Ecological adaptation of coastal communities based on social energy: A case of natural disasters potential on the north coast of West Java

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Abstract. Coastal communities in the North Coastal of West Java are threatened by sea level rise. The rate of sea level rise in Java's Pantura is 6-10 mm every year. Society confronts this phenomenon required to be able to adapt to changes that occur. The purpose of this study is to analyze creative cultural social energy as an alternative adaptation to the dynamics of changes in the ecology of life, and the impact of empowerment on the demeanor of ecological adaptation in coastal communities. The study method used participatory action research by placing field researchers as facilitators of community empowerment. The results of the study indicate that the creative cultural social energy has the potential to be the right alternative to adapt to ecological changes. The demeanor of community adaptation is proven to be closely related to the level of education, social status and activeness in the community, initiatives to respond to ecological phenomena, potential opportunities that can be achieved, and ownership and control of assets. An effective empowerment process is closely related to the demeanor of community adaptation to the phenomenon of ecological changes in life.

Keywords: coastal abrasion, community empowerment, ecological adaptation, social energy

1. Introduction
The people of the north coast of West Java run the risk of flooding ponds and settlements for at least the last ten years. According to Klein [1], Diposaptono and Budiman [2] sea level rise on the North Coast is the impact of climate change that can be understood and felt directly by coastal communities in the form of tidal flooding, abrasion / erosion and sea water intrusion which can cause losses.

Aware of these conditions, IPB University has formed a partnership with PT Pertamina EP Tambun Field that has tried to make alternative solutions to the problem of the impact of rising sea levels, which is a follow-up effect of the occurrence of global warming. Concrete steps have been developed in the

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coastal community empowerment program to overcome and anticipate the side effects of climate change in the form of rising sea levels that have inundated settlements and community ponds. The empowerment pattern is carried out in a participatory manner with a view to the sustainability of activities that are considered by the community to be beneficial in facing potential threats to the impacts of climate change. This action was taken because a similar approach was effective in increasing the empowerment of the people of West Java in other locations [3].

The experience of community empowerment in Mount Puntang, in other West Java communities shows that the application of creative social energy is effective in developing community empowerment/independence [3]. Creative cultural social energy includes three elements, namely ideals, ideas, and friendships. Ideals are desirable conditions to be achieved or realized in the development of society, namely clarity of goals, hopes and visions or even shared ideals. These ideals will guide the clarity of ideas, namely the ways taken together to realize these ideas, namely the clarity of program strategies, activities, methods or techniques that are developed creatively and appropriately. Ideas become a guideline for related parties to develop friendship, which is a network of cooperation between them through the application of strategic partnerships [4].

Creative social energy is a form of participatory social engineering, proven effective for community empowerment, especially the development of smallholder farming. This participatory social engineering is in determining the ideal, ideas, and friendships of, by and for the community of coffee farmers. In this case the community acts as the main actor so that there is no domination in the program planning and evaluation process, its implementation, and the utilization of the results of collaboration carried out by the community. Such conditions are a picture of creative socio-cultural energy that is prepared in a participatory manner as conveyed by Sumardjo [4,5].

In the process of community empowerment it is proven that the level of community empowerment as a result varies, this is related to the attitude of community adaptation to the ecological changes in their lives [3]. In this study, the aspects analyzed as the impact of empowering coastal communities on the following impacts of climate change in the North Coast of West Java.

The purpose of this study is to analyze creative social energy as an alternative adaptation to the dynamics of ecological changes in life, and the impact of empowerment on the attitude (demeanor) of ecological adaptation in coastal communities.

2. Method of The Research
The research method used is participatory action research by placing field researchers as facilitators of community empowerment. Data and information were collected through observation, in-depth interviews with informants, interviews with questionnaire instruments, and focus group discussions (FGD). Secondary data, such as climate change data and their impacts are obtained from literature review and related document sources. Activity data on the empowerment of coastal communities and phenomena that are the background of the behavior and participation of coastal communities. Data on factors closely related to adaptation attitudes was collected through a census of all participants in the empowerment program using a questionnaire. Creative social energy is extracted from the results of interviews and questionnaires. Empowerment was analyzed from the results of observations and in-depth interviews during the research process. The results of the analysis are discussed in the FGD involving relevant parties that are considered to understand or have an influence in the process of community empowerment, to obtain objectivity over related facts.

