

## **Research Article**

### **Analyzing the Sustainability of Mangrove Management with Wanamina System in Coastal Blanakan Subang, West Java**

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**Abstract:** Mangrove becomes main ecosystem that the more important supporting life in coastal regions. Subang regency is one of areas in West Java that still has mangrove region. The result of data analysis LANDSAT-TM Multitemporal that show in the period 1988-1992 had happened mangrove areas reduction (of 2.087,7 ha to be 958,2 ha) that caused by activities of land conversion including the expansion of fishpond areas, while the addition of board (to 3.074,3 ha) in the period 1992-1995 that show the successes of social forestry which was conducted through tumpang sari fishpond/wanamina/silvofishery. The utilization of mangrove for wanamina in the regency of Subang is currently undergoing rapid development so that required assessment of the sustainability of resources and against efforts have been done in wanamina. One of tools used to evaluate the sustainability of mangrove management with wanamina system is Rapid Appraisal for Fisheries (RAPFISH) that is a method of assessment of the sustainability of fisheries based on multidimensional scaling. The objectives this study were (a) to calculate the level of business feasibility with wanamina system, and (b) to determine the status of sustainability of mangrove management with wanamina system in coastal Blanakan, Subang. The study was conducted in coastal Langensari village Blanakan district Subang Regency, Province of West Java for three months in October until December 2014. Wanamina activities conducted in coastal Langensari has a level feasibility is quite effective and efficient. The economic analysis of four parameters under consideration entirely show a positive contribution to sustainability of wanamina, i.e. (a) there are a large number of species that is utilizing of mangrove, (b) existence of interaction biofisik, (c) across the result of cultivation of fish/shrimp and non cultivation of mangrove large enough, and (4) low input from the activities of wanamina. The results of ordinasi RAPFISH impact on all dimensions of sustainability, whether the ecology dimension, economic dimension, social dimension and multidimension entirely show "enough sustained status" with the value of the index was at >50-75 hose value. This condition can reflect that mangrove management with wanamina system in coastal Blanakan, Subang regency be in state of being sufficient optimal. Based on analysis of Leverage in the method RAPFISH there are seven sensitive indicators contributed to the sustainability index, i.e. (a) water quality, (b) density of mangrove, (c) market of fishpond yields, (d) job types, (e) the status of land ownership of fishponds, (f) work pattern, and (g) the level of public education.

**Keywords:** Coastal Blanakan, RAPFISH, Sustainability index, Wanamina.

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#### **INTRODUCTION**

Indonesia has the mangrove broad in the world [1], i.e reached 4.25 million ha or about 3.98 % from all broad of Indonesia forest. But broad mangrove Indonesia ecosystem continues to decrease. Based on the latest data 2009 that was released by BAKOSURTANAL (Coordination Agency Surveying and National Mapping) that broad of mangrove forests in Indonesia are still reached 3.2 million ha.

Subang regency is one of areas in West Java still has the mangrove area. Data analysis LANDSAT-TM multitemporal 1988, 1990, 1992 and 1995 shows that broad mangrove in this area at the period 1988-1992 broad experienced a decrease of 2.087,7 ha in 1988 to 1,729.9 ha 1990 and 958,2 ha 1992. But between 1992

and 1995 happened the addition of space being 3,074.3 ha. This reduction in activity associated with the conversion of land including the expansion of fishpond area, while the increase of the on the period of late indicate the success of forestry uncouple social program which was conducted through by wanamina system. Fish pond silvo fishery activities are one of the utilization mangrove ecosystem in an optimum manner.

The mangrove utilization to silvofishery in Subang regency now has that incredible ramp-up, so that required assessment on the sustainability of resources and business done in silvofishery. Rapid Appraisal System for Fisheries (RAPFISH) is one of the instrument used to evaluate the sustainability of mangrove management with wanamina system. It is an

assessment method of the sustainability of fishery based this multidimensional scalling approach.

The objectives this study were (a) to calculate the level of business feasibility with wanamina system, and (b) to determine the status of sustainability of mangrove management with wanamina system in coastal Blanakan, Subang.

## METHODOLOGY

### Materials and instruments

The instruments used in research i.e. the equipmet sampling and measuring instruments parameters of fisika-kimia water (pH meter, Refraktometer, Termometer, DO meter, Secchi disk, and sample bottle of water), kuisisioner to the needs of data ekologi-ekonomi and social, RAPFISH software, and the writing tool. The materials needed are a water sample, data as a result of quisioner and an interview with the respondents.

### Time and Place

The research activity was done at the people fishpond area of Langensari village, Blanakan district Subang regency West Java Province. The time it takes to implement this research activity during 3 months, namely in October until December 2014. The research sites located at 107°31'-107°54'EL and 6°11'-6°49'LS.

### Data Collection Method

The data collected in the activities of this research include primary and secondary data. Primary data was collected by identifying in the form of observation physically and direct interview with inhabitants, public figures, government officials and key local person around the research. The field observations were done to get data on the water quality, vegetation coastal waters, biota waters, institutional of social and economic data.

Secondary data collected through the study of literature, research reports dealing with current research study has been done by various related agencies, i.e. Development Planning Agency (BAPPEDA), Central Statistics Agency (BPS), forestry office, fisheries and oceano grapy office, environment office, College, cooperatives and other institutions which are relevant.

