



CLIMATE
RESILIENT
AND INCLUSIVE
CITIES



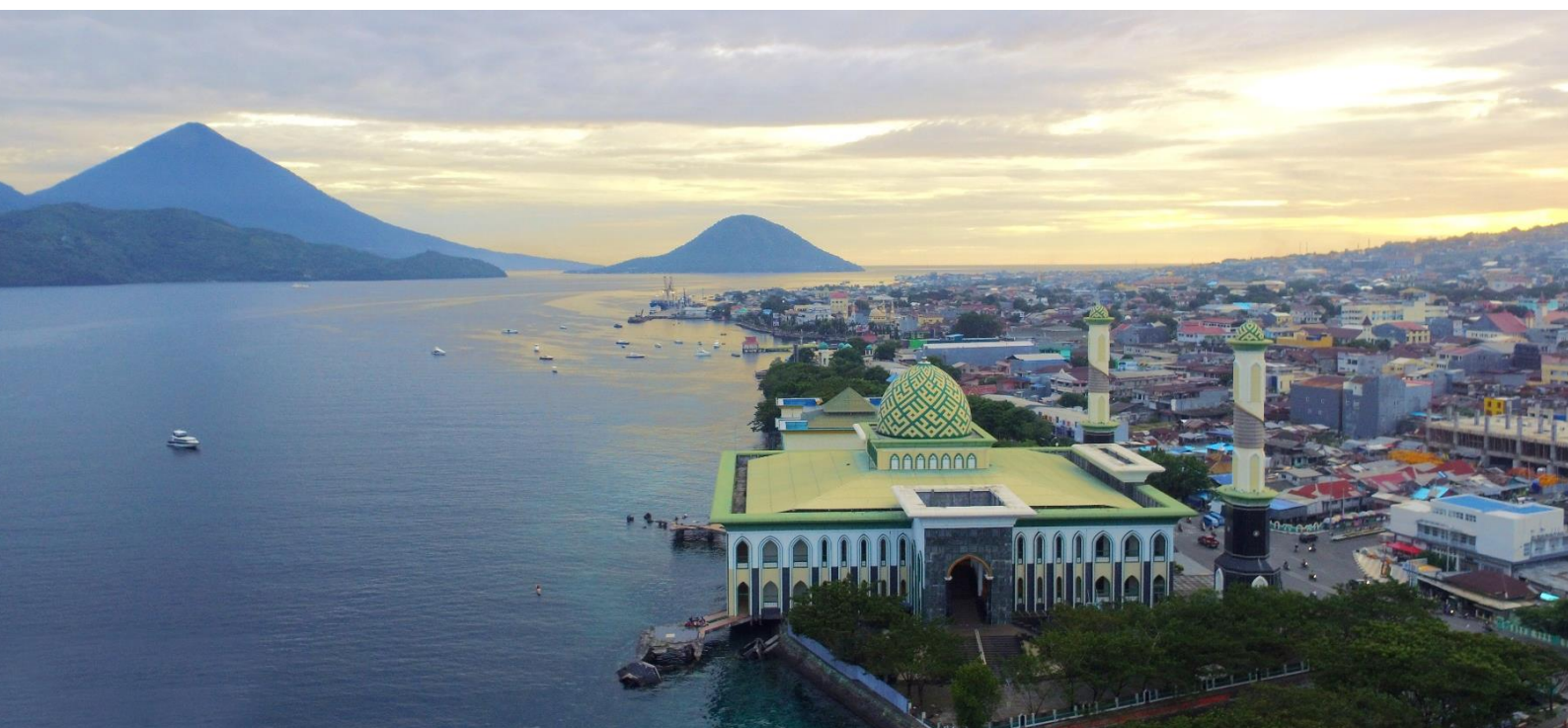
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URBAN ANALYSIS REPORT 2020

01

TERNATE

Harya S. Dillon
Adinda Alnur Angelica
Achmad Firas Khudi



FOREWORD



Addressing the threat of climate change remains a top priority for the European Union (EU). The European Green Deal is a response to these challenges; it aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy with zero net emissions of greenhouse gases by 2050.

Through the Climate Resilient and Inclusive Cities (CRIC) project, the EU and Indonesia are working together to help cities build a resilient and inclusive future. We do so by building partnerships between governments, businesses, local communities and research institutes in Europe, South Asia and Southeast Asia.

Clearly, there are hurdles along the way, especially in the midst of the COVID-19 pandemic. However, our response to this pandemic needs to be a sustainable one, addressing the challenges of climate change as well as economic recovery. Just last month, in Sukabumi City of West Java Province, a flash flood cost lives and forced hundreds of citizens to leave their houses. According to the Indonesian National Disaster Management Agency, Indonesia is about to experience more hydrometeorological disasters due to climate change. The CRIC Urban Analysis Report is a timely reminder that cities cannot delay their sustainable transition.

This Urban Analysis Report for ten Indonesian pilot cities under the CRIC project offers a comprehensive overview of city characteristics, policy gaps and climate-related policies in the cities of Pangkalpinang, Pekanbaru, Bandar Lampung, Cirebon, Banjarmasin, Samarinda, Mataram, Kupang, Gorontalo and Ternate.

The report provides empirical evidence to help cities develop policies and tools to strengthen climate change-affected sectors. I am happy to note the consultations among a wide range of stakeholders including government officials, academicians, civil society, professional practitioners, NGOs, and the private sector, ensuring that the proposals are inclusive.

We look forward to seeing how the cities will take up the given recommendations by transforming them into local climate-proof policies and programmes and to further working together to build climate resilient and inclusive cities.

Jakarta, October 2020

Vincent Picket

EU Ambassador to Indonesia and Brunei Darussalam

Foreword



Mayor of Ternate

Ternate, as an island city, is aware of its climate risks and the importance of strengthening community resilience to climate-induced disasters. So, we're delighted to be part of the Climate Resilient and Inclusive Cities (CRIC) Project as one of its ten pilot cities.

Ternate Urban Analysis Report is a strategic document produced as part of the collaboration between Ternate City Government and CRIC Project. Different stakeholder groups in Ternate – government, the community and civil society organisations- have been involved during the

study, since data collection process, interviews and public consultation meeting.

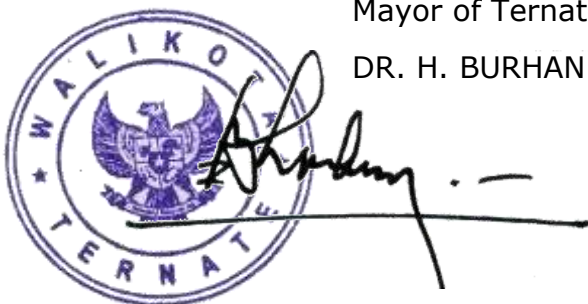
This report reflects some challenges in Ternate when it comes to preparedness to climate-induced disasters, access to water and sanitation, waste management and coastal erosion. It also offers a set of policy and tool recommendations to be adopted in Ternate to tackle these challenges.

This report represents a significant step for us to pave sustainable city for our communities, through integrated and comprehensive climate change mitigation and adaptation actions.

Thank you.

Mayor of Ternate

DR. H. BURHAN ABDURRAHMAN SH, MM





Climate Change is an issue of humanity, it is not merely a threat to the environment only. It is one of most visible humanitarian crises of the century. On very many occasions, we have seen how climate-induced disasters disrupted local economy, food system, basic services and left vulnerable groups more powerless. As an association connecting more than 10,000 cities and local governments in the Asia-Pacific region, UCLG ASPAC is responsible of supporting cities to be climate-resilient, something that we take seriously.

The cost of inaction now is huge. It is therefore urgent for cities to act and find solutions that should be based on data and scientific rigour enabling evidence-based decisions that subsequently reduce the impact of climate change. I emphasise, continual and periodic assessment of risks and change in attributes of cities are critical in enhancing resilience. In light of this, I commend the Climate Resilient and Inclusive Cities (CRIC) team and our urban experts for their hard work to publish this Urban Analysis Report. Great thanks to all the pilot cities of CRIC for their support in producing this Report. It presents a comprehensive outlook on climate risks, programmes and policies at a city level and provides recommendations and solutions to tackle climate change.

This report also underlines the importance of coordination that transcends administrative boundary as climate has no border! It is something that UCLG ASPAC can contribute through the CRIC Programme, by connecting the dots between cities in Asia and the Pacific and beyond within the framework of sub-national and national governments for vertical integration. We intend to bring cities on the center stage of “Blue Ocean” and “Blue Sky” agenda through action-based proposals and approaches on circular economy, air pollutions and cross-cutting issues. And we are committed to ensuring that climate change best practices can be up-scaled and replicated for greater multiplier impact.

I look forward to seeing how the plans are put into actions to create climate resilient and inclusive cities. Our future will depend on how cities act today. Every concrete step on climate action we make now will bring closer our dream for inclusive, prosperous and sustainable cities and communities.

Dr. Bernadia Irawati Tjandradewi

Secretary General of UCLG ASPAC



As President of Pilot4Dev, I have had the honor to be directly involved in the Climate Resilient and Inclusive Cities Project from its very inception. It was with great pleasure that I attended the CRIC Kick-off event back in January 2020 which allowed us to meet up with our Indonesian partners in order to prepare and launch the project. A great added value from this event was the possibility to meet up with the mayors of the cities piloting the implementation of the project. Today, there is a myriad of cities in need of support in terms of urban environment and climate change resilience.

Pooling the expertise and knowledge of EU partners including ACR+, Pilot4DEV, University Gustave Eiffel, ECOLISE and Asian partners UCL ASPAG and AILSG, this very ambitious five years project aims to establish a long lasting and unique cooperation. It is carried out through a triangular cooperation between cities and research centres in Europe, South Asia (India, Nepal, Bangladesh), and Southeast Asia (Indonesia, Malaysia, Philippines, Thailand). It aims to contribute to sustainable integrated urban development, good governance, and climate adaptation/mitigation through long lasting partnerships, and tools such as sustainable local action plans, early warning tools, air quality and waste management in consultation with experts' panels. The final beneficiaries include the local community of the cities/provinces, including women, marginalised sector, civil society and private sectors.

Now entering the 10th month of its implementation, this project has already proven to be a fruitful endeavor now implemented in 10 different cities in Indonesia. Among the chief results obtained so far, 10 urban analysis reports have been written and edited, and assess the current capacities of the different target cities. The project in itself has required the direct involvement of local authorities' officials, generating a real eagerness to make the cities more resilient and inclusive at the local level. The next steps of this project will involve the release of the Urban Analysis Reports along with policy briefs and recommendations adapted to the different pilot cities which have been involved in the project so far. This release will be completed by the creation of tools put together by the International Partners of the CRIC project, in order to equip local authorities and possibly tackle the urban and environmental challenges they face.

Due to high urban growth rates in countries such as Indonesia, Vietnam and the Philippines it is predicted that a significant share of the population of those countries will be living in cities in the next ten years. Cities in the South Asian and South East Asian regions are already impacted by climate change, and they could substantially benefit from long lasting solutions in terms of climate resilience and inclusiveness. The CRIC Project aims to inform and facilitate the equipment of local governments, cities, urban stakeholders working on climate resilience, mitigation and adaptation of those cities by pooling the best resources available and transferring and adapting as much knowledge as possible. Since urban areas host most of the vulnerable populations, as well as vital and social infrastructure, and local governments get increased pressure to develop services, infrastructure and employment, it is therefore of utmost urgency to make sure that we are all up for the challenge presented by climate change.

Isabelle Milbert, President of Pilot4Dev



The CRIC project represents for the Association of Cities and Regions for sustainable resource management (ACR+) - a network of local and regional authorities mainly based in the EU and the Mediterranean Area - a unique opportunity to cooperate and strengthen the role of cities to deliver on resiliency and inclusiveness.

ACR+'s core mission is to develop sustainable resource management initiatives involving local and regional authorities; in particular regarding waste management, one of the priorities raised by the urban analysis report. As such and for more than 25 years, we have been designing and implementing initiatives on circular economy, waste prevention, and waste management, building through this an extensive knowledge basis. Several ACR+ members have been already cooperating in the South-East region, whose experiences could be capitalized on and further developed through CRIC.

Conversely, this project provides a great learning opportunity for ACR+ members, to understand how local initiatives make a difference at global level. The present report contributes to effectively comprehend the local context, shedding the light on the key challenges and priorities. It shows that the exchange of methodologies to support decision-making processes rather than transfer solutions is crucial to successfully deliver sustainable projects.

