Building a Community Adaptive Capacity Model: a Case Study of The Tanjungmas Sub District in Semarang Municipality

by Rukuh Setiadi

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Building a Community Adaptive Capacity Model: A Case Study of the Tanjungmas Sub-District in Semarang Municipality

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Intan Hapsari Surya Putri[1], Rukuh Setiadi[2]

[1,2]Department of Urban and Regional Planning, Universitas Diponegoro, Semarang, Indonesia
intanhsp@gmail.com

Abstract

Climate change has pushed communities to make continued adjustments in various aspects of their life in order to adapt and survive. Adaptive capacity is a key concept in understanding this context. Although a number of researches in the discipline of social sciences have examined the meanings and categories of adaptation capacity, the extent to which this knowledge is used in the field of physical geography has not been adequately studied. Most studies on adaptive capacities within this discipline are focused largely on measuring the level or status of adaptation capacity (i.e. high, medium, or low) in a given region. Moreover, these studies have typically interpreted adaptation capacity as rigid and static. Thus, it sets the same index for all adaptive capacity categories. Sometimes it provides a varied index, but it does not give adequate consideration to the actual condition influencing adaptation capacity (i.e. the characteristic of adaptation goals, actors, resources, and etc.). With a case study approach focused in Tanjungmas Sub-district, this study aims to build a conceptual model which connects overall adaptive capacity categories using qualitative methods. We interviewed 18 key persons including sub-district officers, community leaders, women associations, and other local organisation members. This model may help researchers in the area of physical geography to conceptualize adaptation capacities and to establish an index that more accurately reflects local conditions following additional brief field assessments.

Keywords: adaptive capacity; climate adaptation; community level analysis

1. Introduction

The IPCC (2014) provides detailed climate projections showing that the earth will continue to get warmer even though countries reduce their greenhouse gas emissions. These conditions will affect the whole planet, including the ocean and coastal system. In addition to its vital role to the urban economy, coastal areas are known as a fragile and highly sensitive region. Climate change affects the marine and coastal environment in various ways, such as through rising temperature, increasing sea levels and changes in the frequency and intensity of extreme weather (Hansen, 2010; IPCC, 2007).

Local communities who are living in the low elevation of coastal areas are directly exposed to these changes. The impact of climate change exacerbates many of the pre-existing problems and vulnerabilities faced by communities in coastal areas (Zikra & Lukijanto, 2015). Regardless of the level of exposure and their sensitivity, every local community has different coping or adaptive capacity – the ability to design and implement effective strategies to deal with the effects of climate change. Adaptive capacity, which is also closely related to a number of other common concepts such as management capacity, stability, flexibility, and resilience. De Silva & Soto (2009) suggest that increasing a community's adaptive capacity is essential interventions to reduce the risks faced by the community.

[1] Corresponding Author: Department of Urban and Regional Planning, Universitas Diponegoro, Semarang, Indonesia
Email: intanhsp@gmail.com

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All traits which are attributed to a system that makes it easy to adjust to external change are known as the drivers or determinants of adaptive capacity. In the determination of adaptive capacity, there are various indicators that need attention. Some experts have classified several determinants of adaptive capacity, which include economic resources, technology, information and skills, infrastructure, the availability of strong and well-organized institutions, and equitable access to resources (IPCC, 2014). Adaptive capacity also reflects the learning aspects of system behaviour in response to disruption (Smit & Wandel, 2006).

Adaptation actions include activities to build adaptive capacity. Adaptation actions are relevant at least to the (local) governments, communities and households (Peñalba & Elazegui, 2011). This paper focuses on the community level, since it is the interface between households and local governments. It is not either too broad or narrow. It is a unit in which adaptation is mostly represented by local government. We explore adaptive capacity of community in Tanjungmas, a sub-district of about 7,500 households (BPS Kota Semarang, 2019), which is adjacent to the north coast of Java.