### The Determination of Respondents Technique

The selection of respondent accordance with the condition the environment and the number of respondents taken namely respondents considered to represent study and understand the problems. The determination of done with a method of expert judgement survey conducted in two ways:

- a) Respondents from the community (stakeholders) who deal directly with mangrove management activities with wanamina system, conducted using a method of purpose random sampling.

- b) Respondents from the community of scholars were selected deliberately (purpose sampling). Respondents were having mastery in accordance with the plane of the study.

## RESULTS AND DISCUSSION

### Business Feasibility Wanamina

The feasibility analysis of wanamina efforts intended to find out the level of effectiveness and efficiency of the use of mangrove forests as fishpond aquaculture is environmentally friendly. According to Walters *et al.* [2] is now a method that can be used to assess the mangrove support against commercial fisheries is the approach the function of production namely the mangrove laid down as a determining to fish catch. To identify and assess fish catch commercial both subsistence and the total who were supported by the mangrove, economic analysis should pay attention to the following issues:

- Species that utilize the mangroves as a habitat
- Interaction biofisik in a coastal area
- The direct and indirect catch of shrimp or fish and mangroves
- Aquatics industry that relies on input

### The Species that utilize the mangrove

The existence of mangrove ecosystem is very important for a range of terrestrial of the biota mangrove because they generally as a place to feed , a stopover or regional as a place of his life.The various types of the biota using mangrove is related to physical function mangrove as spawning, a nursery and feeding ground.

Based on the data village administration was obtained information that the village Langensari having mangrove forest area of 75 ha which is at the fishponds the community and mangrove forest as a protected forest area of 100 ha. Various kinds of fauna that can be seen in mangrove trees at village Langensari it is intermediate between various other species of birds (blekok rice fields, bambangan brown, grouse kembang, kokokan sea), various species of mammal (garangan java, beavers north ) , and various species of reptiles ( lizards, snakes kadut belang, snakes fish-ponds).

To many kinds of fish and shrimp most it was found in an ecosystem mangrove that has been integrated with the activity aquaculture, in this case wanamina activities. The kinds of fish and shrimp could be found was a mujair fish (*Oreochromis mosambicus*), milkfish (*Chanoschanos*), blanak fish, mix fix (as catfishes), fire shrimp, peci shrimp, and bago shrimp. Besides, we could find crab mangrove (*Scylla serrata*).This is in line with the condition of the waters around the mangrove in other areas, as in the waters of Indramayu, can be found many kinds of fish among other kapasan fish, pieces fish (of Gerreidae), gelodok

fish (*Periophthalmus* sp.), blanak fish (Mugilidae), and milkfish (Seftiany and Amelia 2010) [3]. According to Bhagawati *et al.* [4] several kinds of fish economically important that could be found in waters Cilacap is *Anguillabicolor*, *A.mauritiana*, *Chanos chanos*, *Lutjanus argentimaculatus*, *L. sanguineus*, *L.johni*, *Muraenesox talabon*, *Epinephelus tauvina*, and *Labotes surinamensis*. Wahyudewantoro [5] stated in the waters of mangrove estuary Angke North Jakarta could be found 32 species of fishes of the 26 family with the kinds of dominant namely *Leiognathus equulus*, *Xiphophorushelleri*, *Aplocheilus panchax*, *Ambassis gymnocephalus*, *Trichogaster trichopterus*, *Periophthalmodon schlosseri*, *Liza subviridis*, *Cyprinoides megalops*, and *Chanos chanos*.

According to Sewiko [6] on the research of fish community structure in the coastal village of Langensari found 13 species of fish of the 12 family with the kind of fish dominant kuro fish (*Polynemus plebius*) with relative abundance 38.53%. With regard to the 13 types of fish are *Bagarius yarrelli*, *Penaeus monodon*, *Cynoglossus bilineatus*, *Arius maculatus*, *Polynemus plebius*, *Liocarcinus hull*, *Scylla scutellaria serrata*, *Periophthalmodon schlosseri*, *Glossogobius circumsepectus*, *Otholitoidea brunneus*, *Puntiusbinotatus*, *Mugil cephalus*, and *Chanos chanos*.

The invention of various kind of the biota especially the biota ecosystem waters in mangrove trees

at village Langensari indicate that the existence of mangrove trees having a positive contribution to the structure of the community fish. This means that the sustainability of be able to support activities it produces wanamina with the results of the cultivation and a by-product of the catch nature with an adequate quantity but it should remain the quality of the surrounding environment the mangrove.

**Interaction biofisik in a coastal area**

Capacity and balance structure coastal ecosystem controlled by some physical, chemical and biological component [7]. Waters a set of ecosystem is the integral of physical, chemical and biological component. Therefore if there is any change in components fisik-kimia waters , this will certainly be encourage changed biological components , both in quantitative and qualitative. In principle analysis biological components in coastal regions and the sea is the measurement of biological response on changes in the environment as a consequence of degradation the quality of waters.

The water quality can be used as one of the criteria in determining the level of the feasibility of farms or to conformity. The water quality shows environmental conditions around mangrove and fishponds. The result of measurement parameters of the water quality at the sample station in the study locations shown in Table 1.

