A Study of Application and Framework Smart City in Bandung: A Survey

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Abstract. The purpose of this research is to find out the analysis of Bandung's smart city governance, explain the infrastructure system, applications and software of the concept of the smart city of Bandung city. The research variables used were adaptations of smart city theory and adapted to government policies in Bandung. The method in this study began with a literature study to discover indicators of Smart City conducted by the Bandung city government. Then a survey of the required data, processing survey, analysing and evaluating current conditions of smart city policy. The result after knowing the current conditions of the Bandung Smart City policy, the formulation of strategies, focus, programs, and indicators of the plan is made so that the policy can be easily understood by the public. Governance is to realize effective, efficient, communicative governance and governance of local government, and continue to improve bureaucratic performance through integrated innovation and technology adoption. Smart governance, smart city development analysis, infrastructure requirements, data centers, applications and software requirements are implemented by the city of Bandung in the development towards smart city Bandung.

1. Introduction
Implementing construction with Smart City approach in this increasingly dynamic world is no longer an option, but has become a necessity, especially for the government in providing faster and more efficient public services. Regarding information and technology, Smart City is primarily based on the exchange of information that flows between many separated subsystems and creates ecosystem in a sustainable framework for public services [1]. The Smart City Framework has been developed by many experts and academics, both from local and inter local. Some institutions such as the Smart City Council, CISCO, the European Union, and IEEE have developed a framework for Smart City construction. In constructing Smart City, a city/district must first have a Smart City Readiness. There are several main elements in Smart City Readiness, namely nature, structure, infrastructure, superstructure, and culture shown in Figure 1.

- **Structure**: the development of human resources for implementing and beneficiaries of Smart City, preparation of budget resources, and human resources for the governance.
- **Infrastructure**: the development of Smart City supporting infrastructure which includes physical, digital, and social infrastructure for public interest.
• **Superstructure**: preparation of regional policies, regulations, institutions, and management of the implementation of Smart City construction.

![Smart City Readiness Diagram](image)

**Figure 1.** Element of Smart City Readiness.

Furthermore, Internet of Things can be connected to integrate human society and physical system. Machines, people, tools/equipment, etc. can be managed in an integrated system through computers and cloud computation, so that the productivity of people’s live can be managed more precisely and dynamically to increase income as well as the relationship between humans and nature [2]. Meanwhile, the core or essence of smart city itself still has a variety of interpretations in the regional autonomy system as well as national planning and development system in Indonesia. However, an associated smart cities terms are available in national development planning document, especially dealing with the improvement of human resource development to manage natural resources effectively and efficiently, as well as a tool to perform urban development innovation to accelerate urban competitiveness by the support of the advance of technologies [5]. Another definition views a smart city from a different angle. Caragliu et al. [4], [5] claim that a city is smart “when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” (p. 70). Their claim highlights the role of smart city initiatives by stressing where a city should invest (human and social capital, traditional and modern communication infrastructure) and how it becomes smarter (wise management of natural resources, participatory governance). The application of information and communications technology (ICT) in the context of future cities is often indicated by the notion of smart city. This concept has been quite fashionable in the policy arena in recent years. Compared with the concept of digital city or intelligent city (Lombardi et al. 2009), the main focus is not limited to the role of ICT infrastructure but is mainly on the role of human capital/education, social and relational capital, and environmental issues. These are considered important drivers of urban growth [6].

This study presents the first results of an analysis primarily based on semi-structured interviews with government officials and managers who are responsible for smart city initiatives in Bandung, West Java, Indonesia. The objectives of this study is find out the analysis of Bandung's smart city governance, which is to explain the infrastructure system, applications and software of the concept of the smart city of Bandung city.
2. Method
The research variables used were adaptations of smart city theory and adapted to government policies in Bandung. Analysis data from architectural frameworks in smart city development in Bandung, identifying the characteristic framework and technology of Bandung Smart City. In doing this method of analysis between the results of analysis in quantitative and qualitative testing against experts according to the characteristics of Bandung [3]. These cities are making critical efforts—through a variety of initiatives—to become smarter and more innovative. The cities range widely in terms of many conditions such as population, demographics, economy, and location, and thus smart city initiatives reflect differences in contexts and conditions around the cities’ efforts toward becoming smarter [4].