There are many definitions of adaptive capacity from many experts all over the world. Adaptive capacity is the ability of communities to use resources to make changes in adjustable, reactive and proactive ways (Gallopín, 2006). Adaptive capacity varies by time and space. Adaptive capacity is context-specific and varies from country to country, from society to society, between social groups and individuals over time. It varies not only in terms of value but also by its nature (Füssel, 2007). Meanwhile, Plummer & Armitage (2007) argue that adaptive capacity is the ability of a system to adjust its own characteristics or behaviour to extend its range of responses under existing climate variability or future climatic conditions.

Practically, adaptive capacity is the ability to design and implement effective adaptation strategies, or to react to emerging hazards and pressures such as to reduce the likelihood of occurrence and or the magnitude of harmful impacts from climate-related hazards (Seara, Clay, & Colburn, 2016). The adaptation process requires the capacity to learn from previous experiences to tackle current climate challenges and to apply lessons taken from those experiences to address future climate change possibilities (Smit & Wandel, 2006).

Climate adaptation capacity is closely related to the notion of resilience and vulnerability. Adaptive capacity reflects and contributes to a system's resilience, a robust system that has the capacity to prepare, avoid, mitigate and recover from changing climate impacts. Lower adaptive capacity affects a system's resilience in negative ways. Therefore, building adaptive capacity is important to enhance resilience by reducing a system's vulnerability (Brooks, Adger, & Kelly, 2005).

The Africa Climate Change Resilience Alliance (ACCRA) (2012) has identified five characteristics of adaptation capacity to apply at the local or community scale in the face of new shocks and systemic pressures. These five characteristics include asset ownership, institutions, knowledge and information, innovation, decision making and governance. Furthermore, Peñalba & Elazegui (2011) identified some adaptive capacity indicators, which consist of infrastructure, economics resources, technology, social media, skill and knowledge. The concept of adaptive capacity is also highlighted by Wall & Marzall (2006) who describe five aspects of adaptive capacity at the community level: social, human, institutional, natural, and economic resources.

The criteria of adaptive capacity in the economic aspect became one of the decisive factors which has received attention from the above mentioned by experts. This factor can be used as a determinant of adaptive capacity of vulnerable people living in coastal areas. Stronger economic resources will increase adaptive capacity as lack of financial resources often limit options for climate adaptive actions at the community level. In addition, the greater the financial assets owned, the more people in a region are able to recover from material losses. Indicators used in analysing the adaptive capacity on the economic aspect are the household's financial condition and asset ownership.

Social factors are another of the influencing factors that have received attention. People's involvement in the local community groups add to local social networks and a well-networked community will increase its adaptive capacity in responding to the impacts of climate change. Indicators of these social aspects include participation in community groups, access to assistance from or via community groups and community education schemes.

Information and technological factors are important factors in measuring adaptive capacity. Technology and information constraints can limit adaptation options so that access to information and technology will ensure rapid response and increase adaptive capacity. Access to climate change information is one of the indicators under this factor. Equally important, innovation factor is also important in shaping adaptation capacity because it relates to the ability of a system to support innovation related to climate change. Finally, infrastructure also plays an important role to form adaptive capacity such as better road infrastructure and good evacuation shelter. Access to adequate infrastructure will increase the capacity of adaptation. Main indicator on the infrastructure aspect is access to available infrastructure (see Table 1).

Previous study in Tanjungmas, Kumalasari (2014) focused on measuring adaptive capacity status and limited at the households level particularly in Tambak Lorok neighbourhood. The study suggests that the household in the neighbourhood has a high level of adaptive capacity, while at the community and city levels are at a moderate level (Kumalasari, 2014). Several other studies on adaptive capacity such as Fitriawati & Suroso (2017) and Purifyningtyas & Wijaya (2016) have so far focused on measuring adaptive capacity levels and they mostly employ quantitative methods by measuring adaptation status or levels.

