Implementation of smart city for building disaster resilience in West Java Province

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Abstract. Developments of technology and digitization encourage more efficient and integrated regional and city management through the smart city concept. The concept covers various aspects, such as environmental, economic, and social, including disaster management. West Java is known as a province with high disaster risk in Indonesia. There are various types of hazards and the average annual frequency is approaching 1,200 disasters. Comprehensive management is required to minimize losses also to build disaster resiliency. West Java Province has begun moving towards digitization of disaster management, integrated with the West Java Command Center, within the scope of the West Java Resilience Culture Province concept. This research will focus on reviewing the component of disaster management digitization in the context of a smart city, and its influence on building provinces with a resilient culture. In establishing a smart and resilient province, a development strategy covering all phases of disaster is vital, not only for emergency response but also for mitigation and rehabilitation. Further development is required, covering infrastructure, technology, and collaboration to achieve a higher level of resilience in West Java.

1. Introduction

West Java is known as a province with high disaster risk in Indonesia. The Indonesia Disaster Risk Index (IRBI/Indeks Risiko Bencana Indonesia) score for West Java is 152.13 [1]. West Java has various disaster hazards, ranging from a volcano eruption, flood, wildfire, land movement, to [2]. Those things are associated with the region characteristic, which is heterogenic from highland to the coast, divided into 27 regencies/cities, 626 districts, 645 sub-districts, and 5,213 villages. It classified 4,465 sub-districts/villages as disaster-prone.

From 2013 to October 2019, there were 8,165 disaster cases happened in West Java [3]. Hydro-meteorological disasters, such as floods and windstorms, and geological disasters, such as landslide and earthquake, dominate those numbers. In the last four years, the number of disaster cases has increased. As the most populous province in Indonesia, with approximately 49 million inhabitants [4] and its strategic role as a region, it is vital to comprehensively manage disasters to minimize losses, both material, and fatalities.

West Java Provincial Government has stated the target to improve disaster resilience as the third mission of the 2019-2023 Regional Mid-term Development Plan (RPJMD/Rencana Pembangunan Jangka Menengah Daerah), which related to the living environment [5]. As further elaboration, the
Governor of West Java initiated a governor’s priority program named West Java Resilience Culture Province and assigned West Java Disaster Management Board (BPBD/Badan Penanggulangan Bencana Daerah) as the leading sector. West Java Resilience Culture Province is the comprehensive blueprint for disaster management in West Java, also the step to engrain the disaster resilience culture to all people.

*Up to October 2019

**Figure 1.** Number of disasters in west java, 2013 - october 2019.

Related to that, the West Java Provincial Government is also aiming to become a digital and smart province, one of the efforts done was by creating West Java Digital Service (JDS/Jabar Digital Service). This working unit covers the acceleration and improvement of digitization implementation. One of the programs that JDS runs is developing technology and information systems integrated to West Java Command Center (JCC/Jabar Command Center), and the derivative applications inside. That digitization effort approaches various development aspects, including disaster management. It anticipates faster and more efficient disaster monitoring and management by creating an integrated information system.

The implementation of digitization generally relates to the smart city concept. Implementation of the smartness concept lies at the city level, the regional (province), and national level; in this specific context, the implementation is done at the province level. Generally, information and communication technology (ICT) is essential in implementing the smart city concept. IBM [6] explained smart city as the city capability in utilizing ICT to analyze and integrate critical information from the system which worked in a particular city. The smart city concept was included in Indonesian development planning documents to improve human resources capability in managing natural resources effectively and efficiently, as well as a tool in urban development innovation to increase competitiveness with the support of technology [7].

