DYNAMIC SYSTEMS MODELING FOR SUSTAINABLE ECONOMIC EMPOWERMENT IN CILACAP

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Abstract

This paper investigates the dynamic problem of living system in Kampung Laut, Cilacap, which includes social problems and ecological changes. The paper uses a dynamic system model to structure the problems. The model simulates various feasible scenarios, from which the best becomes the base to impose a policy to empower their sustainable economy. The model conceptualizes variables related to the problem to build a figure of Causal Loop Diagram (CLD), which is then simulated using Powersim 2.5 software package. Using the scenario of intensification and population control, the paper finds that it can increase the people's income, with positive trend until the end of simulation.

Keywords: Dynamic modelling, sustainable economic empowerment, causal loop diagram
JEL classification numbers: Q01, Q23, Q25

Abstrak

Makalah ini menyelidiki masalah dinamis dari sistem kehidupan di Kampung Laut, Cilacap, yang meliputi masalah sosial dan perubahan ekologi. Makalah ini menggunakan model sistem dinamis untuk menyusun struktur permasalahannya. Model ini mensimulasikan berbagai skenario, dimana skenario yang terbaik akan dijadikan dasar untuk menetapkan kebijakan pemberdayaan ekonomi berkelanjutan. Model tersebut mengkonsepkan berbagai variabel yang berhubungan dengan masalah yang ada untuk membangun sebuah *Causal Diagram Loop* (CLD), yang kemudian disimulasikan menggunakan paket perangkat lunak Powersim 2.5. Menggunakan skenario intensifikasi dan pengendalian populasi, penelitian ini menemukan bahwa dimungkinkan untuk meningkatkan pendapatan masyarakat, dengan tren positif sampai akhir simulasi.

Keywords: Pemodelan dinamis, pemberdayaan ekonomi berkesinambungan, causal loop diagram
JEL classification numbers: Q01, Q23, Q25

INTRODUCTION

Life in Kampung Laut communities has been long sustained by the presence of marine and mangrove forests that grow in that region. Their livelihoods are mostly as fishermen. However, the abundance of natural resources was not enough to make their lives quite well. Generally, fishermen in Indonesia are low-income people. Powerlessness due to entrapment brokers, loan sharks and high fuel prices become classic problems that make poverty attached to the economic life of fishermen.

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Today they are experiencing desperately economic life since the destruction of aquatic ecosystems and the mangrove in the region. Damage to ecosystems is characterized by the declining quantity and quality of waters and mangrove forests in the region. The process of sedimentation is massive, and illegal logging became ringleader of the damage.

Water with its mangrove forest play important role in supporting economic and social life of the society, not only within the region, but also people in areas around the region. The damage has caused the balance of nature widely disrupted. Disasters such as flood in various areas around the region were inevitable.

Given the important role of the Segara Anakan region, the district government of Cilacap enacted local laws to manage the area, primarily to preserve the water and mangrove forest. The rules are embodied in Act No. 6/2001 concerning Spatial Planning Area of Segara Anakan and followed by Act No. 28/2001 concerning the establishment of the Segara Anakan Area Management (BPKSA). The activities are mostly mangrove conservation and dredge arisen land.

As the sedimentation process massively continuous in Segara Anakan, the implication is emerging widespread land accretion. The existence of land accretion has led to the shrinking and narrowing water. This has a direct impact on decreasing the catch of fishermen. The situation is further exacerbating the poverty of fishermen.

The economic pressure has encouraged people to adapt. An available realistic option available is to switch to the profession into cultivation, a farmer with arising land use or as a fishpond farmer. Consequently, the demand for land has increased, especially for rice farming activities. The high population growth increases demand more land, resulted in illegal activities and increasingly widespread mangrove conversion.

There are some issues need to be considered in understanding the characteristics of fishermen before any attempt to help them. According to Subade and Abdullah (1993), those fishermen remain in their business because of the low opportunity cost. This means that the fishers do not have a lot of job opportunities.

Another reason is the rigidity in fishering business industry. Smith (1979) finds that the fixity and rigidity of fishing assets in Asia has become the main reasons why those fishers remain in the business, even though they are poor. Panayotou (1992) assert that the fishers remain in the business because it is already their way of life, and it seems that they are reluctant to change their job even though the new jobs will give them higher income.

The problem then becomes complicated, especially for the government as policy makers. On the one hand the existence of mangrove waters should be maintained, but on the other hand, economic pressure requires attention and resolution. In this situation, it is not infrequently conflict arises between the government and society. The conflict appears more related to the utilization of protected mangrove forest. According to residents, the government is considered not too accommodated in making the policy, because they do not consider their economic interests. The government also did not appreciate the existence of Ulayat rights - the right of citizens to the Communal Land in the mangrove forest.

The people in Kampung Laut who are basically as fisherman, have interest in the preservation of marine and mangrove forest. But economic interests are much more urgent for them. This forces the people not to consider about the conservation. This behavior is reinforced with their confidence that the culprit of the problem was not originally derived from them, but due to people's behavior in the upstream and watersheds (DAS) who perform illegal logging, causing erosion and sedimentation in lagoon.

In such situations, the government must respond wisely. The policies that do not accommodate the interests of citizens, whatever ideal, will only produce an endless conflict. For that, in policy formulation the government should always involve the citizens within the framework of sustainable development. Sustainable development, in essence is the development to achieve "balance" between benefits and sustainability of resources. This means that these resources can be exploited for human benefit, but do not make the environment damaged.

To implement sustainable economic development in Kampung Village, two important things under review and evaluated are related to spatial planning policy and the policy of economic empowerment. For effective policy, the community should be involved, including the formulation of policy planning.