Table 1: Adaptive Capacity Indicators

Adaptive Capacity Indicators	
Economics	Household Economics Condition
	Asset ownership
Social	Participation in Community
	Access to aid
Information and Technology	Information about climate change
Infrastructure	Access to infrastructure provided
Innovation	Willingness to adapt

The way adaptive capacity measurement is conducted and then used in larger context (e.g. in vulnerability analysis) by previous studies also provides an interesting point of view. For example, Vincent (2007) and Sietchiping (2006) in their study determines the value or weight on each adaptive capacity indicator contradictorily. While Vincent's adaptive capacity study provides the same value for each adaptive capacity indicator, Sietchiping (2006) gives different values on each indicator. It means there is inconsistency on how to determine the value. It raises the issue of the comparability of vulnerability analysis grounded in inconsistent quantitative-based adaptive capacity assessment. Most research in measuring adaptive capacity and vulnerability do not specifically consider adequate explanation when determining the value (Adger et al., 2007). The basis, assumption or evidence underlying determination of value of each adaptive capacity is often overlooked in research. This paper attempts to fill this gap by exploring whether the differences of approach to value adaptive capacity matter.

By reviewing the interrelationships between adaptive capacity indicators in the study area, this study aims to build an adaptive capacity model and to find out the most influential indicators of adaptive capacity. This study employs a qualitative approach in analysing adaptive capacity to fill methodological gaps. It is to complement previous research on adaptive capacity that has been done before. Thus, this study does not claim either quantitative or qualitative approach as the best methods in adaptive capacity analysis. Through this study, the most appropriate step or adaptation strategy to be implemented in the future can be formulated. In addition, this study is expected to contribute to strengthening the qualitative approaches in adaptive capacity studies.

2. Research Method

This study employed a qualitative approach. This study aims to build a model which connects overall adaptive capacity categories. Despite some issues about its clarity (at this infancy stage), the model is expected to bridge physical geography and social science practitioners to have a more productive connection when working on adaptive capacity topics.

Interviews were conducted with a purposive sampling technique that is the selection of key informant informants by using certain criteria in order to obtain reliable and capacity samples in accordance with the research topic. Several criteria such as they are categorized as vulnerable people who get impacted from flood/tidal flood and they understand about climate change problem in Tanjungmas Sub-district. Accordingly, this study uses interview data from interviews of nine key persons in Tanjungmas Sub-district. The interviews were conducted in 2018 and involved sub-district secretary, chiefs of neighbourhood (RT/ RW), and members of the local fishing community. Using focused-semi structured interviews, the interviews were organised around three main themes: (a) the impact of floods, including tidal floods, (b) the element of adaptive capacity available to the community and (c) the meaning and priority of each adaptive capacity element to the community. After that, the data from the interview was transcribed and analysed thematically based on three main themes of study.

Furthermore, this study also involves a survey of the relevant institutions to obtain secondary data. There are some institutions involved such as Semarang City Central Statistics Bureau (BPS), Tanjungmas Sub-district office, Meteorological Climatology and Geophysics Agency (BMKG) of Semarang and Disaster Management Board (BPBD) of Semarang. The secondary data in this study is utilized to give illustration about Tanjungmas sub-district condition in terms of basic study profile, disaster event and climate events.

2.1 General Description of Tanjungmas Sub-District

Tanjungmas Sub-district, which has urban characteristics, is located in the northern part of Semarang Municipality. Administratively, Tanjungmas Sub-district consists of 16 neighbourhoods (RW) and 129 blocks (RT). In terms of socio-cultural sense, Tanjungmas Sub-district is divided into three kampongs. These are Kebonharjo (RW 1 to RW 11), Tambak Mulyo (RW 12 to RW 15), and Tambak Rejo (RW 16). Figure 1 shows the location of the sub-district.

This location is perfect as a study area because approximately, a half of the area of Tanjungmas is prone to flood, either from rain and or tidal. Based on data from 1993 to 2014, it shows the tidal flood in the sub-district has increased in terms of height and duration over the period. The height of the tidal flood has increased more than 50 cm, while the duration of tidal flood takes up to 5 hours (Kumalasari, 2014). In the last few years, fishermen have also suffered from disruption in the sea due to extreme weather conditions.

Big waves and strong winds prevent them from catching fish leading to decreased income (Perdana, 2015).