However, more than a mere exchange of experiences, CRIC is a timely reminder that cooperation is key, at all levels and between countries. The EU cannot deliver alone the ambition of the European Green Deal for a climate-neutral, resource-efficient and circular economy. Activities like the ones developed within the CRIC project (trainings, stakeholder engagement, tools development, local action plans) can provide solid evidence to support bilateral and regional policy dialogue actions aimed at implementing the Green Deal and 2030 Agenda's objectives beyond the EU. Unfortunately, we cannot and should not forget the wider context in which the project is unfolding: the COVID-19 outbreak has been posing tremendous challenges at local level. With the hindsight we have so far, we see that local agenda based on resilient models contribute to better adapt and mitigate the negative impacts of the pandemic. Having this in mind, ACR+ has been supporting its members in overcoming the situation and is determined to also follow this path in CRIC.

Françoise Bonnet

ACR+ Secretary General

A handwritten signature in blue ink, appearing to read 'F. Bonnet', written in a cursive style.

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Irene Purman Cahyani



Asih Budiati



Maria Serenade



Putra Dwitama

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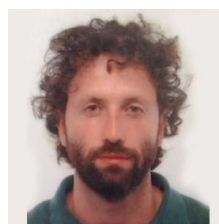
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GLOSSARY

Abbreviations are alphabetically arranged and used for both Bahasa to English translation.

Bahasa	English
<i>Badan Penanggulangan Bencana Daerah (BPBD)</i>	Regional Bureau of Disaster Management
<i>Buku Putih Sanitasi</i>	White Book of Sanitation
<i>Indeks Risiko Bencana</i>	Disaster Risk Index
<i>Kota Ternate</i>	Ternate City
<i>Kota Ternate dalam Angka</i>	Ternate Municipality in Figures
<i>Maluku Utara dalam Angka</i>	North Maluku in Figures
<i>Memorandum Program Sanitasi</i>	Memorandum of Sanitation Program
<i>Pemetaan Investasi</i>	Investment Mapping
<i>Pusat Kesehatan Masyarakat (Puskesmas)</i>	Public Health Center
<i>Rencana Aksi Daerah</i>	Local Action Plan
<i>Rencana Pembangunan Jangka Menengah (RPJM)</i> <i>RPJMD: RPJM Daerah</i> <i>RPJMN: RPJM Nasional</i>	Mid-Term Development Plan Local Mid-Term Development Plan (Provincial/Municipal) National Mid-Term Development Plan (Hierarchy is the same with RPJP, RTRW)
<i>Rencana Tata Ruang Wilayah (RTRW)</i>	Spatial Plan
<i>Strategi Sanitasi Kota</i>	City Sanitation Strategy
<i>Statistik Kesejahteraan Rakyat</i>	Welfare Statistics

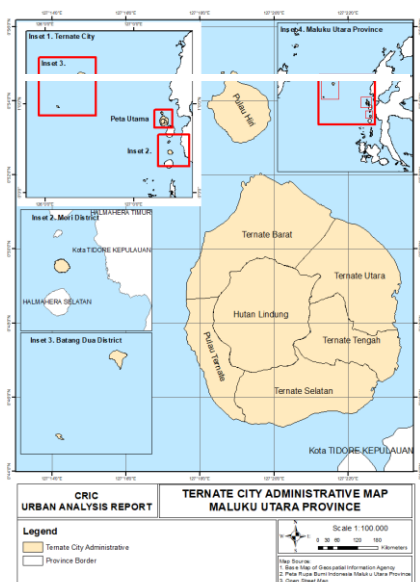
CHAPTER 1

Overview of Ternate

1.1 General Description

Ternate is the largest city in the province of North Maluku. It was the former capital of the province before the capital was relocated to Sofifi in 2010. The city is located at 0°–2° north latitude and 126° –128° east longitude. Maluku Sea surrounds the city on its West, North and South borders and Halmahera Strait on its Eastern border. Ternate is an island city, spanning eight islands, 3 of which (Maka, Mano, and Gurida Islands) are uninhabited. Ternate Island is the main island where most people live, followed by Hiri, Moti, Mayau, and Tifure. Its topography is hill dominant with volcanic and reef islands. Ternate is also a volcanic island.

Figure 1 - General View of Ternate



Authors, 2020

On Ternate, Hiri, and Moti islands, the commonly found type of soil is Rogusa whereas Mayau, Tifure, Maka, Mano, and Gurida islands have Rensika soil. Ternate is a major transportation and trading hub for the Province of North Maluku and East Indonesia. It has one airport, four bus stations, and three seaports. Sultan Babullah Airport is situated in North Ternate District. Gamalama, Bastiong, Sulamadaha, and Dufa-Dufa bus terminals operate and are complemented with the harbor's three specific functions, including on collection, feeder, and special terminal. According to the Medium-Term Regional Development Plan Year 2016-2021, Ternate is facing urbanization problems. The city focuses on strategies to accommodate urban growth, disaster management, infrastructure conditions -especially for isolated areas-, traffic congestion and environmental concerns, as well as smart city programs that have been identified as priority programs.

1.2 Topography and Climatology

Ternate Island's topography varies from its highest peak on Gamalama Mountain in the middle and descending to coastal areas. It is classified into three categories: Lowlands, between 0-500 meters above sea level (mamsl), are developable for housing, farming, fishing, trading, and government offices. The hills range between 500-700 mamsl is reserved for forest conservation and sustainable forestry. The highlands, 700 mamsl and higher, are strictly reserved for tropical forest nature reserves. All of the districts (*kecamatan*) are situated in the lowlands. Being located in a volcanic island poses a constraint to urban growth, and rising sea levels exacerbate these constraints. Temperature ranges from 24°C to 32°C, while humidity varies from 56% to 94%, averaging at 82% in 2018. Rainfall intensity was 348mm and raining days were 197.

1.3 Demographic Characteristic

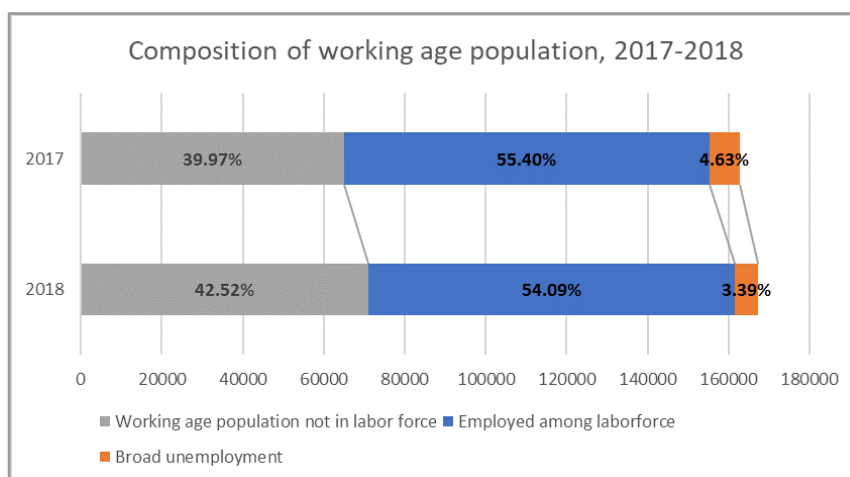
Ternate has a population of 233,208 in 2019, growing at a rate of 2.21% annually. The number of inhabitants has tended to increase in the past five years, as the figure below shows. Meanwhile, the districts in Ternate have varying densities, also shown in the table below. The districts with the most important populations are also the ones most dense: Ternate Selatan, Ternate Tengah, and Ternate Utara. The most populated district is Ternate Selatan. However, in terms of density, Ternate Tengah is the most densely populated.

Table 1 - Population Density

No.	District	Number of Population	% of Ternate City Population	Density (km ²)
1	Pulau Ternate	8,720	3.82%	501
2	Moti	5,404	2.37%	218
3	Pulau Batang Dua	3,055	1.34%	105
4	Pulau Hiri	3,359	1.47%	502
5	Ternate Barat	9,326	4.09%	275
6	Ternate Selatan	78,300	34.33%	3,872
7	Ternate Tengah	63,960	28.04%	4,824
8	Ternate Utara	55,981	24.54%	4,022

Ternate Municipality in Figures, 2019.

Figure 2 - Working Age Population 2017-2018



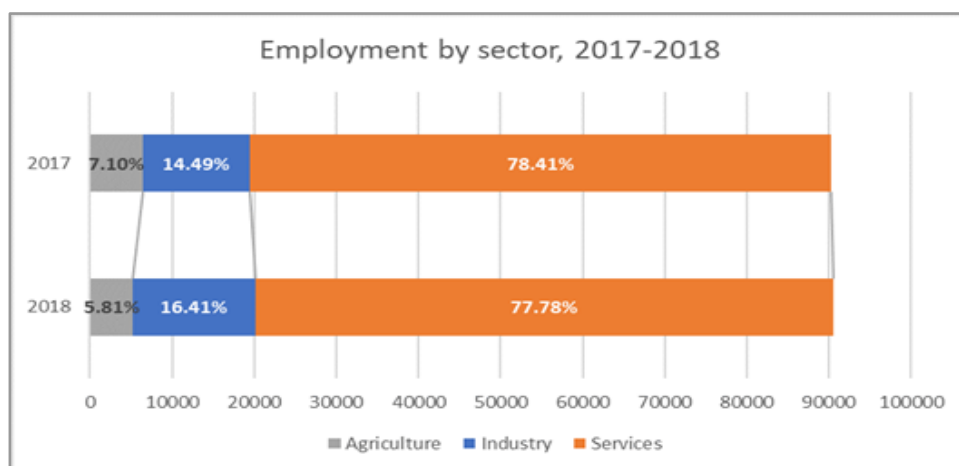
Authors, 2020

The core and overall unemployment rates declined between 2017-2018. The overall unemployment rate fell from a higher level, from 7.71% to 5.91%. However, the core unemployment decreased from 6.36% to 5.12%. The core unemployment rate excluded unemployed people who are available to work but not seeking work. Both the overall unemployment rate and the core unemployment rate declined by 1.8% and 1.24%. However, as the working-age population's composition showed, this reduction seemed to be driven by a rise in labor market exit instead of more permanent employment.

1.4 Social Structure

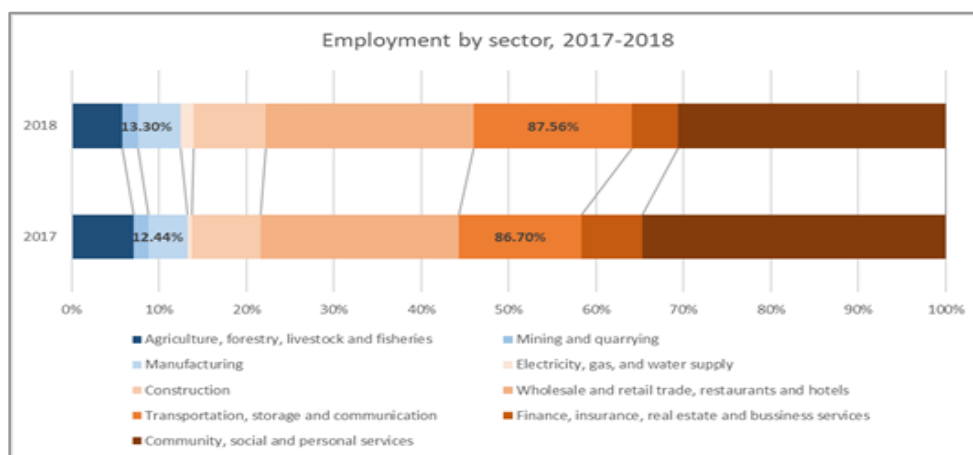
The majority of Ternate City's labor force works in the services sector. The share of workers in the service sector was 78.41% in 2017. It slightly declined by 0.63% in 2018, as shown in the figure below. As for the service sector itself, the most dominating service sectors in Ternate for the past five years are wholesale and retail trade, repair of motor vehicles and motorcycles; transportation and storage; public administration and defense; compulsory social security; information and communication; and financial and insurance activities. These dominating sectors are determined using each sector's contribution to Ternate's GDP.

