indicators, then synthesizing the literature to determine the research variables. In the process of data analysis, researchers used mixed methods. The mixed-method study combines quantitative analysis and qualitative analysis. The process of compiling research variables is the stage of quantitative analysis.

Furthermore, the researchers conducted an analysis or verification through interviews with qualitative analysis methods. To analyze regulations, implementation and application of the smart city concept, all three use qualitative methods. To analyze stakeholder preferences, the researcher used content analysis techniques. Table 1 shows research variables and indicators.

![Figure 1. Delineation of the Old City Area (Local Government Regulation No. 2 of 2020 concerning RTBL for the Old City Site)](image)

| No | Variables   | Indicators       |
|----|-------------|------------------|
| 1  |             |                  |
| 2  |             |                  |
| 3  | Smart Governance | Legal Framework |
| 4  |             | Public Service   |
| 5  |             | Integrated Management |
| 6  |             | Participation    |
| 7  |             | Management       |
| 8  |             | Infrastructure   |
| 9  |             | Materials        |
| 10 | Smart Environment | Energy          |
|    |             | Water            |
|    |             | Waste            |
Data collection was carried out primary and secondary. Primary data were collected using observation and guided interviews. Observing the goal is to find out how far the implementation of the smart city concept in the Old City of Semarang is. On the other hand, the guided interview was to find out the opinions of experts regarding the implementation of the smart city concept. Guided interviews are a combination of informal and structured interviews in which the researcher does not entirely follow the questions previously made [16].

Secondary data collection is through document review in the form of articles/journals and books (literature) about the smart city concept, models for implementing the smart city concept and indicators for implementing the smart city concept. Another document is a regulation related to implementing the smart city concept in the City of Semarang [17].

We are selecting interview sources through the purposive and snowball sampling methods. Snowball sampling is asking for recommendations from resource persons to recommend other sources with a lot of information related to the research topic [18]. In this study, the selection of sources was based on two limitations: the data saturation point and the snowball sampling technique or resource recommendations. The number of resource persons is 12 people and divided into four groups. The group is the Semarang City Government, represented by the Spatial Planning and Communication and Information Office, the Old City Area Management Agency (BPK2L), entrepreneurs/building owners in the Old City Area, and observers/academics.

This research went through 4 stages of analysis. Figure 2 shows the stages of analysis in this study. The first analysis is to examine regulations related to Smart City in Semarang City, and the subsequent examination is about their implementation in the Semarang Old City area. The third analysis, in the form of a study of stakeholder preferences, uses content analysis. The content analysis was carried out in three stages, namely the preparation stage, the organizing stage, and the reporting stage. The preparation stage is to prepare data in the form of interview data/interview transcripts that have been rewritten in Microsoft Word. The organizing stage is coding the data by determining keywords to create categories and themes. The reporting stage describes the results of the process of organizing the data. The fourth analysis is the analysis of the application of the smart city concept, which compares the three previous analyzes (see Figure 2).
Figure 2. Stages of Analysis.

3. Result

3.1. Analysis of Smart City Regulations in Semarang

The plan for implementing the smart city concept in Semarang City is based on Mayor Regulation Number 26 of 2018 concerning the Smart City Semarang Master Plan. In the Old Town area of Semarang, it turns out that it can only fulfill 5 of the 6 dimensions of a smart city in the program plan. In addition, the program plans in the regulations only meet 12 of the 25 smart city indicators. Table 2 shows the regulatory analysis results.

| Program                      | Indicator       | Description                                                                 |
|------------------------------|-----------------|------------------------------------------------------------------------------|
| Smart Governance             | Legal Framework | Smart city programs that have the potential to be developed in Old Town      |
| - Development of spatial-based development planning |                  | fall into two smart governance indicators                                    |
| - Development of information data |                |                                                                              |
| - Wi-fi in public areas      | Public Service  |                                                                              |
| - Shelter information system |                  |                                                                              |
| - e-tax service (parking, restaurant, hotel) |                |                                                                              |
| - Holographic information media |              |                                                                              |
| - Public information services |                  |                                                                              |
| - ‘Lapor Hendi’ (online)     |                  |                                                                              |
| Smart Environment            | Infrastructure  | The Old Town area has the potential to develop five smart environment        |
| - Construction of retention pond |                | indicators into the Smart City program                                       |
| - Improve pedestrian paths and street furniture in the neighborhood |     |                                                                              |
| - Repairing and managing Semarang River |         |                                                                              |
| - Monitoring water and air conditions |              |                                                                              |
| - Flood control              |                |                                                                              |
| - Utilizing energy from household waste and food stalls |     |                                                                              |
| - Develop spatial-based development planning |        |                                                                              |