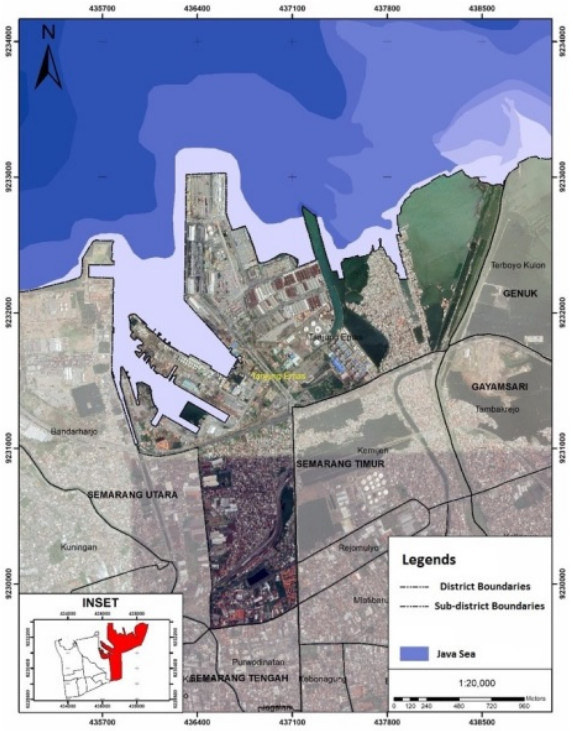


Figure 1. Map of Tanjungmas Sub-district

3. Result and Discussion

3.1 Impact of Flood/Storm Water in Tanjungmas Sub-District

This study confirms that the community in Tanjungmas Sub-district and its surrounding environment experience climate change impacts. These impacts affect the condition of public health, household assets, community business, access to basic services and infrastructures, and the environmental quality.

Flood and high tide that often occur in Tanjungmas affected the health condition of the local community. Flood comes usually mixed with mud, rubbish and salty water. Some of the health impacts felt by the community include the diseases of water flea, skin diseases, itching, illness and sleep difficulty. The flood smells fishy and may contain toxic materials. Local people believe it causes skin diseases or itching, especially for children. When the flood recedes, the humid condition in the district's neighbourhoods provides a fertile environment for insects such as mosquitoes to breed. It exposes the community with other vector-based diseases. A community leader, one of neighbourhood's heads, during the interview stated:

> "As for the health aspect, inundation of flood which is mixed with garbage, fish, or anything else can cause itching for those who can't stand with it." (Neighbourhood Head/RW)

> "Rubbish disposal also washed away when a tidal flood came; it is dirty; it causes itching. Water fleas can also break out." (Neighbourhood Head/RW)

> "Tidal floods can trigger diseases; it makes our environment uncomfortable and it smells bad because of dirty inundation. Sometimes there are larvaes too, so many mosquitoes which cause sleep disruption." (Fisherman)

Flood leads to home submergence and gives impact to household assets because flood water that enters and soaks the community houses is corrosive. It can damage electronic goods and household appliances. In addition, it reduces asset lifetime such as vehicles as they are easily porous. Moreover, flood or tidal flood in Tanjungmas Sub-district also give impacts on local business and access to basic community services. Flood has paralysed access from and to this sub-district and prevents those who want to do local business or day-to-day travel. Flood also disrupted fish drying activities, especially in

Tambakmulyo and Tambakrejo, where community livelihoods in these kampongs come from fisheries and marine sectors. Another impact is the disruption of trading activities. When the flood submerges the road and houses, the community stalls are also temporarily closed. Consequently, the seller's income during flood periods decreased. Moreover, in the end of 2017, one of the education facilities in this sub-district (e.g. Barunawati Junior High School) was flooded and paralysed teaching and learning activities for several days. Flood soaked the stocked books that would be used for the next semester.

3.2 The Meaning of Community Adaptive Capacity for Community in Tanjungmas

This part explains the meaning of adaptive capacity from community point of views. It consists of five adaptive capacity elements namely economic, social, technology and information, infrastructure and innovation.