Figure 3 - Employment by General Sector 2017-2018



Authors, 2020

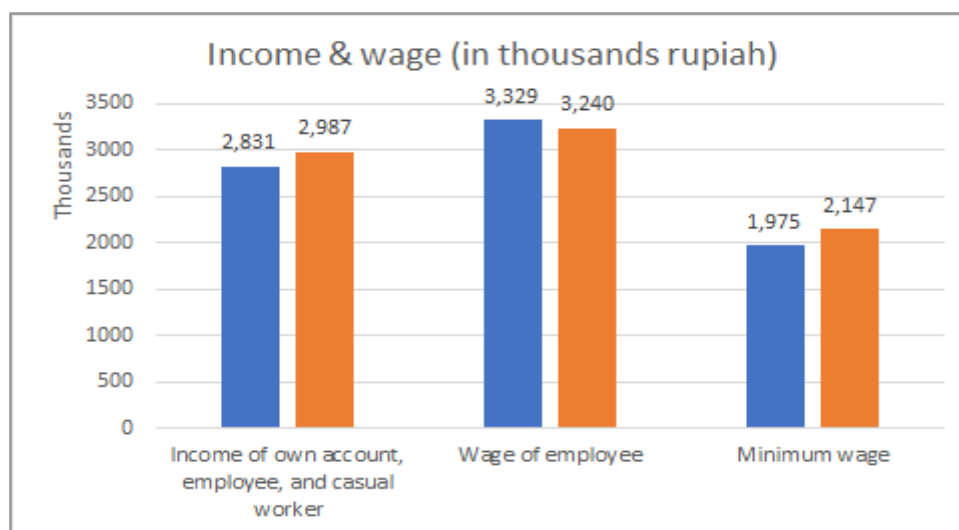
Figure 4 - Employment by Specific Sector 2017-2018



Authors, 2020

There seems to be a pattern of industrialization, as the share of workers employed in manufacturing increased by 1.92%, mainly at the agricultural sector's expense, which shares declined by 1.29%. The figure above shows a more detailed breakdown into nine sectors, with tradable sectors shaded in blue and non-tradable sectors shaded in orange. As it can be seen, the share of employment in the tradable sector grew from 12.44% to 13.30% between 2017 and 2018. The three largest sectors were the community, social and personal services (30.67% in 2018); wholesale and retail trade, restaurants and hotels (23.79% in 2018); and transportation, storage, and communication (18.11% in 2018). However, the share of community, social and personal services fell by 4.04% between 2017 & 2018, while the share of the transportation, storage, and communication sector increased by 4.18%.

Figure 5 - Income and Wage

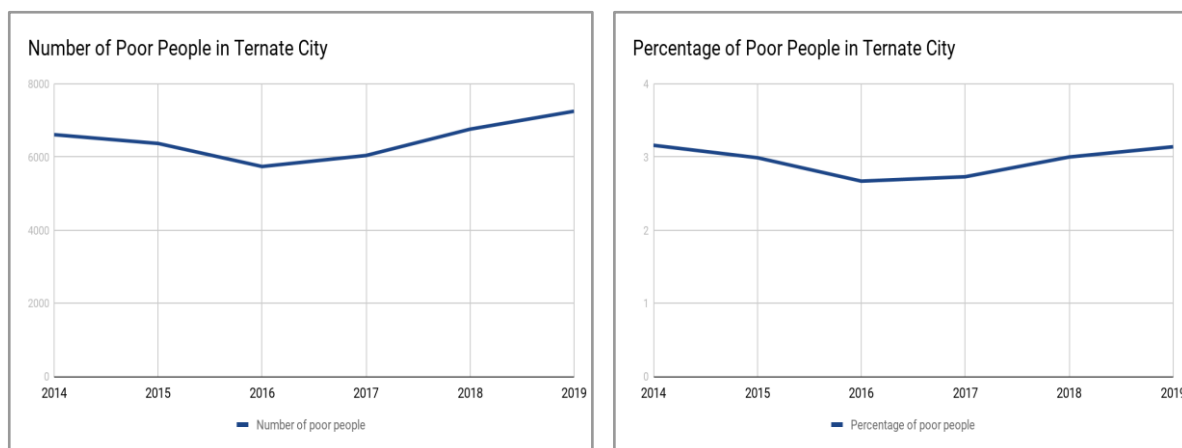


Authors, 2020

The figure above shows the income and wages of workers in Ternate City. The regional monthly minimum wage increased by 8.7%, from IDR 1,975,000 (~USD 133) to IDR 2,147,000 (~USD 146). However, the average wage of employees, which was over 1.5 times the minimum wage, declined by -2.68% (or as much as IDR 89,000 or ~USD 6). Even with the large share of employees, the average employee wage decline did not drag down its account, employee, and casual workers' income. Their income increased by 5.53% between 2017 and 2018.

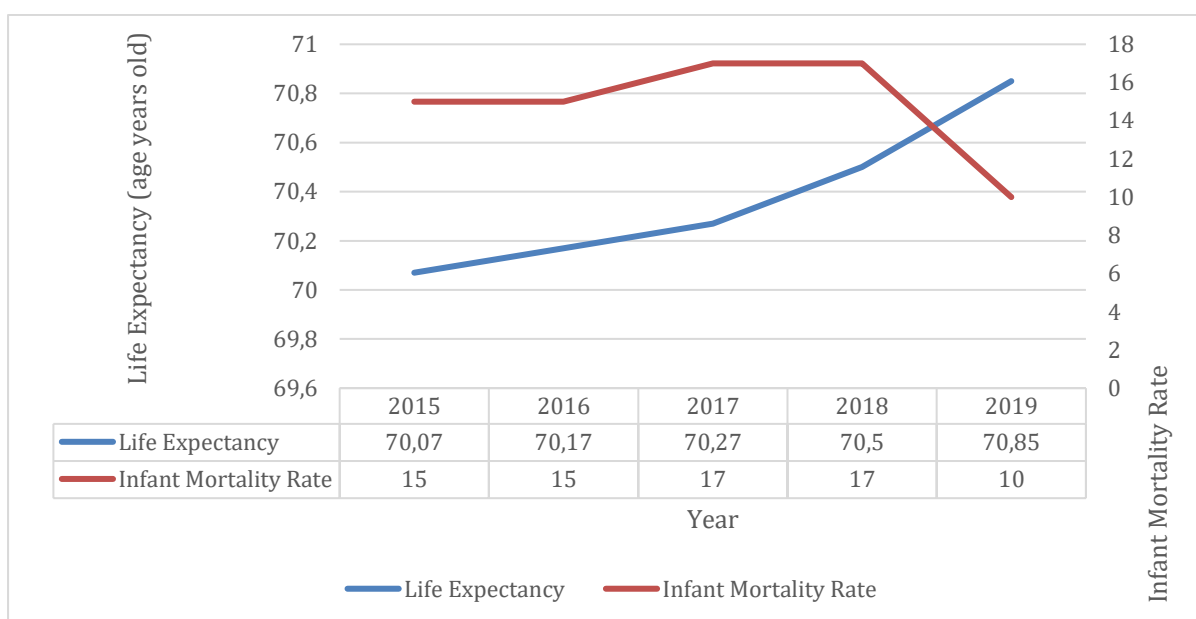
The method used to calculate the poverty line consists of two components: the Food Poverty line (FPL) and the Non-Food Poverty Line (NFPL). The increasing poverty line typically indicates the increasing welfare of the city's population. However, the number of poor people in Ternate City does not necessarily decrease along with the increasing poverty line; instead, it tends to fluctuate, as shown in the figures below. From discussions with stakeholders, the relatively stagnant poverty rate can be attributed to the high unemployment and underdeveloped economic sectors –their agriculture and fisheries sector are still mainly focused on extraction. Facilities for production/added value are minimal, while it is known that Ternate mainly relies on trade.

Figure 6 - Number and Percentage of Poor People 2014-2019



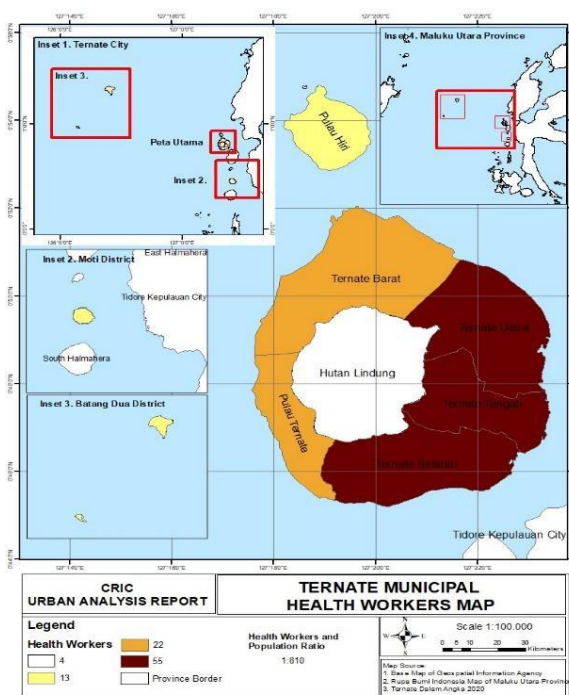
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Figure 7 - Life Expectancy and Infant Mortality



Ternate Municipality in Figures, 2016-2020

Figure 8 - Workers Distribution by District



Ternate Municipality in Figures, 2020

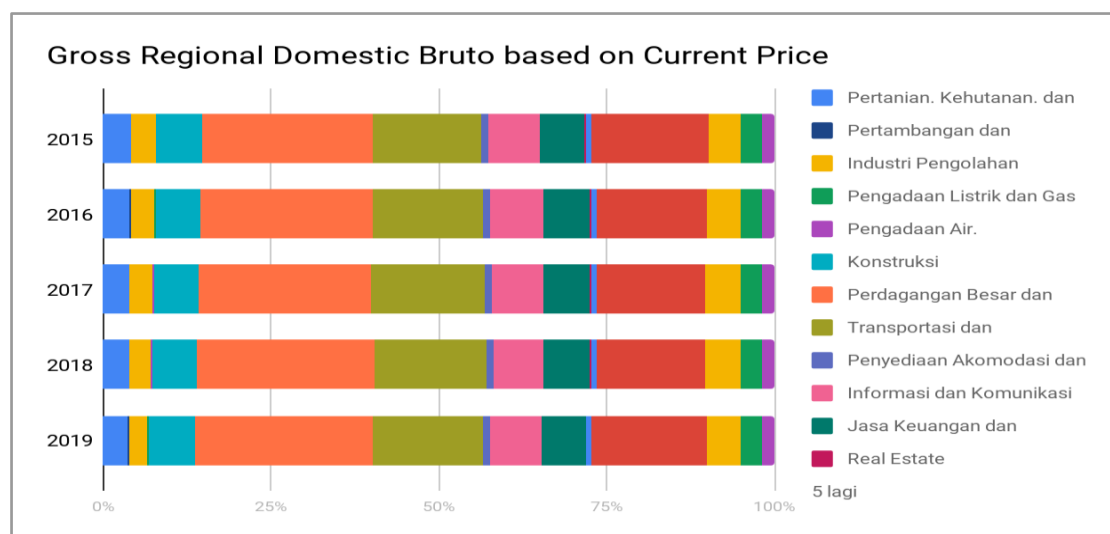
Furthermore, the number of low weight and malnourished infants slightly decreased from 2016 but started to rise in 2019, resulting from 55 to 50 infants. Nevertheless, there are promising trends in life expectancy, which has continuously increase to 70,8 years, whereas the infant mortality rate decreased to 10. Distribution of health workers supported the current health trends, where the Eastern part of the city has more health workers than the Western counterpart.

1.5 Economic Structure

Gross Regional Domestic Product (GRDP) at current market prices in Ternate City has increased from 2015-2019. Ternate's Gross Regional Domestic Product (GRDP) at current market prices is the highest compared to other cities and regencies in Maluku Utara Province. Based on the industry, the largest proportion of Gross Regional Domestic Product (GRDP) at current market prices in 2019 was wholesale and retail, car and bicycle repair (26.65%), government administration, defense and mandatory social security (17.13%), and transportation and warehousing (16.46%).

Ternate City has two shopping malls, namely Jatiland Mall, located in North Ternate District, and Muara Mall, located in Central Ternate District. Available entertainment includes a cinema located in Jatiland Mall. There is also a shopping center called Hypermart, located in North Ternate. Besides, traditional markets spread across North Ternate District, Central Ternate District, and South Ternate District.

Figure 9 - Gross Regional Domestic Product by Current Price 2015-2019



Ternate Municipality in Figures, 2020

1.6 Environmental Data

1.6.1 Waste

The average municipal solid waste production in Ternate in 2019 has reached 300 tons/day, and is expected to increase 5% every year, as indicated by the Ternate City environment agency. Among the waste produced, 60% of it is organic waste, while the remainder includes 15% of plastic waste and 25% consisting of paper, glass and iron. In several districts, attempts to sort and separate organic and inorganic waste have been carried out by either the community (from the source) or waste collection officials (during transportation/temporary disposal sites).