Creative social energy is measured by three elements, namely ideal, ideas, and friendship, referring to the concept of creative social cultural energy from Sayogyo [6], Sumardjo [7] about the concept of creative social cultural energy, which is a modification of the concept of social energy [8]. The demeanor of ecological adaptation refers to the concepts and research results of Sumardjo et al. [3], which includes the demeanor level of adaptation from the weakest to the strongest following: fatalist, reactive, proactive, and anticipatory. While the measurement of the level of empowerment of coastal communities refers to the concepts and research results of Sumardjo [9] and Sumardjo et al. [10], which include: (1) filtering power, (2) competitiveness and (3) partnerships.
3. Results and Discussion

3.1. The Impact of Global Warming on the Coastal Ecology of the Coastal Communities
The Coastal communities in the North Coast of West Java have now felt concern over rising sea levels and/or the occurrence of coastal abrasion marked by a pool of sea water up to about 300 meters inland. According to Diposaptono [2] the rate of sea level rise in Java's coast is 6-10 mm/year or as high as 8 cm for 10 years.

The community has felt the effects of climate change in the form of rising sea levels that have inundated the area of their ponds and settlements. Community responses to climate change are varied. Some people do not care about changes in sea level conditions that have occurred. Most reacted after experiencing a direct impact on ponds and settlements due to sea level rise. Some people behave/act proactively, and a small number behave/act anticipatively. This is very similar to the results of Sumardjo et al. [3] as follows.

From the field observations, each participant was assigned their typology of ecology adaptiveness. The research indicated four types of community adaptation to ecological changes and land use innovations, namely: (1) apathetic type, (2) reactive type, (3) proactive type, and (4) anticipatory type. This sequence also describes the more adaptive to changes that occur. Community profile based on the type of adaptation to the changes in the ecology in detail as explained below.

This analysis of ecological adaptation referred Sumardjo et al. [3] that revealing there were four types of community adaptation to environmental changes and yard use innovations, namely: (1) apathetic type, (2) reactive type, (3) proactive type, and (4) anticipatory type. The order showed the level adaptiveness occurred (more adaptive). The results of this study turned out to be in line with Sumardjo et al. [3] conducted on family empowerment for organic medicinal plants. Community profile based on the type of adaptation to the environmental changes in detail as follows:

1. The type of apathy occurred in participants with low levels of education and income, including the lower levels of society that depend on the intervention of other parties. Influence or encouragement of other parties are affecting the adaptation, like the role of local cadres and counselors/assistants.
2. Reactive type occurred in participants with basic education level, including middle to lower class society, and tend to locality. This type adapts by react to the risks and consider the role of other participants in terms of information to make changes.
3. Proactive type, occurred in participants with secondary education, relatively cosmopolitan and have the access to the information from local cadres or facilitators. This type is acts fast after getting information from sources from local community leaders and assistants, or business partners. Usually this type actively participates in the program so that he has sufficient insight, adequate skills, and a positive attitude towards the possibility of business risks.
4. Anticipatory types, occurred mainly in local leaders who have developed adaptation attitudes. This type has a relatively high and cosmopolitan level of education, as well as access to cyber extension digital information and actively communicates with counselors/assistants. This type is able to digest information from various sources and plan their business by considering the impact of changes and risks expected to occur.

As Sumardjo et al. [3], to minimize the risk, it is necessary to strengthen adaptive attitudes that are more proactive and anticipatory than those that are reactive. Assistance activities in the program turned out to be successful in strengthening adaptation attitudes from those who tend to be reactive and apathetic to proactive and anticipatory.

3.2. Creative Socio-Cultural Energy as Alternative Adaptation for Ecological Change
Creative social energy is proven to be an appropriate alternative to adapt to these ecological changes. Ideal, ideas, and friendships in community empowerment that have been taken in a participatory manner,
proved to be a participatory social engineering. The process is pursued through a process of dialogue between participants in the empowerment program both when making decisions in program planning; determining activities in program implementation, monitoring and evaluation as well as utilization of results.

The ideal of community empowerment is agreed upon is the realization of the empowerment of participants in anticipating the effects of climate change. While the ideas are starting from program initiation, program development, stabilization, strengthening, and otonomous which can be seen in detail in figure 1.

