The Resilience of Banjarmasin City in disaster management

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Abstract. Banjarmasin City is regarded as the capital of South Kalimantan Province, acknowledged as the high-risk area of 2 major issues, such as flood due to sea-level rise, and settlement fire. Banjarmasin is located in tidal marsh zone with elevation of 0.16m below the sea level which relatively leads to annual urban flooding. Floods occur in Banjarmasin in 2021 become one of threats to city resilience. Thus, building city resilience against the unexpected climate change is of importance to create a sustainable and livable city. This study focuses on resilient city of Banjarmasin by utilizing the two different methods of analysis, including: public and SWOT analysis. Public analysis is utilized to assess Banjarmasin City policy of manifestation of city resilience.  SWOT analysis is applied to identify various factors systematically in formulating the planning strategy. The results indicated that innovation in handling disaster by the local government towards resilient city has been apparent through several programs of disaster mitigation by collaborating with private sectors or institutions, with aims: to provide maximum public services, to promote climate change awareness to all levels of society, and to handle river issues such as river normalization.

1. Introduction
Cities have to continue facing the new and ongoing challenges related not only on job creation, food security, other essential services (including housing, clean water, sanitation, health, and basic education), but also on planning and maintenance of green open spaces and waste management. Therefore, cities will remain growing on size, population, and complexity. Moreover, it is necessary to reminisce that the vulnerability of cities to extreme measures and future disasters also increase proportionally [1]. Resilience is a comprehensive concept that has been used in many disciplines, it evolves over time dependent on the sector. The foremost purpose of resilience aims to reduce the impact of a disturbance, nevertheless there is no single definition for resilience. Yet, it can be concluded that resilience is the ability of a system resisting and/or adapting to certain turbulences, to restore normal function or to balance state [1]. Refining city resilientities therefore becomes an important need for urban communities, especially for areas that are as vulnerable of being affected by disasters, whether natural disasters or by humans-caused disasters. Recovery of post-disaster and city restoration provides the opportunities for urban communities, ultimately increasing urban community resilience [2].

Currently, numerous cities have realized their role as climate change contributions, so cities must struggle not only to reduce their impact on the environment but also to build the resilience of the city itself. In order to be able to face the impacts of climate change so that it can become a more sustainable city [3]. The issue of climate change in Indonesia has become one of the development priorities, stated in the National Long-Term Medium-Term Plan (RPJMN) 2020-2024, specifically on...
second issue priority, that is to increase disaster and climate resilience. The city of Banjarmasin also has guidelines in Banjarmasin Long-Term Development Plan (RPJP) 2005-2025 and Banjarmasin Regional Medium-Term Development Plan (RPJMD) 2016-2021, both contain decree policies to the environment, that is resilient to disasters, climate change, and city inclusion.

Banjarmasin City is the capital of South Kalimantan Province, having an area of 98.46 km² and a population about 657,663 people in 2020 [4]. Based on the identification of disaster risk and climate change from the 2020 Climate Resilient and Inclusive City Document, it is recognized that Banjarmasin is most vulnerable to two problems, specifically flood disaster and conflagration. Moreover, there are also policies in reducing greenhouse gas emissions in order to minimize the impact of climate change in the city of Banjarmasin. Recently, in the early 2021, there was the biggest flood disaster in Banjarmasin which had never happened in the last few decades; thereby presenting the major threat to the future city's resilience.

2. Method
Research on the Resilience of the City of Banjarmasin to Disasters was conducted by taking a case study in the City of Banjarmasin. This study uses two analytical techniques, including policy analysis, and SWOT analysis.

2.1. Policy Analysis
Policy analysis was conducted by using content analysis techniques. Content analysis refers to an analytical technique used to study and analyze communication systematically, objectively, and quantitatively towards visible messages [5]. Content analysis is also a systematic technique for analyzing a message or a tool for observing and analyzing the content of the open communication behavior of selected communicators. The benefit of this analysis is to describe media content or compare media content with reality or actual events [6]. Content analysis on analyzing policies regarding the resilience of the City of Banjarmasin.