3.2.1 Local Economic Capacity

Adaptive capacity research from ACCRA (2012) and Hogarth & Wójcik (2016) highlight that economic capacity represented as income and asset ownership are vital elements to maintaining and increasing adaptive capacity. Capacity of economics in Tanjungmas Sub-district relates to people's ability to afford house renovation or uplifting, daily consumption, cost of education and additional after-school private courses, boat improvement (especially for fishermen), and local road improvement. Local community acknowledges that the capacity of economics is important to be considered in improving their ability to adapt to flood or tidal flood in the sub-district. In addition, the community considers that good economic capacity can support them to do various adaptations to flood or tidal flood and capacity to have better life conditions. This is understandable as almost all adaptation measures by the community require adequate financial support. Figure 2 shows the various meanings of economic capacity to adapt to the situation in Tanjungmas.

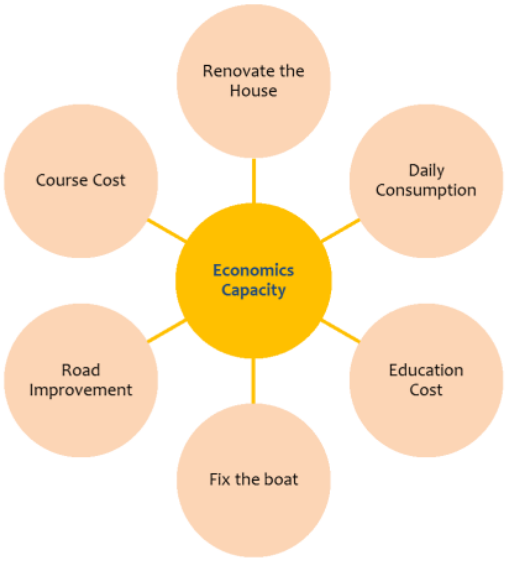


Figure 2. Economic Capacity in Tanjungmas

3.2.2 Capacity of Social

Based on the results of interviews, there are four important elements to be considered in the social aspect. These are (i) the type and (ii) role of community groups or communities, (iii) the sources and (iv) types of assistance or support received by the community so far in order to adapt to flood and tidal flood. There are many community groups in this study area who have different roles and have made several contributions in helping people to deal with floods. Figure 3 explains about the type of communities and what they have done in Tanjungmas Sub-district.

The majority of people in Tanjungmas Sub-district are classified in the low-middle income communities, hence they cannot face their problem by themselves. So far, there are many supports to help them adapt to flood, though with different intensity, from various institutions such as corporate social responsibility from companies or program allocation from academic institutions, government agencies (local, province, or central), navy, local disaster management board, Indonesian Red Cross, and also mosque council. The support is delivered in various forms such as human resources and financial assistance and physical and institutional support. The results present that government and external support substantially improve local activities capacity.

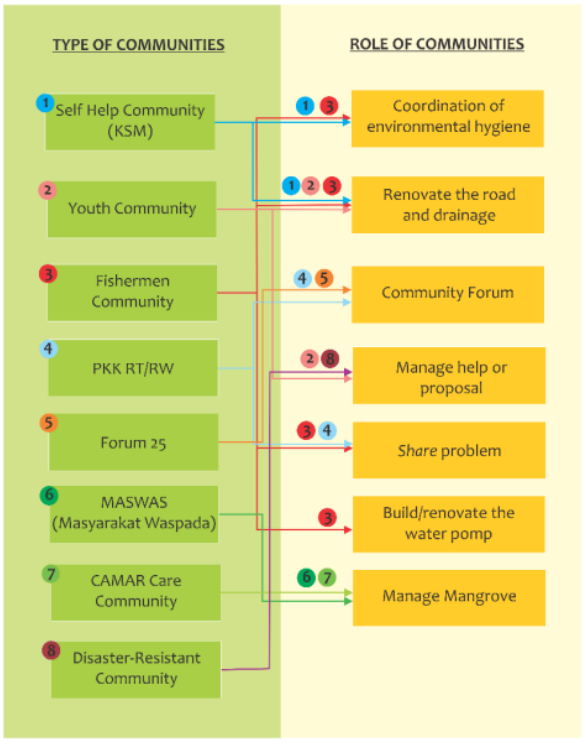


Figure 3. Type and Role of the Communities

Through existing local community groups, adaptation efforts in this sub-district can be more coordinated and directed. As for supports received by the communities, they consider that the support is one of the important things for them for helping them able to survive. The community feels that they would not been able to handle and solve their problems without the help from these institutions.