The sorting waste program supported the city development plan of 2015-2020, which targeted the waste collection percentage to 76% in 2020. Based on 2015 data, only 54.67% of the waste produced has managed to be collected and disposed of at the temporary disposal site or transfer station. The temporary sites here mean different types of waste stations, whether built from trash box, cemented box, container pools, or 3R station before the trash moved to landfill. Among the waste that has reached the temporary disposal site, not all the waste could then be transported to the final disposal landfill, the Bukuderu Takome Landfills. Currently, the landfill still uses an open dumping system.

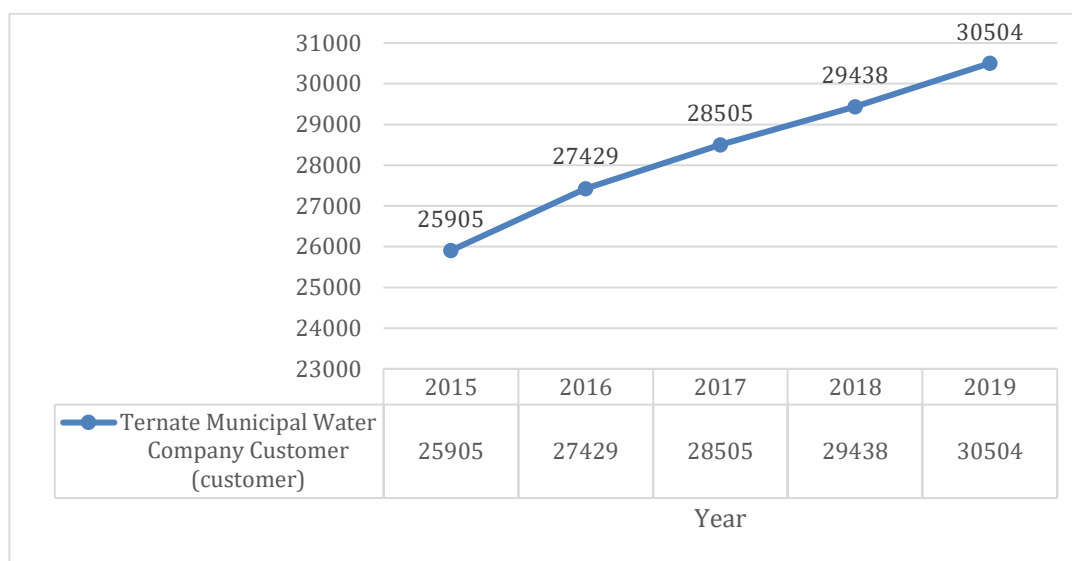
1.6.2 Water and Sanitation

Water supply of the city mainly comes from the Ake Gaale water spring where the local water company utilizes and channels it to customers. An international organization assessed the vulnerability of the water spring. The results of an assessment show that the Ake Gaale water debit has decreased by 42% from 130 liters/second to 75 liters/second. Furthermore, the water becomes polluted in terms of quality due to seawater intrusion, polluted by domestic water waste (black water and gray water) originating from the toilets. These springs and other organic chemical elements in groundwater contain Colli bacteria (USAID IUWASH

PLUS, 2019). Water customers across time increased considerably and reached 30,504 in 2019. The number of the water company' clientele from 2015 to 2019 can be seen on figure 1.10 below.

The existing drainage networks in Ternate City are primary, secondary, and tertiary channels. The primary drainage channel in Ternate City is in the form of Kalimati. In principle, the drainage in the Ternate City area flows toward the sea through the route, which crosses the Ternate City area and partly goes directly to the beach outlet. The existing conditions that generally drainage channels in Ternate's city are open and closed by following road development direction, where the drainage channel functions as rainwater runoff and household wastewater.

Figure 10 - Water Customer



Ternate Municipality in Figures, 2016-2020

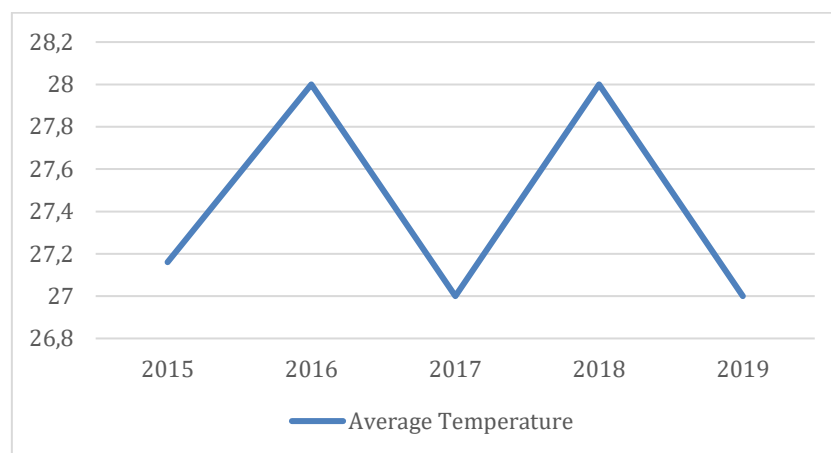
Based on the Environmental Health Risk Assessment (EHRA) data from 2014, 85.42% of Ternate's population has septic tanks. However, 81.5% of the population is never emptying the septic tanks, and only 53.7% of septic tanks have been desludged by desludging services. According to the White Book in Sanitation of Ternate City (2014), most people still use the waterbody as a disposal site for domestic wastewater that is channelled through ditches. This condition can lead to the contamination of the groundwater, waterbody, and the environment.

1.7 Climate Change and Disaster Risks

A rise in average temperature is present in Ternate City. The 2003 yearly average temperature was 26.8°C, whereas it increased to 27°C in 2019. Ternate City had a minimum temperature of 24°C in 2003, increasing to 24.4°C in 2019. Meanwhile, maximum temperature has considerably increased; in 2003, the maximum was 31°C, while most recently, in 2019, it had reached 32.9°C. This increase in temperature is a strong indication of the reality of climate change. However, there is limited data to identify which sector contributes the most to greenhouse gas emissions and climate-related impacts to the city.

At the national level, two of the most significant contributors to climate change include land-use change and peat fires, contributing around 48% of the greenhouse gas (GHG) emissions, followed by the energy sector at about 35% (WRI, 2017). At the provincial level, the latest data found was from 2010, whereby WRI mapped the primary source of emission for that base year as Agriculture and Forestry. More robust data would be required to pinpoint the primary sector of focus in terms of emission reduction for Ternate, but the trends found at the national and provincial levels should apply to the city, as it continues to experience rapid physical urbanization. Ternate still has a high risk of earthquakes, tsunamis, volcanic eruptions, and forest and land fires. Especially for volcanic eruptions, Ternate sits at the top 30 of municipalities/regencies presenting the highest risk to volcanic eruptions. To date, a record of 72 eruptions has occurred in the past 435 years (USAID, 2018).

Figure 11 - Yearly Average Temperature



Ternate Municipality in Figures, 2016-2020

Figure 12 - Disaster Classification

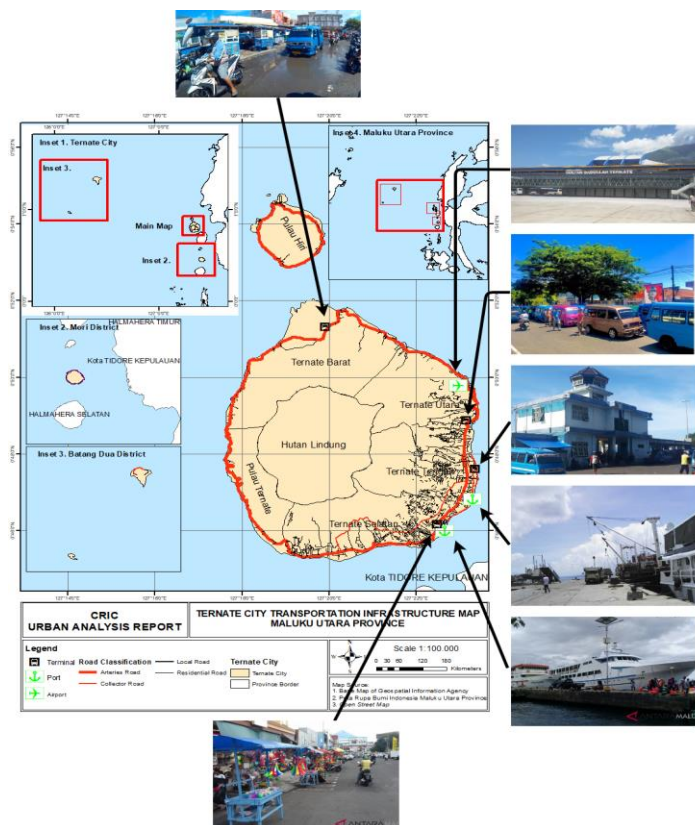
Disaster Type	Score	Risk Class	National Rank
Earthquake	12.6	High	342 / 514
Tsunami	14.0	High	152 / 252
Volcano eruption	14.0	High	26 / 92
Forest and land fire	21.0	High	404 / 506
Landslide	14.0	Medium	288 / 514
Rogue waves and abrasion	14.0	High	284 / 321
Extreme weather	4.0	Low	498 / 511

Indonesia Disaster Risk Index, 2018

1.8 Spatial Planning and Infrastructure

There are several infrastructure issues in the city plan of 2016-2021. Land for urban growth is very limited and cannot keep up with the population growth and demand for housing. It gives rise to slums and sub-standard residential neighborhoods lacking the necessary infrastructure. Other islands remain in relative isolation. The city uses one airport, Sultan Baabullah Airport in North Ternate District, and four bus terminals of Gamalama, Bastiong, Sulamadaha, and Dufa-Dufa. Because of its location surrounded by the sea, sea transportation has a vital role for Ternate's people; the city has three seaports to support its activities. Its characteristic is an island under the foot of the Gamalama volcano in North Maluku Province. Sea transportation is vital for Ternate's citizens, but the territorial waters of Ternate are among the riskiest areas due to several ship accidents that have claimed lives. One of the efforts made by the Ministry of Transportation is to carry out Sailing Safety Technical Guidance in 2019.

Figure 13 - Transportation Map



Authors, 2020

Not all of the bridges in Ternate City are in proper condition. There are still bridges that are vulnerable to damage and are not suitable for use. Many bridges are still built using traditional technology and materials, which is prone to fracturing and decay –for example, some alternative bridge of the Gambesi-Sasa Sub-district and a semi-permanent bridge located in the border of Moya and Marikurubu as shown in the pictures below. Landslides on both sides of the bridge occur. There are also plans for the construction of the Ternadore Bridge connecting residents in the cities of Tidore Island, Maitara Island, and Ternate Island

that will accelerate economic growth in the three regions, allowing smoother transportation of people, goods, and services compared to current using sea transportation which is often significantly disrupted during extreme weather.

Figure 14 - Alternative Bridges Gambesi-Sasa and Marikurubu

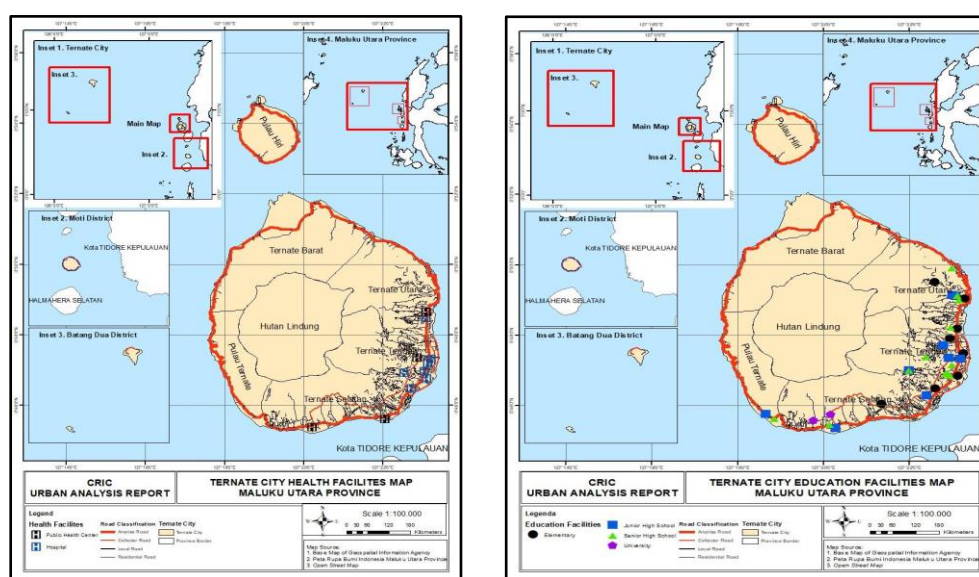


Source: Authors, 2020

1.9 Social Infrastructure and Service

The average length of schooling in Ternate City continues to increase every year, with 2019 having 11.58 years and the expected length of schooling in Ternate City, reaching 15.73 years. Besides, based on the 2015 Ternate City School Participation Rate, it was found that as many as 98.54% of the population aged 7-12 was attending elementary school; 98.40% of the population aged 13-15 was attending junior high school and 86.42% of the population aged 16-18 was attending senior high school. The school participation rate for elementary schools is still below the North Maluku Province school participation rate, but the school participation rates for the junior and senior high school is already above.