2.2. SWOT Analysis
SWOT analysis systematically identifies various factors to formulate planning strategies following the objectives [7]. In this analysis, it is interpreted that the complexity of the condition of the planning area is interpreted where internal and external factors have an equally important position. SWOT analysis is a strategic planning method used to evaluate strengths, weaknesses, opportunities, and threats in activity planning. This process involves determining the specific objectives of activity planning and identifying internal and external factors that support and which do not achieve these goals. SWOT is applied to set more realistic and effective goals and formulate the most effective strategies. SWOT analysis is acknowledged to present the strengths and opportunities that exist as positive factors in achieving goals is illustrated in Figure 1.

![Figure 1 SWOT matrix](image)

3. Result and Discussion
3.1. The Pattern of Disaster Events in The City of Banjarmasin
The National Disaster Management Agency (BNPB) measured the vulnerability of cities in Indonesia in a disaster risk index. The overall index value of Banjarmasin City in 2018 was 96.4 (Table 1), classified as medium category. This score was the lowest among the 13 cities/districts in South
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Kalimantan, and it indicated that other cities/regencies in South Kalimantan were even more disaster-prone areas.

Table 1. Banjarmasin City Disaster Risk Index Value in 2018

| Disaster         | Score | Category |
|------------------|-------|----------|
| 1 Flood          | 21.6  | High     |
| 2 Fire           | 21.6  | High     |
| 3 Drought        | 14.4  | High     |
| 4 Extreme weather| 13.6  | High     |
| 5 Earthquake     | 10.8  | Medium   |
| 6 Tsunami        | 7.2   | Medium   |
| 7 Earth Slide    | 7.2   | Medium   |

Source: [4]

Banjarmasin is located in a tidal swamp area with a ground level of 0.16 meters below the sea level, causing the city's subgrade surface to be relatively inundated throughout the year [8]. This causes flooding, influenced by the tides, and the city of Banjarmasin is traversed by hundreds of rivers, encouraging this city to adapt and mitigate. In addition, coupled with the number of residential houses that are above or on the banks of the river and based on the identification data of slum settlements in 2020 from the Department of Housing and Settlement Areas of Banjarmasin, the slum areas located on the river banks comprises 83.7 hectares.

In early 2021, in January, South Kalimantan Province was hit by a severe flood, and the Banjarmasin became one of the cities affected. The city of Banjarmasin, a downstream area of the province of South Kalimantan was flooded like never before in decades. Based on information from the River Division of the Banjarmasin City Public Works and Spatial Planning Office, one of the causes of the flood that occurred at the beginning of last year was flooding from upstream. The map of the area affected by the inundation of Banjarmasin City is apparent in Figure 2.

![Figure 2 The Map of Banjarmasin City Flood Affected Areas](chart.png)

Based on an official article issued by Lambung Mangkurat University, Banjarmasin entitled Land Deformation of Banjarmasin City [9]. Several factors are suspected of causing the duration of the
puddle that hit the city of Banjarmasin, including problems with the city's drainage infrastructure. Where many residential areas partially block waterways. For this problem, the Banjarmasin City government had taken concrete actions by control the building development especially along the rivers and drainage channels. However, the Center for Geospatial Information Infrastructure Development (PPIIG) at Lambung Mangkurat University (ULM) suspected that other factors also contributed to the length of waterlogging in Banjarmasin City in 2021, including the possibility that several locations in Banjarmasin City experienced land subsidence. In addition to other factors previously mentioned, including problems with water channels, this allegation requires proof in the form of a direct study.

3.1.1. Fire
The hallmark of the house in this city is stilts made of wood. However, this leaves its problem, especially in densely populated residential areas. The danger of fire often hits the Banjarmasin. Coupled with the majority of houses made of wood in dense populated settlements, fires spread quickly. Another problem is not because the houses are made of wood, but also because the settlements are densely populated and irregular, so that the potential for fires can occur, especially in slum areas. In addition, negligence in electrical installation is also one of the causes of fires. Throughout 2019, fires were the most frequent disasters that occurred in Banjarmasin 67 events and 46 event ini 2020.