Table 2. Results of Regulatory Analysis.
3.2. Implementation of Smart City Infrastructure in Semarang Old Town Area

The development of the smart city concept is still in the early stages or at the planning level. Programs related to smart city development in Kota Lama, currently under construction, include fibre optic ducting and planting, area revitalization, CCTV installation, wi-fi in public areas, and application development. Now, the progress of infrastructure development supporting the existing smart city concept is repairing roads, pedestrians, and street furniture drainage, as well as installing utility boxes and SR in the core zone of the Semarang Old Town Area.

Other supporting facilities such as applications and public facilities have begun to be developed. Only 5 of the six smart city dimensions have begun to be implemented in the Semarang Old Town Area. In addition, program implementation only meets 8 of the 25 smart city indicators. Table 3 shows the analysis results.

| Indikator Smart City | Keterangan |
|----------------------|------------|
| **Public Service**    | Free Wi-fi at Srigunting Park (slow internet speed) |
| **Smart Environment** |            |
### Indikator Smart City

| Keterangan | Tabel 4 | 2022/03/01 | 1082 (2022) 012034 | doi:10.1088/1755-1315/1082/1/012034 |
| --- | --- | --- | --- | --- |

#### Keterangan

**Management**
- Retention Pool
- Revitalization of Old Town Semarang (Repair roads, pedestrians, drainage, and street furniture)
- Ducting

**Infrastructure**
- Smart Economy
  - Semarang Old Town App
  - Wis Semar Travel App
  - Gowes App
- City Image
  - Revitalization of the Old Town of Semarang
- Finance
  - Digital Financial System (mobile payments such as ovo, gopay)

**Smart Economy**
- Tourism
  - Semarang Old Town App
  - Wis Semar Travel App
  - Gowes App
- City Image
  - Revitalization of the Old Town of Semarang
- Finance
  - Digital Financial System (mobile payments such as ovo, gopay)

**Smart Living**
- Safety
  - CCTV (not yet integrated and only as a traffic monitor)

**Smart Mobility**
- Integrated ICT
  - Moovit App
  - Trans Bus App

### 3.3. Stakeholder Preferences on the Implementation of Smart City in Old Town Semarang

Based on the content analysis results, the researcher determined six themes from the keyword category statements of the 12 experts. The themes are facility development, innovation, public service, empowerment, integrated management, and environmental management. The results of the findings on the theme of stakeholder preferences tend to group answers. From the radar diagram (figure 3) shows that the most significant theme, namely the theme of integrated management, stems from the tendency for many respondents to answer categories and often discuss integrated management. The next theme is the innovation and facilities theme. They were followed by environmental management, empowerment and public services themes.

![Stakeholder Preference Radar Diagram](image)

**Figure 3.** Stakeholder Preference Radar Diagram.

### 3.4. Implementation of Smart City Concept in Old Town Semarang

The following analysis is a combination of the previous analysis, namely the analysis of smart city regulations, analysis of the implementation of the smart city infrastructure of Old Town Semarang, and analysis of stakeholder preferences, as shown in table 4.
Table 4. Implementation of the Smart City Concept in the Old Town Area of Semarang.