Interviews, based on the Smart City Initiatives Framework, were used to qualitatively understand concepts and factors that characterize smart city initiatives. We conducted semi-structured interviews with individuals who are responsible for projects and initiatives underway in each of the four cities [4].

3. Results and Discussion
3.1. Smart Governance
Smart Governance can be interpreted as smart management, where the component of governance generally highlights the governance of local government as an institution that controls the joints of city life. So that Smart Governance in the Smart City dimension is an illustration of governance that is able to change traditional patterns in the bureaucracy so as to produce business processes that are faster, more effective, efficient, communicative, and always make improvements shown in Figure 2. The goal of Smart Governance is to realize effective, efficient, communicative governance and governance of local government, and continue to improve bureaucratic performance through integrated innovation and technology adoption.

![Figure 2. Smart Governance.](image)

At a municipal level by assessing their transparency to give public information. In making changes to traditional patterns of governance, it can be done in various ways, but the adoption of technology is something that will accelerate these changes. Smart Governance must be implemented into three elements in governance, namely public service, bureaucracy, and policy [1]. The initiative of Smart Governance development includes the following indicators:
3.1.1 Public Service

- Administrative services for public: this product include citizenship status, business status, certificate of competence, ownership, or mastery of belongings. The form of this product is official documents such as route permit, business permit, ID card, land certificate, etc.
- Increasing the provision of infrastructure and monitoring the provision of basic commodities for the society, such as basic needs, clean water, etc.
- Increasing the provision of infrastructure and monitoring the provision of basic service needs for the society such as telephone, electricity, internet, etc.

3.1.2 Bureaucracy

- Bureaucratic governance oriented to fairness, accountability, and transparency. For example: e-Planning, e-Budgeting, e-Money, etc. The development of e-Gov applications must be directed towards integrated and inter-operability e-Gov or that communicate with each other and connect between one application to another and cross OPD or what is called Smart e-Gov. this Smart e-Gov service needs to be supported by a City Operation Centre (COC).

3.1.3 Public Policy

- Taking public policy by prioritizing aspects that have positive impacts on the society through a mechanism to listen to people’s aspirations in an ongoing basis.
- System information on government policies (Regional Regulation and Regional Head Regulation) that can be easily accessed by the society.

3.2 Strategic Analysis of Smart City Development

In the strategic planning of developing Smart City a methodology is needed to determine what strategic steps need to be taken so that the goals of Smart City development can be achieved. One methodology that is quite commonly used for various types of strategic design is the SWOT analysis.

- **Strength**: Strength is an internal condition that drives the success of success in a Smart City work program or project. Determining strength must be done objectively so that it can actually produce a realistic and appropriate strategy. Strength can be in the form of ownership or access to necessary resources including human resources, financial resources, technology, etc. Strength can also be in the form of experience, policies that have been formulated and consistently applied and other things. It needs to be reminded that general power is something that is internal, in this case the local government.

- **Weakness**: Weakness is an internal condition that has the potential to become an obstacle in achieving Smart City development goals or as part of the development of Smart City. Things that do not become true strengths are weaknesses. Likewise, a good strategy is to make the right effort so that weaknesses can be reduced so that at one time it becomes a strength. Weaknesses can be in the form of unavailability of things needed such as policies, HR competencies, funding sources, basic infrastructure. Other things such as resistance to innovation and change, low literacy of the community can also be weaknesses which if not addressed can hinder the achievement of the Smart City development goals.

- **Opportunity**: Opportunities in general can be recognized as external conditions which are the drivers of the success of developing or realizing Smart City. This opportunity can take the form of investment interest, economic growth, rising welfare, turnover of generations, support from the central government, community participation, potential contributions from the business sector. Meeting forces with the opportunities they have has the potential to be an important strategic step.