3.2. Policy Analysis
Policy analysis applies the content analysis techniques to study and analyze communication systematically, objectively, and quantitatively towards visible messages [5]. This policy analysis aims to assess the policies of Banjarmasin towards the realization of city resilience (Table 2)

Table 2. Policy Analysis

| Programs                                      | Resilience | Adaptive Capacity | Vulnerability |
|-----------------------------------------------|------------|-------------------|--------------|
| River normalization program:                  |            |                   |              |
| 1. Normalization and dredging of major rivers |            |                   | X            |
| 2. Routine maintenance of drainage and rivers | X          |                   |              |
| 3. Normalization of small rivers              |            |                   | X            |
| 4. Plan for large rivers, including by making sirens/cliffs/river embankments | | | |
| 5. Maintenance of the Martapura River         | X          |                   |              |
| 6. Repairment of small river channels by making siring | | | X |
| 7. Socialization to the community regarding river and drainage arrangements | X | | |
| Program for structuring riverside residential areas | | X | |
| Regional Regulation Number 14 of 2009 concerning Stage Buildings | | | X |

The program that supports the realization of the Banjarmasin resilience consists of three programs. These three programs will help realize the Banjarmasin resilience against floods by conducting regular maintenance of the river and drainage, organized by the Banjarmasin City Public Works and Spatial Planning Office. These programs include: routine maintenance of drainage and rivers; maintenance of the Martapura River; conducting outreach to the community regarding river and drainage arrangements.

3.3. SWOT Analysis
SWOT analysis is the identification of various factors systematically to formulate a planning strategy following the objectives. The following is the result of a SWOT analysis for research on the Banjarmasin resilience to Flood Disasters (Table 3)
### Table 3. SWOT Analysis

| Strengths | Weaknesses |
|-----------|------------|
| 1. The disaster risk index value of Banjarmasin City in 2018 was 96.4, which indicates that other cities/regencies in South Kalimantan are even more disaster-prone areas. 2. Most of the houses in Banjarmasin are houses on stilts, so they can be used as an adaptation strategy to flood disasters. | 1. The Banjarmasin is located in a tidal swamp area with a ground level of 0.16 meters below sea level, making it prone to flooding. 2. The city of Banjarmasin is traversed by hundreds of rivers, making the area prone to flooding quite extensive. 3. There is a problem with the city's drainage infrastructure due to residential areas closing the drainage. 4. There is a possibility of land subsidence which further increases the possibility of a flood disaster. 5. Most of the houses in Banjarmasin are made of wood, so they are prone to fire disasters. 6. Many residential settlements are dense and irregular, making them prone to fire disasters. 7. Often, there is negligence in installing electrical installations, making it prone to fire disasters. |

| Opportunities | Threats |
|---------------|---------|
| 1. There is a program of controlling buildings along the river and drainage to cope with flood disasters. 2. Three programs support the Banjarmasin resilience against floods to minimize the impact of the disaster | 1. The environmental conditions of Banjarmasin are influenced by the environmental conditions of the upstream area, so if there is environmental damage in the upstream area, the City of Banjarmasin will also be affected. 2. The existence of garbage shipments from the upstream area of the river, which is one of the causes of the flood disaster. |
| 1. Formulation of policies for the construction of houses with the construction of stilt buildings. 2. Construction of a footbridge that becomes the boundary of riverside housing development to maintain the width of the river body and river border lines. 3. Construction of flats to organize riverside areas. | 1. Cooperation between regions as well as between the Regional Government and the Central Government is also essential to reduce the risk of disasters, especially flood disasters. |
| 1. Preparation of priority programs for river normalization and dredging. 2. Implementation of the bridge demolition program is to restore the water flow pattern so that inundation can immediately recede. 3. Implementation of programs for structuring riverside includes residential areas, especially for slum areas. 4. Procurement of 279 fire fighting units. 5. Community training on the basics of disaster and fire resistance. 6. Operation of disaster and fire alert posts 7. Making E-Damkar make it easier for the public to submit online complaints about fire or rescue incident. | 1. Implementation of solid waste and waste management programs, by improving the solid waste and sanitation system. |