Some big cities in Indonesia have already declared smart cities concept implementation, such as Jakarta, Bandung, Bogor, and Surabaya [8]. However, further study is needed to understand the overall smart city concept compatibility with the local context, such as participation and community acceptance, ICT readiness, and other factors [9]. Likewise, the implementation by West Java Province does not lie to the city level but province, which may have a different point of views or functions.
This research will review the digitization steps in increasing disaster resilience, and its position in implementing the smart city concept in West Java Province level. It will compare the current performance to the smart city components summarized from previous literature. This study expects to become a suggestion for the conceptual and system improvement in the implementation of the smart city concept, as well as strengthen the improvement of disaster resilience in West Java Province. This article is divided into five main parts, which are as follow:

- **Introduction.** Discuss the research background, introduction to disaster, and smart city in West Java, also the purpose of this research.
- **Methodology.** Explain the chosen method in this research.
- **Literature review.** Discuss the theoretical and legal basis of smart city and disaster management at the province level.
- **Analysis.** Describes the effort done by West Java Provincial Government in the implementation of a smart city within disaster resilience context and reviews its compatibility with smart city components.
- **Conclusion.** Explain the research results of the compatibility review of West Java Provincial Government's effort towards smart city components.

2. **Method**

This paper utilized a literature review method using scientific journals, official documents, and other supporting literature to explain smart city implementation compatibility within the disaster management context in West Java Province. It will compare those existing conditions to the smart city component and readiness level summarized in previous literature. A descriptive method was utilized to elaborate on the analysis. Those methods were aimed to develop an understanding of a particular case [10], which is, smart city implementation in West Java's disaster management context.

3. **Literature Review**

3.1. **Smart City Concept**

Development of the smart city concept began since the middle 1990s; since then, the scope and definition have developed [9]. The first idea of a smart city is making a city ‘smart’ through technology, infrastructure, ICT, and the involvement of stakeholders in the private sector to implement and develop ideas [11]. In another perspective, Anavitarte and Trantz-Ryan [12] explained that the smart city concept is a city in which the function was run and supported by ICTs efficiently and continuous public service. Some literature stated that the definition of the smart city is not limited by ICT support, but broader, including those related to the city’s sustainability in the social, environment, economy, and cultural sector [13].

Various literature explained the definition of a smart city in a different scope and components within those concepts. Gil-Garcia et al. [14] stated that a smart city at least covers four components, which are data and technology, physical environment, society, and governance. Each component has a specific element, as shown in Table 1.

| No | Smart City Component     | Element                                         |
|----|--------------------------|-------------------------------------------------|
| 1  | Data and Technology      | ICT and other technology                        |
|    |                          | Data and information                            |
| 2  | Physical Environment     | Environment and ecological sustainability       |
|    |                          | Fostered environment and infrastructure         |
| 3  | Society                  | Economic knowledge and pro-business environment  |
|    |                          | Human resources and creativity                  |
In a regional and city planning context, Calthrope and Fulton [15] explained cities' constellation in a region is also applicable in a smart city context, it will form the network's degree as a community network, economy system network, and cultural network. That perspective also explains the smartness concept exists at the city level yet varies at the community level; from the village level to the regional level. The critical thing to respond to that perspective is that the smartness concept must connect the economy, ecology, and social aspect, supporting the sustainable development of a region.

In Indonesia, Sutriadi [7] defines the smartness concept based on typology and the region's scope into a smart city, smart region, smart village, and technopolis. It explains that the component of the smartness concept consists of community integration, history and culture, spatial context, economy base, technology readiness, technological impacts, the technical and political process, also stakeholders. Each typology has a unique feature and character in the smartness component related to Indonesia's condition.

The smartness concept implementation follows the authority and function of each level of government whether it is national, province, and regency/city level. On the regency/city level, the smartness concept aimed to deal with technical matters and services, some are getting direct contact with people; on the province level the concept aimed to coordinate and facilitate inter-regional services, and on the national level the concept aimed to deal with macro-policy and special national authority services. Sari et al. [16] defined the regional readiness for smartness concept implementation at the province level, as shown in Table 2.

| Category   | Description of Achievement                                                                 |
|------------|---------------------------------------------------------------------------------------------|
| Non-existent | Regencies/cities in this category are have not been initiated to undertake ICT-based development. The characteristics of the development of ICT services are still in migration stages from manual to digital data. |
| Initialized | Regencies/cities have taken the initiative to develop ICT-based services, although done partially. Partial data sharing exists in this category. |
| Scattered   | Regencies/cities have a full commitment to develop ICT-based services, even though still done separately. At this level, the initiative is still carried out by the structural department/agency as a series of separate projects with other departments/agencies. This category has started data sharing. |
| Integrated  | In this category, initiatives are much better coordinated, seeking synergies for improvement and more collaborative governance. There is valuable information that is the result of analytical data from sharing data across departments/agencies. |
| Smart       | In this category, the smart city/region development initiative is part of a holistic master plan managed by the government, including citizens and the private sector. In this category, smart city services can be accessed anytime, anywhere, and by anyone. |