Figure 15 - Health and Education Facilities Map



Authors, 2020

Despite a remaining provisional gap, health facilities such as local public clinics are already found in each sub-district alongside 6 hospitals. Public health center services in Ternate are quite good because they are easily accessible, widespread, and already have inpatient facilities. However, the hospitals access is not optimal because, in order to reach the facility, like the hospital from Moti Island and Batang Dua Island, one needs to cross the sea for about 132 miles which takes about 4-5 hours.

With regards to tertiary education, Ternate is home to three public universities, namely: (i) Khairun University; (ii) Ternate State Islamic Religion Institute; (iii) Ternate Health Polytechnic besides eleven private universities. The problem in education infrastructure are gaps in the provision of educational facilities and lack of land, so that if there are additional students, then the school building will be raised vertically. Other than that, access to ICT is still not evenly distributed, so the learning process from home during the COVID-19 pandemic is quite disrupted.

1.10 Urban Governance

Several organizations are working in the field of sustainable development in Ternate, such as *Komunitas Sadar Sampah Kota Ternate*, *Komunitas Peluk Bumi Kota Ternate*, *Komunitas Pecinta Laut*, *Save Ake Gaale*, and *Komunitas Peduli Air Hujan*. Ternate has a Rainwater Management Installation program that involves some NGOs and environmentalists. The community has been involved in the Harvesting and Saving Water Movement through the district and subdistrict to preserve water.

The municipal government also built cooperation with the NGO USAID IUWASH PLUS which operates in the clean water, sanitation, and healthy behavior programs. There are few USAID IUWASH PLUS activities in Ternate City which, among others, aim at:

- Assisting the PDAM of Ternate City on energy efficiency activity, business plan development and water tariff evaluation.

- Preparing and strengthening the Water Safety Plan (RPAM) for water source, operator, communal and consumers program.
- Implementing urban Community-Based Total Sanitation (STBM): program socialization, participatory assessment and WASH-related behavior change activities at community level.
- Developing a partnership with CSR Programs to support the improvement of WASH Sector.
- Supporting the local government to allocate local budget for capitalization of WASH loan program through Micro Finance Institution (MFI).

The USAID Indonesia Urban Water, Sanitation and Hygiene *Penyehatan Lingkungan untuk Semua* (IUWASH PLUS) project is an initiative designed to assist the Government of Indonesia in increasing access to water supply and sanitation services as well as improving key hygiene behaviors among urban poor and vulnerable populations. USAID IUWASH PLUS works with governmental and donor agencies, the private sector, NGOs, communities and others to achieve the following "high level" results:

- An increased access to improved water supply service for one million people in urban areas of which at least 500,000 are from the poorest 40% of the population (also referred to as the "bottom 40%" or "B40"); and
- An increased access to safely managed sanitation for 500,000 people in urban areas

It would be possible to include civil society and grassroots organizations to develop key work in municipalities. For example, in making city plan for Ternate in 2010-2015, the drafting was carried out comprehensively, integratively and thoroughly, prioritizing participatory community involvement by considering and accommodating stakeholder aspirations. Ternate City also has internal collaboration mechanisms among the different departments. For example, in the Ternate City Sanitation Working Group formation, several department units related to sanitation have been established, both from the planning, budgeting, implementation, evaluation and monitoring functions.

CHAPTER 2

Policies and Strategies for Climate Resilient and Inclusive City

2.1 Nation-Wide Policies, Strategies and Target

There is a development agenda in the living environment, increasing disaster resilience, and climate change, which is directed through policies to improve the quality of the environment, increase disaster and climate resilience, and the low carbon development in the National Medium-Term Development Plan of 2019-2024. The strategies comprise improving environmental quality, disaster resilience and climate change, and low carbon development. Furthermore, the National Action Plan for Climate Change Adaptation (RAN-API) is prepared to achieve targets, including realizing economic resilience, social order resilience, ecosystem resilience, and strengthening individual area resilience in urban, coastal, and small islands.

Programs and activities on adaptation to climate change also need to consider endeavors to reduce vulnerabilities, particularly to social groups vulnerable to climate change, such as women, children, low-income populations, and the aging population. RAN-API's objectives consist of five sectors: economic resilience, livelihood resilience, the resilience of environment services, the resilience of particular areas, and supporting systems. This national action plan should be considered and further adapted into a regional action plan (RAD API). For now, Ternate has not released one RAD API that

implicates the clarity of strategic and programmatic plans addressing climate change adaptation issues.

2.2 City-Wide Policies, Strategies and Target

The vision of long-term development of the Ternate City in 2005-2025 is "Ternate City is Independent, Advanced, Fair, and Prosperity based on the island," which is realized through five regional development missions as follows: 1) Creating quality political life, legal certainty, human rights enforcement, gender equality and justice, and a professional government apparatus; 2) Realizing the development of cultural cities, maritime cities, and history; 3) Realizing quality of social welfare and human resources in Ternate City; 4) Realizing advanced infrastructure and regional economy in the field of trade, tourism, and maritime-based island; 5) Creating beautiful and sustainably-managed natural resources and a living environment management.

The National long-term plan of 2005-2025 informed the climate change issues and strategy that the city government has adopted into its long-term city plan. The strategies are an equitable distribution of clean water services, attaining a trash-free and freed from flood. Ternate. These strategies focus on urban areas and other areas that emphasize slums and a program for both the development of

mandatory environmental affairs and mandatory public works affairs.

There are plans for wastewater activities, solid waste activities, and drainage activities, but the city development plan discussed less of these issues. There should be regulations and strategies regarding climate resilience more detailed in RPJMD Kota Ternate than those in the RPJP Kota Ternate. Nevertheless, the city does have some regulation regarding environmental control and climate change, such as Ternate Local Regulation No. 05 the year 2016 concerning making infiltration wells; Ternate Local Regulation No. 02 the year 2017 concerning green open space management; Ternate Local Regulation No. 06 the year 2018 concerning domestic wastewater management; Ternate Local Regulation No. 21 the year 2018 concerning Water Quality Management and Water Pollution Control and Ternate Local Regulation No. 24 the year 2018 concerning Environmental Protection and Management.

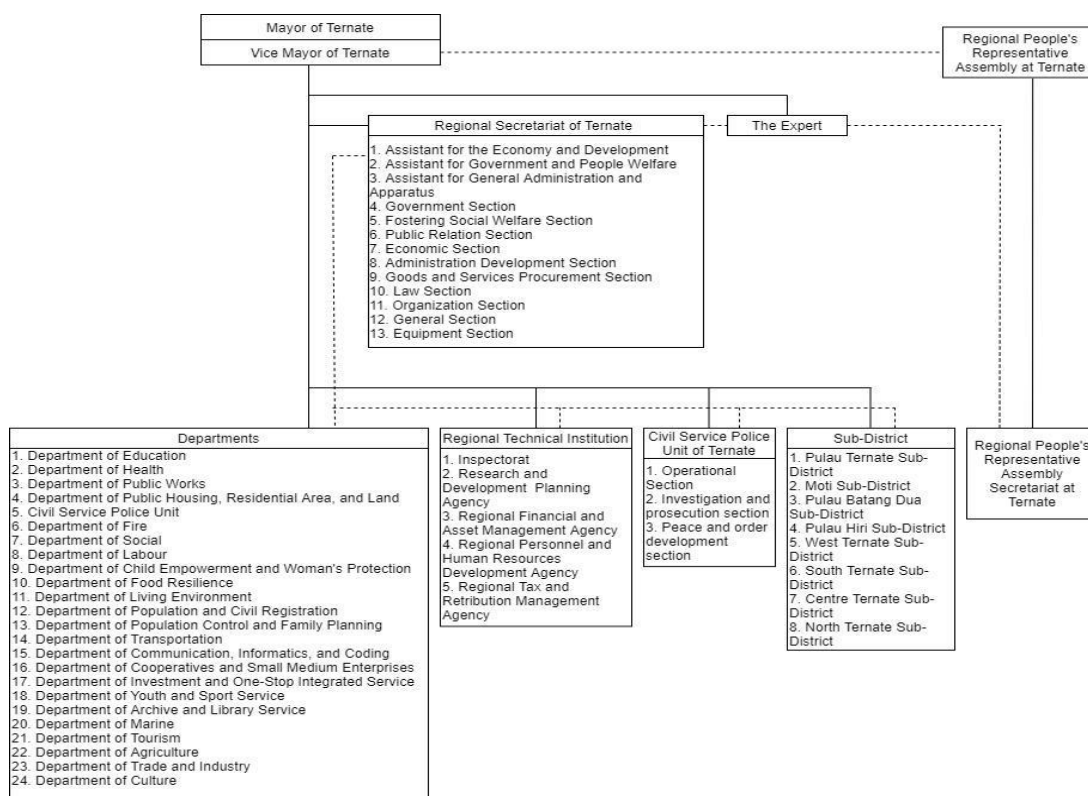
The municipal government implements several essential concepts in maintaining the city's resilience to climate change. These concepts include strengthening regulations on resilience and institutions

by forming related institutions for the integration of resilience issues, enforcing and supervising regulations, building collaboration with NGOs and the business community in reducing carbon emissions that affect air quality and the environment, and optimizing budget spending for the city resilience.

2.3 Government Structure and Decision-Making Process

The mayor leads the city with help from the vice mayor. There is a supporting group of a regional secretary, local representative council, regional inspectorate, 23 local government units, and 4 agencies. The regional offices coordinate with regional bodies, regional inspectorate, regional secretariat with the directives order from the mayor and vice mayor in the decision-making process. The details are on below:

Figure 16 - Government Structure



Source: MPS, 2015

2.4 Stakeholders Involvement in Policymaking

Ternate already involves many stakeholders in their policymaking. The development of the city's medium-term plan executes in a comprehensive and integrated way. It features the society's involvement with accommodating and considering the stakeholders' aspirations (Local Development Plan, 2010-2015). Furthermore, the city carries out Development Planning Forums or *Musyawah Rencana Pembangunan* (Musrenbang) in multiple stages. In April 2019, a Musrenbang for the Revision of the Ternate City Medium-Term Development Plan (RPJMD) 2016-2021 was held in the presence of Forum *Koordinasi Pimpinan Daerah* (Forkopimda) Kota Ternate, academia from several universities in North Maluku, some officials from the municipal government, and many other stakeholders. The city also held Musrenbang in the districts (*kecamatan*) level every year, which involves the sub-districts (*kelurahan*) representatives. The mechanism means deliberation is held to discuss community members from the village offices level to the sub-district level, where there is a budget allocation every year. However, these Musrenbang are not entirely effective because the public expenditure disbursement is not optimal in the Ternate Tengah district.

