

Building a transformative adaptation: Comparing municipal government' and community's initiatives on minimizing the risk of coastal inundation in Pekalongan

Artiningsih^{1,3}, S Worosuprojo², R Rijanta², S R Hardoyo², M H S Pratama¹, and N C Putri¹

¹ Urban and Regional Planning Department, Diponegoro University, Semarang-50271, Indonesia

² Faculty of Geography, Gadjah Mada University, Yogyakarta-55281, Indonesia

artiningsih@undip.ac.id

Abstract. In 2006, coastal inundation was firstly reported to start entering community's agriculture land in Northern part of Pekalongan, Central Java, Indonesia. The exposure covered most of paddy fields and fishponds. The disturbance has become bigger, when the exposure of coastal inundation has started to cover some part of settlement areas in 2010. Increasing salinity has prevented farmers to grow paddy cultivation and has forced them to find a new way for living. Pekalongan Municipal Government prepared Pekalongan City's Resilience Strategy (PCRS) in 2010 in cooperation with PAKLIM-GIZ, and it involved significant and meaningful local stakeholders' participation process. One of the concerning strategies was to minimize the risk of coastal inundation. In terms of PCRS implementation, observed local community has different planning interpretation in comparison to the municipal government. This paper aims to evaluate the implementation of PCRS by comparing the municipal government' and community's initiatives - either in the stage of planning or/and implementation - from a transformative adaptation perspective. Data for this study was collected through interviews with several key informants, who were selected by purposive sampling method. These key informants consist of Pekalongan Municipal Government Agencies' members and local community figures in Northern Pekalongan Sub-district. This research reveals a double development standard from the side of municipal government, when it comes to prioritize both the economy and the environment. However, the local community prefers to choose a new livelihood, which provides them not just economic security, but also social and ecological benefits.

1. Introduction

Transformative adaptation, defined as adaptation that is recognized for its potential address root causes of poverty and failures in sustainable development, including the need for rapid progress on mitigation. Thus, municipal government has to prepare a framework that support relevant investment, behavior among household, communities and enterprise [1]. Case study on several cities and regencies in Central Java conveyed that there are 4 types of transformative adaptation scenario in terms of economic development namely 1) a profitable economic scale, 2) fostering fisheries and marine resource on livelihood shifting and diversification, 3) vertical (from agriculture as primary sector to industry,



commercial and trade, and end up on tourism) and horizontal (from food-crop to fisheries/livestock or from an-organic to organic farming) transformation and 4) modernization [2].

Sustainable Development Goals' (SDGs) implementation on urban areas has many challenges. Achieving sustainable nations need encouragement on creating resilience cascade, start from community, cities, regions and end up on national level [3]. In order to make cities and human settlements inclusive, safe, resilient and sustainable (Goal no 11), many attempt related to underpinning combating climate changes (Goal no 13), end of poverty (Goal no 1) and hunger (Goal no 2) are needed [4].

Many coastal areas are vulnerable to increasing inundation as an impact of Sea Level Rise (SLR). Recently, many coastal areas in Central Java Indonesia are already subject to coastal hazard due to tidal inundation and flood. The impact of the inundation is predicted to be even more severe with the prediction of sea level rise in the next 20-100 years [5]. Extended coastal inundation has become endangered coastal community livelihood.

In 2006 coastal inundation was firstly reported start to entering community's agriculture land in Northern part of Pekalongan, Central Java, Indonesia. The exposure covered most of paddy fields and fishponds. The disturbance has become bigger, when the exposure of coastal inundation has started to cover some part of settlement areas in 2010. Increasing salinity has prevented farmers to grow paddy cultivation and has forced them to find a new way for living. Loss and damages of community assets and public facilities has been occurred. This why, human and biophysical vulnerability are needed to consider accordingly. Community readiness is a key of success on adaptation process. This readiness include social learning and flexible networking which has become an important practical tools for finding sustainable livelihoods which enhance community persistence to live at risk [6].

