ISSN 2579-4396
E-ISSN 2579-440X

Journal of Government & Civil Society

Journal of Government and Civil Society | Volume 8 | No. 1 | Pages 1 - 160 | April 2024 | ISSN 2579-4396

Published By:
Government Science Study Program
Faculty of Sosial and Political Sciences
Universitas Muhammadiyah Tangerang

Daftar Isi (Table of Content)

Journal of Government & Civil Society

Journal of Government and Civil Society
Vol. 8, No. 1, April 2024, pp. 58-76
DOI: 10.31000/jgcs.v8i1.9530
Received 24 August 2023 ■ Revised 9 April 2024 ■ Accepted 19 April 2024

Makassar City Climate Change Handling Policy

Aswar Annas[1], Resky Amalia P[1*]

[1] State Administration Science Study Program, Faculty of Administrative Sciences, Universitas Pepabri Makassar, Indonesia

[*] Email Correspondence: reskyamaliah04@gmail.com

ABSTRACT

The urgency of climate change is now crucial. Climate change is not only an environmental problem but also threatens the survival of urban communities, affects urban spatial planning, and encourages government initiatives to increase public capacity and integrated social services. This study aims to identify and analyze the implementation of policies and handling of climate change by the government of Makassar City. This study uses qualitative data sources, namely statements from informants and local action plan documents for climate change adaptation and disaster risk reduction. Data collection through interviews and relevant literature review. The study results show that the climate change countermeasures policies implemented include; adding green open spaces, clean water management, rehabilitation and normalization of canals, mitigation through planting mangroves, developing aquaculture to empower island communities, and socializing strengthening climate change regulations. Other policies were carried out, including the ecological dimensions of forming strategic areas and cultivation, the social dimension of public capacity building and integrated social services, technical dimensions of the development of urban spatial pattern structures.

***Keywords**: Public policy, government policy, climate change policy, environmental policy, climate change*

ABSTRAK

Urgensi perubahan iklim saat ini menjadi krusial. Perubahan iklim bukan hanya mengenai masalah lingkungan, tetapi juga mengancam ketahanan hidup masyarakat kota, memengaruhi penataan ruang kota, dan mendorong inisiatif pemerintah untuk meningkatkan kapasitas publik dan layanan sosial terpadu. Penelitian ini bertujuan untuk mengetahui dan menganalisis pelaksanaan kebijakan dan penanganan perubahan iklim yang dilakukan pemerintah Kota Makassar. Pendekatan penelitian menggunakan kualitatif, sumber data yaitu pernyataan yang berasal dari informan, dan dokuman rencana aksi daerah adaptasi perubahan iklim dan pengurangan risiko bencana. Pengumpulan data melalui wawancara dan telaah literatur relevan. Hasil penelitian menunjukkan bahwa kebijakan penangan perubahan iklim dilakukan, meliputi; penambahan ruang terbuka hijau, pengelolaan air bersih, rehabilisasi dan normalisasi kanal, mitigasi melalui penanaman mangrove, pengembangan budidaya perikanan pemberdayaan masyarakat pulau, dan sosialisasi penguatan aturan perubahan iklim. Kebijakan lain dilakukan, yaitu; dimensi ekologi pembentukan kawasan strategi dan budidaya, dimensi sosial peningkatan kapasitas publik dan layanan sosial terpadu, dan dimensi teknis pengembangan struktur pola ruang perkotaan.

Kata Kunci: Kebijakan publik, kebijakan pemerintah, kebijakan perubahan iklim, kebijakan lingkungan, perubahan iklim

Citation : Annas, A., & Amalia P., R. (2024). Makassar City Climate Change Handling Policy. *Journal of Government and Civil Society*, 8(1), 58–76. https://doi.org/10.31000/jgcs.v8i1.9530

INTRODUCTION

Climate change is a crucial problem in various cities in Indonesia today. (Gouel & Laborde, 2021). Climate change impacts environmental destruction, death, intense natural disasters, the threat of sinking of small islands, and affects the resilience of urban communities. (Cappelli, Costantini, & Consoli, 2021; Fraser, 2021). In addition, climate change also causes damage to the diversity of plants and animals. (Varvastian & Kalunga, 2020), moreover, threaten public health. (Unsworth et al., 2018). Rapid change triggers the urgency of climate change in big cities. For example, the city has always been an urban community area with a population density that is relatively rapid yearly (McDonough et al., 2020), this is because some people make the city a place of economic livelihood.

For example, Makassar City is one of the cities that has a rapid and urgent climate change impact. However, it is affected by the population density that continues to increase every year, both the local population and urban communities. (Didiharyono, Giarno, & Sapareng, 2022). As a result of this, it also has an impact on increasing community housing clusters, so that the land area of Makassar City is increasingly decreasing; Makassar City Government's efforts to answer these problems have carried out beach reclamation activities in the context of providing housing development land for urban communities (Suhardi, 2021). In addition, another impact of the increasing population of Makassar City, which has a significant impact on climate change, is the daily use of motorbikes and cars (Zakaria, Ramli, Hustim, Alimuddin, & Pratiwi, 2022).

vThe widespread use of motorbikes and cars has significant implications for air pollution in Makassar City (Al Madhoun et al., 2021). The impact of air pollution can significantly change lousy air conditions, causing urban warming so that urban air temperatures experience fluctuating temperature rises. Air pollution Vehicle air pollution is caused by the number of vehicles operating that exceed the tolerance limits of the environment around the city, where urban green areas are not balanced with the total heat generated from operating vehicles (French et al., 2021). Besides damaging the environment, air pollution can also interfere with the human respiratory system; Dirty air makes urban people very vulnerable to respiratory diseases (Deng, Jalaludin, Antó, Hess, & Huang, 2020; Joshi, Goraya, Joshi, & Bartter, 2020). The rise of industrialization also causes another urgency to climate change in Makassar City.