In sustainable development planning, Kampung Laut people should be viewed as the main stakeholders of the development. Kampung Laut Area as a habitat for marine village community should be viewed as a system, which consists of interrelated sectors of the social-economic-population, as well as sub-region. As a comprehensive system, changes in one sector or a sub region must affect its overall system.

So far it shows the sector ego in the regional planning. Sector planning planned and executed by the departments or agencies led to the planning done linearly. A department or agency was only thinking about developments in their selves. This occurs because at the moment the government bureaucracy is a key actor in development.

It is urgently required for comprehensive development planning. The existence BPKSA who manage of the region of Segara Anakan actually have a strategic role as a mediator for the community and government to achieve a more participatory development planning.

One approach that can be used to formulate policies in a participatory way is to utilize the dynamic system model. This model can be a tool of analysis for the government together with all stakeholders in economic development to map out the various problems that occur in the system under study, and simulate various policy scenarios on the system. By simulation, it can be seen implications that would arise if a policy plan implemented. In the end governments and citizens can choose which policy will be taken, in accordance with the objectives that have been planned together.

This study aims to develop a dynamic model of sustainable economic problems in the village of marine communities. The model can be used to construct better plan as well as better empowerment policy-making in future.

METHODS

Sources and Data Collection Techniques

According to Qualls and Wilson Jr. (2006), the dynamic system models are designed to capture the essence of the more sophisticated models at benchmarked operating conditions and mimic their results over limited operating ranges while operating in a reasonable period of time when tied to the model of the balance of the plant. After the empirical issues have been clear, and then it is made structures that cause these problems arise. To build a full and deep understanding of the problems that occurred in the Kampung Laut, especially regarding economic and environmental issues, the researcher collects data from various sources, both directly (primary data) and indirectly (secondary data). The model built through dynamic system methodology is the model that is developed based on empirical problem instead of correlation relathionship. (Teten Avianto, 2009).

The secondary data is obtained through literature searches from Indonesia Central Bureau of Statistics or BPS (Badan

Pusat Statistik) (2007) and BPKSA (2008) Cilacap. Meanwhile the primary data are obtained through direct observation and interviews with residents and local government.

In determining the informant for the interview purpose it is used the snowball technique. Since Kampung Laut has four villages, so the determination of the informants considers the distribution on each cluster. In other words, in each village is determined the informants to be interviewed.

Model Development

The process of model development for planning support of sustainable economic empowerment in Kampong Laut consists of five stages (see Sterman, 2005) namely: (1) The determination of the problems examined, (2) formulation of dynamic hypotheses, (3) formulation of simulation model, (4) testing the model (validation), (5) evaluation and design of policy proposals.

RESULTS DISCUSSION

Overview of Regional and Community of Kampung Laut

Social Welfare

Kampung Laut community is a community of living water in the area of Segara Anakan, a lagoon which is the estuary of several rivers flowing from West Java and Southern Central Java namely Citanduy, Cimeneng, and Cibereum rivers.

Geographically, Kampung Laut is a marine fishing communities, the communities that live, grow and develop in coastal areas. It is a transition area between land and sea territory. As a system, fishing communities are made up of social categories that form of social unity. (Kusnadi, 2009).

There are four villages in the district of Kampung Laut namely Ujungalang, Klaces, Ujunggagak and Panikel. To reach the villages in Kampung Laut it must be taken via the water except for Panikel village which is now directly connected to the sub Kawunganten. From Panikel village, water trip to the other villages can only be reached by small boat made of fiber glass or wood. Most people are working in marine fisheries sub-sector, as catch fishing in Segara Anakan Lagoon.

Considering from the condition of housing and amenities, it indicates that the people of Kampung Laut are still lower income group. In addition to the physical condition of housing, the availability of shelter facilities can be used as an indicator of household welfare (Indonesia Central Bureau of Statistics, 2007). In general, residential building facilities like bathroom facilities, landfills feces, and water sources for cooking in Segara Anakan are also inadequate. These are related to natural conditions or environment influenced by brackish water. Consequently for daily purposes, in the rainy season the majority of population uses rain water as the primary source for cooking. While some others in a specific place take water from unprotected springs or from the Nusakambangan island.

Main fuel used by households for cooking is accounted for 61.2 percent using firewood, 37.8 percent kerosene and other fuels of 1.0 percent other fuels. Given the various situations described above, the people in Kampung Laut are less prosperity. Quantitatively, poverty is reflected by its low level of income. Based on expenditure, the income Percapita was Rp 154,126 per month, or Rp 5,130 per day. Of this amount, majority or 68.04 percent is still used for food consumption. Although population income increased compared to 1999 which amounted to Rp 95,647 per month, but the prices of basic needs also go up so that no significant effect on household consumption patterns. Interestingly, the consumption expenditure about Rp 104,862 rupiah per month or 11.6 percent were for tobacco/cigarettes. It is higher than the expenditure for rice and other food.

Table 1: Households Classified by Bathroom Conditon in KSA

Classification of Bathroom	Percentage
Owned Bathroom	39.4
Joint Bathroom	27.8
Others	32.8
Total	100

Source: Suseda KSA 2007, Indonesia Central Bureau of Statistics, Cilacap

Table 2: Population of Segara Anakan Region

Village	SP 1990	Suseda 1999	SP 2000	Suseda 2007
Ujunggagak	3,219	3,421	3,550	3,897
Ujungalang	4,231	4,508	3,897	4,650
Klaces	-	-	794	1,247
Panikel	2,961	3,906	4,293	5,113
Total	10,411	11,835	12,534	14,907

Note: In 1990 Klaces Village was still part of Ujungalang Village.
Source : Suseda KSA 2007, Indonesia Central Bureau of Statistics, Cilacap

The lower level of income dues to several factors i.e. the cheaper price of fish, the absence of side jobs or alternatives outside the fishery, and the low quality of human resources. The formal education is mostly less educated (93.5 percent) which is 33.2 percent completing primary school and 60.3 percent not completing primary school.