3.2.3 Capacity of Technology and Information

The availability of information to the community can assist them to overcome problems associated with floods. Local community argues that the existence of good information and technology can facilitate and make their work easier. It is because when the flood hits, people already get notification in advance. Thus, it can reduce the likelihood of losses incurred from the flood and reduce the possibility of casualties. On the other hand, information also plays a strategic role to facilitate communication between citizens, as well as with stakeholders. There are some stakeholders that give flood information to community in Tanjungmas, i.e. Tanjungmas Sub-districts officer, North Semarang District's officer, Meteorology Climatology and Geophysics Agency (BMKG), Local Board of Disaster Management (BPBD), and Indonesian Red Cross.

Based on the previous explanation it can be seen that information and technology plays an important role in increasing the community's knowledge about the actual and factual environmental conditions of the neighbourhoods. The constant sharing of information from various parties is supported by the use of technology such as smartphones. Chief of neighbourhood, head of sub-district, and city government officials can maintain communication easily to discuss flood preventive actions and responses. Improved access to climate-related information increases the community's early awareness of flooding.

3.2.4 Capacity of Infrastructure

The meaning of infrastructure capacity according to the Tanjungmas community can be associated with the availability of supporting public facilities and infrastructures. In this case, the facilities and infrastructures can help to prevent flood or tidal flood entering their neighbourhoods or to protect the community from flood. Public facilities available in Tanjungmas Sub-district include roads, drainage, dikes, water retention pool, flood channel, breakwater, and bridge.

The interview results suggest that infrastructures are important to be considered for improving the ability to adapt to floods in Tanjungmas. In addition, the community considers that adequate and well-functioned infrastructure can support them to maintain day-to-day activities. The diversity of infrastructures in Tanjungmas enhances community resilience to flood or tidal flood.

3.2.5 Capacity of Innovation

The results of interviews suggest that innovation capacity refers to any efforts by local communities and stakeholders to create new strategies or techniques that can help them to overcome flood. Some of the existing innovations are mangrove cultivation practice, establishment of CAMAR community group, the application of sediment traps and drainage nets. Other types of innovation include the development of retention ponds, a floating community hall and concrete plates. One famous innovation in this community is the floating hall, which was developed by the support from the central government through the Ministry of Public Works. This floating hall is a new innovation and has become the first floating hall in Indonesia. This floating hall is utilised for community meetings and is equipped with a library. The floating hall is also used by local people to do informal gathering and as a place to increase community interest for reading. In addition, the electricity to run this floating community hall is from solar power, while sanitation facilities for this hall apply *biofil* technology. The result of the interview confirms that innovation is important in order to improve adaptation to floods and they also believe that innovation is key for significant progress in their neighbourhood.

3.3 The Linkages of Adaptive Capacity Indicators

This section describes an interconnections model of adaptive capacity indicators of Tanjungmas Sub-district. The model is expected to be useful to understand the constellation of all adaptive capacity indicators, which may also relevant to other communities. This model can be seen as a single entity of all adaptive capacity elements. The model consists of ten elements of adaptive capacity, which are then be organised into four major elements namely: (1) Agents, innovation, and information-technology, (2) function or role of community organisations and technologies; (3) resources; and (4) goals. The model can be illustrated as Figure 4.

3.3.1 Element of Agents/IT/Innovation

A number of adaptive capacity elements such as availability of community network (C), availability of aid institutions (D), the information sources (G) are interrelated. In addition, innovation (J) and IT performances (H) is in the heart of this adaptive capacity element. The communication between actors needs to be supported by the advanced information communication technology (H) to make it faster, more effective and more efficient. When local government allocates aids or supporting stuff for this neighbourhood, the role of local community (2) is required, so that aid can be equitably distributed and managed accordingly. Similarly, in the dissemination of disaster-related information or natural conditions, the information providers such as BMKG or BPBD also require coordination with district, sub-districts, and local community groups so that the information can be equally distributed to the community. In addition, the availability of communication technology and devices facilitate communication. Furthermore, the community also needs to be supported by constant innovation, so that they can find new efforts or alternatives to have better solutions in overcoming floods.