People come up with some choices as alternative for livelihood shifting/diversification and adaptation. They tried to learn new thing, such as milk-fish, tilapia-fish, vaname-shrimp or tiger-shrimp and sea-weed cultivation. Considering the difficulties and opportunities in doing those new experience and regardless their existing skill capacity, technique and knowledge, they force to decide what the best option for living. It is *...crucial to support the ability of urban communities to negotiate their need and rights in order to increase their the flexibility and inclusiveness....* [7]. Nevertheless, there are lack of information about how people in urban area build a transformative adaptation through their community's initiatives.

This paper will evaluate what choices have made by coastal farmers on Northern Pekalongan Sub-district. These choices would represent as community's initiatives on build a transformative adaptation.

Regarding on inclusive development, Pekalongan Municipal Government has prepared Pekalongan City's Resilience Strategy (PCRS) in 2010 in cooperation with PAKLIM-GIZ (Donors from Germany). It involved significant and meaningful local stakeholders' participation process [8]. One of the concerning strategies was to minimize the risk of coastal inundation. In terms of PCRS implementation, observed local community has different planning interpretation in comparison to the municipal government. Therefore, this paper aims to evaluate the implementation of PCRS by comparing the municipal government' and community's initiatives - either in the stage of planning or/and implementation - from a transformative adaptation perspective.

2. Research Method

Using qualitative approach, case study research was occupied to answer the question of 'why and how' [9]. Especially for answering some question such as:

1. Why did the community live in an inundated settlement? How did they tackle their environment changes?
2. Why did they choose to livelihood shifting or diversification? What kind of livelihood experience did they have?
3. How did the community build transformative adaptation to reduce the risk of coastal inundation and floods? What kind of initiatives have they done?

4. How was the local government tackling the coastal hazard? What kind of initiatives have they done?

Deep knowledge of an individual could give much useful information instead of hundred respondents who do not know anything or have limited knowledge [10]. Data for this study was collected through interviews with several key informants, who were selected by purposive sampling method. These key informants consist of Pekalongan Municipal Government Agencies' members and local community figures in Northern Pekalongan Sub-district. However, the local community prefers to choose a new livelihood, which provides them not just economic security, but also social and ecological benefits. Some triangulations have been done to gain data validation and verification. These triangulations involve related donors and NGO.