**Table 1 Data of fishponds water quality in the Langensari village**

| Sl. No. | Parameters     | Unit | Avarage | Sample |       |       |       |      |      | Descriptons              |
|---------|----------------|------|---------|--------|-------|-------|-------|------|------|--------------------------|
|         |                |      |         | 1      | 2     | 3     | 4     | 5    | 6    |                          |
| 1       | Temperature    | °C   | 28,83   | 30     | 31    | 29    | 28    | 28   | 27   | Fishponds: 1,3,5         |
| 2       | Salinitasion   | ‰    | 19,83   | 28     | 22    | 17    | 15    | 20   | 17   |                          |
| 3       | pH             |      | 7,92    | 8      | 8     | 8     | 7,5   | 8    | 8    | Fishponds Channel: 2,4,6 |
| 4       | DO             | mg/l | 5,16    | 5,39   | 3,9   | 7,74  | 6,18  | 3,86 | 3,87 |                          |
| 5       | Total Nitrogen | mg/l | 0,13    | 0,17   | 0,13  | 0,09  | 0,1   | 0,16 | 0,11 |                          |
| 6       | Total Fosfhat  | mg/l | 0,019   | 0,01   | 0,018 | 0,026 | 0,017 | 0,02 | 0,02 |                          |

Based on the measurement in general parameters of water quality in the Langensari be in the range of content still to be accepted by the body of fish and shrimp. This shows that the water quality give a positive influence on wanamina business, but the water quality can also have negative effects if the value of the quality of the water is outside the range of the threshold of that can be accepted by the fish and shrimp. The parameter of water quality is very important to determine the success of fishery cultivation (like shrimp and fish).

**The direct and indirect catch of shrimp or fish and mangroves**

Fisheries activity in the Langensari village was done through fishponds aquakultur with silvofishery.

Production of fish is the cultivation of commodities that are kept in fish farms with commodities windu shrimp, mujair fish and milk fish. The commodity which stood at a certain season depending on the size of the fish that desired by owner fish-ponds, and the fish production non cultivation or fish catches area commodity that was arrested in nature, not captured in the fishpond areas, and usually catch every day or on particular daysby owner fishponds.Non the cultivation of commodities including fire shrimps and peci shrimps. The shrimp are arrested by using fishnet mounted on around the sluice or captured directly by fishermen using a net around fishponds silvofishery. The results of the commodities production cultivation and non cultivation on Langensari during 3 last year can be seen in Table 2.

Table 2: A list of fish and shrimp production in Langensari village

| Sl. No.       | Type of Fish and shrimp      | 2012            |                      | 2013            |                      | 2014            |                      |
|---------------|------------------------------|-----------------|----------------------|-----------------|----------------------|-----------------|----------------------|
|               |                              | Production (Kg) | Total (Rp)           | Production (Kg) | Total (Rp)           | Production (Kg) | Total (Rp)           |
| 1             | <i>Metapenaeus Elegans</i>   | 12.014          | 268.811.700          | 12.820          | 274.825.000          | 10.221          | 222.985.000          |
| 2             | <i>Penaeus Merguensis</i>    | 12.740          | 445.098.300          | 13.983          | 443.087.000          | 10.830          | 347.483.800          |
| 3             | <i>Penaeus Semiculcaltus</i> | 7.831           | 587.334.400          | 9.276           | 616.979.000          | 4.618           | 266.638.000          |
| 4             | Mujair Fish                  | 13.581          | 95.688.100           | 19.557          | 125.247.500          | 15.634          | 105.402.000          |
| 5             | <i>Mugil Cephalus</i>        | 832             | 7.295.600            | 701             | 5.414.100            | 540             | 4.408.000            |
| 6             | Milk Fish                    | 20.563          | 239.338.500          | 30.779          | 349.949.100          | 26.698          | 322.039.800          |
| 7             | <i>Lutjanus Sp</i>           | 1.115           | 41.085.900           | 1.174           | 40.060.600           | 869             | 26.788.500           |
| 8             | Other Fish                   | 194             | 767.700              | 306             | 1.300.100            | 191             | 799.100              |
| <b>Amount</b> |                              | <b>68.870</b>   | <b>1.685.420.200</b> | <b>88.596</b>   | <b>1.856.862.400</b> | <b>69.601</b>   | <b>1.296.544.200</b> |

Information : KUD Mina Langgeng Jaya from January 2012 to September 2014

According to Sodikin [8] the results of the production of the fisheries sector and maritime Indramayu is a potential the largest fisheries in west java and from year to year continues to increase. As an example in 2007 production in the fisheries sector of 125.702.65 tons rising by being 147.436.64 tons and in 2008 rising around 17.29 %. The result of the arrest of all the fish of the sea, fishponds, the pool, public water and marine cultivation. The directorate general of fisheries KKP (2014) [9] that production BBPAP Jepara in 2012 with broad areas 5,000 m<sup>2</sup> to be estimated production windu shrimp (*Penaeus monodon*) of 2.125 kg. Indra [10] said that there is a positive relationship between the ecosystem and the production of mangrove fishing catch in Aceh, with the value of the coefficients 27.21 % which means that the production of fisheries get 27,21 % contribute by the existence of mangrove ecosystem. If mangrove areas in Aceh can be increased from the existing wide 44.125.8 ha become 113.976.61 hectare to the number of effort can be increased from existing effort 151.250.26 trip/yr be 180.406 trip /year.

The results from the interview the community is quite aware that the existence of mangrove around fishponds very important because the mangrove area as a nursery area shrimp natural that has become one of limiting factors to abundance of shrimp in waters off the coast of. Mangrove ecosystem not influence directly against production fishery mangrove but the existence of this would affect indirectly namely affect the state of the environment with enrich organic material that will eventually impact on fishery production especially the production of non cultivation in nature.