Currently, although the price of fish is much better, the welfare of fishermen are still low even getting worse. This is happened since the faster sedimentation in Segara Anakan leading to shrinking fish stocks in the water. The rapid population growth in Kampung Laut was also another factor of decreasing income of fishermen. During the period 2000 - 2007 the population of all villages in the region tends to increase each year.

Between 2000-2007, the population increased by 2,373 people or on average at 2.7 percent per year. This figure increased significantly compared to yearly average growth 1990-2000 which was recorded at 1.94%. The quite isolated location and limited/expensive means of water transportation has made limited access of development. So there was not enough economic revival that create new jobs other than fisherman for the residents of Kampung Laut. On the other hand, the ease to get money from the fish catch has created reluctance to be more creative to create new jobs or cultivation. In fact, the alternative employment is needed especially in the lack of fish or lean season. This issue seems related to the lower quality of human resources itself.

Citizens Economy

Community of Kampung Laut are always relying on her life from nature. Living in the natural ocean environment with rich in fish and other catches, has established Kampung Laut community as a fishing community. It has been long time ago the residents are hanging from capture of fisheries.

Initially they were looking for fish and shrimp with traditional boats made of concaved wood called Jukung. These small boats are powered by timber oars manually. Fishing gear used is still traditional that are nets. The way it works is to spread a net into the water and then removed after a time.

However, it has been a lot of people using motors to run the boats, and current fishing gear used today is Apong. Apong is a kind of wide net with a 6-7 meter diame-

ter and the height is adjusted with the depth of water. These nets are similar to trawling. Fishermen use it in such a way stocked in the water of Segara Anakan. Unlike the drawn trawling boats, Apong left for a few days for many fish caught and then removed every few days. Fishermen put Apong on their own territory - which is held by their hereditary from his family. The ownership is based on the Communal Land Rights.

In addition to catch fish and shrimp, fishermen also catch mud crab trap by placing a tool made from 10-15 cm width bamboo-shaped cone and 30-50 cm length called Wadong. To Madong (term to crab catch activity) is relatively costless because it is just for the procurement of Wadong that can be used many times. As for Ngapong (catch fish and shrimp with Apong) takes more costs for the procurement of equipment and boat engine fuel. Fuel cost of Ngapong is one liter of gasoline, to get to apong area, so the return trip takes 2 liters of gasoline plus the cigarettes, then to once ngapong need Rp 12,000 - Rp 15,000. Unlike Madong which is working alone, Ngapong activity usually carried out 2-5 people depending on the area of Apong. The team members are usually their children or relatives. Labor costs for team members are given in the form of the catch or money from the sales. The income of fishermen will be highly dependent on the amount of their catches. The catch is large enough during the rainy season (October - April).

The catches are usually sold to local collectors (middlemen) in Kampung Laut. Furthermore, the collectors then sell to markets in other areas outside the village like Sleko (Cilacap) and Pangandaran (West Java). Fishermen can not sell their catches directly because there is no fish auction spot (TPI). The selling price to the collectors is of course lower because the price is usually determined by middlemen. The difference was around Rp 20,000, (it is significant amount of profit to middlemen) with no bargaining process. However if the fishermen do not owe capital to fishermen, then there is still a bargain depending on the type of fish or shrimp and crab sold.

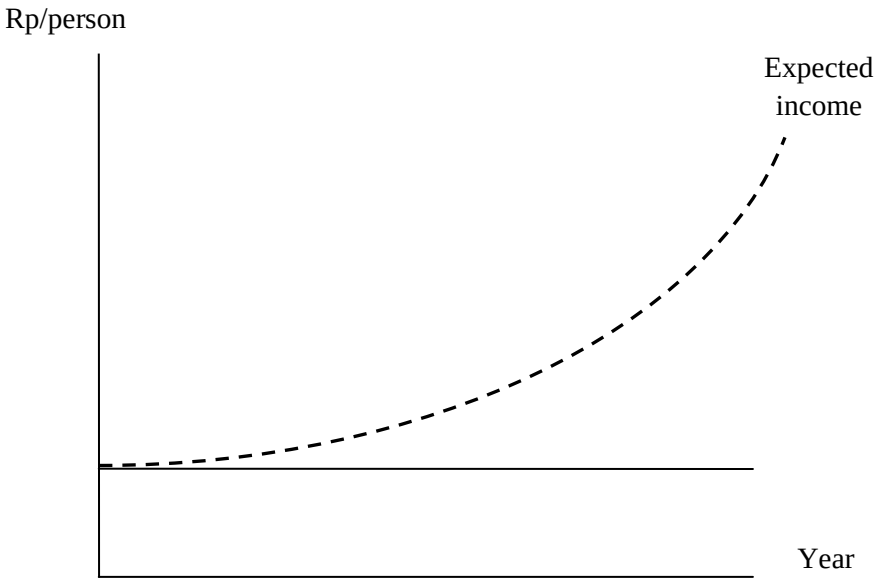


Figure 1: Reference Pattern of Percapita Income

The goal of sustainable economic empowerment is the fulfillment of economic interests and improvements without sacrificing ecological factors. The indicators in the model are to increase people's income on the one hand, and maintenance of water areas and as the support of the existence of mangrove forest ecology. The key variables involved in the issue of sustainable development in Kampung Laut and the area can be grouped in three domains namely ecological, economic and social. Variables include aquatic ecology, mangrove ecosystems, and land accretion. Economic variables include the production, cultivation of land, productivity, employment, income, economic capital, social capital and culture.