### 3.4. Innovation of Disaster Management Towards the Resilience of Banjarmasin

The innovation of disaster management by the Banjarmasin City Government towards a resilient city is apparent from several programs that the Banjarmasin City Government has conducted through the related Regional Work Units (SKPD).
3.4.1. Flood
The disaster management innovations by the Banjarmasin City Government to prevent and overcome floods are as follows:
1. The Banjarmasin City Government has a policy related to the process of adapting to tidal conditions, by issuing Regional Regulation Number 14 of 2009 about Stage Buildings. Through this regional regulation, every building built in the Banjarmasin must be conducted on stilts. Stilt building which means that the construction of the building is in the form of a stage and is not backfilled so that it does not eliminate the function of water absorption in the lower part of the building.
2. Programs conducted by the Banjarmasin City Public Works and Spatial Planning Office, and in 2020 there are 8 (eight) prioritized river normalization programs with a budget of approximately Rp. 22.8 billion in 2020 and a budget of approximately Rp. 27.5 billion in 2021 (DPA of the Banjarmasin City Public Works and Spatial Planning Office 2020-2021). The activities to restore the function of the river in Banjarmasin City are as follows normalization and dredging of significant rivers; routine maintenance of drainage and rivers; normalization of small rivers; planning for large rivers is by making sirings/cliffs/river embankments; maintenance of the Martapura River; repair the small river channels by making siring; and conducting outreach to the community related to river management and drainage.

Normalization is conducted to restore the width of the river body to its original condition and restore the river border. While the pictures below (Figure 3 and Figure 4) are the results of the river normalization and dredging program in Banjarmasin City by the River Division of the Banjarmasin City Public Works and Spatial Planning Service.

![Figure 3](image.png) **Figure 3** Muara Kelayan River of Banjarmasin Before Backfill

![Figure 4](image.png) **Figure 4** Muara Kelayan River of Banjarmasin After Backfill

3. Living by the river has become the identity of the City of Banjarmasin, but problems often arise by increasing the number of residents in riverside residential areas, causing informal settlements that are dominated by the poor citizen. The program for structuring riverside residential areas, especially for slum areas, was delivered by the Banjarmasin City Housing and Settlement Area Office. In addition to the riverside village structuring program described earlier, there is also a program for building flats.

3.4.2. Fire
The budget used for disaster and fire prevention in the 2020 Fiscal Year was Rp. 1.02 billion with the Banjarmasin City BPBD and the Civil Service Police Unit, and the Banjarmasin City Fire Department. The disaster management innovations by the Banjarmasin City Government to prevent and overcome fires are as follows:
1. Operate 279 firefighting units in 2019 supported by five main programs in the Disaster Resilience Sector at the Banjarmasin City Regional Disaster Management Agency (BPBD).
2. Conducting programs focusing on socializing preventive measures in various communities, including outreach to school students to direct outreach to the community. In 2020, the Banjarmasin City BPBD also targeted to hold basic training on disaster and fire resistance for community.
3. The budget provision for the community for the disaster management and fire alert posts for 12 months is also conducted to prevent fire hazards.

4. One of the steps to realize a smart city in Banjarmasin and make it easier for the public to submit online complaints about fire or rescue incidents, the Banjarmasin City Government created an E-Damkar with its address at https://e-damkar.banjarmasinkota.go.id. This E-Damkar was created in 2020 by the Banjarmasin City Information and Statistics Communication Service, equipped with a manual to make it easier for the public to use. In the manual, it is stated that E-Damkar is an application created to provide information about public online complaints, both reports of fire incidents and reports of rescue incidents in the Banjarmasin, enabling all firefighters to reach the location of the incident accurately.

4. Conclusion

Innovations in governmental policies have been conducted by the Local Government of Banjarmasin in terms of disaster mitigation, additionally supported by partnerships or collaborations with private parties or non-government organization in coping disaster. Furthermore, Local government needs to raise urban society responsiveness for the impacts of climate change. The Local Government has encouraged climate awareness campaigns at all levels, that are in urban society level and the early educational level. Moreover, establishing cooperation between regions is important to reduce the risk of disasters, especially the flood disaster. Cooperation is expected to involve not only Balai Wilayah Sungai Kalimantan II as representative of the Central Government, but also with the Provincial Government of South Kalimantan in managing and normalizing the river.

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