- **Threat**: Threats are external conditions that have the potential to hinder the achievement of Smart City's development goals. This condition is generally difficult to overcome or fully controlled. What can be done is to reduce the impact of this condition through mitigation and avoid strategies that require conditions that are actually a threat. Potential threats can be in the form of things such as climate change, natural disasters, social upheavals in the community,
conflicts between communities, disruption of public order and others. In addition, in the application of technology as part of innovation in the development of Smart City, threats can also be found such as excessive dependence on certain business actors and technology, lagging behind the rapidly developing / changing technology, increasing license fees and certain technological maintenance costs. Understanding of threats can be very useful in determining what strategic steps will be taken in developing Smart City with minimal risks that can be managed properly.

**Table 1. Example of a SWOT Analysis Smart Governance.**

| Internal Factor | Strength | Weakness |
|-----------------|----------|----------|
| **Strength**    | there is government human resources with high competence | |
| **Weakness**    | little amount of government human resources | in collaboration with universities to help the shortage of human resources in government |

| External Factor | Opportunity | Threat |
|-----------------|-------------|--------|
| **Opportunity** | There are universities in the region | Quality local human resources empowerment by government HR |
| **Strength**    | HR within the government collaborate with universities to compile information on governance of Smart City | encourage the use of freelance human resources to overcome the shortage of quality human resources |
| **Weakness**    | in collaboration with universities to help the shortage of human resources in government | |

**3.3 Analysis of Smart City Supporting Infrastructure Requirements**

Infrastructure requirements in supporting smart city in this matter are ICT infrastructure (Information Communication and Technology). Some of the main needs that need to be prepared for Smart City to be built are:

- Availability of urban computer networks.
- Availability of NOC (Network Operation Center) and or Data Center.
- Availability of COC control room (City Operation Center) that is integrated with control room applications and sensing applications, such as surveillance cameras (CCTV) and other sensor devices scattered in the city area.

**3.4 Smart City computer network in the province/district/city**

Network infrastructure is technology and facilities related to operating system hardware network management systems and environments that support the processes that run in applications that are used very rapidly developing computer network technology along with the progress and development of information and communication technology. In the field of networks, nowadays wireless networks have been developed or known as Wireless LANs (WLANs). Wireless LAN is increasingly used to be used as a physical path of data, voice and image communication as a substitute for networks using cables.

The development of Wireless LAN networks is also triggered by increasingly inexpensive hardware ranging from notebooks and other wireless equipment. The implementation of wireless technology in government institutions is absolutely necessary as a media for accessing information for every employee in the local government where the location of office agencies is mutually separate, as well as a medium of access between provinces / districts / cities. This intranet network between OPDs will be used for data, voice and image communication so that with the presence of a network blueprint, the development can be carried out in a gradual, realistic and measurable manner and no waste occurs. Technical requirements of network architecture E government and internal pathways must be in accordance with the specified standards. For this reason, it is necessary to have a guideline to meet the standard qualifications.
of network architecture, usually to document network architecture, a blueprint documentation for the local government should be established where the purpose of making this network infrastructure blueprint is:

- As a guideline in planning the development of each institution's computer network infrastructure.
- As a guideline in the management of computer network systems, especially computer network security.
- Providing a thinking platform for comprehensive, efficient and effective e-government network infrastructure developers.

3.5 Data Center and NOC

To ensure the connectivity and interoperability of all information spread across various work units, a unit is responsible for regulating and coordinating all operational activities city/district of the smart city intranet network. The operational activities include facilitating the storage / processing of data and applications needed on the intranet and ensuring a layered security system facility. This unit is referred to as the Network and Data Center Management Center or often called the NOC and Data Center is shown in Figure 3. This unit functions as a facilitator and enabler, which can be used by all work units. To carry out this function, this unit has the duty to:

- Manage the smooth running of e-Government information services and infrastructure;
- Manage the storage and smoothness of data and information traffic;
- Regulate access to information in accordance with the authority of each work unit.