Collaboration becomes an essential thing in smart city implementation. It is impossible if only the government who takes action, the private sector role is also critical in the smart city. In this context, the relationship among actors in the idea creation process and capitalization are illustrated through the
triple helix, which contains government, industry, and university [17]. Each actor has a crucial role in actualizing each component within the smart city concept.

Regarding resilience realization, the smart city concept has an essential contribution in the middle of uncertainty in urban and regional development. It explains the resilience terminology in a city context as the ability to withstand hazard, shock, and pressure through adaptation or transformation to achieve long term sustainability for primary function, character, and structure of the city [18]. City resilience is a complex system, with various components and interactions, other tools that can bridge that thing in increasing city capacity are required. A smart city can take part in the improvement of city resilience through the software-oriented side, whose role is utilizing ICTs to improve the environment and life quality [9]. Through that perspective, the smart city concept at least must fulfill some qualifications, as follows:

- Utilization of ICTs;
- Awareness and smartness, welfare, participation, effective, and community competitiveness;
- The ability to overcome hazard, shock, and pressure;
- The ability to survive, adaptation, determination, and transformation;
- The process of facing changes in the era of uncertainty;
- The ability to create a good quality of life, in line with the improvement of environmental quality; and
- Achieve sustainability.

According to some literature review above, the smart city concept is related to support city resilience. Based on the city resilience approach, there is a formulated smart city components shown in Table 3.

| Component                        | Lombardi et. al. (2012) | Gill-Garcia et. al. (2015) | Arafah et. al. (2017) | Sutriadi (2018) |
|----------------------------------|-------------------------|-----------------------------|-----------------------|-----------------|
| Technology                       | ✓                       | ✓                           | ✓                     | ✓               |
| Data and information             | ✓                       | ✓                           | ✓                     | ✓               |
| Human resources and society      | ✓                       | ✓                           | ✓                     | ✓               |
| Environment and spatial aspect   | ✓                       | ✓                           | ✓                     | ✓               |
| Economy                          | ✓                       | ✓                           | ✓                     | ✓               |
| Governance                       | ✓                       | ✓                           | ✓                     | ✓               |

3.2. Disaster Management in Indonesia

Disaster management has become a global concern because of the number of disasters over time, which resulted in many losses at various places in the world. Nowadays, disaster management and disaster risk reduction are included in international development document, showing a strong commitment by stakeholders in achieving disaster resilience. Sustainable Development Goals contain targets related to disaster resilience, namely goal 11, sustainable cities and communities, and goal 13, climate action [19]. Those goals are the follow-up from Sendai Framework for Disaster Risk Reduction (SFDRR), the global framework for disaster risk reduction. SFDRR aims to develop the resilience of the nation and community toward disaster [20].

In Indonesia's context, disaster management is arranged by Law No. 24/2007. The law defines a disaster as an event or series of events that threatens and disturbs life and livelihoods caused by natural or non-natural factors, including human factors, which caused human casualties, environmental damage, property loss, and psychological effect [21]. Disasters are categorized as a natural disaster caused by natural activity, a non-natural disaster caused by non-natural activities such as technology failure and epidemic, and a social disaster caused by human interaction and activities. There is a designated institution to undertake disaster management function at the national level, namely the National Board of Disaster Management (BNPB/Badan Nasional Penanggulangan Bencana).
A natural disaster is more mainstream in regards to various geographical profile and disaster hazards than other categories in Indonesia's disaster management practices. An exception is a Covid-19 outbreak, which is categorized as a non-natural disaster, that pandemic settled as the first non-natural disaster since Law No. 24/2007 was ratified [22]. It also explains disaster management's integrity with the spatial planning system as physical consideration within spatial patterns [23]. The spatial context in disaster management becomes essential not only about the physical state but also about data and spatial information related to the disaster management process.