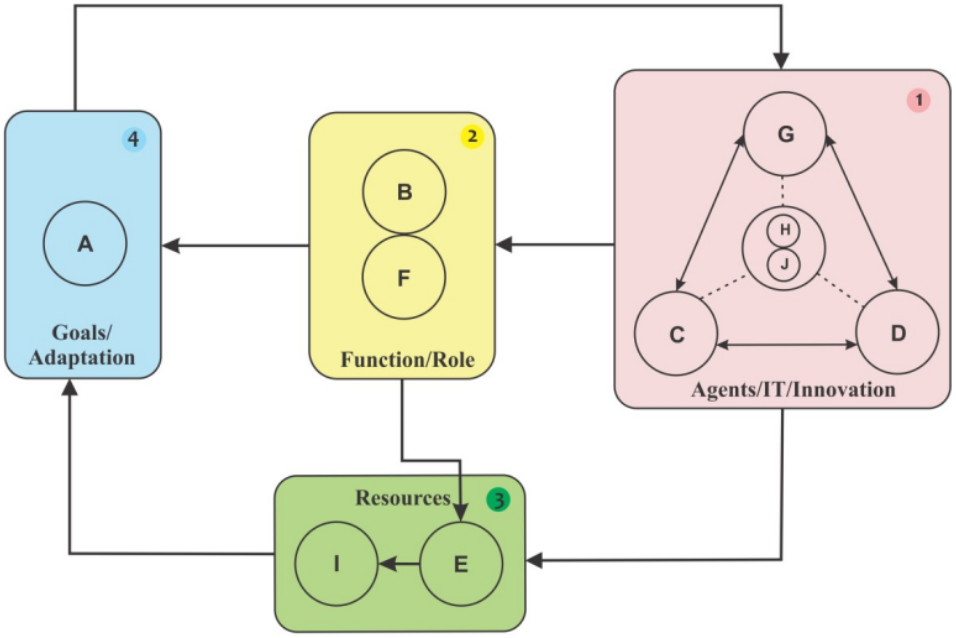
3.3.2 Element of Function/Role

This section describes the community capacity to perform (B) and capacity of information providers (F) as supporting systems to develop and enhance adaptive capacity in Tanjungmas Sub-district. This study indicates that the function or role of a community varies such as managing aids, drafting aid proposals, renovating road or drainage, coordinating environmental hygiene activities, cultivating mangroves, and others. The role of information and technology is to facilitate communication, simplify the work to become more efficient and effective, and also means to share problems or news. The role and function of community groups and information technology works well if supported by good quality actors (i.e. as the conditions described in the elements of agents/ innovation/ information technology). This study confirms that a community can perform its functions properly if supported.

3.3.3 Element of Resources

This element consists of infrastructure capacity (I) and type of support or aid (E) received. Infrastructure is in the form of public facilities that supports the community to survive in Tanjungmas Sub-district. These facilities include roads, drainage networks, embankments, water retention systems, floodways, wave breakers, and bridges. In addition, Tanjungmas Sub-district also received various types of support both in the form of physical or non-physical supports. Physical supports include likely roads, drainage, communal sanitation system, and house renovation. Meanwhile, non-physical supports include training and compensation money.

Obviously, both physical or non-physical supports are obtained through other donors or funders. Community in Tanjungmas cannot stand alone in overcoming the flood. A collaboration is required between the community and the donors or funders. So that the resource element (3) is linked to the agents/ information technology/ innovation element (1). It will be easier and more coordinated if community that can help to manage aids from outside donors is available. In addition, the actors are not only required but also capable of performing functions and roles very well, so that the management and maintenance of available infrastructures can be used by the community optimally. Therefore, the resource element (3) is related to the function/ role element (2) and the agents/ information technology/ innovation (1).