Apart from Makassar City, there are several large cities in Indonesia experiencing the same conditions, such as several cities located on the island of Java which experience similar conditions, such as; Cilacap City, Pemalang, Semarang, Demak, Grobongan, Sragen, Rembang, Pati, and Semarang City. In general, cities on the island of Java have an urgent climate change which causes impacts in the form of flooding, drought, and attacks by plant pests targeting the agricultural sector so that the decline in crop production

both in quantity and quality experiences quite significant changes, it is known that the decline in yields agricultural production in the Java region due to climate change, ranges from 20 to 40%. These conditions greatly affect the quality of welfare of the people of the region (Antriyandarti, Nawang, Werdining, & Samputra, 2024; Estiningtyas, Mulyani, Sumaryanto, & Kartiwa, 2021; Satyawan, Wibisono, & Binangun, 2021).

For the island of Sulawesi, especially Makassar City, as one of the cities with a dense population, climate change comes from a fairly high industrialization process, the large industrial center in the middle of Makassar City has a significant influence on the city's climate conditions (Yahya, M., Ananto Yudono, Farouk Maricar, 2020) this is because industrialization is vulnerable to changing weather conditions and air pollution due to factory waste smoke containing hazardous gases and chemicals. (Kristanto & Koven, 2019). Therefore, reducing the various phenomena above regarding climate change studies in Makassar City, the city government is currently taking various steps to solve existing problems in policy formulation, policy implementation, and collaboration between institutions within the scope of City government agencies. Makassar to face this problem (Anirwan & Qamal, 2023; Malik, Abdillah, Rusnaedy, & Khaerah, 2021).

Even though the Makassar City government is implementing various steps in managing climate change and adaptation policies, the policies implemented and the Makassar City government's response still need to be more optimal in encouraging and seeking adaptive policy models to support climate change policy ideas (Rusnaedy, Haris, Congge, & Prianto, 2021). Research studies on climate change policy governance have generally been carried out in Indonesia; several studies on this topic reveal that even though climate change policy is being pursued by collaborating between sectors, agencies, and levels of government so that it can run optimally (Pratiwi, Lee, & Suzuki, 2021; Ravikumar, Larson, Myers, & Trench, 2018).

However, several regional government programs in Indonesia have been quite successful in overcoming the problem of climate change with various handling models implemented (Suraharta et al., 2022). For example, the presence of an acceleration program for electric vehicles for transportation in several regions in Indonesia is on the regional government's agenda in supporting the central government's policy regarding environmentally friendly vehicle transformation which aims to create clean air quality that is far from air pollution so that it can affect the health quality of urban communities (Yuniza, Pratama, & Ramadhaniati, 2021). As a result of the success of this program, based on a report from the World Tourism Organization or United Nations World Tourism Organization (UNWTO), it is stated that the electric vehicle sector can reduce 5% of total CO2 emissions, in addition to gas emissions resulting from oil-fueled transportation can be reduced by around 32%. from the presence of electric vehicles (Huda, Aziz, & Tokiatsu, 2019). In several studies regarding climate change policies related to urban spatial planning.

Other studies also reveal that policies must consider urban spatial planning to accommodate climate change preparedness and sustainable development planning (Setiowati, Hasibuan, & Koestoer, 2018; Yoseph-Paulus & Hindmarsh, 2018). So far, although studies on the governance of government policies related to climate change are already very familiar in Indonesia, there is still a need for more discussion on this topic outside Java Island, such as Sulawesi Island, especially Makassar City. In addition, very few studies have been found that outline the study of public policy ideas focusing on ecological, social, and technical dimensions. This is the novelty of this research and is a differentiator from previous studies.

This study aims to identify and analyze policies to deal with climate change and adaptation of urban communities. The research questions in this study are described as follows; (1) What are the climate change management policies implemented in Makassar City? (2) How are implementing policies from ecological, social, and technical dimensions in accommodating urban climate change?. Answer the following two questions to help find policy ideas, descriptions of policy implementation, and policy situations related to the adaptation of urban communities to climate change.

RESEARCH METHOD

This study uses a qualitative method, with a descriptive type that utilizes the researcher as an instrument to obtain data. The research was conducted in Makassar City, and field data was collected from May to June 2023. The study framework focuses on handling climate change policies in the ecological, social, and technical dimensions. Sources of data were obtained through primary data, namely statements from informants, and secondary data obtained from the Regional Medium Term Development Plan (RPJMD) documents, spatial and regional planning documents, Regional Action Plan documents for Climate Change Adaptation and Disaster Risk Reduction (RAD API - PRB). , as well as other relevant literature studies in journals and books.

The criteria for informants in this study are those who understand and are directly involved in handling climate change, including; Regional Development Planning Agency (Bappeda), Environmental Office (DLH), Public Works Office (PU), Department of Spatial Planning and Building (TRB), Communication and Informatics Office, and Regional Disaster Management Agency (BPBD) Makassar City. Data was collected by observing the urban situation, interviewing informants directly, and reviewing related documents. Data analysis was carried out by organizing the tendency of the results of the interviews to become information to be concluded and then visualized in the form of descriptive sentences. The impact of this research can influence the resulting policy ideas and the Makassar City government's response regarding the handling of policies and adaptation of urban communities to climate change.

DISCUSSION AND ANALYSIS

Climate Change Handling Policy

Makassar City Government carries out various policy models for climate change issues. Strengthen the issue of climate change in society related to the impact it causes. The Makassar City Government, through related agencies, collaborated to define the forms of climate change that are occurring in urban areas, then identified the fatal impacts of each sector affected by climate change based on regional segmentation (Sipato, Darlin, Mustari, & Kaimuddin, 2021; Aswi et al., 2020). Makassar City Government has also launched various climate change management strategies through certain agencies. For example, the Environmental Office and Department of Spatial Planning and Building carried out the strategy of adding urban green open space through the park alley program to deal with the impact of increasing city temperatures (Yanti, Ala, Dungga, & Arif, 2021; Setiowati, Hasibuan, & Koestoer, 2018). There are also other climate change management policy programs, as shown in the table below.