Following the decentralization concept in Indonesia's government, disaster management is conducted by the disaster management board in the national, province, as well as regency/city level based on its scale. Each level has each responsibility in every phase of disaster management: pre-disaster (mitigation), disaster time (emergency response), and post-disaster (rehabilitation and reconstruction). Disaster management responsibility took place at the nearest level with the community to deliver faster response and emergency. Related to that, first-level disaster management is in the regency/city level. Local disaster management function is conducted by the Regional Board of Disaster Management (BPBD/Badan Penanggulangan Bencana Daerah), the main functions are coordination, command, and execution of disaster management. In the province level, the provincial government has the responsibility and authority in disaster management, as follow:

- **Provincial government responsibility in disaster management**
  a. Guarantee the fulfillment of people’s and refugees’ right who are affected by disasters by minimum service standards;
  b. Public protection from disaster impact;
  c. Disaster risk reduction and integration of disaster risk reduction with development program; and
  d. Allocation of sufficient disaster management fund in regional budget (APBD/Anggaran Pendapatan dan Belanja Daerah).

- **Provincial government’s authority in disaster management**
  a. Establishment of disaster management policy;
  b. Arrangement of development planning;
  c. Implementation of disaster management collaboration;
  d. Technological countermeasure that has potential as a threat;
  e. Formulation of policies to prevent natural resources exploitation;
  f. Collect and distribute aid money or goods on a provincial scale.

As head of the region, the governor also holds the highest command function in their region during disaster emergencies [24]. Disaster management is everyone’s responsibility, not only the government’s. In Indonesia, the government has already put the triple helix concept as a priority to accommodate collaboration in disaster management. Collaboration in disaster management has been regulated for the community [25] and business institutions [26]. Community or business institution participation in disaster management may involve, as follows:

- **Community participation can be:**
  a. Decision making;
  b. Giving correct information to the public;
  c. Supervising;
  d. Planning;
  e. Implementing; and
  f. Maintain disaster management program and activity.

- **Business institution participation can be:**
  a. Introducing and monitoring disaster risk;
  b. Participation planning of disaster management;
  c. Developing disaster awareness culture;
  d. Organizing, installing, and testing an early warning system;
e. Organizing, socializing, training, and emergency response mechanism rehearsal;
f. Spreading the information about disaster caution, and evacuation way set up; and
g. Other disaster risk reduction-related activities.

4. The Implementation of Smart City in Disaster Resilience in West Java Province

To define the development target of West Java Province, especially related to the improvement of disaster resilience, the governor launches the West Java Resilience Culture Province as one of the governor's priority programs. West Java Resilience Culture Province is a comprehensive blueprint for disaster management implementation in West Java, containing all activities in each phase of disaster management, with the purpose to reduce the disaster risk of West Java and to improve disaster resilience well-roundedly [3]. West Java Resilience Culture Province also accommodates collaboration among disaster stakeholders in the Penta helix concept, consisting of government, education institution, business institution, community, and media. Regarding that, progress achievement for disaster management in the framework of West Java Resilience Culture Province is not only counted from the government side but accumulation from all stakeholders that took part [27].

Embedding disaster resilience culture in every stakeholder’s components as the ultimate goal, West Java Resilience Culture Province defines resilience as six components and two supporting instruments:

- **Resilience component**
  a. Resilient citizen. Creating citizens who are aware of disaster risk, having preparedness, toughness, and ability to quickly recover if exposed to disaster;
  b. Resilient knowledge. Utilizing disaster-reliable science, technology, and local wisdom;
  c. Resilient infrastructure. Disaster-resilient infrastructure and adequate to function as a mitigation tool;
  d. Resilient institution and policy. Institutional governance and policies that include disaster management and qualified in supporting the implementation of disaster management;
  e. Resilient ecology. Reducing disaster risk through maintaining environmental carrying capacity, as well as supporting sustainable development; and
  f. Resilient financing. Innovative and collaborative funding for comprehensive disaster management.

- **Supporting instruments**
  a. Resilience center. West Java Resilience Culture Province's embodiment media, functions as a disaster education center, command center, and logistics which spread in various locations; and
  b. Resilience index. Measuring instrument for the achievement of disaster resilience in West Java.