Based on Table 2 seen that the production of fish and shrimp from 2012 to 2013 increased production of 68.870 kg to 88.596 kg with a total value of Rp 1.685.420.200 up to Rp 1.856.862.400. This shows that there are the achievement of the increase in the production of 10.17 %. Likewise for the production of fish and shrimp in 2014, there is an upward trend in that

the data obtained by the not yet full of until December 2014 so it is not obtained a total value of which could be compared with a value of production in 2013.

With this condition can be indicated that the activities of wanamina/silvofishery has been done in the village langensari can provide economic impact for the community and also be a means of economic development society-based with fixed attention to the environment around farms cultivation.

#### Aquatics industry that relies on input

The concept of silvofishery developed as one form of the cultivation of sustainable fisheries with low input. In the business of silvofishery, this input in the form of feed and seeds. The community in the village Langensari generally cultivating milkfish, mujair fish and windu shrimp with traditional system because without the provision of artificial feed, with the harvest about four months. The farmers hanged the fulfillment of feed on fish and shrimp on the nature. The existence of mangrove is important because leaves and twigs that falls to fishponds can be a source of klekap and natural food for organism cultivation.

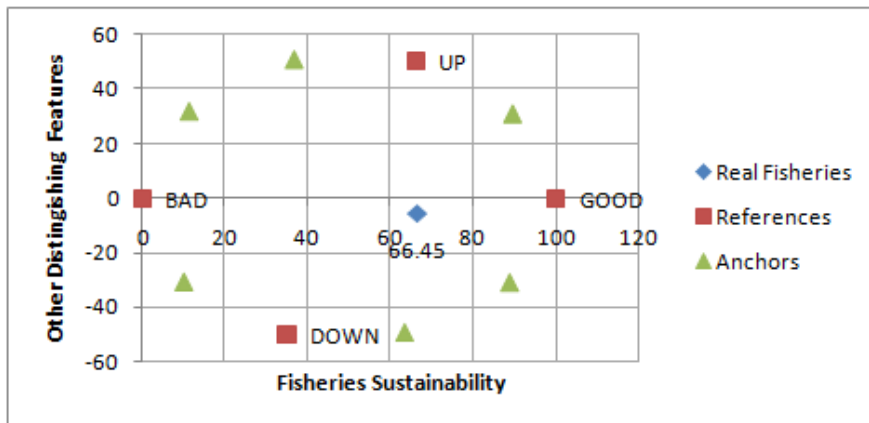
According to interviews with Mr. Syamsudin, that the farmers did not provide seeds for the commodities will be cultivated. The seed commodities cultivation provided by cooperative village unit (KUD) as partners of farmers and these seeds obtained from outside the region (Indramayu, Karawang). Several factors that very much determines the success of the activities of fishpond cultivation are solid distribution and the quality of seed, human resources, infrastructure support activities fishponds cultivation and management fishponds that good. These factors can influence on the success of the production of cultivation.

**The sustainability status of mangrove management with wanamina system**

The determination of the sustainability status of mangrove management with wanamina systems this was done by using the RAPFISH method of the 3 (three) dimensions that support the sustainability of resource management, i.e. ecological dimension, economic dimension and the social dimension. According to Marhayudi [11], grouping dimension is not the important thing, but the criteria in every dimension or the more important as possible so that will include indicators that can be used to assess the sustainability resources management status.

**The sustainability status of ecological dimension**

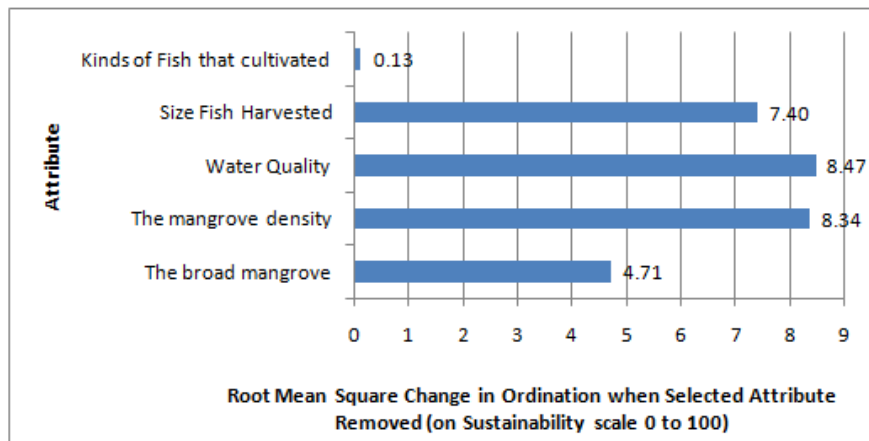
The results of ordination RAPFISH to the ecological dimension, obtained the value of the sustainability index 66.45 (Fig. 1). This means that the status of the sustainability of ecological dimension to categorized “sustainable enough” because the resulting index value was the interval value > 50-75. The indicators who is expected to give influence against ecological dimension in the mangrove management with wanamina system is composed of five indicators i.e. (a) the broad mangrove, (b) the mangrove density (c) water quality (d) size fish harvested and (e) kinds of fish who cultivated.



**Fig. 1: The result of RAPFISH ordination for ecological dimension**

Analysis of Leverage in the RAPFISH method aims to see sensitive indicators contribute to the ecological dimension of sustainability index value. Leverage assessed analysis based on the standard error difference between score with attributes (indicators).

Fig. 2 shows that there are two sensitive indicators index value of the sustainability of ecological dimension, i.e. (a) the water quality and (b) the mangrove density.