For the simulation purposes, it is determined intervals studied which is covering 50 years, from 1980 to 2030. The main consideration is based on data availability. Identification of the reference pattern is performed to find a picture of problem behavior on a set of variables related to economic development in Kampung Laut. Data from various publications like Indonesia Central Bureau of Statistics and BPKSA (2008) Cilacap explain that the income level is still low level.

This situation will continue if the system is left running without any policy that is more conducive to improving people's income. It is expected to have remedial action that can change people's income, and increase revenue trends over time, as illustrated in Figure 1.

Refers to research title, the dynamic modeling results will be used to simulate scenarios to create better economic conditions in Kampung Laut on one side as the indicator described in reference pattern. On the other hand, environmental conditions will be maintained with the existing of aquatic environment and mangrove forest. Thus the expectation of sustainable economic conditions will be achieved. Based on this, the initial hypothesis proposed is that sustainable economic empowerment to the people in Kampung Laut Cilacap can not deliver improved welfare.

From this hypothesis the model set the boundaries of the variables which are the variables endogenous and exogenous, a variable that can represent change in policy or interference from outside the model. List of endogenous and exogenous variables are presented in Table 3.

Based on the hypothesis, the key variables, the reference pattern and empirical data it can be described phenomena and the relationship of economic variables, environmental and social in Kampung Laut as shown in Causal Loop Diagram in Figure 2.

Conceptual model as outlined in the Causal Loop Diagram is further translated into computer language using the Powersim Contractor 2.5. The result of development of the computer models is shown in Figure 3.

The computer program is run by giving the value of the parameters, the relationship behavior of the system, and the initial conditions of the system. The values of parameters and prediction of the initial conditions are given based on empirical data listed in Table 4.

After testing the structure, behavior and policy implications, it is getting model approaching actual system conditions. Here are the results of the simulation model based on empirical data, parameters and initial conditions of the phenomenon being modelled (started in 1980 as the initial year). During the simulation period, 1980-2030, physical environmental degradation of Segara Anakan is reflected on the decrease in water area and mangrove forest. If this condition is left unsolven, it is predicted that by 2020 the waters of Segara Anakan will be disappeared.

Table 3: Boundaries of Model of Sustainable Economic Empowerment

Endogenous Variables	Exogenous Variables	Fixed
1. Ecology Sub Model		
Water		
Water Decreasing		
Arisen Land		
Extension of Arisen Land	Rate of Arisen Land Per Year	
Dredging of Arisen Land	Percentage of Dredging	
Mangrove		
Incremental of Mangrove	Percentage of Mangrove Planting Percentage of Mangrove Growing in Arisen Land	
Cutting of Mangrove	Percentage of Mangrove Cut	
Open Area		
Total of Land Need	Time Average for Land Use	
2. Economic Sub Model		
Fish Stock		Stock of Crab and Scallop
Incremental of Fish Stock	Percentage of Cultivation	
Production of Captured Fish	Percentage of Capture	
Dead Fish	Percentage of Natural Dead Fish	
Productivity of Capture Fish	Price of Capture	Tax and Other Costs
Number of Fishermen	Percentage of Fishermen	
Farming Production		Non Paddy Production
Farming Area	Land Need Per Person	
Farming Productivity	Normal Productivity of Farming	Crop Failure
Value of Farming Production	Price of Farming Commodity	▪ Price of Other Farming Commodities ▪ Tax and Other Costs
Number of Farmer	Percentage of Farmer	
Production of Aquaculture		Harvesting Losses
Aquaculture Area	Land Need Per Person	
Aquaculture Productivity	Normal Productivity of Aquaculture	Aquaculture Harvesting Failure
Production Value of Aquaculture	Price of Aquaculture Commodities	Tax and Other Costs
Number of Aquacultivator	Percentage of Aquacultivator	
Cultivation Area		Other Cultivation Area
Effect of Social Capital on Cultivation Productivity	Average Education	
Effect of Financial Capital on Cultivation Productivity	Average Investment Per Year	
GDRP Kampung laut		▪ Production Value of Agriculture and Non Agriculture ▪ Natural Disaster
GDRP Growth	Time Average for GDRP Growth	
Percapita Income		
3. Population Sub Model		
Population Growth	Percentage of Population Growth	Seasonal Migration
Laju pengurangan penduduk	Percentage of Mortality Percentage of Emigration	
Labor Force	Percentage of Labor Force	
Settlement Area	Average Settlement Use Per Person	