On the other hand, in realizing the vision as a digital province, West Java Provincial Government formed a particular working unit in charge of accelerating digitization, named JDS. JDS aims to improve the efficiency and accuracy of data and technology-based policymaking and to revolutionize the use of technology in community and government in West Java [28]. One of the programs initiated was to develop the JCC, a center for data visualization and integration in West Java, aimed to support more precise data-based monitoring, coordination & decision-making activities [29]. JCC also directly connects the command center at the regency/city level. Currently, there are command centers in five regencies/cities in West Java. JCC has various functions, one of which is disaster management. The disaster management application aims to help coordinate disaster management and disaster information services integrated at West Java Province level [30]. The application provides support for strategic disaster decision making by the governor as the highest command during a disaster emergency.

The Disaster Management application integrates the disaster reporting system that was run manually with the regional disaster logistics system. The Disaster Management application framework is conducted side by side with existing applications that are connected to the national disaster system.
of BNPB, such as InDRA (for assignment of disaster volunteers), InaWARE (for disaster monitoring and early warning system), and InaRISK (for disaster risk reduction). BPBD remains as the primary operator that receives, follows up, and screens disaster information collected from each regency/city. Figure 2 explains the flow of information in the Disaster Management application. Currently, the Disaster Management Application involves at least three main actors, with each of the following functions and authorities:

- **Regency/city BPBD**
  a. Input disaster report and data;
  b. Update on disaster management processes;
  c. Monitor disaster events and data in each regency/city;
  d. Propose logistic and disaster equipment assistance.

- **Provincial BPBD**
  a. Monitor overall province disaster events and data;
  b. Verification of disaster events;
  c. Monitor the progress of disaster management;
  d. Logistics and disaster equipment management;
  e. Filter out disasters to be displayed on the JCC dashboard. Provincial BPBD will forward the disasters with strategic value only to the JCC to shows on the governor's dashboard.

- **JCC**
  a. Showing disasters passed from the provincial BPBD;
  b. Monitor the progress of disaster management.
Figure 2. The flow of information and business process of disaster management application.

Within the West Java Resilience Culture Province framework, in the future, it is expected that there will be resilience centers spread across each regency/city and areas with certain high disaster risks. It intends to broaden the reach to educate people regarding disasters, accelerates disaster management response when a disaster occurs, and a broader, faster, and integrated collection of disaster-related data. With a broad network, disaster management can be done more comprehensively, at all phases, and touch broader components of people. Overall functions of the West Java Resilience Center include:

- Education. Community education center related to disaster to increase awareness of disaster risks;
- Command. Command center and disaster information at various levels and specific to disaster; and
- Logistics. Storage of disaster logistics reserves that are closer to areas potentially affected by disasters.
Another related digitization program is Sapawarga, a media for information dissemination on public service access and aspirations at the micro-level of community, a hamlet (RW/Rukun Warga). Through its head of RW, people can report anything to the provincial government, including disaster events. At present, Sapawarga has been used by 21,423 RWs, with 19,147 RWs already trained [29]. Sapawarga has the potential to become one of the actual input data in the future, and open up more extensive space for community participation. It certainly needs to be followed up with verification from BPBD as the holder of the disaster function, to ensure the quality and validity of data.

5. Compatibility of Disaster Management in West Java Within the Context of Smart City

Various disaster management efforts in West Java and future development planning, which previously described, will be reviewed in the smart city context to determine the smart city concept's implementation achievements. Components used in reviewing the implementation compatibility of the smart city concept include technology, data and information, human resources and society, environmental and spatial aspects, economy, and governance.

5.1. Technology

Technology plays an essential role in implementing the concept of a smart city. In the implementation of disaster management in West Java, ICT becomes the main instrument integrated with other technology systems. The disaster management application accommodates the emergency phase of disasters, monitors when disasters occur—including logistical arrangements. This technology's presence affects the efficiency of reporting on disaster events, changing routines that run manually to a digital basis.