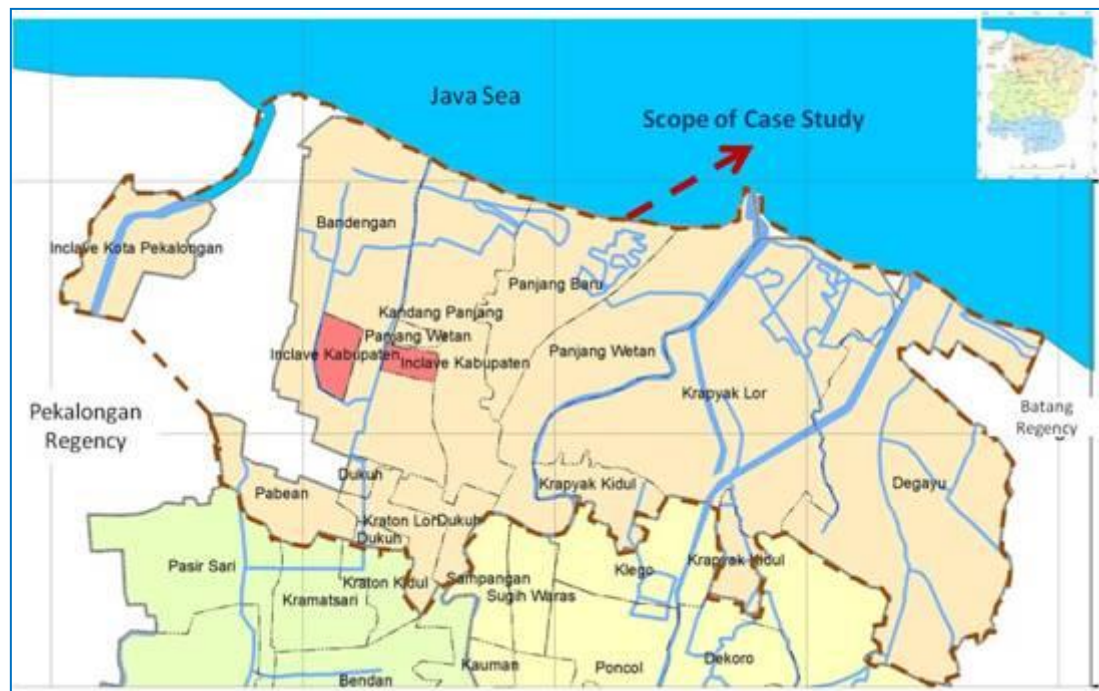


Figure 1. Scope of case study [11].

Scope of case study area consists of 6 sub-districts on North Pekalongan District, namely Bandengan, Padukuhan Kraton, Kandang Panjang, Krapyak, Panjang Baru and Degayu. See Figure 1 which illustrated the location of scope of case study has taken. Those areas selected based on the most recently inundated area, which have triggered communities to elevate their capacity from vulnerable to cope with, adapt and short term resilience. Considering increasing community's capacity as a process, there was various achievement on each process that followed on transformative path ways respectively [6]. Important critical point on how the community decide to move on further process has proven both of transformation adaptation and resilience thinking. Some of them has attained either environment recovery or higher capacity in reducing the risk of coastal inundation. Those transformative adaptation was identified by community experienced, novel knowledge on reducing their vulnerability by minimized risk of coastal inundation, especially on livelihood adjustment either alteration or diversification.

Evaluation analysis has been done based on PCRS implementation performance by assessing development outputs/outcomes on social, economical, physical and ecological aspects. Elaboration from some important findings which were supported to related SDGs achievement were needed in order to compare Pekalongan Municipal Government and communities' initiatives.

3. Result and Findings

Community initiatives on economical and ecological development aspect were determined based on their transformative adaptation which was indicated by livelihood choices. Table 1 provides information of coastal farmer's consideration on livelihood choices. Their choices mostly was determined based on how does their livelihood alternatives give them sustainable benefit with low of production cost, what kind of potential risk and failure related each choices respectively and what kind of consequences in terms of livelihood sustainability. When coastal inundation was entering their paddy fields in 2006, land salinity has been increasing and prevented them to grow paddy and jasmine any longer. Thus the community tried to find a new way of life by livelihood shifting or diversification.

In line with Handayani et al, 2015 [2], which reveal with vertical and horizontal livelihood transformation in Central Java Province. Vertical livelihood transformation in North Pekalongan District slightly revealed as outcome of aqua-culture livelihood, indicated by emerging local tourism activities. Mostly transformative adaptation illustrated by horizontally shifting livelihood transformation from former community livelihood on mangrove cultivation and agriculture (paddy and jasmine cultivation) to aqua-culture (fishery on fishpond) and combination of it. Little part of community conveyed livelihood diversification as simultant activity to gain multiple income from agriculture and informal sector employment such on household enterprise or batik industry.