**Fig. 2: The result of the analysis sensitivity for ecological dimension**

Although the index sustainability of mangrove management with wanamina system of having sustained enough category, but still there are indicators that can be repaired so that the mangrove management with wanamina system this become more optimally. The Result of sensitivity analysis shows that there were two

indicators sensitivity i.e. (a) water quality and (b) mangrove density, but both of these have good indicators, the water quality with a score of 3 and mangrove density with a score of 2.

The quality of water as an indicator that reflects the condition of the environment around cultivation waters can support productivity coastal areas with contributing to the production of fish resources in those environments. In general the quality of water fishponds in the research locations being in a condition those are good for the growth of organisms. It is also the state of fishponds in Wanamina area in the village Langensari according to the results of observations that refers on the outcome of the quality of the water, actually it is still be able to optimize the production of fisheries.

The other indicator that was sensitive for the ecological dimension is mangrove density. In the wanamina area at the Langensari village based on observation known level variation of density and wide the mangrove vegetation. There were some zones in the territorial waters of Langensari with a system of fishponds that which is retained right, so that the condition is causing the mangrove density vegetation on the high zones relatively.

In the Mayangan area and Blanakan area, the existence of the class the age of fish spread on the condition of the ecosystem all mangrove. The big contribute for the existence mangrove ecosystem has density 50-200 trees per hectare, production litter 4 tons/ha/year. The existence of fish with size juvenil spread on the condition of mangrove ecosystem having high density (200-300 trees per hectare), the production litter value 4 tons/ha/year. This indicates the fish juvenil would need ecosystem conditions which protected as an effort to avoid predators and a bad environment [12].

**The sustainability status of economic dimension**

The results of RAPFISH ordination against economic dimension, obtained the value of sustainability index of 58.90 (Fig. 3). This means that the status of the sustainability of economic dimension to categorized “sustainable enough” because the resulting index value was the interval value >50-75.

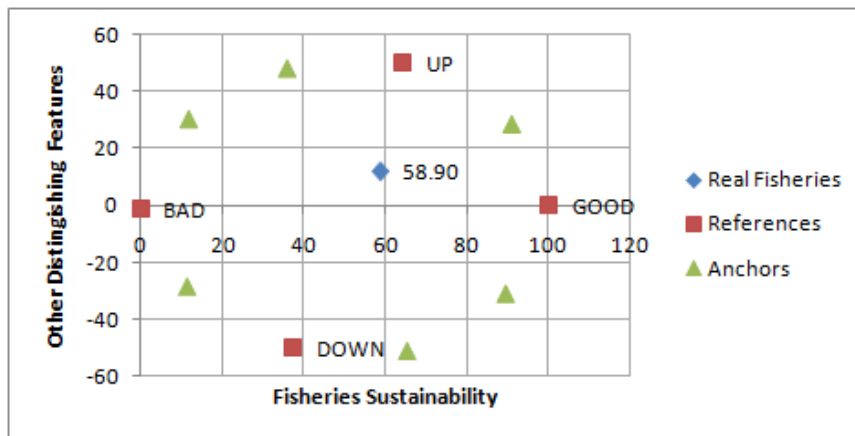


Fig. 3: The result of RAPFISH ordination for economic dimension

The index to the sustainability of economic dimension was at the y-axis, it means we need repaired the indicators which affected the index in order to increase the status of index. The indicators that are expected to provide the level of influence on the

sustainability of economic dimension consists of five indicators i.e. (a) the average income of farmers (b) the job type, (c) the results of market fishponds, (d) source working capital and (e) utilization mangrove types.

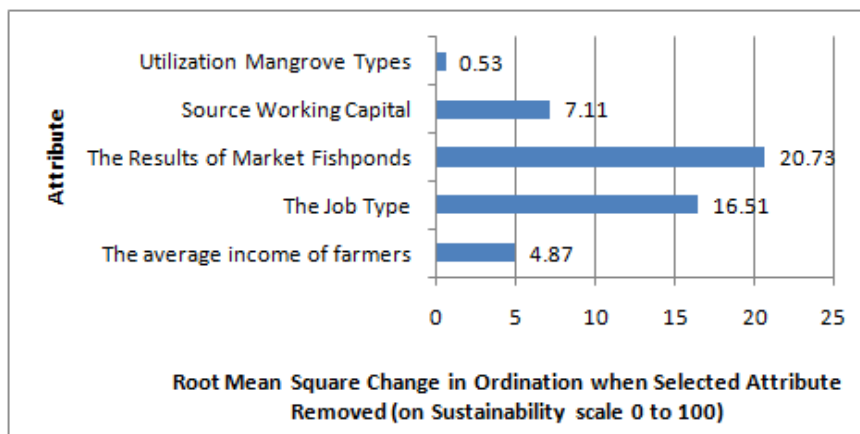


Fig. 4: The result of the analysis sensitivity for economic dimension

Based on the leverage analysis seen in Fig. 4, there were two indicators that sensitive to the index value sustainability of economic dimension, i.e. (a) the results of market fish ponds and (b) the job type. The results of market fishponds have the criteria the bad score of 1 while indicators job type possesses the criteria a good score (3).