Climate Change Impacts	Policy Program	Implementing Agencies
1. Increased Temperature (emissions)	1. Addition of urban green open space (Lorong Garden)	Environmental Office (DLH) and Department of Spatial Planning and Building (TRB)
	2. Supply and Management of Clean Water	Public Works Office (PU)
2. Increased Rainfall	1. Rehabilitation and maintenance of drainage channels	Public Works Office (PU) and
	2. Channel normalization/dredging	dan Regional Disaster Management Agency (BPBD)
3. Sea Level Rise	1. Disaster mitigation through planting mangroves	Maritime Affairs, Fisheries, Agriculture and Animal Husbandry Office
4. Socio-Economic Community	1. Increasing the welfare of farmers	Maritime Affairs,
	2. Development of aquaculture and fisheries extension	Fisheries, Agriculture and Animal Husbandry
	3. Empowerment of coastal and island communities through group capital assistance	Office
5. Dissemination of rules/regulations	1. Dissemination of climate change issues in the community	Communication and Informatics Office

Source: Badan Penanggulangan Bencana Daerah Kota Makassar, 2020; Damayanti, Sipato, Barkey, & Demallino, 2021

Table 1 shows that the Makassar City Government responds to climate change conditions by implementing various policy measures and adapting them to the impacts. The impact of rising temperatures is overcome through the Lorong Garden policy. Lorong Garden focuses on increasing urban green space by initiating the movement of 1,000 green plants in every alley in Makassar City; The plants were packaged in polybags and filled with various plants such as chilies, tomatoes, lemon grass, shallots, herbs, and tubers. Others are considered easy to grow and can be utilized by the local community as processed household crops. The urban alley greening movement significantly impacts reducing temperature and can create beautiful urban areas (DeRieux, 2022; Nur, 2020). Apart from reforestation, the management and provision of clean water is also the focus of the city government to anticipate rising temperatures.

Policy program for managing and supplying clean water in an integrated manner in all areas of Makassar City. This is done by checking five water treatment installations that serve the clean water needs of urban communities, namely; The first Water Treatment Plant in the Ratulangi area from the Jeneberang River water intake through a raw water transmission pipe, The second Panaikan installation takes raw water from the Jeneberang River and Lekopaccing Canal, the third Antang installation uses water to take from the Lekopaccing Canal, the fourth Maccini Sombala installation comes from taking water from the Jeneberang River, and the fifth Somba Opu water treatment plant comes from taking water from Bili-Bili. The five water installations can distribute clean water as much as 3,365,291 m3/day and initiate the water cycle due to increased extreme temperatures. (Karim, Desi, & Ahmad, 2022). Apart from the clean water supply program, there is also a drainage rehabilitation policy and channel normalization due to the impact of increased rainfall due to climate change.

Policies for rehabilitating drainage canal maintenance and normalization of canals, a program initiated by the Makassar City government and implemented by the Public Works Office and Regional Disaster Management Agency (BPBD) in response to increasing rainfall in urban areas. The main focus of rehabilitation is centered on the final disposal of waterways, such as dredging the Pampang River with a distance of 3.2 kilometers, the Biringjene River with a distance of 1.6 kilometers, the Balangturungan River in Daya 1 kilometer, and the Sabbeng River in Antang with a length of 2.5 kilometers. To normalize the canals themselves, the government focuses on vital city channels such as the 4.23-kilometer Gowa Canal, 1.5-kilometer Perumnas Canal, 1.3-kilometer Antang Canal, and intensive maintenance of the canal gates. Rehabilitation and normalization of canals are essential so that the high volume of water increased due to rainfall does not cause flooding in urban areas (Mustamin, Maricar, & Hatta, 2023; Makbul, Ruslan, Erdawaty, & Setiawan, 2023).

There is also a mitigation policy through planting mangroves carried out by the Makassar City government to anticipate the impact of sea level rise due to climate change. The Maritime Affairs, Fisheries, Agriculture and Animal Husbandry Office implements this program. The coastal area of Makassar itself is estimated that in 2025 there will be an increase in seawater as high as 30 cm; in 2050, it will be 60 cm; in 2075, it will reach 90 cm; and in 2100, it will increase by 122 cm (Auni, Bachtiar, Paembonan, & Larekeng, 2020). Makassar City Government maximizes mangrove planting in coastal areas with high vulnerability, such as the Barombong coast, Tanjung Merdeka coast, and Maccini Sombala coast. As many as 200 thousand mangrove trees were planted with an area of up to 15 kilometers. Mangrove planting was carried out to protect Makassar's coastal areas from abrasion and regulate the high waves that hit the coastal areas. (Massiseng, Tuwo, Fachry, & Bahar, 2020; Sari, Budimawan, & Selamat, 2023).

The City Government of Makassar has also launched policies to improve the welfare of farmers, develop cultivation and fisheries counseling, and empower coastal and island communities through group capital assistance to build socio-economic resilience due to climate change. Maritime Affairs, Fisheries, Agriculture and Animal Husbandry Office carries out this program. The city government provided fishing gear assistance to coastal communities through 65 longline rods, three units of paid nets, 16 units of fiber boats, 34 units of crab nets, 27 units of hangiri longlines, and 1 unit of solar power engine. It was given to fishermen groups of 100 million / group for business capital assistance, namely the Mubarak fishermen group, the Sinar Bahari group, and the Bungaya Pancing group. This assistance is called Mina Politan Business Development; this financial assistance is intended so that the Makassar coastal fishing community can increase their group's income and business to form the socio-economic resilience of the Makassar City coastal community (Sakharina, Daud, Hasrul, Kadarudin, & Assidiq, 2020; Nain, 2022).