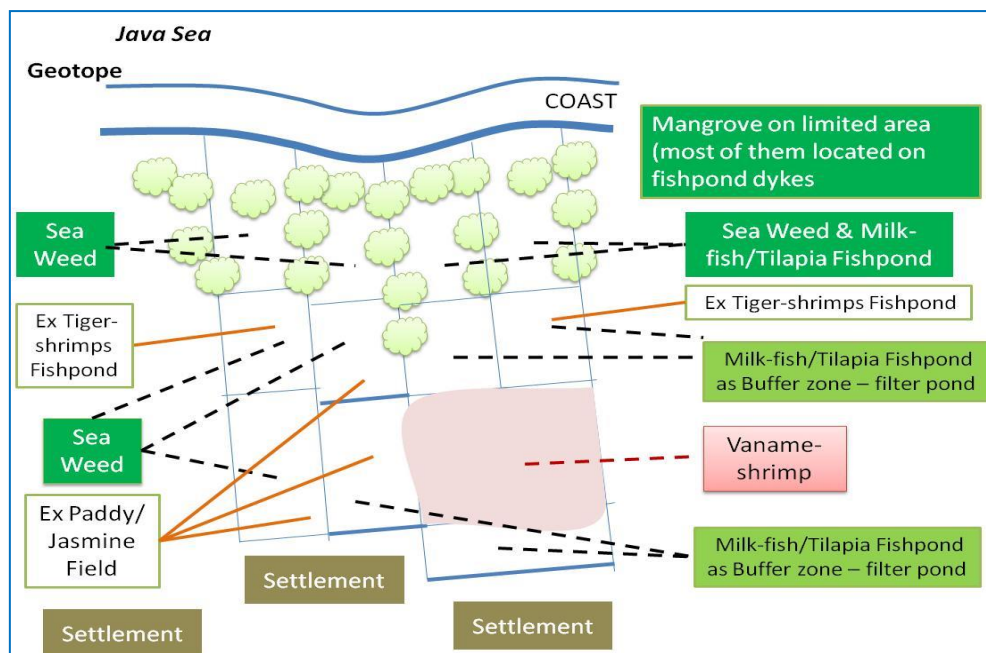


Figure 2. Imagery of adjustment space as livelihood shifting consequences.

Livelihood shifting triggered by exploitation of mangrove forest which convert to fishpond, due to high-demand export of tiger-shrimp in early 1990s. After a decade of growing mangrove conversion, livelihood shifting continued with paddy and jasmine cultivation into milk-fish/tilapia-fish cultivation at the beginning of transformative adaptation phase and continued with vaname-shrimps or sea-weed cultivation on the advance process of it. Those livelihood shifting illustrated on Figure 2. Parcel of land has facing different occupancy from time to time. This phenomena represented on adjustment space as livelihood shifting consequences.

Table 1. Coastal farmers consideration on livelihood choices as community initiatives.

Livelihood Alternatives	Possible Benefit	Possible Cost	Supporting to SDGs Achievement
Mangrove Cultivation	<ul style="list-style-type: none"> • Protection from abrasion • Bio-diversification (mangrove, prawn, shrimp, & wild fish) & economic benefit 	Reducing mangrove intensity due to lack of maintenance; community's illegal cutting	High support on conservation attempt which give important effect for providing resources supply recovery
Tiger Shrimp Cultivation on Fishpond	<ul style="list-style-type: none"> • High Economic Value • Fulfilling Export Demand • Tiger-shrimps cultivation give bigger income for farmers 	<ul style="list-style-type: none"> • Total production was decreasing after 2 years due to chemical feeds and drugs • Increasing threat of Mangrove extinction due to altering land cover to fishpond 	Contra-productive with Mangrove Conservation. So give low support to achieve sustainable agriculture.
Paddy Crops on Paddy field	<ul style="list-style-type: none"> • Huge productivity until beginning of 2004 & decline until 2006 • High economic value • Give farmers ability to pay the cost of pilgrim 	Increasing chemical fertilizer uses	None, as consequence of increasing salinity
Jasmine Plantation	<ul style="list-style-type: none"> • Huge production until 2010 as paddy intercropping • Fulfilling the need of Jasmine Tea Industry • High economic value • Ability to fulfill children education tuition fee until bachelor degree 	Increasing chemical fertilizer uses	None, as consequence of increasing salinity
Milk-fish Cultivation	<ul style="list-style-type: none"> • High tolerance with pollutions • Small capital and low cost of maintenance. • Simple technology • Fishing as attraction activity on local tourism 	soil-smelling milk-fish due to low water supply in dry season, push down the selling price	<ul style="list-style-type: none"> • Medium sustainability • Farmers did Milk-fish cultivation as side job not primary livelihood
Tilapia-fish Cultivation	<ul style="list-style-type: none"> • High tolerance with pollutions • Small capital and low cost of maintenance. • Simple technology 	Risk of drift out fishpond due to flooding	<ul style="list-style-type: none"> • Medium sustainability • Farmers did Tilapia-fish cultivation as side job not primary livelihood