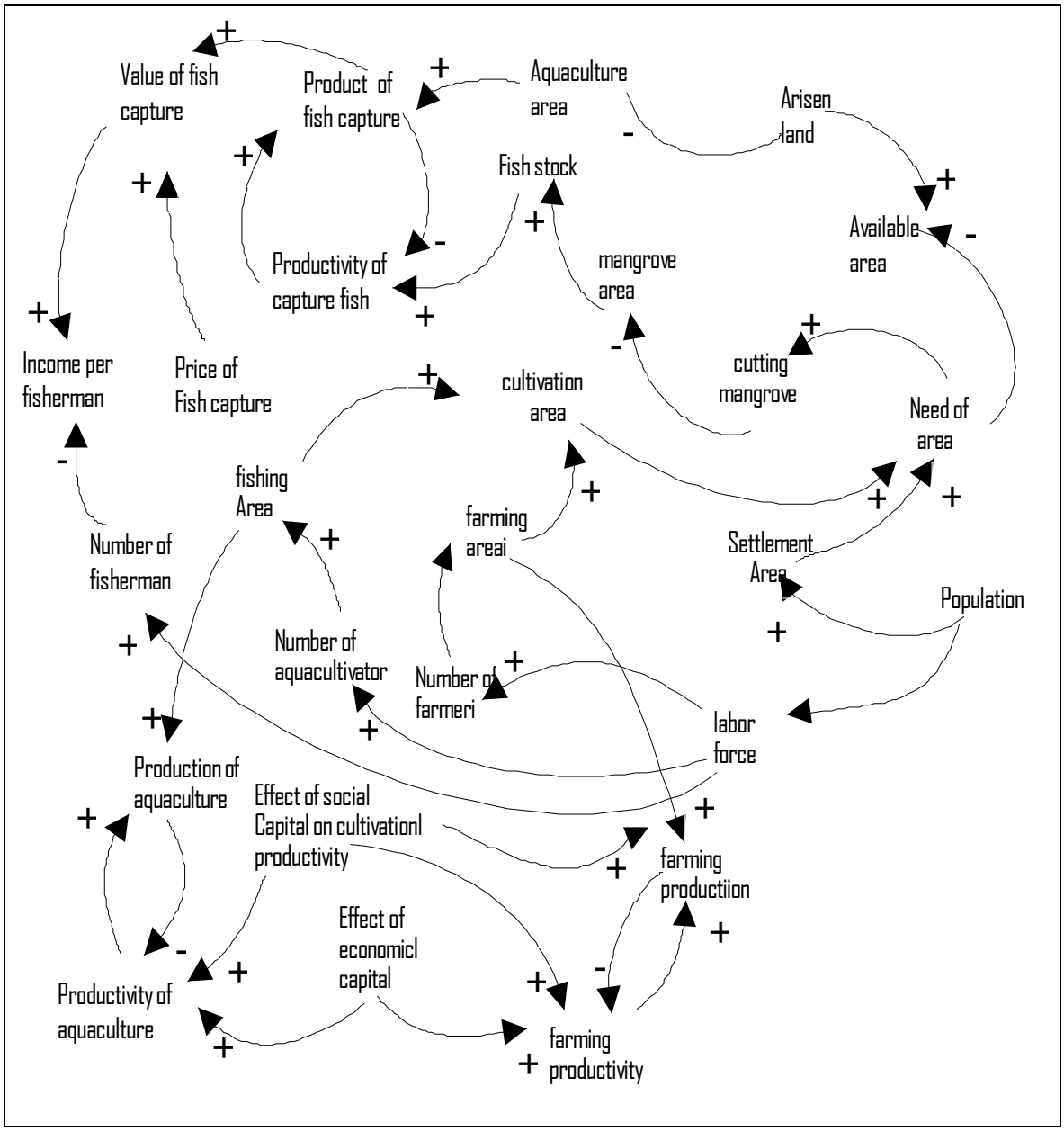
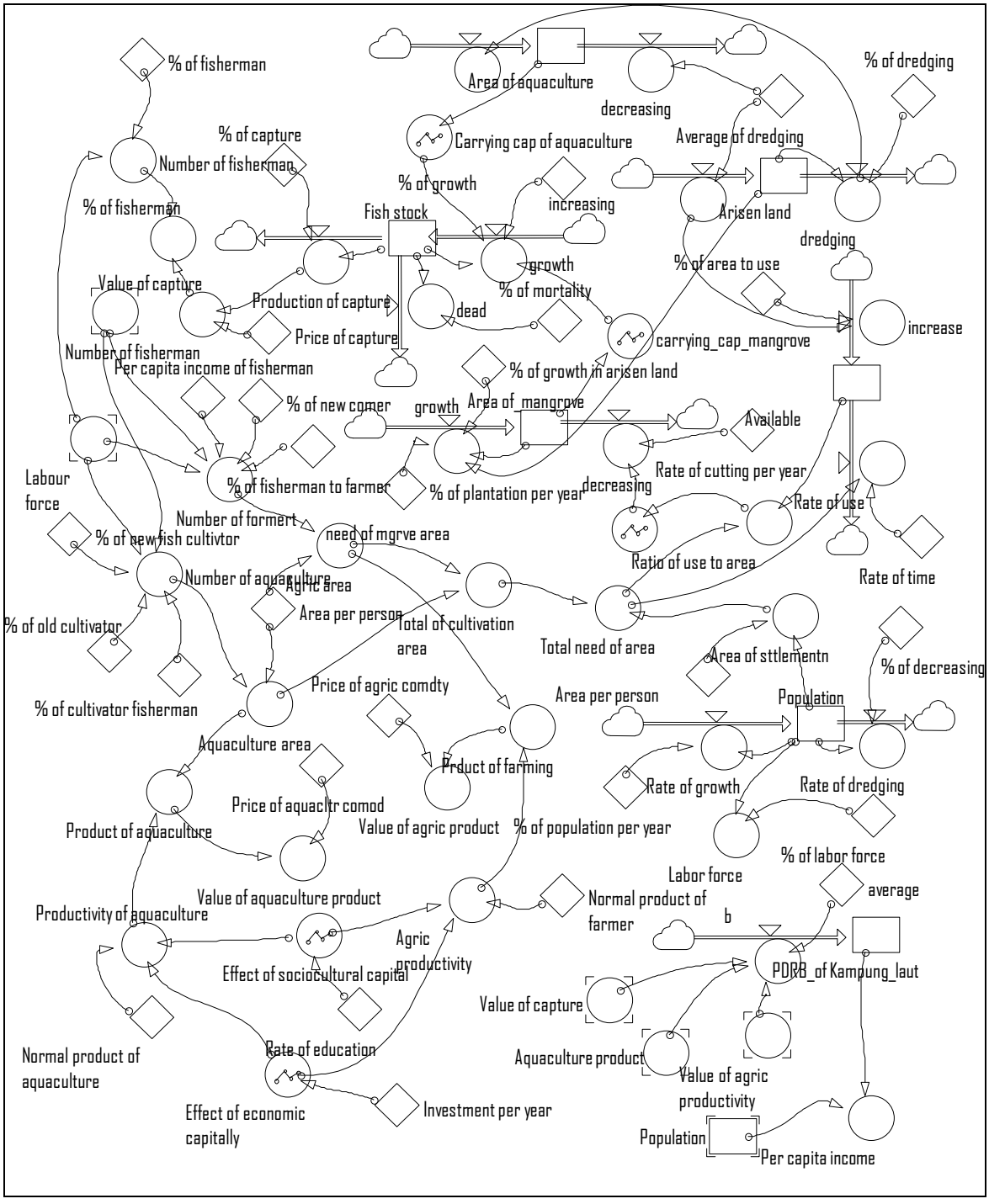