The operationalization of the technology allows division of authority at the regency/city and provincial levels. It accommodates the regency/city's role as the nearest authority when a disaster occurs with the disaster reporting feature that can only be filled out by regency/city. The technology encourages more efficient synergy and coordination, not only between regency/city BPBDs and provincial BPBD but also with regency/city and provincial governments because they are directly connected to command centers at both levels. Actors who play a role in the implementation of technology are still limited to the government. However, there has been a collaboration between agencies, in this case, provincial BPBDs, JDSs, to regency/city BPBDs, but there has not been other actors' involvement.

Overall, currently implemented technology only act as substitution by digitizing the process and act as enhancement by efficiency reporting, monitoring, and disaster management synergies. It is important to note that the process only accommodates a small part of the overall disaster management, the emergency phase. It expects more extensive use of ICT in disaster management, covering the pre-
disaster and post-disaster phases. It is also necessary to support and provide other technological infrastructure for system improvement and development, such as early warning systems for various disaster hazards, and other disaster technology tools.

5.2. Data and information
Data and information become the main supporting components in the implementation of a smart city. The availability of data as a basis for disaster analysis is a prerequisite in implementing a smart city in disaster management, and data is obtained hierarchically according to the authority and function of each level. Data is inputted only by regency/city BPBDs to give better accuracy and validity and minimize false and mistargeted data. Also, the digital reporting process provides a more comprehensive data record, which can be used for further data analysis to decide more grounded solutions and policies.

With the division of roles between provinces and regencies/cities, this platform is beneficial not only for the provincial level. The regency/city level can also utilize disaster data and connect directly to each command center. Data sharing between province and regency/city exists through this system, although it is covered only BPBD and JDS, not every related department. This data can support decision making in the field of disaster management at all levels. However, this is still very limited in the emergency phase. It is necessary to develop other disaster data, including other phases of disaster, to support this system to run more comprehensively.

Data sources that currently only come from regency/city BPBDs can be developed by involving public participation through the integration of Sapawarga applications that have public aspiration functions. On the other hand, more robust screening, validation, and verification efforts need to be made at the regency/city level to ensure that the incoming public data is worthy of follow-up and meet the responsibilities and authorities at such levels of government. It is necessary to develop legally permissible open-source data so that broader stakeholders can be utilized and therefore create a smarter ecosystem, such as business institutions for business review, academics for research, encouragement of other innovations in disaster management, and others.

5.3. Human resources and society
As a directly affected party, disaster resilience improvement in the community is critical, and it is achievable through this digitization process. With the essential characteristics of West Java, which have high disaster risk, naturally, the community already has a culture that applies from generation to generation which supports disaster management implementation. Dissemination of such local wisdom is a need, so that community acceptance is better in responding to disaster resilience because it is close to their daily lives.

With the highest population in Indonesia, West Java Province certainly has a high diversity of population characteristics. To reach the communities it requires a variety of strategies to educate and increase public awareness of disasters. The system developed in the smart city concept must connect the community as a user, and consider their actual characteristics and needs. The fundamental social values that have been developed such as volunteerism and mutual assistance are positive points that are also required to form a society that is resilient to disasters collectively.

The implementation of a smart city, which is currently limited to the emergency phase, needs to be developed, including other phases. It needs qualified human resources to support the implementation of a smart city. The approach of implementing ICT in various regions in West Java needs to consider different characteristics and needs complying with each region's characteristics. Collaboration and sharing with professional partners and educational institutions outside the government are needed to disseminate quality human resources to support the system's realization.

5.4. Environment and spatial aspects
The current implementation of ICT, in general, has only touched reporting and monitoring of disaster events—therefore has not seen the effect on the environment and spatial aspects. However, this can be
the first step in a long process of disaster management to minimize the environmental impact, with more efficient monitoring and faster response delivery. The diverse geographical characteristics of West Java Province needs to be taken into account with environmental and spatial issues in disaster management. Handling in urban and rural areas requires different things, especially each location has its uniqueness, both from the function and type of disaster hazards. Spatial data usage has started as a basis for analysis at this stage. It needs functional integration with spatial planning data in general, both at the regional and detailed levels. Implementing the smart city concept must ultimately contribute to fostering sustainable development in West Java in general.