Another policy carried out by the City Government of Makassar in dealing with climate change is implementing the socialization of related regulations and climate change issues in society. The Communication and Informatics Office implements this program. The form of socialization was carried out, namely forming Focus Group Discussions (FGD), published in billboard advertisements; socialization was carried out by RT and RW heads from house to house residents. The socialization content is about community adaptation to natural disasters, then an explanation of material sourced from the 2020 Climate Change Adaptation and Disaster Risk Reduction Regional Action Plan (RAD API-PRB) document. Socialization activities in increasing community mitigation of the threat of natural disasters due to climate change must be done to minimize victims of floods, landslides, fires, earthquakes, and other natural disasters (Mustafa, Farida, & Yusriadi, 2020). Reducing the various policy strategies above, the government of Makassar City is also implementing policies from ecological, social, and technical dimensions related to climate change.

From the various program approaches taken by the Makassar City government in overcoming climate change. There are 3 main policies which are priority aspects, these three aspects are from the ecological, social, and technical dimensions. Research studies show that in the 1960-2008 era, Makassar City only experienced flood disasters around 20 times, resulting in 5,763 victims being affected. In 2019-2020, Makassar City experienced flooding 24 times over two years, resulting in 8,328 victims being affected, there were also 10 public facilities damaged (Sabara, Afiah, & Umam, 2022; Arifah, Salman, & Demmallino, 2021). There were 21 strong wind incidents in the 2012-2013 period which killed 180 people and damaged 384 houses (Malik et al., 2021). With this phenomenon, the city government is implementing priority policies from 3 dimensions to minimize natural disasters arising from climate change. This also becomes a benchmark in assessing the success of Makassar City government policies both before the policy is implemented and after the policy is implemented.

Implementation of Climate Change Policy Ecological, Social, and Technical Dimensions

The government is carrying out a climate change policy in Makassar City. Apart from being handled with a climate change impact approach that involves relevant agencies, it is also carried out based on the policy dimension. Handling with an approach to ecological, social, and technical policy dimensions is urgently needed so that climate change can be optimally decomposed. This is evidenced by various priority programs adjusted to developing policy directions based on the segmentation of policy dimensions. This handling pattern often becomes a practical model because the situation and direction of development can easily measure climate change policies (Apraku, Morton, & Apraku Gyampoh, 2021). To find out the implementation of climate change policies on ecological, social, and technical dimensions in Makassar City, as shown in the table below.

Table 2. Three Dimensions of Climate Change Policy in Makassar City

Policy Dimensions	Priority Program	Policy Direction Development
1. Ecological Policy Dimensions	Formation of Strategy and Cultivation area	1. Preservation and improvement of the function and carrying capacity of the coastal environment through reclamation and revitalization of coastal areas; 2. Preserving and increasing the functions and carrying capacity of the environment to maintain and enhance the balance of ecosystems and the function of protecting areas, preserving biodiversity, natural uniqueness, and the heritage of various local cultures; 3. Development and improvement of regional functions in developing the economy of urban areas that are productive, efficient, and able to compete in regional, national, and international economies; 4. Optimum and sustainable utilization of natural resources and development of science and technology (science and technology) to improve people's welfare; 5. Preserving and increasing the diversity of local social and cultural qualities 6. Development of underdeveloped areas to reduce socio-economic and cultural disparities between regions.
2. Social Policy Dimensions	Public Capacity Building and Integrated Social Services	1. Encouraging the development of relatively inexpensive, safe, and comfortable settlements. 2. Encouraging the acceleration of integrated social services for urban communities. 3. Ensure the fulfillment of citizens' basic needs with decent living conditions. 4. Build social spaces that are pro-disabilities, friendly, child-friendly, beautiful green environments, and far from pollution. 5. Increase government institutional capacity in climate change preparedness by involving Non-Governmental Organizations (NGOs) and other community organizations.
3. Technical Policy Dimensions	Development of Urban Spatial Structure and Patterns	1. Increasing access to urban services and centers of economic growth in land, sea, and small island areas equitably and hierarchically; 2. Increasing the degree of quality and coverage of telecommunications infrastructure network

	services, water resources, energy, and other urban infrastructure in an integrated and fair manner throughout the City; 3. The spread of more thematic and integrated urban activity centers; 4. Development of a global standard city infrastructure network, including flyovers, toll roads, and urban rail networks; 5. Development of an integrated water transportation network system and land transportation network system 6. Development of an integrated and hierarchical intermodal transportation system.

Source: Badan Penanggulangan Bencana Daerah Kota Makassar, 2020

Table 2 shows that the Makassar City government handles climate policy issues by focusing on three critical policies: ecological, social, and technical. In the policy of the ecological dimension itself, the Makassar City government's priority program is establishing strategic areas and cultivation. This priority program then has six development policy directions to manage the urban environment, such as preserving and increasing the function and revitalization of the coastal environment, developing and preserving biodiversity, unique natural features, and local and regional cultural heritage. Economic development through marine products, optimizing science and community welfare, preserving local society and culture, and developing underdeveloped urban areas.

There is also a climate change policy program that has been quite successfully implemented in several large cities which has similarities with the environmental planning process as carried out by the Makassar City Government, in the environmental dimension as an effort to minimize problems with the environmental pollution in the city area, as a result, coastal reclamation processes and factory waste pollution in urban areas (Novita, 2021; Sunarya, 2024). Several environmental management programs in the face of climate change in several cities in Indonesia, such as; carrying out greening in coastal areas, identifying and mapping coastal vulnerable areas, revitalizing coastal areas, and limiting the operations of industrial companies in city centers which have the potential to hurt changes in the air situation in urban areas (Rahayu et al., 2019; Rudiany & Rica, 2023). Environmental issues are a priority aspect that the Makassar City government responds to in anticipating climate change.