Livelihood Alternatives	Possible Benefit	Possible Cost	Supporting to SDGs Achievement
Vaname Shrimps Cultivation	<ul style="list-style-type: none"> Fishing as attraction activity on local tourism High price and demand Milk-fish and Tilapia fish on filtered pond as positive externalitas of vaname cultivation 	<ul style="list-style-type: none"> Big capital High cost of maintenance Vulnerable with some disease High risk of crop failure Total production was decreasing after 2 years due to chemical feeds and drugs 	<ul style="list-style-type: none"> Low sustainability, need government support in cooperation with private sector
Sea-weed cultivation	<ul style="list-style-type: none"> Small capital with low cost maintenance High tolerance with pollution The role of Milk-fish and Tilapia fish as pest-plant eater 	<ul style="list-style-type: none"> Need dyke-fishpond support Threat of chemical utilization as farmer choices on anorganic farming due to push up the production volume 	<ul style="list-style-type: none"> High sustainability (if kept on organic farming) Potential to give either economic, social or ecological benefit as a production package

Compare to community initiatives, Pekalongan Municipal Government Agencies performed selected programs implementation from PCRS related to several aspects of developments. Those implementation have been experiencing some difficulties, since it have not been reinforced and supported by any special Cities Act. However, part of them has similarity with Municipal Agency's Programs and Projects.

Considering goals of Pekalongan City's resilience, many of them mostly intend to reduce city's emissions through related development's sectors as mitigation attempts. Therefore, transformative adaptation program related to community capacity and resiliency enhancement attempts become less priority.

Table 2 shows Government initiatives. The development orientation was considered more on physical aspect such as public infrastructures, which has become not just local or regional but also national authorities. Social economical aspect, especially on building socio-ecological resilience has become the second layer of development. Controlling flood and coastal inundation strategy due to increasing rain intensity have been targeted as risk reduction on 2015. Pekalongan City's drainage plan and program improvements done by DPUPR (Pekalongan Public Works and Settlement Agency). Neither selected city road nor paved road elevation on settlements area were consider on Pekalongan City's Resilience Action Plan. But surprisingly, regarding community satisfaction, it gave good performance effectively on North Pekalongan District risk reduction attempts.

Table 2. Selected development sectors as government initiatives.

PCRS	Pekalongan Municipal Government Initiatives	Supported Planning & Development policy
Mitigation: Infrastructure improvement on inundated area for vulnerable public facility/ utility and settlements in particular	<ul style="list-style-type: none"> • Improve access (road elevation) to Fish Market and Port on coastal core area (2015) • Encourage Local Tourism Attraction on coastal area (boat-ride, fishing, fish market, culinary) • Fishery & Marine Techno-park upgrading (2016) • Build 'Geotope' as sea wall along the coast to reduce abrasion and minimize coastal inundation (2014-2015) • Housing upgrading for the poor • Cleaning beach environment regularly 	<ul style="list-style-type: none"> • Developing <i>Minapolitan</i> (Fish-city) on North Pekalongan District • Drainage Master Plan (2014)
Mangrove Conservation	<ul style="list-style-type: none"> • Mangrove plantation on limited coastal area (10.000 mangrove was planted, but less than 50% were survive) 	Developing Mangrove Information Centre
Community Empowering	<ul style="list-style-type: none"> • Sending selected farmers for training on vaname-shrimps cultivation • Manage Public Private Partnerships on vaname-shrimps cultivation 	

Drainage Masterplan has been made by BAPPEDA (Pekalongan's Development and Planning Board) in 2013. Therefore, there were some difficulties on financing polder system due to limited support from national budget (which need more than 250 billion rupiahs). This polder system were planned to reduce inundation on east part of Pekalongan. However, some significant progress of drainage system improvement reveal, since a big portion of inundated area in Slamaran, located on northern-east part of Krapyak Sub-district, has been succeeded to break free from inundation. This succeed was supported by prior river diversion management on Old Banger River.