CHAPTER 3

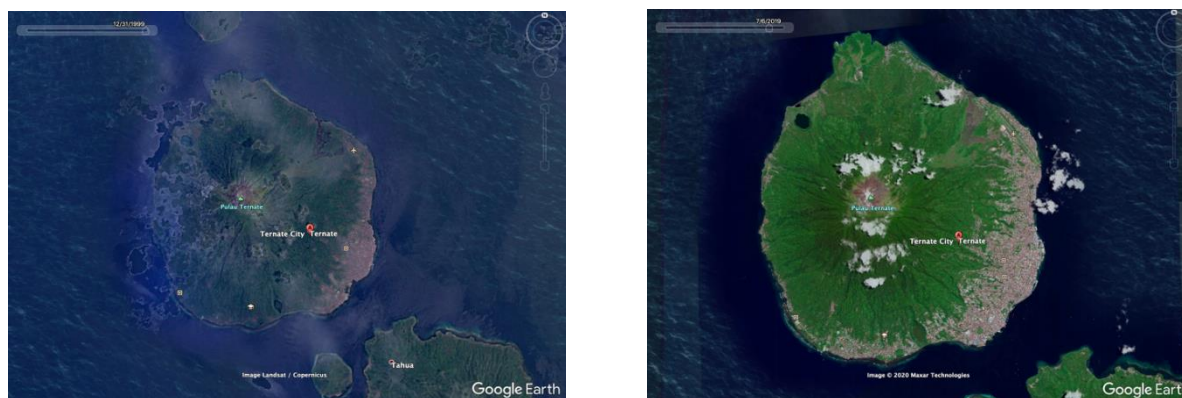
Key Problems, Challenges and Opportunities in Priority Sectors

3.1 Climate Change Adaptation and Mitigation

The effects of climate change are already visible in Ternate City. Using the latest national and provincial data as a proxy, one key driver of climate change in Ternate is the rapid urbanization and the increase of urban activities, including land-use change, as illustrated in Figure 3.1. This issue is even more critical for the city since some coastal areas concentrate urbanization, so the climate change impacts appear stronger in those areas, where most of the population dwells.

As Ternate is a coastal city, the hazards of sea-level rise and seawater abrasion affect urban settlements. The land-use change of green spaces or other environmentally related functions into economic activity also brings climate change effects, according to the city official in the FGD. Current local services and programs from related units implicated the climate-related development progress came to light. The most fundamental problem occurs from the absence of a tool for measuring greenhouse gas (GHG) emissions. The lack of GHG information implicates more to the deliverable degree of other air pollution control programs, solid waste management, water conservation, and disaster prevention.

Figure 17 - Aerial view of Ternate City in 1999 (left) and 2019 (right)



Source: Google Earth, 2020

The condition of air quality and GHG emissions play an important role in determining the achievement of the third goal of local development missions about achieving equal services infrastructure and trade among urban areas. Local officials have worked on measures to maintain the good quality of air by implementing pollution control and control of environmental degradation, natural resources conservation, and green lines development.

Emission test of vehicles and waste management applied to reduce GHG emissions across the city. Department of transport has reached a 25% increase in testing vehicles'

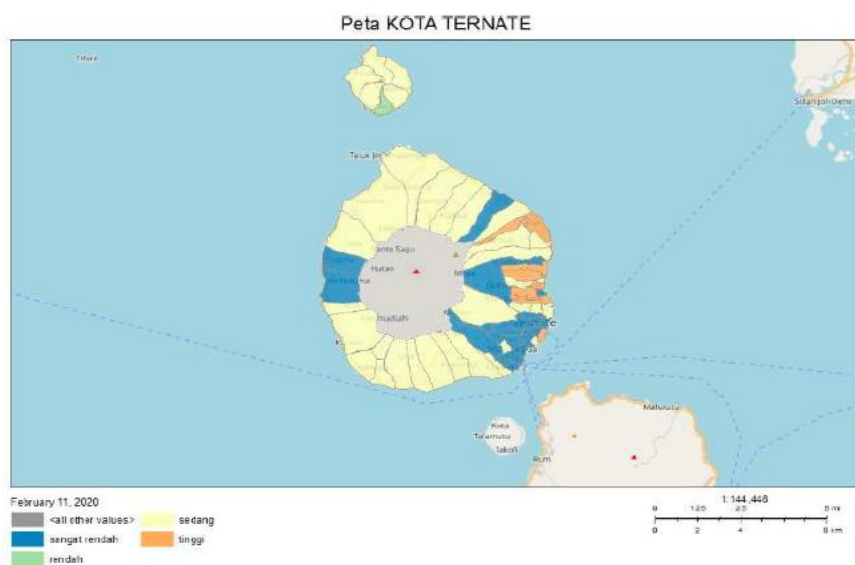
performance. Besides, the Department of environment achieved a 5% increment in collecting waste during the period between 2015 and 2019 (Revision of Local Mid-Term Development Plan of Ternate, 2016-2021). The air quality monitoring system still also applies intensively as the primary indicator toward those mentioned programs.

3.2 Disaster Risk Reduction

Disaster risk reduction in the city consists of two types of climate-related and related geological disasters, both highlighting the significant roles of humans and governance in prevention, adaptation and mitigation alongside. Concerning climate-related disasters, Ternate has recorded 34 disaster occurrences, which have caused material losses, injuries, and fatalities from 2010-2016 according to the regional mitigation agency. Floods have occurred 9 times while tornados and rogue waves have occurred 7 times, and landslides have occurred 4 times. Most of the injuries and fatalities are due to floods and landslides. The impacts of these disasters indicate an alarming condition that is likely to pose an even greater risk. Each district suffered disaster risks to a relatively even proportion. Hiri Island, Moti, Batang Dua Island districts are prone to earthquakes, rogue waves, and constitute tsunami-risk areas (*Buku Putih Sanitasi*, 2014). In the transitional season, high waves can happen, causing water sea abrasion.

Most of Ternate City has a medium risk from climate change based on the Ministry of Environment and Forestry (2018). Several districts have a higher risk, while some are lower, as shown in Figure 3.2. In the map, light yellow indicates medium risk; orange indicates high risk while blue indicates a very low risk. Findings from FGD and interviews on land reclamation and floating waste confirmed the impact of local ecosystem change in the coastal area. These effects implicate the degree of sea abrasion that led to the district distribution of climate risk.

Figure 18 - Map of Climate Change Risk



Ministry of Environment and Forestry, 2018

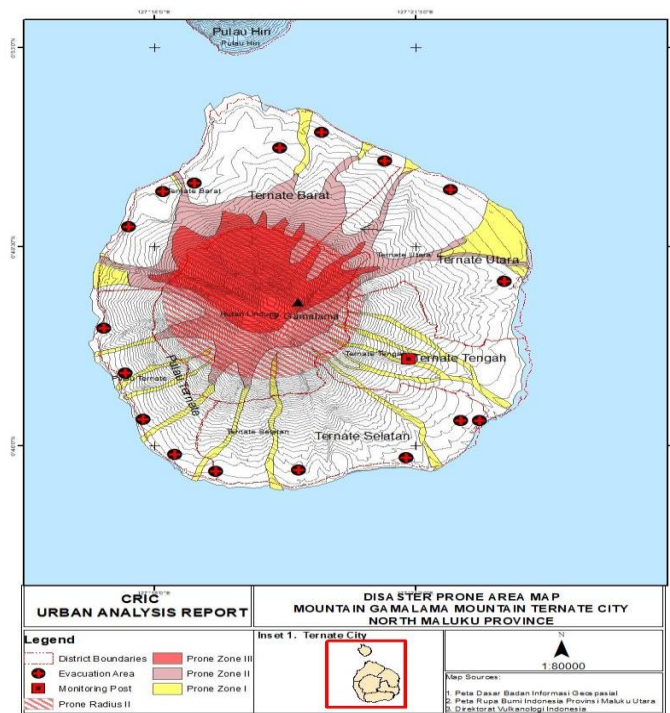
Ternate is naturally prone to disasters upon Gamalama volcanic mountain's activeness in the middle of the city. The volcanic mountain might erupt at any time, threatening Ternate inhabitants; thus, disaster precautionary is essential. A participant from the university in Ternate during the FGD informed that the volcano naturally erupts every ten years. Another disaster threat is found in earthquakes, as the city lies on two geological plates. This risk goes hand in hand with the high risk of tsunamis.

Regarding landslides, the majority of the city has a high-medium vulnerability based on the figure above. High vulnerability areas occupy 60% of the city. Meanwhile, medium vulnerability areas occupy 30% of the city. A focus on decreasing vulnerability and increasing the capacity to mitigate the apparent risks of earthquakes, volcano eruptions, and tsunamis is urgent for Ternate City as these constitute irrevocable hazards. Ervita et al. (2019) have conducted a study for some parts of Ternate Island, which divides them into three zones of tsunami vulnerability: high, medium, and low vulnerability areas.

Ternate Island is a volcanic island with a radius of 5.8km covering an area of 40km square. Based on the map above, there are three disaster-prone zones: 1) Disaster Prone Zone 1: Lava and its flow extension, as well as the potential possibility of pyroclastic flows; 2) Zone 2: Pyroclastic flows, lava flows, glowing rock fragments and lava are likely to happen; 3) Zone 3: Frequently affected by pyroclastic flows, lava flows and ejected rock fragments.

The city government gradually plans on disaster mitigation for the high-risk category of earthquakes, volcanic eruptions, tsunamis, landslides, and the medium risk 1 such as forest fires, water abrasion at the beach, flash floods, and cold lava floods. Mitigation plans are also included in their spatial planning documents. According to the city disaster agency, Ternate requires non-infrastructural mitigation efforts such as disaster management frameworks, standard operating procedures and training. The representative believes that such frameworks, standard operating procedures and training will help society react and evacuate during disasters as per information of the FGD. Evacuation for the other side of the city proceeds to the farthest from the Gamalama Mountain. The details of evacuation are on below:

Figure 19 - Prone Areas of Gamalama Volcanic Mountain

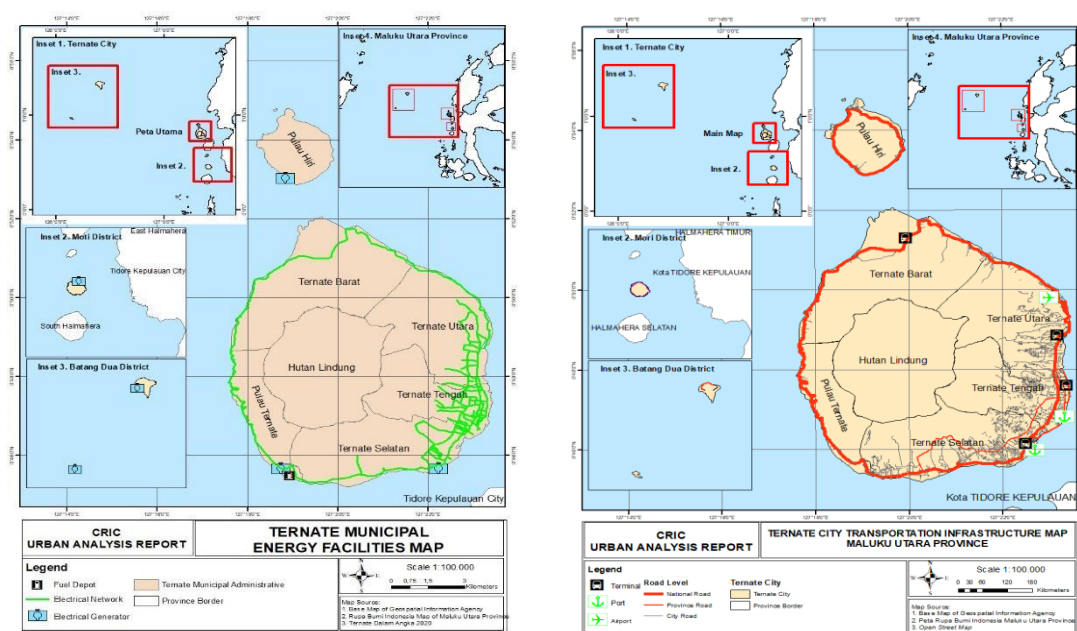


Authors, 2020

3.3 Energy and Transport

The energy sector is the second-largest emitter in Indonesia based on the proxy to national data due to the limited data regarding emissions at the city level. Data on the electrification ratio is still difficult to infer for the city. Likewise, there are no mentions of sustainable energy sources nor renewable energy exploration in the medium-term development for the city. The national electrical company has delivered its supply to 52,131 consumers with an electrical productivity of 195,144,470KWh with the sold electricity supply to consumers reached at 176,900,027MWh (Ternate Municipality in Figures, 2020). Electrical generators are also distributed at Moti and Batang Dua district, but there are yet only two for the Ternate mainland. Other energy infrastructures exist in the city that fuel depot operates in Pulau Ternate District.

Figure 20 - Transport and Energy Facilities Map



Ternate Local Development Agency, 2020

In terms of transportation, the needs of Ternate are unique as public land, and water transportation would be required to connect the urbanizing archipelagic municipality. The road length expands as long as 40.2km in Ternate's mainland, while there is only 12.7km in Pulau Hiri District, 22.4km in Moti District, and 20.8km in Pulau Batang Dua District.