The Makassar City government is making environmental problems a priority for handling because the urban environmental situation is very complicated to manage and very vulnerable to the effects of climate change (Meharg, 2023). Damage to the urban environment also has a reasonably high impact and can be fatal for the continuity of activities in urban areas (Didiharyono et al., 2022). In addition, the United Nations, in its report, also stated that in modern and developing countries today, the urban environment is an area that is very vulnerable to the effects of climate change. This is because urban areas need more levels of mitigation and adaptation (UNEP Intergovernmental Panel On Climate Change, 2023). In addition to focusing on handling policies with an ecological dimension, the Makassar City Government also focuses on handling the social dimension.

For handling policies on the social dimension, the government of Makassar City provides priority programs, namely community capacity building and integrated social services. This priority program has five development policy directions to support the implementation of programs that are entirely directed at public services, including encouraging the development of housing that is relatively inexpensive, safe, and comfortable, encouraging the acceleration of integrated social services for urban communities, ensuring the fulfillment of citizens' basic needs by decent living conditions, Building social spaces that are pro-disability, environmentally friendly and child-friendly, as well as beautiful green environments and far from pollution, and Increasing government institutional capacity in climate change preparedness by involving Non-Governmental Organizations (NGOs) and other community organizations.

Makassar City Government has prioritized community capacity-building programs and integrated social services as policies to address the social dimension of climate change. This is a form of accommodation and facilitation of the increasing number of gray hair in the Makassar City area. Building relationships between communities to create friendship encourages preparedness and self-adaptation when disasters occur due to climate change conditions. With integrated and integrated public services in all sectors, the community will be served quickly and obtain information disseminated by the government (Satterthwaite et al., 2020; Liu, 2021). Apart from the social dimension, the government of Makassar City also handles other policies. There is also a technical dimension to the policy.

Handling policies on the technical dimension, the City Government of Makassar initiated a priority program, namely the development of urban spatial structures and patterns. This priority program has six development policy directions, including increasing access to urban services and centers of economic growth in land and sea areas and small islands evenly and hierarchically and improving the degree of quality and coverage of telecommunications infrastructure network services, water resources, energy, and other urban infrastructure in an integrated and equitable manner throughout the City,

Socialization of urban activity centers that are more thematic and integrated, Development of cities with global standard infrastructure networks including flyovers, toll roads, and urban rail networks, Development of an integrated water transportation network system and land transportation network system, and Development of an integrated land transportation network system between integrated and tiered transportation modes.

The policy on the technical dimension focuses on developing integrated urban spatial patterns and public facilities as a solution step for the government of Makassar City. The development of integrated urban transportation modes is likely to influence city people's interest in using these services in their daily activities, thereby reducing the operation of motorbikes and cars. The impact of the reduced number of private vehicles operating can also reduce air pollution in cities (Agaton, Collera, & Guno, 2020; Tang, McNabola, & Misstear, 2020). In addition, integrated public transportation facilities can reduce congestion and vehicle density in the Makassar City area, minimize environmental pollution, and normalize city air conditions so that people can breathe fresh air (Renne, 2016; Ambarwati, Verhaeghe, van Arem, & Pel, 2016; Rachman, Nooraeni, & Yuliana, 2021).

CONCLUSION

This study found that adverse situations, including ecological, social, and technical crises due to climate change, are very threatening. This tends to be influenced by adaptive and solutive policies. The implementation of various policies in Makassar City is proof of this. Makassar City Government has dealt with climate change issues with various policies. The policy program focuses on the latest approaches to the impact of climate change on cities related to increasing temperatures, increasing rainfall, rising sea levels, the socio-economic resilience of communities, and strengthening regulations. This policy was carried out to restore the urban situation due to the threat of climate change. In addition, the City Government of Makassar has also initiated climate change management on the ecological aspect of forming regional cultural strategies, the social aspect of increasing community capacity and integrated services, and the technical aspects of developing the structure of urban spatial patterns.

The implications of this policy have an impact on adding urban green space, availability of clean water during the dry season, creating integrated and environmentally friendly public services and facilities, establishing community and government solidarity regarding preparedness and self-adaptation, encouraging people to use public transportation modes in their activities, reducing urban air pollution pressure, as well as creating normalization and fresh air circulation in urban areas. This research's contribution can be considered an alternative policy in the future. This can also encourage the commencement of the expected policies, particularly climate change policies on ecological, social, and technical

aspects. The implications of this research are also beneficial for further studies, especially studies that study relevant literature. The limitation of this research lies in the observations caused by climate change, which is so dynamic at any time.

REFERENCES

Agaton, C. B., Collera, A. A., & Guno, C. S. (2020). Socio-economic and environmental analyses of sustainable public transport in the Philippines. *Sustainability (Switzerland)*, *12*(11), 1–14. https://doi.org/10.3390/su12114720

Al Madhoun, W., Gul, F. A., Ros, F. C., Isiyaka, H. A., Mallongi, A., & Rasyid, A. (2021). Spatial assessment on health impact of atmospheric pollution in Makassar, Indonesia. *E3S Web of Conferences*, *331*(0), 1–9. https://doi.org/10.1051/e3sconf/202133102019

Ambarwati, L., Verhaeghe, R., van Arem, B., & Pel, A. J. (2016). The influence of integrated space-transport development strategies on air pollution in urban areas. *Transportation Research Part D: Transport and Environment*, *44*, 134–146. https://doi.org/10.1016/j.trd.2016.02.015