Note:

A : Financial Capacity	F : Capacity of Information Providers
B : Community Capacity to Perform	G : Source of Information
C : Availability of Community Nerwork	H : IT Performance
D : Availability of Aid Institutions	I : Infrastructure
E : Type of Support	J : Innovation

Figure 4. Adaptive Capacity Model in Tanjungmas Sub-district

3.3.4 Element of Goals

As for the goals in element (4), it can be achieved when necessary supports from the role/ function element (2) and resource element (3) are available. If these two supporting elements are not available, the adaptation goals are something difficult to achieve. Infrastructures and different types of support received by the community and coupled with the role of community and information technology, can help them to achieve the adaptation goals. For example, the goal of the community is to get the local roads improved. So, they need funding support or assistance, and the involvement of the community so that the road can be fixed. From such linkages, the achievement of existing adaptation goals can improve the condition or quality of agents/ actors who are involved in Tanjungmas Sub-district.

The four major elements of the model in Figure 4 should be illustrated by boxes with thickness variations indicating the relative importance of each element in the adaptive capacity assessment. However, this study finds that the position and status of each adaptive capacity element is equally important and interrelated. So, the established adaptive capacity model in Figure 4 illustrates that each box of elements has the same thickness. The model of adaptive capacity illustrates the interrelationships between elements that can influence each other, so it can form like a cyclic process. It can be seen that between the elements of goals (4), function/ role (2), agents/ innovation/ information technology (1) and resources (3) have a relationship. Thus, it can be said that the adaptive capacity indicators are mutually supportive and equally important in determining the overall community adaptive capacity. This study suggests that all indicators of adaptive capacity are important, and the indicators of adaptive capacity are interrelated. In order to improve the capacity of the community, ideally, all adaptive capacity indicators must be addressed in a systematic manner, so it is not just focusing on a single element. It is crucial to maintain that all adaptive capacity elements can work and perform well.

This model may support previous adaptive capacity-related studies that provide critical adaptive capacity largely by quantitative methods through the calculation or measurement by giving equal weight to each indicator or element. The results of this study can give evidence to the background of previous research on how to give the same score or value for each indicator of adaptive capacity. Although ideally

there is a hierarchy in prioritizing adaptive capacity, at the practical level it is difficult to figure them out. Besides that, this research tried to make differences in assessing the adaptive capacity by developing models as the output of study. The adaptive capacity model in Tanjungmas Sub-district illustrates how each indicator can be interrelated in supporting the adaptation capacity of Tanjungmas community.

The adaptive capacity model in the future is not related to the quantitative process of quantifying adaptive capacity but can be useful in enhancing the capacity of adaptation activities in a region. In order to enhance adaptive capacity, it is important to take account of linkages and to consider alignment among elements, so that capacity building efforts can be created by providing intervention or investment in any element. Increased capacity in resource elements and role/ function elements can have a direct impact on goal achievement. However, resource and functional elements also cannot support the achievement of goals directly, if not supported by actors, technology and innovation.

4. Conclusion

This study uses the Tanjungmas Sub-district as a case study to better understand the inter-linkages in overall climate change adaptation capacity at the local level. Tanjungmas Sub-district is one of the urban areas in Semarang which is prone to storm and tidal floods. This study assesses five elements of adaptive capacity namely economic, social, information and technology, infrastructure and innovation. Accordingly, a model of community adaptive capacity is developed showing that each adaptive capacity element is connected to each other in a cyclical manner. This study highlights that any assessments on a community's adaptive capacity should consider a number of factors and should be aware that all these factors are connected. They should be equally weighted in importance.

Despite its strength to develop an initial model of adaptive capacity, this study failed to identify the relative importance of each adaptive capacity indicator from a community point of view. As all the elements are interlinked, the local community finds that it is very difficult to determine the most important adaptive capacity. Using similar weights for each adaptive capacity element assumes that they are in a composite model is equally important to local community members, but this might not be the case. This research demonstrates that further work is required to elicit the views of local people about their adaptive capacity, in order to develop more locally sensitive plans and strategies for dealing with the increasing impacts of climate change in vulnerable urban communities.

Exploration on the use of either analytical tool (e.g. analytical hierarchy process/AHP; analytical networking process/ANP) to develop a more conceptual model of this adaptive capacity could be potential for future research. Thus, some further work could be done with local key actors to develop some local indicators relating to each factor.

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