Figure 2: Causal Loop Between Economic, Environmental, and Social of Kampung Laut



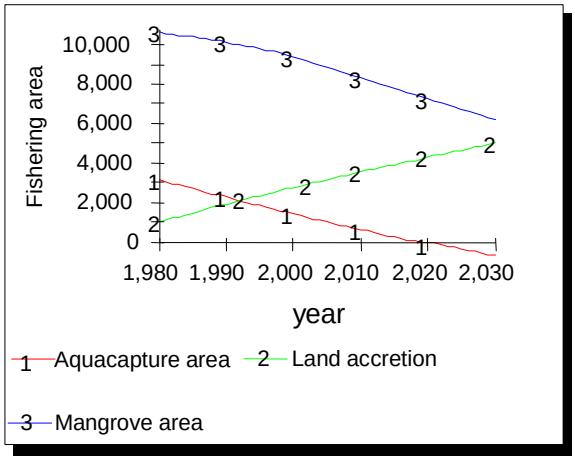
Notes: The positive arrow indicates influences due to changes in the same direction. The negative arrows indicates influences due to changes in the opposite direction.

Figure 3: Computer Model For Simulation

Table 4: Some Initial Value Parameter of Key Variables

Name of Variable	Initial Value	Unit
Ecology Sub Model		
Water	3250	Hectare
Arisen Land	1100	Hectare
Average Rate of Arisen Land	98.6	hectare/year
Percentage of Dredging	0.006	Per year
Mangrove	10725	Hectare
Percentage of Mangrove Planting	0.001	Per year
Percentege of Mangrove Grown in Arisen Land	0.001	Per year
Average Cuting	192.9	hectare/year
Open Area Available	4000	Hectare
Average Time Land Requirement	50	Year
2. Economic Sub Model		
Fish Stock	4000	Tones
Percentage of Cultivation	0.07	Per year
Percentage of Captures	0.10	Pe year
Percentage of Natural Dead	0.008	Per year
Price of Captures	10	Rp Million /tones
Percentage of the Number of Fishermen	0.80	-
Farming/Aquaculture Land Requirement	1	Hectare / Person
Normal Productivity of Farming	2	Tones/hectare/year
Price of Farming Commodity	3	Rp Million /ton
Percentage of Farmer	0.001	-
Percentage of Incoming Farmer	0.40	-
Persen Fishermen and Farmer	0.30	-
Normal Productivity of Aquaculture	1	Tones/hectare/ year
Price of Aquaculture Commodity	20	Rp Million /tones
Percentage of Aquacultivator	0.01	-
Percentage of Incoming Aquacultivator	0.20	-
Percentage Fishermen and Aquacultivator	0.10	-
Average Education	2	Year
Avarage Investment Per Hectare	1000	Rp Million/year
PDRB Kampung laut	6840	Rp Million/year
Time period of PDRB incremental	50	Year
3. Population Sub Model		
Population	9000	Person
Percentage of Population Growth	0.022	Person/year
Percentage of Population Decrease	0.01	Person/year
Percentage of Labor Force	60	Person/year
Average Settlement Use Per Person	0.01	hectare/person

The existence of the sedimentation process has added to an increasingly wide area of land arises every year, and cause loss of water. On the other hand, sedimentation processes have shaped the land accretion which is then overgrown with mangroves. The existence of mangroves that grow in soil-risen and also conservation programs can slower the rate of decline of existing mangrove area. However, due to the high rate of logging, mangrove area tended to decline over time.

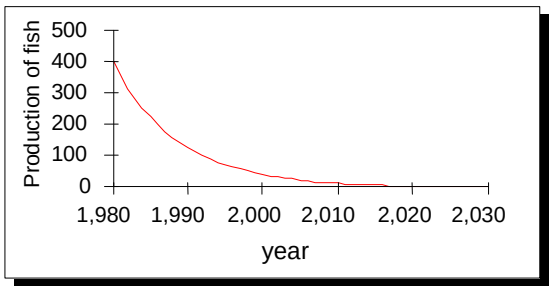


Source: Data calculation.

Figure 4: Water Area, Mangrove Forests and Land Accretion (Hectares)

Environmental degradation has affected the availability of fish in the waters of the lagoon. The shrinking fish stocks have resulted in declining catches of fishermen. Economy resident who had been depended on this sector is endangered. Although the price of fish is quite good, but the income of fishermen continued to fall in line with the production fall.