Anirwan, & Qamal. (2023). Collective Action and Climate Change Adaptation in Makassar. *Journal of Government and Politics (JGOP)*, *5*(1), 19–31. https://doi.org/https://doi.org/10.31764/jgop.v5i1.13376

Antriyandarti, E., Nawang, D., Werdining, A., & Samputra, L. (2024). The dual role of women in food security and agriculture in responding to climate change/ : Empirical evidence from Rural Java. *Environmental Challenges*, *14*(September 2023), 100852. https://doi.org/10.1016/j.envc.2024.100852

Apraku, A., Morton, J. F., & Apraku Gyampoh, B. (2021). Climate change and small-scale agriculture in Africa: Does indigenous knowledge matter? Insights from Kenya and South Africa. *Scientific African*, *12*, e00821. https://doi.org/10.1016/j.sciaf.2021.e00821

Arifah, Salman, D., & Demmallino, E. (2021). Farmer's Perception of Climate Change and the Impacts on Livelihood in South Sulawesi. *IOP Conf. Series: Earth and Environmental Science*, *810*(012010). https://doi.org/10.1088/1755-1315/810/1/012010

Aswi, A., Cramb, S., Duncan, E., Hu, W., White, G., & Mengersen, K. (2020). Climate variability and dengue fever in Makassar, Indonesia: Bayesian spatio-temporal modelling. *Spatial and Spatio-Temporal Epidemiology*, *33*(0), 1–8. https://doi.org/10.1016/j.sste.2020.100335

Auni, A. H., Bachtiar, B., Paembonan, S. A., & Larekeng, S. H. (2020). Growth analysis of mangrove (Rhizophora apiculata bl) propagule toward differences in types of water and planting media at Makassar mangrove center. *IOP Conference Series: Earth and Environmental Science*, *575*(1). https://doi.org/10.1088/1755-1315/575/1/012137

Badan Penanggulangan Bencana Daerah Kota Makassar. (2020). *Mitigasi dan Adaptasi RAD (Rencana Aksi Daerah) Perubahan Iklim Kota Makassar* (Vol. 15). Makassar. Retrieved from https://www.bnpb.go.id/sistem-penanggulangan-bencana

Cappelli, F., Costantini, V., & Consoli, D. (2021). The trap of climate change-induced "natural" disasters and inequality. *Global Environmental Change*, *70*(July), 102329. https://doi.org/10.1016/j.gloenvcha.2021.102329

Damayanti, E., Sipato, W. D., Barkey, R. A., & Demallino, E. B. (2021). Strategi Adaptasi Dan Pengendalian Dampak Perubahan Iklim Kota Makassar. *Jurnal Sosio Sains*, *7*(1), 1–13. https://doi.org/https://doi.org/10.37541/sosiosains.v7i1

Deng, S. Z., Jalaludin, B. B., Antó, J. M., Hess, J. J., & Huang, C. R. (2020). Climate change, air pollution, and allergic respiratory diseases: A call to action for health professionals. *Chinese Medical Journal*, *133*(13), 1552–1560. https://doi.org/10.1097/CM9.0000000000000861

DeRieux, A. C. (2022). *Transformer Networks for Smart Cities: Framework and Application to Makassar Smart Garden Alleys* (Virginia Polytechnic Institute). Virginia Polytechnic Institute. Retrieved from http://hdl.handle.net/10919/111788

Didiharyono, Giarno, G., & Sapareng, S. (2022). Changes in Rainfall Intensity, Rising Air Temperature, Wind Speed, and Its Relationship with Land Use in Makassar City. *JST (Jurnal Sains Dan Teknologi)*, *11*(2), 441–450. https://doi.org/10.23887/jstundiksha.v11i2.45604

Estiningtyas, W., Mulyani, A., Sumaryanto, & Kartiwa, B. (2021). Assessing the vulnerability of food farming system to support climate change adaptation: A case study in Java, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *648*(012093), 18–29. https://doi.org/10.1088/1755-1315/648/1/012093

Fraser, T. (2021). Japanese social capital and social vulnerability indices: Measuring drivers of community resilience 2000–2017. *International Journal of Disaster Risk Reduction*, *52*, 101965. https://doi.org/10.1016/j.ijdrr.2020.101965

French, M. A., Fiona Barker, S., Taruc, R. R., Ansariadi, A., Duffy, G. A., Saifuddaolah, M., … Leder, K. (2021). A planetary health model for reducing exposure to faecal contamination in urban informal settlements: Baseline findings from Makassar, Indonesia. *Environment International*, *155*(0), 1–12. https://doi.org/10.1016/j.envint.2021.106679

Gouel, C., & Laborde, D. (2021). The crucial role of domestic and international market-mediated adaptation to climate change. *Journal of Environmental Economics and Management*, *106*(106), 102408. https://doi.org/10.1016/j.jeem.2020.102408

Huda, M., Aziz, M., & Tokiatsu, K. (2019). The future of electric vehicles to grid integration in Indonesia. *Energy Procedia*, *158*(2018), 4592–4597. https://doi.org/10.1016/j.egypro.2019.01.749

Joshi, M., Goraya, H., Joshi, A., & Bartter, T. (2020). Climate change and respiratory diseases: A 2020 perspective. *Current Opinion in Pulmonary Medicine*, *26*(2), 119–127. https://doi.org/10.1097/MCP.0000000000000656

Karim, A., Desi, N., & Ahmad, A. (2022). Regional Public Water Company Business Plan for Sustainable Economic in Makassar City, Indonesia. *Specialusis Ugdymas / Special Education*, *2022*(43), 1. Retrieved from http://www.sumc.lt/index.php/se/article/view/1815

Kristanto, G. A., & Koven, W. (2019). Estimating greenhouse gas emissions from municipal solid waste management in Depok, Indonesia. *City and Environment Interactions*, *4*(2019), 100027. https://doi.org/10.1016/j.cacint.2020.100027