5.5. Economy
Alongside environmental and spatial aspects, economic aspects have not been directly affected by the implementation of the smart city concept in disaster management. Although one of the implementation's final objectives is to create independence and resilient economic growth that can withstand disasters, further development is still needed to achieve this. Another thing related to the economy is financing the implementation of the concept, which currently relies solely on the government budget. Other innovative funding needs to be encouraged outside the government budget to multiply more sustainable financing. It requires good collaboration with the business institution, both within the West Java Province's internal scope, nationally, and even internationally. In future development, it needs to accommodate disaster management's economic aspect in the smart city concept platform. Due to its institutional function, it needs to integrate the system with other departments of financing, investment, and budgeting.

5.6. Governance
Disaster is not only a matter of government, especially only specific departments, it requires collaboration for comprehensive and impactful disaster management and on improving overall disaster resilience. Operationalization currently involves regency/city BPBDs, provincial BPBDs, and JDS, meaning that collaboration within the government has started. However, there are still plenty of collaboration spaces with other governmental agencies. Regarding the coordinating function conducted by provincial BPBDs, each department owns each disaster-related technical data, those need to collaborate immediately, not only in the emergency phase but also in other disaster phases.

According to the West Java Resilience Culture Province concept, which encourages Penta helix collaboration, it needs to develop space for collaboration with those actors within the framework of smart city implementation. Communities can be encouraged not only as users but also as data sources. Business institutions can take a role in improving smart city infrastructure, information dissemination, and disaster education. Academics can play a role as a center of innovation in disaster and the smart city. The media hold the function of education and dissemination of public information. It needs improvement of the collaboration framework in digital platforms facilitated by ICT or in the real field to achieve disaster resilience.

Following the province's functions and authorities, which aim to coordinate and facilitate the regencies/cities, the provincial-level achievements depend on each regency/city. To summarize the achievements of implementing disaster management and its compatibility with the concept of a smart city, showing the current stage of each component at West Java is described in table 4.

Table 4. Achievements in implementing disaster management with the smart city concept for each component in west java

| Component | Description of Achievement | Category |
|-----------|-----------------------------|----------|
| Technology | ICT-based development has been implemented at the provincial level but still limited to specific functions, not covering all phases of disaster. | Initialized |
| Data and | There has been data sharing between provinces and | Initialized |
Component | Description of Achievement | Category
---|---|---
Information | Regencies/cities, although it has only involved BPBD and JDS, not integrated with all departments yet. | Initialized
Human resources and society | Not yet accommodated in the existing system. Other applications strengthen the outreach to the community, but not integrated yet. | Initialized
Environment and spatial aspects | It only accommodates monitoring and response delivery functions related to disasters, has not had a direct impact on the environment. There has not been data sharing with spatial planning data. | Initialized
Economy | Not yet facilitated and affected by the existing system. | Non-Existent
Governance | The provincial government has initiated and carried out the implementation of the smartness concept. It has started to integrate within some departments, but there has been no collaboration with other actors outside the government. | Scattered

In general, the application of the smart city concept in disaster management in West Java is still in its early stages. There is still plenty of room for functional development and actor collaboration to form a smarter system. The implementation of this concept needs more massive support in terms of investment, technology, and community engagement.

6. Conclusion
With its unique characteristics, surrounded by various disaster threats, West Java needs a comprehensive response framework to reduce disaster risks and increase disaster resilience. On the other hand, the vision as a digital province pushed West Java to implement ICT in various aspects, including disaster management. Based on the implementation efforts and planning for future development, the smart city component uses to review the disaster management position, including technology, data and information, human resource and society, environmental and spatial aspects, economy, and governance.

Overall, each of the components shows that the existing implementation of the smart city concept is still in the initial phase, only to accommodate the emergency phase process. It has caused no effect on the macro aspects such as the economic, environmental, spatial planning, and people's quality of life. There is still plenty of room for future developments, especially in the framework of the West Java Resilience Culture Province's overall implementation. Investment in various disaster technologies is also required to support the smart city concept run comprehensively. Further massive collaboration should be encouraged between government agencies and other actors, including the public, business institutions, academics, and the media, to accelerate the achievement of the disaster-resilient West Java realization.

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