Meanwhile, other sub-districts such as Kandang Panjang and Panjang Wetan have reduced the risk of inundation as an impact of city main road and local pave road elevation, from 30 to 60 cm high. However, there were some emerging negative externalities which has not been considered before, since road elevation at some area caused some new inundated area on surrounding settlements which have lower elevation.

Ecological sustainability has become less important since mangrove conservation experiencing difficulties due to limited area for plantation, disturbance from coastal flood/inundation and irresponsible visitors. On the contrary, local government encourage on developing park and city forest on the city centre instead on the coastal areas. Greening program on the coastal area mostly were intend to develop green pathways along the beach with shade's tree planting. However, there was Mangrove Information Centre (MIC) which give new experience for people to learn how mangrove conservation were managed. Information include plantation-demo on at least 2 mangrove species, namely Red Mangrove (*Rhizophora Mangle* sp.) and Black Mangrove (*Avicenia Germinans* sp), from seedling, planting, and keep them growing in limited area

Table 3. Building a transformative adaptation: comparing government's and community's initiatives.

Government's Initiatives	Community's Initiaves
<ul style="list-style-type: none"> • Mitigation Oriented • Provide Basic Need Infrastructure and maintain its services • Get international/national/ regional financing to enhance infrastructure services (case of Geotope, road elevation, Old Banger River diversion) • Supporting on Public Private Partnership (Case of Vaname Shrimp Cultivation) • Encourage more on Vaname-shrimp cultivation rather than Mangrove Cultivation • Mangrove Information Centre 	<ul style="list-style-type: none"> • Adaptation Oriented • Altering Paddy/Jasmine to Milk-fish/Sea-weed Cultivation as sustainable livelihood (instead of Vaname-shrimp) • Protect fishponds from abrasion and flood by mangrove plantation on fishpond dykes • Minimize cost/crop failure, grab potential social & economic benefit • Enhancing Capacity through social networking, partnership and gain novel knowledge • Build social learning by establishing self-help group

In spite of community sustainable livelihood become a key of creating communities' resilience, there were limited related initiatives from municipal agencies. Some exception programs were done in cooperation with donors, regional NGOs and higher education institution, particularly on integrating the mitigation and adaptation on environmental improvement attempts. BINTARI as local NGO has incorporated an integration of mitigation and adaptation in 2015 through serial training and practising mangrove plantation on Bandengan Sub-District. This initiative was undertaken in cooperation with Mercy Corp Indonesia.

Pekalongan Farming, Fisheries and Marine Agency (DPPK) prefer to encourage vaname-shrimp cultivation which are high cost and contra-productive with mangrove conservation. Some Mangrove leaves floated on surrounding fishpond could attract any bacteria and viruses which caused vaname's decease. Furthermore, vaname-shrimps cultivation also threatened the environment capacity due to utilization of chemical disinfectant for preventing vulnerable vaname-shrimps from any potential decease.

4. Conclusion

The main conclusion comes from evaluation of Pekalongan Municipal Government initiatives on both of managing public private partnerships on vaname-shrimps cultivation for encouraging economic benefit and mangrove conservation in limited coastal area. Since both initiatives are contra productive, the more vaname-shrimps production the less mangrove conservation. These initiatives indicated a double development standard from the side of municipal government, when it comes to prioritize both the economy and the environment. Regarding on resilience thinking, build a transformative adaptation means taking any initiatives which reboost environment recovery as driving factor on saving resources supplies for further benefit on achieving sustainable development. This finding neglected Goal No 12 responsible consumption and production. However, the local community prefers to choose a new livelihood, which provides them not just economic security, but also social and ecological benefits. It means the community succeeded in proven their capability on building a transformative adaptation.