Liu, H. K. (2021). Crowdsourcing: Citizens as coproducers of public services. *Policy and Internet*, *13*(2), 315–331. https://doi.org/10.1002/poi3.249

Makbul, R., Ruslan, A. N., Erdawaty, & Setiawan, A. M. (2023). Infiltration rate analysis for determination of aqua pond locations as a solution for flooding in Makassar city. In A. Arifin, Gunawan, D. Adanta, B. Oemar, Zurkarnain, & A. Saputra (Eds.), *AIP Conference Proceedings* (p. 2689). Palembang Indonesia: AIP Publishing. https://doi.org/https://doi.org/10.1063/5.0119258

Malik, I., Abdillah, Rusnaedy, Z., & Khaerah, N. (2021). Coastal Women's Resilience Strategy against Climate Change Vulnerability in Makassar, Indonesia. *E3S Web of Conferences*, *277*(0), 1–8. https://doi.org/10.1051/e3sconf/202127701003

Massiseng, A. N. A., Tuwo, A., Fachry, M. E., & Bahar, A. (2020). A dynamic simulation of mangrove ecotourism management at the Lantebung of Makassar City. *IOP Conference Series: Earth and Environmental Science*, *584*(1). https://doi.org/10.1088/1755-1315/584/1/012039

McDonough, L. K., Santos, I. R., Andersen, M. S., O'Carroll, D. M., Rutlidge, H., Meredith, K., … Baker, A. (2020). Changes in global groundwater organic carbon driven by climate change and urbanization. *Nature Communications*, *11*(1), 1–10. https://doi.org/10.1038/s41467-020-14946-1

Meharg, S. (2023). Sustainable Urban Development in Makassar, Indonesia. *Catalysing Change Agents*, 181–201. Australia: Springer, Cham. https://doi.org/https://doi.org/10.1007/978-3-031-36433-4_8

Mustafa, D., Farida, U., & Yusriadi, Y. (2020). The effectiveness of public services through E-government in Makassar City. *International Journal of Scientific and Technology Research*, *9*(1), 1176–1178. https://doi.org/10.1080/01900692

Mustamin, M. R., Maricar, F., & Hatta, M. P. (2023). Effects of Nipa-Nipa Regulation Pond on Flood Control of Tallo River. *IOP Conference Series: Earth and Environmental Science*, *1134*(1), 012002. https://doi.org/10.1088/1755-1315/1134/1/012002

Nain, U. (2022). The Role of Government in The Development of Coastal Community in Makassar City. *Sosiohumaniora*, *24*(3), 392. https://doi.org/10.24198/sosiohumaniora.v24i3.35845

Novita, A. A. (2021). Environmental Governance and Climate Change Adaptation in Indonesia. *Jurnal Ilmiah Administrasi Publik (JIAP)*, *7*(1), 46–55. https://doi.org/https://doi.org/10.21776/ub.jiap.2021.007.01.6

Nur, K. W. (2020). Alley activation: Genius loci to construct a resilient city. *Journal of Architecture and Urbanism*, *44*(1), 63–68. https://doi.org/10.3846/jau.2020.11015

Pratiwi, A., Lee, G., & Suzuki, A. (2021). Company–community partnership and climate change adaptation practices: The case of smallholders coffee farmers in lampung, indonesia. In D. Riyanti, J. Jupesta, & E. Aldrian (Eds.), *Springer Climate*. Springer International Publishing. https://doi.org/10.1007/978-3-030-55536-8_5

Rachman, F. F., Nooraeni, R., & Yuliana, L. (2021). Public Opinion of Transportation integrated (Jak Lingko), in DKI Jakarta, Indonesia. *Procedia Computer Science*, *179*(2020), 696–703. https://doi.org/10.1016/j.procs.2021.01.057

Rahayu, H. P., Haigh, R., Amaratunga, D., Kombaitan, B., Khoirunnisa, D., & Pradana, V. (2019). A micro scale study of climate change adaptation and disaster risk reduction in coastal urban strategic planning for the Jakarta. *The Current Issue and Full Text Archive of This Journal Is Available on Emerald Insight*, *11*(1), 119–133. https://doi.org/10.1108/IJDRBE-10-2019-0073

Ravikumar, A., Larson, A. M., Myers, R., & Trench, T. (2018). Inter-sectoral and multilevel coordination alone do not reduce deforestation and advance environmental justice: Why bold contestation works when collaboration fails. *Environment and Planning C: Politics and Space*, *36*(8), 1437–1457. https://doi.org/10.1177/2399654418794025

Renne, J. L. (2016). *Transit Oriented Development* (1st ed.; C. Curtis, Ed.). London: Routledge. https://doi.org/https://doi.org/10.4324/9781315550008

Rudiany, N. P., & Rica, C. (2023). Greening" the National Growth: How Global Green Growth Institute (GGGI) Collaborates with Indonesia in 2014-2020. *Insignia Journal of International Relations*, *10*(2), 199–213. https://doi.org/https://doi.org/10.20884/1.ins.2023.10.2.9707

Rusnaedy, Z., Haris, A., Congge, U., & Prianto, A. L. (2021). Adaptive Climate Change Governance in Makassar, Indonesia. *Journal of Governance*, *6*(2). https://doi.org/10.31506/jog.v6i2.12384

Sabara, Z., Afiah, I. N., & Umam, R. (2022). Integration of Green Ergonomics in Robust Decision Making Approach in Water Resources Management in Makassar City. *International Journal of Technology*, *13*(September 2021), 264–273. https://doi.org/10.14716/ijtech.v13i2.5113

Sakharina, I. K., Daud, A. A., Hasrul, M., Kadarudin, & Assidiq, H. (2020). Work and lives in Makassar coastal community: Assessing the local government policy. *Hasanuddin Law Review*, *6*(1), 89–99. https://doi.org/10.20956/halrev.v6i1.2281