Figure 1. The idea of participatory community empowerment programs in adaptation to ecology, especially sea level rise as a result of climate change.

The stages of program development participatory community empowerment programs in adaptation to ecology, as follows:

1. Initiating activity, include: social mapping and need assessment; and program socialization for community based development.
2. Development activity, include: formation of seaweed cooperation; and seaweed cultivation training.
3. Stabilization activity, include: procurement of feed making machines; training in making fish food; development of fish feed made from seaweed.
4. Strengthening activity, include: training in making processed foods; procurement of facilities and infrastructure; and digital literacy farmers.
5. Otonomous activity, include: infrastructure strengthening; and expansion of partners and marketing networks.

The ideal creative social energy is proven to inspire ideas, and ideas inspire the development of friendships as a form of synergistic cooperation network between fellow farmers and with other parties. In the process of developing creative social energy in empowering coastal communities in the North Coast of West Java, these friendships contain the meaning of the social capital strength of coastal communities.
This implies that efforts to strengthen the capacity of coastal communities require the application of concepts relating to social capital. Social capital is basically a value of mutual trust between community members towards their leaders and other communities [3,10,11,12,13,14]. Social capital is also a social institution involving networks, norms and social trusts that encourage social collaboration (coordination and cooperation) to achieve shared interests and goals. According to Sumardjo [4] to strengthen social capital, it is necessary to strengthen human capital, and strengthening human capital is the result of community empowerment or outreach efforts. This means that the community empowerment approach with the development of creative social energy is the right way to implement a strategic plan that has been prepared in a participatory manner by the coastal communities of the North Coast of Karawang.

What is the difference between the results of this study and the results of previous studies [3,9] conceptually? Explanation of these differences is that the concept of creative social energy is more dynamic and innovative, because it does not involve culture, but is still in the form of changes in community behavior due to innovation in empowerment. More details can be explained in the following matrix. Can be seen in Table 1.

**Table 1. The Developing of the concept of social energy in community empowerment.**

| Aspect of Social Energy | Social Energy | Creative Socio-Cultural Energy | Finding of This Research: Creative-Social Energy |
|------------------------|--------------|-------------------------------|-----------------------------------------------|
| 1. Ideal               | Traditional value/ Local wisdom | Actual desirable conditions to be achieved | Ideal and actual desirable conditions to be achieved |
| 2. Ideas               | Indigenous technology | Appropriate technology | Appropriate innovation participatory partnership |
| 3. Friendships         | Institutional Tradition | Government intervention | Impact of digital technology access |
| 4. Local knowledge     | Indigenous knowledge | Influence by contribution of role of development agent | |
| 5. Local wisdom        | Traditional value | Combination between traditional and local value | Something that anticipative adaptability |
| 6. Adaptation Demeanor | Reactive | Proactive | Anticipative |

**3.3. Factors Closely Correlated with the Demeanor of Ecological Adaptation in Coastal Communities**

The demeanor of community adaptation is proven to be closely related to the level of education, social status and activeness in the community, initiatives to respond to ecological phenomena, potential opportunities that can be achieved, and ownership and control of assets. An effective empowerment process is closely related to the demeanor of community adaptation to the phenomenon of changes in the ecology of their lives.

Variables in the community empowerment process show that they are positively correlated with each other except education. Its mean in line with Sumardjo *et al.* [3]. For primary to high school education levels, it turns out that education is not significantly related to activeness, character, initiative, farming outcomes and adaptability to the dynamics of strategic environmental change. The more adaptive participants turn out to be more active, the more a figure has higher position, the more initiative, and more productive [3]. Look at Table 2.
Table 2. Correlation coefficients between education, activeness, status status, and initiative with results and adaptability

| Variable | Gender | Education | Activeness | Social status | Inisiative | Yield | Adaptability |
|----------|--------|-----------|------------|---------------|------------|-------|--------------|
| 1. Education | 1 | -.177 | -1.10 | -.087 | .122 | .000 |
| 2. Activeness | -.177 | 1 | .905** | .867** | .860** | .881** |
| 3. Social status | -.110 | .905** | 1 | .901** | .760** | .874** |
| 4. Inisiative | -.087 | .867** | .901** | 1 | .837** | .845** |
| 5. Yield | .122 | .860** | .760** | .837** | 1 | .832** |
| 6. Adaptibility | .000 | .881** | .874** | .845** | .832** | 1 |

Note: N=34 (hasil sensus)

**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed).

Community empowerment by seaweed innovation of innovation of ecological adaptation is similar with organic medicinal plants in the yard in the semi-urban case community in Bekasi, that has research by Sumardjo et al. [3]. The found of Sumardjo et al. reseach result actually imply to sustainable development adaptation that sustainability was measured from the economic, ecological and social aspects that are relevant to the program.