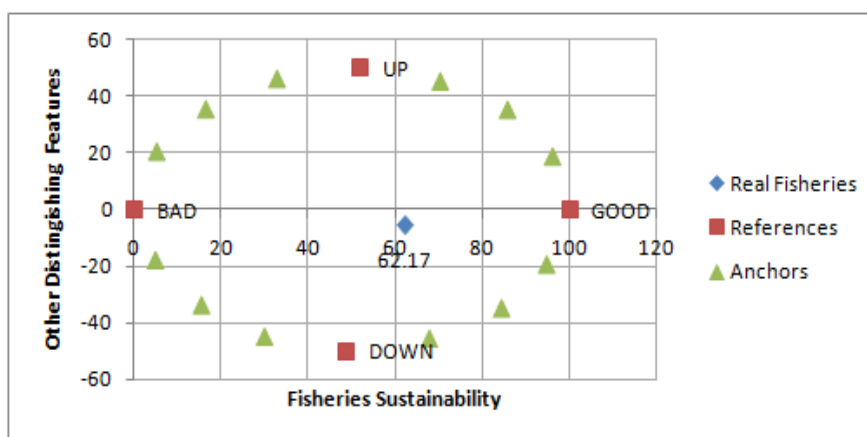
A bad score criteria (1) of the results fishponds market indicators that have caused almost all farmers in the village langensari sell the results of the cultivation and the results of non cultivation of wanamina to cooperative village unit in local village. This means that the result of market fishponds obtained was that local market so that they have no fresh over the value of products on sale but received the price has been set by the village cooperative.

Another indicator sensitive and should receive attention was job type. Based on observation in the

field the majority of fishponds correspondent at Langensari village 96 % make a job as cultivator of the silvofishery full time as a regular job. This actually had a positive impact on activities silvofishery namely fishponds can work with a vengeance to manage fishponds as livelihoods mainly, but the condition of that too can have a negative impact if there was no control clear and binding rules management on fish ponds so that when the fishponds of a desire to get the result that more they can add fishponds space by cutting down mangrove vegetation mangrove at fishponds neighbour hoods around the existing.

**The sustainability status of social dimension**

The results of RAPFISH ordination against social dimension shows that the value of sustainability index of 62.17 (Fig. 5). This means that the status of the sustainability of social dimension to categorized “sustainable enough” because the resulting index value was the interval value > 50-75.

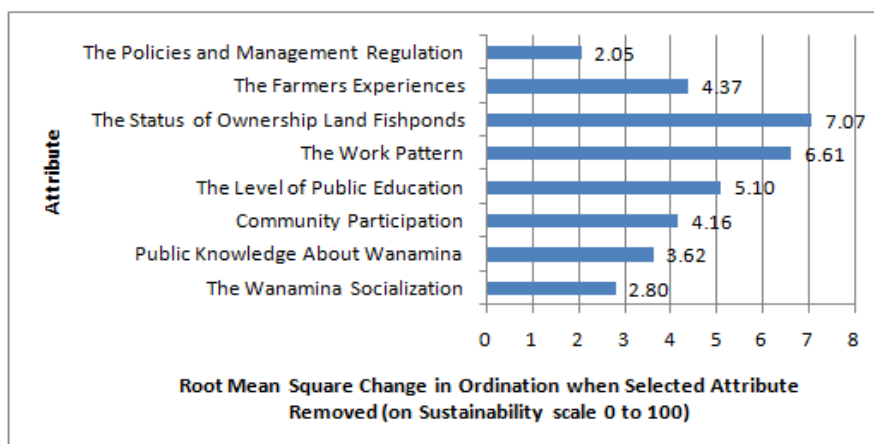


**Fig. 5: The result of RAPFISH ordination for social dimension**

The indicators to give impact on the level of the sustainability of social dimension to consisting of the eight indicators i.e. (a) the wanamina socialization, (b) public knowledge about Wanamina, (c) community participation, (d) the level of public education (e) the work pattern, (f) the status of ownership land fishponds, (g) the farmers experiences, (h) the policies and management regulation.

Based on the result analysis sensitivity (leverage analysis) shown in Fig. 6 there were three indicators

sensitive that influent to value the sustainability index of the social dimension i.e. (a) the status of ownership land fishponds, (b) work pattern and (c) the level of public education. From third of the sensitive indicators there was one indicator having a bad score criteria (1), That is an indicator of the status of ownership land fishponds, while two other indicators have good score criteria, that were an indicator of a work pattern with a score of 3 and the level of public education with a score of 2.



**Fig. 6: The result of the analysis sensitivity for social dimension**

The criteria bad score (1) owned indicators land ownership landfishponds status because in some large (48 %) land fishponds wanamina activities at that existed in the Langensari village its status not belong to own fishponds but of land owned by other parties are PT. Perhutani (Persero) a unit III West Java and Banten. In the realities wanamina fishponds obtain the results of the harvest of fish and shrimp from the cultivation on fishpond land, while parties PT. Perhutani also obtain for results over the use of land by people who conduct cultivation activities in a land fishponds owned by PT. Perhutani. This condition is actually the community as fishponds because even though they have no land their own fishponds could still do business cultivation, but indeed fishponds this not received income intact because they must give incentives on arable land to PT. Perhutani.

An indicator of the working with the good score (3) the sensitive give impact on the sustainability of social dimension and should get attention. The result of research showed that 96 % fishponds at Langensari village to activities wanamina in groups. The certainly positive impact on wanamina activities, cause the work pattern need to be maintained so his conditions.