Sari, K. I., Budimawan, & Selamat, M. B. (2023). Sustainability Study of Mangrove Area Management in the North Coast of Makassar City (Case Study: Lantebung and Untia). *IOP Conference Series: Earth and Environmental Science*, *1134*(1). https://doi.org/10.1088/1755-1315/1134/1/012050

Satterthwaite, D., Archer, D., Colenbrander, S., Dodman, D., Hardoy, J., Mitlin, D., & Patel, S. (2020). Building Resilience to Climate Change in Informal Settlements. *One Earth*, *2*(2), 143–156. https://doi.org/10.1016/j.oneear.2020.02.002

Satyawan, I. A., Wibisono, B. I., & Binangun, P. S. (2021). The impact of climate change in tourism sector in Java Island: a literature review To. *IOP Conference Series: Earth and Environmental Science PAPER*, *724*(012111), 1–8. https://doi.org/10.1088/1755-1315/724/1/012111

Setiowati, R., Hasibuan, H. S., & Koestoer, R. H. (2018a). Green open space masterplan at Jakarta Capital City, Indonesia for climate change mitigation. *IOP Conference Series: Earth and Environmental Science*, *200*(1), 0. https://doi.org/10.1088/1755-1315/200/1/012042

Setiowati, R., Hasibuan, H. S., & Koestoer, R. H. (2018b). Green open space masterplan at Jakarta Capital City, Indonesia for climate change mitigation. *IOP Conference Series: Earth and Environmental Science*, *200*(1), 1–9. https://doi.org/10.1088/1755-1315/200/1/012042

Sipato, W. D., Darlin, E. D., Mustari, K., & Kaimuddin. (2021). Policy analysis of the adaptation of Makassar city's government for climate change and global warming.

IOP Conference Series: Earth and Environmental Science, *807*(2), 1–16. https://doi.org/10.1088/1755-1315/807/2/022037

Suhardi, S. (2021). Analysis of the Center Point of Indonesia (CPI) Reclamation Policy of Makassar City in the Environmental Political Perspective. *International Journal of Multicultural and Multireligious Understanding*, *8*(10), 12. https://doi.org/10.18415/ijmmu.v8i10.2985

Sunarya, A. (2024). Climate and Environmental Policy in Indonesia/ : Challenges and Opportunities. *Jurnal Ilmu Sosial Dan Humaniora Volume*, *7*(1), 195–206. https://doi.org/https://doi.org/10.37329/ganaya.v7i1.3030

Suraharta, I. M., Djajasinga, N. D., Wicaksono, M. B. A., Akbar, R. A., Priono, N. J., Yusuf, M. A., & Gugat, R. M. D. (2022). Electric Vehicle Policy: The Main Pillar of Indonesia's Future Energy Security. *International Journal of Science and Society*, *4*(4), 142–156.

Tang, J., McNabola, A., & Misstear, B. (2020). The potential impacts of different traffic management strategies on air pollution and public health for a more sustainable city: A modelling case study from Dublin, Ireland. *Sustainable Cities and Society*, *60*, 102229. https://doi.org/10.1016/j.scs.2020.102229

UNEP Intergovernmental Panel On Climate Change. (2023). *Climate Change 2023: Synthesis Report | UNEP - UN Environment Programme*. United Nations. Retrieved from https://www.unep.org/resources/report/climate-change-2023-synthesis-report

Unsworth, R. K. F., Ambo-Rappe, R., Jones, B. L., La Nafie, Y. A., Irawan, A., Hernawan, U. E., … Cullen-Unsworth, L. C. (2018). Indonesia's globally significant seagrass meadows are under widespread threat. *Science of the Total Environment*, *634*, 279–286. https://doi.org/10.1016/j.scitotenv.2018.03.315

Varvastian, S., & Kalunga, F. (2020). Transnational Corporate Liability for Environmental Damage and Climate Change: Reassessing Access to Justice after Vedanta v. Lungowe. *Transnational Environmental Law*, *9*(2), 323–345. https://doi.org/10.1017/S2047102520000138

Yahya, M., Ananto Yudono, Farouk Maricar, A. A. (2020). The Potential for Rainwater Harvesting in Makassar Coastal Area , South Sulawesi , Indonesia. *International Journal of Advanced Research in Engineering and Technology (IJARET)*, *11*(10), 1414–1421. https://doi.org/10.34218/IJARET.11.10.2020.135

Yanti, C. W. B., Ala, A., Dungga, N. E., & Arif, S. (2021). Existence of paddy fields in Makassar city as a part of green open space: Ecological perspective on urban farming. *IOP Conference Series: Earth and Environmental Science*, *807*(2), 1–7. https://doi.org/10.1088/1755-1315/807/2/022078

Yoseph-Paulus, R., & Hindmarsh, R. (2018). Addressing inadequacies of sectoral coordination and local capacity building in Indonesia for effective climate change adaptation. *Climate and Development*, *10*(1), 35–48. https://doi.org/10.1080/17565529.2016.1184609

Yuniza, M. E., Pratama, I. W. B. E., & Ramadhaniati, R. C. (2021). Indonesia's Incentive Policies on Electric Vehicles: The Questionable Effort from the Government Mailinda. *International Journal of Energy Economics and Policy*, *11*(5), 434–440. https://doi.org/10.32479/ijeep.11453.This

Zakaria, R., Ramli, M. I., Hustim, M., Alimuddin, H., & Pratiwi, A. (2022). Analysis of NO2gas concentration from the transportation sector through direct measurement and the Caline 4 dispersion program on the Makassar City Toll Road. *IOP Conference Series: Earth and Environmental Science*, *1117*(1), 1–8. https://doi.org/10.1088/1755-1315/1117/1/012052