3.4. The Existence of Coastal Communities as the Impact of Participatory Empowerment

The impact of empowerment on the participants of coastal community empowerment is as follows: about 15 percent of the less powerful/helpless people, 75 percent of the people who have powered, and those who have reached the 10 percent autonomous level (powerfull). Indicators of empowerment can be seen in table 3.

Table 3. Indicator of community empowerment in adapting to the dynamics of ecological change

| Indicator of empowerment impact | Powerless | Quality of empowerment impact | Autonomous/powerfull |
|--------------------------------|-----------|-------------------------------|----------------------|
| 1. Power of filtering          |           |                               |                      |
| a. Innovativeness              | Not innovative | Early majority               | Early adopter/Innovator |
| b. Creativity                  | Past Orientation | Present Orientation          | Optimization         |
| c. Moral etic                  | Traditional value | Local wisdom                | Actual/Innativat local wisdom |
| 2. Power of Competitiveness    |           |                               |                      |
| a. Eficiency                   | Less Important | Important                   | Very Important       |
| b. Efectivity                  | Less Important | Important                   | Very Important       |
| c. Quality                     | Subsistent | Important                   | Very Important       |
| 3. Power of Partnership        |           |                               |                      |
| a. Trust                       | Low       | Less                         | Strong               |
| b. Sinergetic                  | Low       | Less priority                | Prime priority       |
| c. Adaptiveness                | Reactive | Proactive                    | Anticipative         |

Considering the characteristics of different types of outonomy between empowerment participants, it implies to the treatment of empowerment intervention. The different levels of participant empowerment requires different advisory services from community empowerment facilitators and from
participant partners. This happened because the responses of participants with different levels of empowerment proved different to the dynamics of ecological changes in coastal communities on the North Coast of West Java.

The results of this study indicate that there are rather different indicators compared to the empowerment indicators developed in previous studies, conducted by Sumardjo [9] and Sumardjo et al. (2014). Indicators of empowerment in Sumardjo et al. [10] consist of: (1) fatalists, (2) powerfull, and (3) outonomous. Indicators of empowerment in Sumardjo [9] include: (1) helpless, (2) powerfull, and (3) outonomous. While this study is similar to Sumardjo [9], but differs in detail of dimensions between the level of the indicator.

In Sumardjo et al. [10] each level is seen from the same indicator but has different levels of quality, namely: (1) social relations, (2) social processes, (3) initiatives, (4) conditions of relationships, (5) level of competence, (6) inner atmosphere, (7) level of convergence, (8) relationship status, (9) impact of interventions, (10) capacity, (11) level of community development, (12) nature of adoption, and (13) attitude / trust. While indicators in the empowerment of coastal communities in the findings of this study compared to Sumardjo (2018) are more detailed. This can be seen in table 3.

4. Conclusion
Creative social energy is actually proven as an alternative adaptation to the dynamics of ecological changes in life, and the impact of empowerment on the demeanor of ecological adaptation in coastal communities. Creative social energy included the same indicator with creative socio-cultural energy, but this study have describe the detailed of dimension that actually for ecological adaptation to coastal communities. Sustainable development for the community is needed for the level of adaptation in proactive adaptation, even better if the level of adaptation is at the anticipatory level. The high level of ecological adaptation of a society is proven to be in line with the high level of independence. The high level of ecological adaptation of a society is proven to be in line with the high level of education, activeness in empowerment activities, initiatives, and also economic, social and ecological benefits.

This study has found the quality of empowerment of each indicator and each level of empowerment but has not yet arrived at the analysis of appropriate intervention treatments for each of the empowerment typologies. Future research is suggested to broaden the analysis of empowerment with more empowerment targets so that it can reveal the type of empowerment needed for each of the characteristics of these community members. In further research, the implications of the different levels of participant empowerment will be explored and analyzed for the treatment of community empowerment facilitators in developing their tasks and functions.

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