| Dimension dan Indicators of Smart City | Results of Analysis of Smart City Regulations on the Scope of the Old Town Semarang Area | Implementation of Smart City in Semarang Old Town Area | Stakeholder Preference | Description |
|---------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------|------------------------|-------------|
| Smart Governance                      |                                                                                      |                                                      |                        |             |
| Legal framework                       | ✓                                                                                    | ✓                                                   | ✓                      | Not implemented yet |
| Public service                         | ✓                                                                                    |                                                      |                        | Lacking in Implementation |
| Integrated management                 | ✓                                                                                    |                                                      |                        | Alternative program proposal |
| Participation                         |                                                                                      |                                                      |                        | Not yet suitable |
| Smart Environment                     |                                                                                      |                                                      |                        |             |
| Management                            | ✓                                                                                    | ✓                                                   |                        | Not implemented yet |
| Infrastructure                        | ✓                                                                                    | ✓                                                   |                        | Implemented |
| Materials                             |                                                                                      |                                                      |                        | Not yet suitable |
| Energy                                | ✓                                                                                    | ✓                                                   |                        | Not implemented yet |
| Water                                 |                                                                                      |                                                      |                        | Not yet suitable |
| Waste                                 | ✓                                                                                    |                                                      |                        | Not implemented yet |
| Pollution                             | ✓                                                                                    |                                                      |                        | Alternative program proposal |
| Planning and Design                   | ✓                                                                                    |                                                      |                        | Not implemented yet |
| Smart Economy                         |                                                                                      |                                                      |                        |             |
| Innovation                            | ✓                                                                                    | ✓                                                   |                        | Not implemented yet |
| Entrepreneurship                      |                                                                                      |                                                      |                        | Not yet suitable |
| City Image                            | ✓                                                                                    | ✓                                                   |                        | Implemented |
| Productivity                          |                                                                                      |                                                      |                        | Alternative program proposal |
| Tourism                               | ✓                                                                                    | ✓                                                   |                        | Lacking in Implementation |
| Finance                               |                                                                                      |                                                      |                        | Implemented |
| Interconnectedness                    |                                                                                      |                                                      |                        | Not yet suitable |
| Smart Living                          |                                                                                      |                                                      |                        |             |
| Cultural facilities                   | ✓                                                                                    |                                                      |                        | Alternative program proposal |
| Safety                                | ✓                                                                                    | ✓                                                   |                        | Not implemented yet |
| Welfare/Social Cohesion               | ✓                                                                                    | ✓                                                   |                        | Already in plan / Not yet implemented |
| Smart People                          |                                                                                      |                                                      |                        | Not yet suitable |
| Education                             |                                                                                      |                                                      |                        |             |
| Smart Mobility                        |                                                                                      |                                                      |                        |             |
| Transportation management             |                                                                                      |                                                      |                        | Not yet suitable |
| Integrated ICT                        | ✓                                                                                    | ✓                                                   |                        | Lacking in Implementation |

Based on table 4, there are columns marked in grey. The column shows that the application of the smart city concept in Old Town Semarang does not include these indicators. Based on this, applying the smart city concept only fulfills 5 of the six dimensions of a smart city. The implementation of smart city indicators is only 18 out of 25. The Old Town area has not yet fully implemented the dimensions and indicators of the smart city concept, considering that its implementation is still in its early stages. Hence, the facilities and infrastructure that support smart cities still have shortcomings in terms of development.
4. Conclusion
The study results indicate that the smart city concept application in the Old Town area of Semarang only fulfils five of the six dimensions. The dimension of a smart city that does not yet exist is the dimension of smart people. However, the Old Town area has fulfilled the dimensions of smart living. The dimensions that are partially fulfilled are the dimensions of smart governance, smart environment, smart economy, and smart mobility. Each indicator in each dimension does not fully meet, and some fulfill them entirely. One indicator that does not exist in the smart governance dimension is the participation indicator.

Meanwhile, the dimensions of the smart environment have not met two indicators, namely materials and water. Likewise, the smart economy dimension has not met the interconnectedness and entrepreneurship indicators. Furthermore, the smart people dimension has not met the education indicators. Finally, in the smart mobility dimension, there are indicators of transportation management that have been unable to be fulfilled.

The application of the smart city concept in the Old City area of Semarang has not met the indicators of participation, materials, water, entrepreneurship, interconnectedness, education, and transportation management. Overall, the smart city concept application in Kota Lama is still focused on technology-based developments or mobile phone applications. The application of the smart city concept has not emphasized development in terms of community empowerment, participation, and governance (soft infrastructure) in the Old Town Semarang area. The innovation indicator only highlights programs related to application development innovation and tourism promotion, and no research element can be a means of creation.

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