In the NOC network topology and Data Center is divided into two network subnets, namely the subnet that is used to manage the entire Government intranet network and internal subnet that is used for the internal needs of the work unit that handles the network. The first subnet is also equipped with several servers and personal computers used by network administrators and database administrators to supervise and maintain networks and database resumes used by management in smart city government in decision making.

In addition, with the existence of a data center that is used as a backup of all SKPD data in a centralized manner (backup center), it will be easier to coordinate data collection between SKPD which is certainly accompanied by centralized open source and web-based software application systems.
3.6 **COC (City Operation Center)**

The need for a smart city is how the government can monitor and monitor community activities, and activities of each SKPD and can monitor SKPD performance reports in serving the community. Therefore a centralized and integrated ICT instrument that is required by a smart city is needed as a City Operation Center (COC) or in some practices often referred to as the command center, war room or situation room. Control room infrastructure will be used by the government and its staff to conduct supervision and be used to monitor community activities without having to go to the location until the city government can save on mobilization and visit budgets. The Command Center can be realized in a smart city if there are already two infrastructures in points a and b above, namely the existence of urban computer networks and the availability of NOCs and Data Centers, but the most important besides the two things above is the mastery of ICT fields of government HR that run the command center.

3.7 **Analysis of Smart City Supporting Application and Software Requirements**

Since the development of smart city applications is basically the development of e-Government applications whose scope covers the scale of integration, so-called smart government, a communication framework between smart e-Government systems is needed to interact and cooperate or interoperable.
Besides that, the e-Government system scope and function are also quite large (involving all matters relating to government) so that in its construction almost certainly involve many parties, both developers and analysts who are reliable, so we need a standard communication mechanism between systems, so that each application system can synergize to form larger and complex smart e-Government services. Therefore, in developing a smart e-Government application system, standardization of application system development is needed which will ensure that communication between the systems can be carried out by anyone application system developer shown in Figure 4. The following are the Standard Application System Requirements that must be met by every smart e-Government application system:

1. **Reliable**: Ensures that application systems will be able to run reliably, robustly against data entry errors, operating system changes and free of bugs / errors.
2. **Interoperable**: Ensure that the application system will be able to communicate with each other and exchange data and information with other application systems to form system synergies.
3. **Scalable**: Ensures that the application system will be able to easily increase its capabilities, especially adding new features, adding users and greater data management capabilities.
4. **User Friendly**: Ensure that the application system will be easy to operate with the user interface that is commonly applicable in the government and in accordance with the habits of the language and culture of the user.
5. **Integrate-able**: Ensure that the application system has features for ease of integration with other application systems, especially for conducting data and information exchange transactions between e-Government application systems, whether within the scope of one local government and other regional governments. On the other hand, the application system above was developed with the aim of meeting the needs of government functions as defined and grouped in the Functional Framework of the Government System mentioned above. By considering the functions of the application system and its services, the application system is then compiled and grouped into an architectural framework system, which in this guidance document the application system is then referred to as the Smart e-government Application Architecture Framework.

![Figure 4. Smart e-government Application Architecture Framework.](image-url)
By utilizing information and technology to make public policies for city governance make it easier for the bureaucratic system to become easier and more effective. Central government and local government itself must have full attention to solve this problem and create a big city into smart by using information technology. For big population city, public demand on services is definitely high following the population. If the government did not pay attention to transform big city through e-government, then the statement of public official who declared Indonesia smart city campaign increasing public service, is irrelevant to the service they provide.

4. Conclusion
Governance is to realize effective, efficient, communicative governance and governance of local government, and continue to improve bureaucratic performance through integrated innovation and technology adoption. Using SWOT analysis to determine Strategic Analysis of Smart City Development. Good network is a good infrastructure to build Smart City. With Data Centre and NOC to ensure the connectivity and interoperability of all information spread across various work units, a unit is responsible for regulating and coordinating. Smart City Supporting Application and Software Requirements uses as e-Governance system, that each application system can synergize to form larger and complex smart e-Government services.

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