The city has heavily congested traffic with vehicles. According to the city transportation department, there were 39,616 private vehicles and 1,577 government officials registered vehicles. With a total number of 33,433, motorbikes largely dominate private cars (4,659 units). About public transportation, the department recorded 435 units servicing the city's vicinity while 79 units serviced the airport. The city, because of its archipelagic characteristic, also provides water transportation to the nearest islands of Pulau Moti District and Pulau Hiri District. People use speed boats, amounting to 97 units, a decrease of 56% compared to the previous year (Ternate Municipality in Figures, 2020).

3.4 Water and Sanitation

The city's primary water sources come from Ake Gale water spring while others include Tolire and Ngade lakes as secondary sources. As surface water, Ake Gale provides 60% of the overall water supply, which flows primarily to the Northern, middle, and Southern parts of the city. Ngade lake, as surface water, also supplies the water to the middle and Southern part of Ternate. However, the city officials are still assessing the water quality of Tolire lake due to potential hazardous content coming from the Gamalama Mountain. Some urban people still use groundwater for their amenities, at the risk of associated problems.

The growing urban population and activities might pressure the carrying capacity and result in groundwater depletion and land subsidence. If not mitigated, Ternate would be more prone to flooding due to extreme rainfall from the change in weather, and sea-level rise as an effect of global climate change. 85% of households have access to clean water (KLHS

RPJMD Kota Ternate, 2019). Local officials and stakeholders need to address those water provision and groundwater issues.

Concerning sanitation, in 2014, nearly 89% of households had access to private latrines, 6% utilized public toilets, while 5% still practiced open defecation. However, only 36% of those with access to private latrines had access to safe septic tanks. There are still populations that do not have access to decent sanitation, and the unmitigated effects of climate change might put them even more at risk.

3.5 Solid Waste Management

Based on 2014 data, 54.67% of the waste produced is collected and disposed of at the intermediate landfill, then transported to the final disposal site, the Bukuderu Takome landfill. Nevertheless, the same data also indicates that landfill management still uses an open dumping system without recycling. Furthermore, 26% of the waste produced at the household level is still disposed into water bodies or open fields to be left to rot; and the neighborhood has only sorted 11.54% of waste production. The absence of a reliable and sustainable waste management system may result in a high contribution of GHG emissions from the waste sector.

3.6 Sustainable Use of Resources

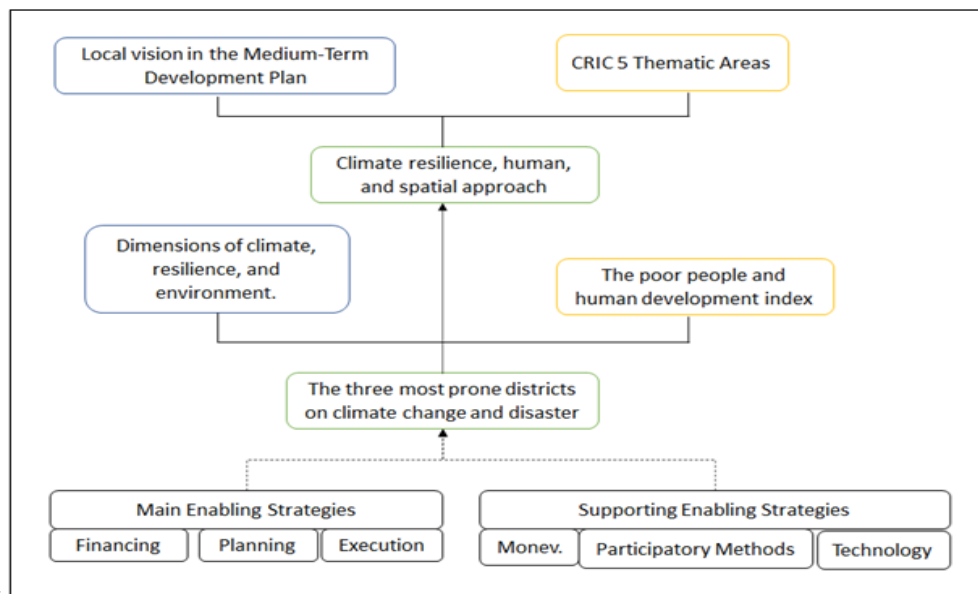
Responsible consumption requires a sufficient supply of electricity and water as part of clean energy. The electricity supply in the city reaches sufficiency even though the supply to three remote districts raises concern. In Hiri Island District, the total number of electricity customers was 605 with an electricity supply of 546,794KWh, and sold at 545,743MWh. There are 499 electricity customers in Batang Dua Island District who rely on a 317,648KWh electric supply sold at the amount of 287,075MWh, whereas Moti Island District has 1086 customers with the supply of 763,296KWh sold at the amount of 810,826MWh (Ternate Municipality in Figures, 2020).

CHAPTER 4

Policy Direction, Recommendations and Enabling Strategies

4.1 Policy Framework

Figure 21 - Climate Resilience Human and Spatial Approach (CRHSA)



Authors, 2020

An analytical tool of Climate Resilience Human and Spatial Approach (CRHSA) is assigned to answer the five themes of disaster risk reduction, climate change, water and sanitation, solid waste, and sustainable use of resources. This tool complements the local development plan and is part of the expected climate change policy target.

Two underlying backgrounds are necessitating this tool in Ternate City. The complexity of the local administrative system makes the climate working group less likely to be productive. The budget spending of five sectors is low compared to the main big four spendings of general administration, public works, health, and education. This tool helps to strategize

and trace related funding to the five climate themes. The illustration in Figure 4.1. explains how to meet those needs.

The city officials can focus on the underdeveloped areas of the five thematic issues and assemble the two closely related issues. In Ternate, the areas most prone to volcano eruption are districts circling the Gamalama Mountain. This should encourage all stakeholders to focus on disaster risk preparedness and the sustainable use of electricity whenever the volcano erupts. Ensuring the electricity supply during and after a volcanic eruption will help the disaster mitigation process and recovery for Ternate's citizens.

In the second step, the analytical tool incorporates the human dimension therein. It is essential, especially in Ternate City, as disaster-prone areas exhibit gender-specific conditions in the community (Rydström, 2019). For instance, 2018 data showed that the sex ratio of seven out of eight districts is higher, showing that men inhabit those districts more than women, whereas Moti District is the only with more women than men (Ternate Municipality in Figures, 2019). It implicates the need for a gender-specific disaster program, which focuses on men and masculinity. The disaster program should include sufficient physical activities for men based on health promotion, considering the intersections between rurality and masculinity (Carnahan et al., 2018).

In the third step can be found primary and supporting enabling strategies. Main enabling strategies include financing, planning, and program execution. The financing part aids the city officials to understand funding related to the five themes across units of expenditure or spender per local government institution, as shown in the table below. Planning is based on the classification of events intensity, such as the classification of small and big floods while program execution needs to address such classification accordingly. Supporting enabling strategies consist of monitoring and evaluation, participatory method, and technology. These three supporting strategies may follow what the Ternate City government has done, such as regular monitoring and evaluation in the planning system, including participatory meetings, and a smart city approach. This research applies literature studies, focus group discussions, and in-depth interviews to inquire about climate change and resilience issues present throughout the policy framework developed in a

narrative, visual, and numeric data and provides relevant recommendations.

4.2 Current and Expected Policies Related to Priority Sectors

4.2.1 Urban Resilience Policy

Resilience in a broad and colloquial sense has the meaning of persistence, toughness, or ability to recover. The recovery ability links to the urban capacity to manage risk i.e. preparing and mitigating incidents. The urban resilience policy address two types of climate disaster and geological disaster risks by combining two relevant policies that need mechanism and program. The first policy on climate disaster risk consists of an instrument on payment for ecosystem services (PES) on solid waste management, water and sanitation, and sustainable use of resources to encourage public environmental awareness. Environmental (or ecological) services essentially describe various advantages taken from the natural environment, including carbon sequestration and storage, biodiversity protection, watershed protection, and landscape beauty, as in ecotourism (Fripp, 2014). The PES program can be combined with the identified needs of knowledge on climate change and disaster risk. It will show how sustainable and resilient knowledge towards climate-related issues and PES program practice is working in practice. The second policy on disaster risk-related issues underpin the importance for Ternate to adopt ten essentials from the UNDRR, expanding from organizational, risk scenario and

urban development to effective disaster response (Amaratunga et al., 2019).

The Department of the environment is the institution in charge of the PES, cooperating with the Local Disaster Management Agency by supporting current regulations. Ternate Local Regulation No. 24 from the year 2018 concerning Environmental Protection and Management can work as an umbrella program to apply PES. The local law accommodates the substantive definition of resilience, both climatically and geologically oriented. The current disaster risk management consists of constructing wave retention infrastructure to protect villages in the coastline area, according to the Head of Disaster Risk Management Agency in the FGD. The agency already prepared evacuation routes in the city in case Gamalama Mountain suddenly erupts. At the moment, the agency is building a tsunami alarm system along with the evacuation route.

The city must secure an evacuation place, especially when tsunami and volcanic eruption happen simultaneously. One possible evacuation process is by the ferry transport line to some ports such as Sulamadaha-Togolobe in Hiri Island, Bastiong-Rum, and Jambula-Rum in Tidore Island, Ahmad Yani-Sidalongi and Dufa-Dufa-Jailolo in Halmahera Island (Syiko et al., 2012).

Hiri Island rarely floods, but extreme weathers accompanied by tidal waves often occur. Abrasion, tidal waves, floods, and landslides also often happen in Moti Island. The disaster risk becomes higher as disaster hazards in Ternate City would affect its thousands of urban citizens. Education on disaster response and disaster risk reduction is highly needed. In the last ten years,

development on Ternate Island has spread further, edging closer to Mt. Gamalama. It has decreased groundwater recharge areas, causing more frequent floods in the city. There should be regulations such as regional regulation or a mayor decree that control development, so it does not take up the protected forest areas around Mt. Gamalama. Besides, Batang Dua Island has many subductions situated near active tectonic plates that cause earthquakes every year.

4.2.2 Climate Change

The significant change of climate in urban Ternate lead the city government to propose an integrative urban climate policy focusing on reducing methane, carbon dioxide (CO₂), and Nitrogen Dioxide (N₂O) as driving factors (Chilingar et al., 2014; Allen et al., 2012; NASA, 2020). In the Ternate context, payment for ecosystem services (PES) on solid waste management, water and sanitation, and sustainable use of resources will encourage people's awareness of the environment.

The air quality in Ternate is overall still good. Large-scale factories and forest fires are minimal, so the prevalence of greenhouse gases is not dominant. However, for Ternate Island, as it is the gateway for Maluku Utara Province, there is a high potential of air pollution from transport emissions; for the long run, this would be of concern. Despite, effects of global climate change can be witnessed in Ternate. Furthermore, the weather has become harder to predict.

The municipal government has not yet established any regulations regarding climate change effects, specifically greenhouse gas emissions and air pollution. However, anticipative steps have been taken: the municipal

government has formed a Local Coordinating Agency for Spatial Planning (BKPRD) that involves related local agencies to discuss issues on spatial planning regarding reducing air pollution and emissions, for example, on green public spaces.

4.2.3 Energy and Transportation

For the next five years, electricity supply should not be a problem and would still suffice. There is a steam-electric power station in Tidore with a production capacity that meets the demands of Tidore itself and Ternate. However, access is a different story, as it is fully available in only a few of the islands. Electricity in Moti, Hiri, and Batang Dua island would only be available during nighttime. Else, the people would have to use their own generators. Public-private partnerships with private renewable energy enterprises have been advocated several times by the municipal government, but the infrastructure and willingness to support it remain limited, and thus the partnerships have never pushed through.

4.2.4 Water and Sanitation

Water and sanitation programs should reorient to the principle of urban resilience policy proposed above. The city government should manage water resources and sustainably tackle its problems. The way of starting is to measure 1 daily consumption per person in meter/cubic in order to help the city government know its water reserves. An underwater pipeline also serves Hiri Island while Moti Island and Batang Dua Island both use water sources within the island.

Ternate City has established a cooperation with USAID IUWASH, which is entering its fourth year. The cooperation fostered productive results between the city government and water stakeholders, as mentioned in part 1.10 Urban Governance. However, this initiative only focuses on Ternate Island. The central government has also conducted improvements in several water sources, such as building additional boreholes and developing the Ake Gaale. Further efforts are required to reach populations on other islands and ensure that water management can sustainably meet demands while keeping its quality up to standards. The city department related units have followed up some programs in 2020 with Central River Basin Management Organization through coordination. However, due to the current pandemic situation, funding has been cut for some, such as the installation of underwater pipelines from Ternate Island to Hiri Island.