Other indicators that were in need of improvement and give the effect on the sustainability of the social dimension is an indicator of the level of

public education with a good score criteria (2). Based on the result of correspondent analysis against fishponds given questionnaires, obtained information about 64 % educated fishponds were sufficient levels junior high school (SMP)-Senior high school (SMA). This result indicates that most of the farmers have an understanding, concern and responsibility enough to sustainability of mangrove ecosystem that was important for wanamina activities. To improve the status of sustainability, informal education on the fishponds community also needs to be improved to further expand provided insight with knowledge and adequate skills so that residents will increase the value added of the utilization of mangrove. Informal education can be done in the form of counseling or training to the community or people self-supporting group other.

In addition to the results of RAPFISH ordination for each of the dimension of sustainability, the results obtained also ordination RAPFISH to joint all dimensions (three dimensions used) or that called the multidimensional. The value of resulting is considered as an index that reflects the sustainability of mangrove management with a wanamina system in the coast of Subang thoroughly. Now the results of RAPFISH ordination to joint all dimensions are presented in a Fig. 7.



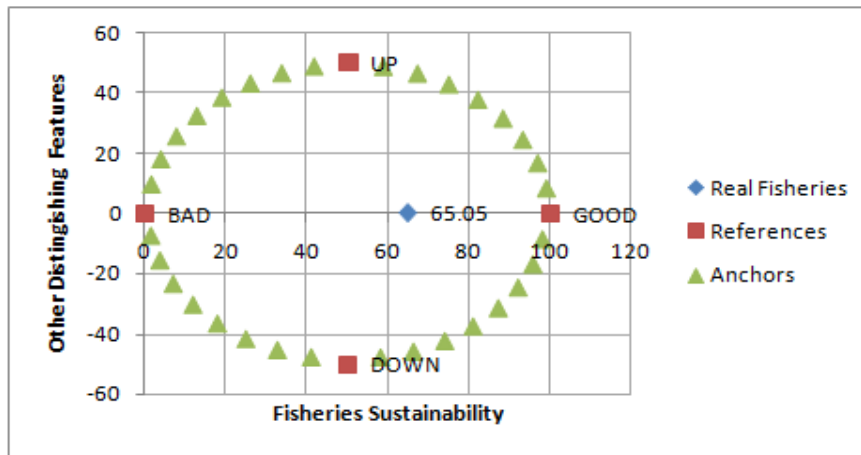


Fig. 7: The result of RAPFISH ordination for multidimensional

The results of RAPFISH ordination against combined all dimensions (multidimensional) with 18 indicators obtained the value of sustainability index of 65.05. This shows that the status of the sustainability for a joint all dimensions were categorized “sustainable enough” because the resulting index value was the interval value >50-75. Of the three dimensions (ecology, economic and social) under consideration, showed that the status of wholly “sustainable enough”. This condition can reflect that the mangrove management with a wanamina system in coastal Blanakan Subang regency be in the state of quite optimally although there were several indicators should be improved.

The results of RAPFISH analysis showed that all indicators were assessed against the mangrove management status with wanamina system provide the results of the analysis and accountable scientifically. This can be seen from the stress value obtained ranged from 12.8 % to 16 % and the coefficients determined value ( $R^2$ ) that range between 0.90–0.96. Kavanagh and Pitcher [13] said that the result of analysis was quite sufficient if the stress value of smaller than 0.25 (25%) and  $R^2$  value approach of 1.

Both the statistic parameters namely the stress value and  $R^2$  showed that all the indicators used in the sustainability of mangrove management analysis with a Wanamina system in coastal Blanakan Subang good in explained that the sustainability of third dimensions that have been analyzed. The smaller of stress value obtained mean getting better quality of analysis undertaken. In contrast to the coefficients determined value ( $R^2$ ), the quality of the results of the analysis will be getting better if the coefficients determined value ( $R^2$ ) is getting bigger (approaching value 1).

With a method of RAPFISH analysis also allows to assess aspects of uncertainty being simulated by using techniques Monte Carlo. Monte Carlo analysis done to show the stability of the sustainability index value produced. Spence and Young in Fitrianti [14] explained that Monte Carlo analysis was done to see the level of the stability of the results of ordinasi useful to see the level perturbation of the ordinasi value. Fauzi and Anna [15] have suggested that engineering Monte Carlo simulation is a method to evaluate the impact of random errors of all dimensions. The results of the Monte Carlo analysis for each dimension sustainability presented at the Fig. 8-11.