5. Acknowledgement

This paper was written based on 2 research findings. First, dedicated as one of publication series from on going doctoral research in Environmental Studies Gadjah Mada University, under title of '*Pola Kerentanan Wilayah Akibat Rob dan Banjir: Studi Kasus Kognisi Spatial Masyarakat di Kecamatan Pekalongan Utara*' (Spatial Pattern of Region Vulnerability as the Impact of Coastal Inundation and Flood: a case of Community Spatial Cognition on North Pekalongan District.' Second, as part of

fundamental research funded by Urban and Regional Planning Departement through DIPA budgeting under Faculty of Engineering, Diponegoro University in 2016, under title of '*Adaptasi Transformatif Penghidupan Masyarakat Akibat Rob Di Pesisir Kota Pekalongan*' (Transformative Adaptation on Community Livelihood As Coastal Inundation Impact on Coastal City of Pekalongan). Draft of this paper was presented on March 6-7 in Malang, at paralel discussion on The 3rd International Conference on Planning in The Era of Uncertainty: Sustainable Nation which held by Urban and Regional Planning Department, Brawijaya University.

References

- [1] Satterhwaite, D. (2014). Editorial: Getting local governments, residents and enterprise to respond to the new IPCC assessment. *Environment and Urbanization*, Vol 26 No 1. Pp. 3-10.
- [2] Handayani, W, A Artiningsih, I Rudiarto, J A Syahbana, Mussadun, I Kusumastuti, A F Zain. (2015). *Membangun Kapasitas Transformatif Masyarakat dalam Upaya Pemanfaatan Bonus Demografi: Kajian Sektor Primer di Jawa Tengah*. Direktorat Analisis Dampak Kependudukan (Ditdamduk) BKKBN, Jakarta.
- [3] United Nations. The Sustainable Development Goals Report 2016. <http://unstats.un.org/sdgs/report/2016/The%20Sustainable%20Development%20Goals%20Report%202016.pdf> accessed on Feb 14th 2017
- [4] Osborn, Derek, Amy Cutter and Farooq Ullah. (2015). *Universal Sustainable Development Goals: Understanding the Transformational Challenge for Developed Countries*. Report Of A Study By Stakeholder Forum.
- [5] Diposaptono, Subandono. (2008). Teknologi Adaptasi Kenaikan Paras Muka Air Laut Di Wilayah Pesisir Dan Pulau-Pulau Kecil. Direktorat Pengelolaan Pesisir dan Lautan terpadu. <http://pirba.hrdp-network.com/e5781/e5795/e6331/e10038/eventReport10187/06TEKNOLOGIADAPTASI-Subandono-.pdf>
- [6] Artiningsih, A, S Worosuprojo, R Rijanta, S R Hardoyo. (2016). Enhancing social-ecological resilience in Indonesia: A case of North Pekalongan District, Central Java. *Jurnal Wilayah dan Lingkungan*, 4(3), 187-198. doi:10.14710/jwl.4.3.187-198.
- [7] Wamsler, C and E Brink. (2014). Moving beyond short-term coping and adaptation. *Environment and Urbanization*. Vol 26 No 1. April 2014. pp. 86-111.
- [8] GIZ PAKLIM (ed). 2011. *Strategi Ketahanan Kota Pekalongan*. Badan Lingkungan Hidup Kota Pekalongan.
- [9] Yin, Robert K. (1989). *Case Study Research: Design and Methods*. Applied Social Research Methods Series, Vol 5. Sage Publication, London.
- [10] Gering, John. (2007). *Case Study Research: Principles and Practices*. Cambridge, University Press. New York.
- [11] Bappeda Kota Pekalongan. *Peta Administrasi Kota Pekalongan* in Artiningsih, A, MHS Pratama, N C Putri. (2016). *Adaptasi Transformatif Penghidupan Masyarakat Akibat Rob Di Pesisir Kota Pekalongan*. Laporan Akhir Penelitian Dasar (Unpublished Fundamental Research Report). Hibah Bersaing Dana DIPA Fakultas Teknik Universitas Diponegoro, Semarang.