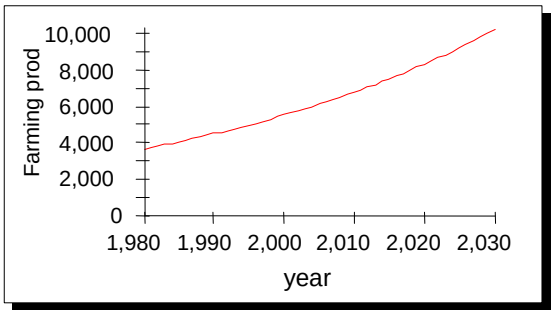
Without any change in the system, approaching the end of the simulation, 2016, it is estimated that the sector can not provide more income to the people, because the captured fisheries production has reached a point of zero, as shown in Figure 5.



Source: Data calculation.

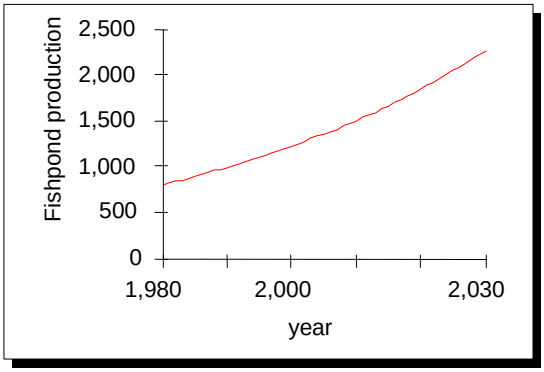
Figure 5: Development of Captured Fisheries Production (Tons/ Year)

On the other hand, increasing agricultural activity and ponds, providing greater opportunities for increased of people income, because the tendency of production that continues to increase as the widespread use of land.



Source: Data calculation.

Figure 6: Development of Farming Production (tones per year)



Source: Data calculation.

Figure 7: Development of Fishponds Farming Production (tones per year)

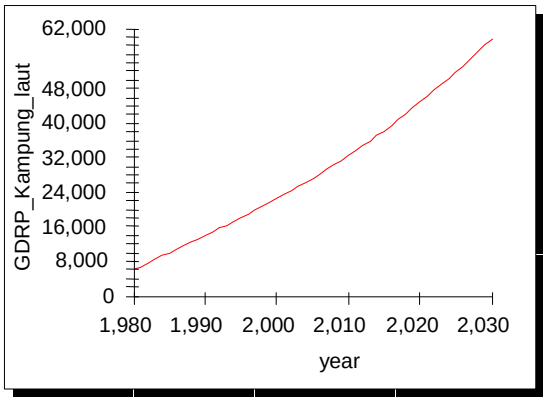
Fishpond production level is still relatively low compared with the level of agricultural production (rice). This is due to people who pursue this farming are still small, and indeed many immigrants practice it.

Although level of production still low, aquaculture sector can contribute to the larger production value. The reason is the price of fish-farming commodities that are relatively higher compared to prices of agricultural products and fisheries. The development of pond production value over the time is as shown in Figure 8 which is in increasing trend.

The low production is also due to aquaculture ponds run in traditional way so

that the productivity is low. The high capital investment for the ponds is a constraint. Low productivity is also influenced by the amount of crop losses due to theft by other citizens. However, this sector has great potential in the future due to the positive development of its production.

Amid the significant declining captured fisheries sector, the presence of new economic activity like agriculture and aquaculture can increase people's income of Kampung Laut. Cumulatively, GDP growth tends to increase sea village from year to year, with positive growth rates until the end of the simulation in 2030.

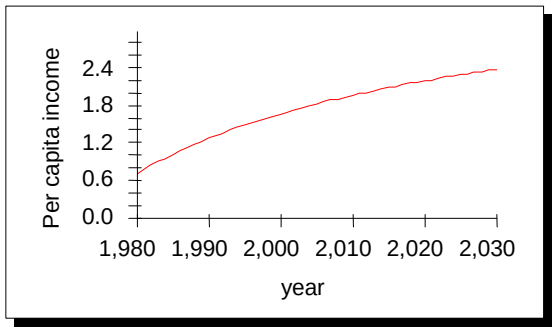


Source: Data calculation.

Figure 8: Development of GDRP (million rupiah)

Positively increasing GDRB has been followed by the same slope of increasing population. The uncontrolled increasing population affected the slow growth of percapita income in the next period. Unfortunately, the increase in income is mostly contributed by the immigrants mastered the skills of local farming and aquaculture. The native fishermen primarily benefit from the sector only from limited the cultivation land lease or profit sharing with the entrants.

The increase in GDP is positively followed by a trend of increasing population growth. Uncontrollable Increased population brings an impact on the stagnation of income Percapita in the future. This is illustrated in the graph of income Percapita as asymptotic.



Source: Data calculation.

Figure 9: Development of Percapita Income (million rupiah)

Although the Percapita income still increasing every year, it is still lower level of income. If the rate of population has always remained, until the end of the simulation year 2030 Percapita income can not reach more than 2.4 million rupiah per year. This means that monthly income of each person will be not more than 200 thousand rupiah.

Design of Proposed Policy

Various future illustrations of the simulation become a foundation to conduct policy simulations with alternative scenarios. Simulations were conducted to evaluate alternative scenarios and designing policy proposals in order to overcome the problems in the system. Policies and strategies should be implemented or how the structure should exist, should be tested on the model, and the most important is to develop human aspect through creative activity.