For the last two years, a Technical Implementation Unit for Domestic Wastewater has done waste collections and is currently conducting surveys and data collection. Besides that, Moti Island, Hiri Island, and Batang Dua Islands face a critical problem in inadequate sanitation services, leading inhabitants to do open defecation. The sanitation system's principal mandate needs to govern the issues and propose strategies to prevent open defecation and provide reliable toilets. Climate Resilience Human and Spatial Approach (CRHSA) encourages the Ternate city government to put exceptional effort into addressing this sanitation issue through considering these underserved districts. It also recommends that the city government take concrete action upon the findings

through evidence-based policy. The policy includes developing the truck's fecal suction in order to intensify it and better serve the uncovered population. Such improvement must be accompanied by an increase of both the quality and quantity of fecal treatment facilities.

4.2.4 Solid Waste Management

City officials of Ternate expect to measure the hazardous impacts of solid waste such as plastic, wood and paper trash on the local ecosystem and local population, together with solutions. The Climate Resilience Human and Spatial Approach (CRHSA) encourages the municipal government to put exceptional effort into addressing this issue through measuring the implication of solid waste hazards to the human dimension and its local ecosystem across different districts in the city.

Moreover, the infrastructure for solid waste management is still very minimal. It is not rare that waste only gets collected once a week. Awareness-raising initiatives done by local CSOs have been implemented in several sub-districts, e.g. Ngade, Maliaro, and Tubo (Tubo's initiative has even been supported by coaching from the Ternate Public Works Agency). However, these local initiatives are not continuous. Several waste banks have halted their activities since coaching from the local public works, and environmental agencies stopped -including ones in the three most significant waste-producing districts of Ternate City: Ternate Selatan, Ternate Tengah, and Ternate Utara. Some others have also stopped their activities due to the inability to monetize the wastes collected in public markets. Since the waste potential is high, there is

hope to revitalize some initiatives, improve waste infrastructure, and enlarge landfill capacity. Minimum service standards for waste should also consider and cover commercial areas such as the public markets.

4.2.5 Sustainable Use of Resources

The city policy towards sustainable resources mainly concerns increasing pollution control programs, the quality improvement and informatics system for natural resources and environment, and performance development in waste management. City officials realized the need for greater understanding to utilize sustainable resources alongside knowledge of what kind of resources are sustainable. It requires assessing evidence from the impacts of environmental pollution and considering energy-efficient and renewables energies as solutions.

4.3 Enabling Strategies and Opportunities in Priority Sectors

Specific laws to ensure the sustainable and equitable supply and for all Ternate urbanites must regulate electricity and water use. Sustainable use of resources depends on the efficiency of raw materials of goods that will implicate sustainable consumption and production. Achieving this requires a sound planning instrument based on an environmental approach. The environmental-based planning will implicate to focus more on the limited carrying capacity.

4.4 Technology for Development

Acquisition of sanitation technology should integrate and interlace with the whole system of waste management. Here, sanitation and technology can use purifying wastewater and increase the number of public toilets as a means for campaigns aimed at stopping open defecation. Installing new technology in Ternate City should consider the electricity supply, especially in the three districts where the supply might be irregular.

Technology for development has broader meanings as techniques to better achieve and advance development progress in several ways. It potentially can engage with indigenous and local practices to combine with governmental programs. About sanitation, the city government can apply the CRHSA by framing sanitation programs in spatial and human development approaches. The CRHSA might apply on how to provide an integrative program to campaign health and clean sanitation embedded with religious practice at mosques or churches. Here, the city government can build a religious site alongside a decent disposal system that informs people about the excellent sanitation infrastructure.

4.5 Challenges and Opportunities for Mainstreaming Sustainable Development

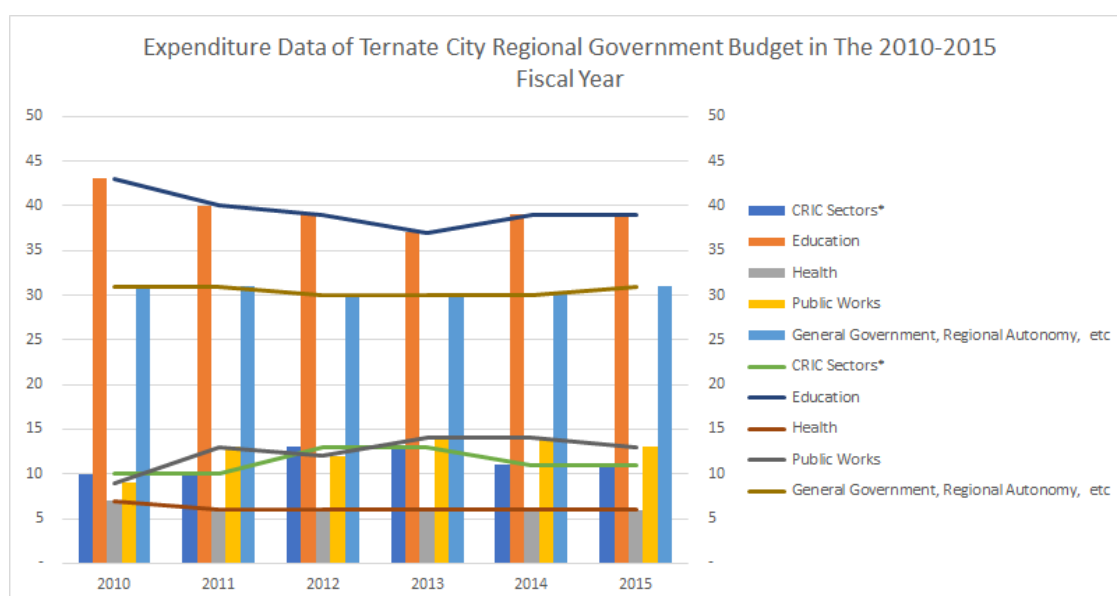
The municipal government oversees the implementation of sustainable development in the context of the marine sector. In the focus group discussion, CRIC expert teams have asked all participants about the Sustainable Development Goals (SDGs), yet participants mainly responded to the city's fishery issues. The main concerns on fishing and farmers' terms of trade are encapsulated in the SDGs discussion. The population in the city approximately consumes 12 tons of fish every day.

As the fish became a primary source of food, fish's death in the coastal line triggered people to comment on this phenomenon and critically link it with climate change. The dead fish incident happened within approximately 4 meters of the coastline and the upwelling process. The incident triggered a decline in fish consumption for around one month, according to a participant in FGD. The considerable degree of climate change caused fluctuations in fishers and farmers' trading terms, making fishing and farm products' sales unpredictable

4.6 Financing instruments

The distribution of spending (see figure 4.2) is based on the institution which disbursed the budget upon the total distribution of 100 percent. The seven types of spending are closely entangled with themes of climate resilience and inclusive cities (CRIC), including the transportation sector, agriculture, environment, forestry, trade, industry, marine, and fisheries. CRIC-related sectors spent around 12% only of the city's total budget from 2010 to 2015, which is equivalent to one-third of public expenditure which is approximately 31%. The small share of CRIC related sectors needs to deal with unsolved problems of open defecation, high risk of sanitation in several districts, unsafe private toilets, and waste disposal issues. Data is only available from 2010 to 2015 from the Local Government Spending Information System of Indonesia's Ministry of Finance. The city official has not granted the recent budget spending data.

Figure 22 - Ternate Public Expenditure 2010-2015



*CRIC Sectors: Transportation, Environment, Agriculture, Forestry, Trade, Industry, Marine and Fisheries Expenditure; Year 2014 were only transportation and environment sectors.

Authors, 2020

4.7 Partnership and Capacity Building

Partnership and capacity building consist of an internal initiative and an external program. The internal initiative started from the Ternate city government, including disaster group congregation, water forum, research cooperation, and spatial plan based on disaster mitigation. Departments of environment, transport, public works, and spatial management gather to execute and ensure disaster-related programs during city budget preparation as part of the disaster group congregation. The water forum addresses water scarcity in highlands and serves as a dissemination way of water-related information. There is also research cooperation on disaster risk prevention with Khairun University to provide inputs for policy formulation. Besides, the spatial plan of Ternate City was modified to adapt to

substantial disaster risks of tsunami, volcanic eruptions and massive urban economic change. It also serves as guidance for the Coordinating Agency of Local Spatial Management.

Cooperation among local governments also relates to the internal initiative among local governments. Such cooperation requires to fulfill something that cannot be afforded by the city government alone. In this case, the city government needs to build excellent and formal cooperation with neighboring regencies for the environmental program and disaster evacuation places. Indonesian decentralization has persuaded such local cooperation under Government Regulation Number 28 the Year 2018 on Regional Cooperation. It intends and urges more local governments close to each other to conduct technical cooperation on development areas, including environmental and disaster resilience.

In the external program, many stakeholders invited Ternate's city government to develop cooperation programs, both domestically and internationally gradually. Those stakeholders included civil society and international organizations. Among them, cooperation with civil society and international organizations shared a significant partnership degree alongside its capacity-building benefits. Rorano, as a civil society organization in the city, developed a capacity-building program to train disaster volunteers in the Batang Dua Islands, located very remotely from the main island of Ternate. For the last three years, the Rorano team has actively assisted Tifure and Mayau Island in the area. Besides, the Indonesia Red Crescent Chapter of Ternate is actively involved in developing Resilience Sub-Districts Program for disaster preparedness. The city government also extensively works with USAID IUWASH PLUS to assess urban water management in the city to strengthen water policy. Details of each stakeholder are listed below:

Table 2 - Development Partners

Civil Society Organization	Academia	International Organization
Palang Merah Indonesia (Indonesian Red Cross Society)	University of Muhammadiyah Maluku Utara (UMMU) Ternate	USAID IUWASH PLUS
Rorano (Civil Society)	Khairun University	
Komunitas Sadar Sampah Kota Ternate (Waste Aware Community of Ternate City)	Politeknik Kesehatan Kemenkes/POLTEKKES (Health Polytechnic of Health Ministry) Ternate	
Komunitas Peluk Bumi Kota Ternate (Embrace Earth of Ternate City)		
Komunitas Pecinta Laut (Sea Lovers Community)		
Save Ake Gaale		

Civil Society Organization	Academia	International Organization
Komunitas Peduli Air Hujan (Rainwater Care Community)		
Muhammadiyah Disaster Management Center (MDMC) of North Maluku		
Forum Pengurangan Resiko Bencana Kota Ternate (Disaster Risk Reduction Forum of Ternate City)		

Authors, 2020

CHAPTER 5

Conclusion and Recommendations

5.1 Conclusion

There are four climate and resilience-related sectors to focus on: air pollution, waste management, water and sanitation and early warning systems for disaster mitigation. The air quality monitoring system should be applied as a measurement tool to indicate the current program's significant progress, including vehicle emission tests and overall environmental program achievement. The city officials should focus more on incrementing waste collection, which has only improved from 5% between 2015 and 2019.

With regard to water and sanitation, the results of an assessment show that the Ake Gaale water debit has decreased by 42%. The seawater intrusion seems to be correlated to this finding. Besides, sanitation issues became crucial problems outside the mainland of Ternate, including Moti, Hiri, and Batang Dua Islands, where effective programs are required.

The lethal consequences of tsunamis and volcanic eruptions, among others, represent multi-hazard risks and should therefore incite the city government to implement more performant early warning systems as a means of disaster risk management. The impact of seawater abrasion also classifies as a disaster risk to the city. Thus, the research argues that

water sanitation and disaster risk management are crucial to Ternate urban development. Spatial consideration includes distant areas such as Moti, Hiri, and Batang Dua Islands. It also suggests regional cooperation with the neighboring cities for placement during possible disaster evacuation.

5.2 Recommendations

Ternate can apply payment for ecosystem services (PES) on water and sanitation to raise public awareness. The reward system in cash or others will encourage people to act in ways that are more eco-friendly. For the early warning systems, the Ternate city government should encourage more actors to be involved and inclusive. Hence, people can become more aware of the impacts of disasters and the importance of climate and geological disaster prevention. Evidence-based policy harnessing the technocratic approach, and local realities will strengthen the policy implementation on climate change and resilience. Besides, the city government may apply regional cooperation to support its climate and resilience programs.

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