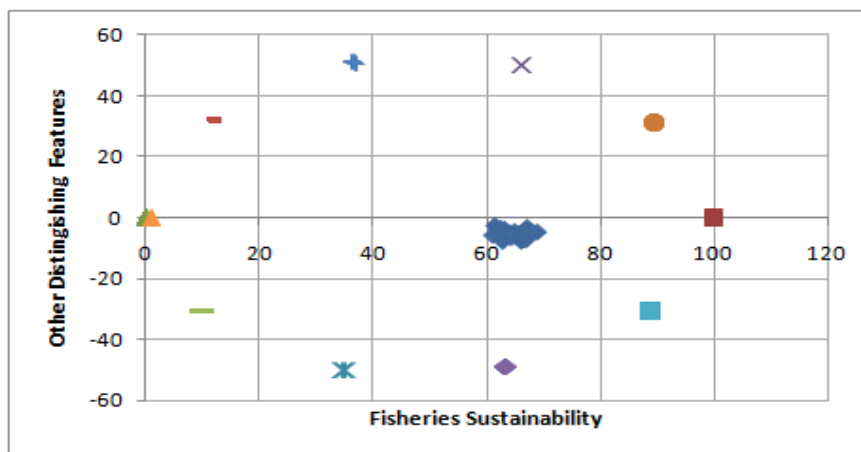


Fig. 8: The stability of ordination value on the ecological dimension

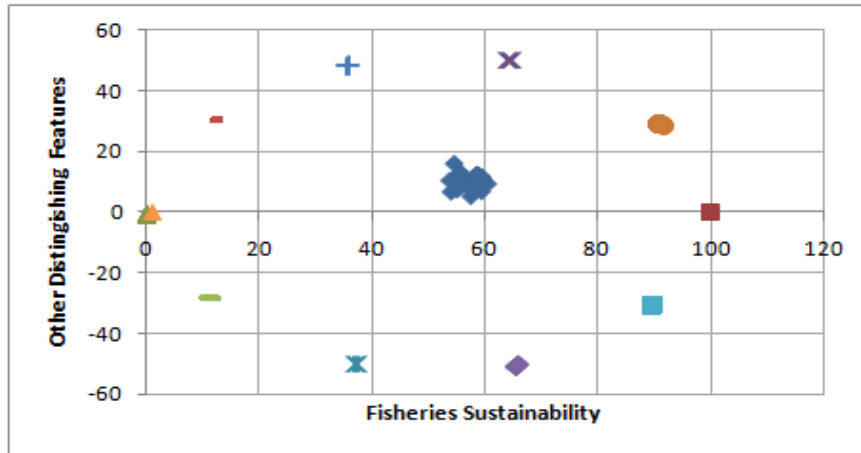


Fig. 9: The stability of ordination value on the economic dimension

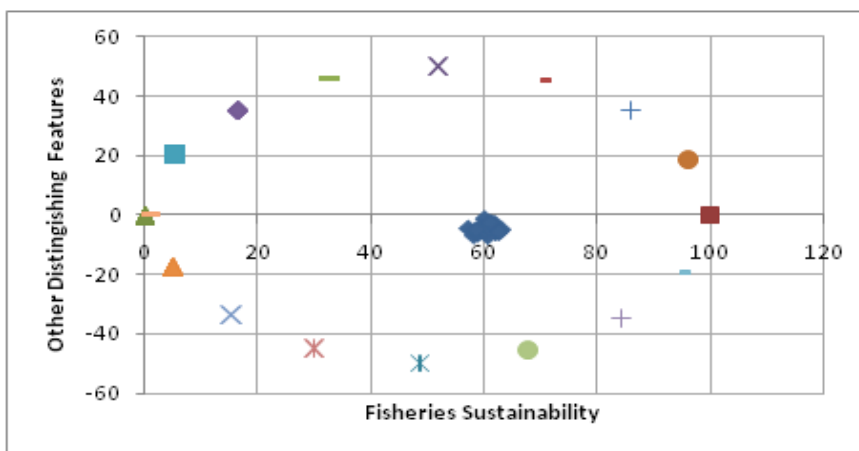


Fig. 10: The stability of ordination value on the social dimension

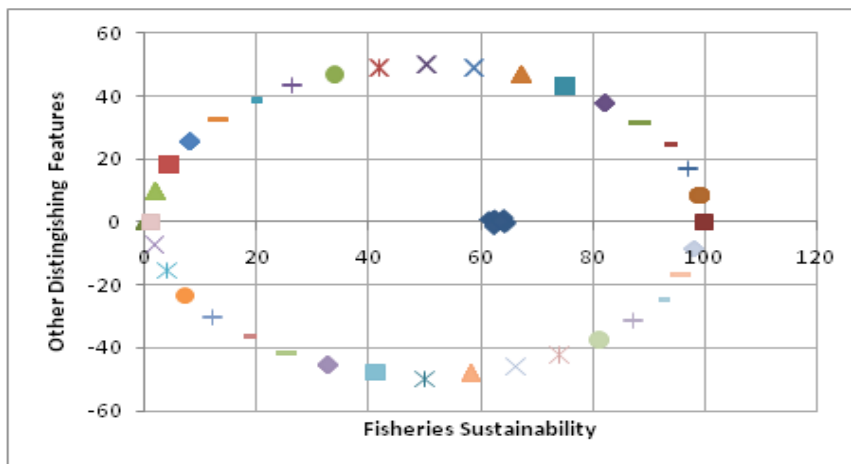


Fig. 11: The stability of ordination value on the multidimensional

The Monte Carlo analysis as Fig. 8-11 stamped on pictures showed a plot that clump together, good joint between the each dimensions and to all dimensions (multidimensional). This means the results of ordination to determine the status of sustainability mangrove management with wanamina system in coastal Blanakan Subang was a relatively stable position and not subjected to interference, both on each dimension and combined overall dimensions of sustainability.

Fauzi and Anna [15] stated that the existence of the aspect of uncertainty or any disturbance of the analysis that causes a plot spread can be caused by the following: (a) the impact of a mistake in scoring due to lack of information, (b) the impact of this variation in scoring due to the difference in scores, (c) errors in the data entry, and (d) high stress value obtained of an algorithm ALSCALL.

## CONCLUSION

Based on the research has been done can be conclusion as follows:

- Wanamina activities conducted in coastal Langensari having the feasibility level that quite effectively and efficiently. The result of economic analysis to four parameters under consideration shows all the parameters of a positive contribution to the sustainability of wanamina.
- The sustainability status of mangrove management with wanamina system at coastal Blanakan Subang can be to categorized "sustainable enough" with the index value range >50–75. These conditions to reflect that the mangrove management with wanamina system in coastal Blanakan Subang regency be in a state of optimally enough although there are still some indicators that needs to be repaired.

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