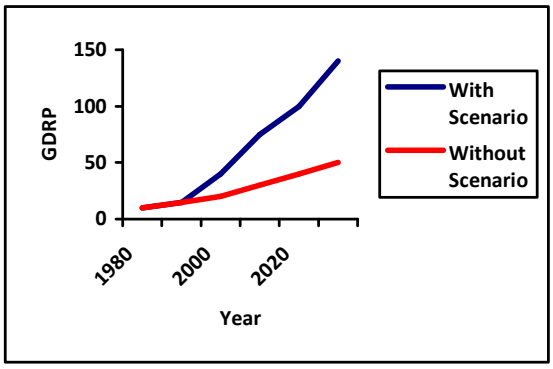
The human development choice is the development process as one that releases, organizes and converts human energy into social capacity and material results. The process consists of pioneering individuals who consciously conceive and initiate new forms of activities which give expression to the subconscious aspirations and preparedness of the society. These pioneers are imitated by others so that the new

activity gets replicated and diffused. Gradually, the general population comes to recognize, accept and support the new activity by formally organizing it through laws, policies, programs, systems, organizations and education. Eventually, the activity may become so fully integrated with the society that the need for formal structures gives way to non-formal social institutions and still later becomes assimilated as cultural values of the society (see Cleveland and Jacobs, 1999). Unfortunately, there are many difficulties of fisherman empowerment are: 1) the programs are not focus on target group as priority, 2) persons in charge in the empowerment have no trust fisherman to implement the programs, and 3) the program implementation are not covered by building social structure.

By considering the condition of the natural environment is increasingly severe, then the policy of sustainable economic empowerment for increasing people's income purpose has should be directed to the intensification effort rather than converting mangroves to increase the land area (extensive effort). Intensification policies will be realized in the form of increased economic productivity of aquaculture, improving socio-economic and culture.

The paradigm in strengthening people's economy includes the fair distribution of economic assets and the attempts to reduce birocracy in organizing and deciding people's life (Sasono, 1999). Therefore, the strengthening of people's life has to be supported, especially for the unfortunate people.

According to Victor (2001), there are some issues need to be considered in menaging and developing PEMP program, as follows, namely acceptability, transparancy, accountability, sustainability, responsiveness, quick disbursement, democracy, equality, and competitiveness. Furthermore, the success of society's development depends on the understanding of value system in the society; such as the way the society reacts to a changes.



Source: Data calculation.

Figure 10: Change in GDRP before and after Scenario

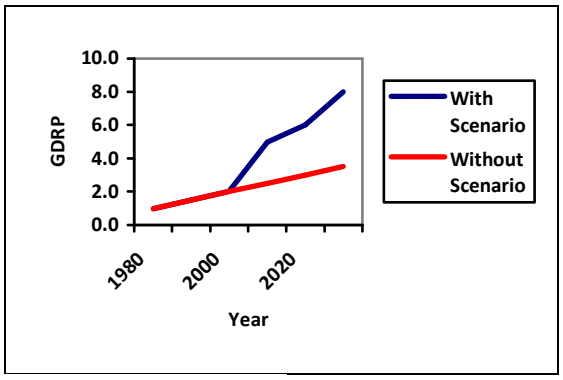
Simulation of intensification policy and population control is run by changing the parameters within target system. Here is the scenario illustration: The investment value as a parameter for economic capital in the cultivation sector increased to 5 million rupiah per hectare; population education level (indicators of social and cultural capital) increased to 6 years, aquaculture and agricultural productivity increased, respectively - each into 4 tones and 5 tones per hectare per year, and the rate of population growth is controlled at the level of 1.5%.

If the other parameters are unchanged, the scenarios stimulate the acceleration of GDRP growth of the marine communities. Before the scenario is run, in 2020 GDRP is only about 40 billion rupiah. With the scenario, in the same year the value of GDRP reached 100 billion rupiah, or 60 billion rupiah higher if no scenario intensification and population control.

The high rate of population led to a decline rate of Percapita income. It is seen from the asymptotic curve. With such situation the policy is needed to control the population growth rate for increase Percapita income growth rates.

Therefore, at the same time of intensification scenario, it also perform is population growth control policy. With controlling the population growth rate from 2.2 per year at the moment to 1.5 percent

per year, Percapita income changes the better as shown in Figure 11.



Source: Data calculation.

Figure 11: Percapita Income Growth before and after the Scenario

With the population control, income Percapita of population increase continually, with the increasing growth trend over time. If this situation is maintained, then in 2020 the income Percapita of Kampung Laut will amount to 7 million rupiah per year, or about 583.3 thousand rupiah per month. It means that it increase 150 percent more than if no scenario, which only accounted for 200 thousand rupiah per month.

To improve the level of Percapita income, without extensive effort, can be pursued by reviving the capture-fisheries sector. Because water area is prerequisite to the existence of this sector, then the consequences is that the government should dredge arisen land and move it to another area to restore the water area. This requires a very large cost. Therefore, until now these efforts has not been implemented.

CONCLUSION

This paper investigated the dynamic problem of living system in Kampung Laut, Cilacap, which included social problems and ecological changing. The paper used a dynamic system model to structure the problems. The model simulated various feasible scenarios, from which the best became the base to impose a policy to empower their sustainable economy. The model conceptualized variables related to the problem to build a figure of Causal Loop Diagram (CLD), which was then simulated using Powersim 2.5 software package.

Using the scenario of intensification and population control, the paper found that it could increase the people's income, with positive trend until the end of simulation. The model for sustainable economic empowerment had been proven valid after the verification of the structure, behavior and policy implications. Therefore, the model can be used as a tool to test various alternative policies before effectively implemented to sustainable economic empowerment of people in Kampung Laut.

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