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COMMUNITY SUSTAINABILITY ASSESSMENT OF SKOUW MABO VILLAGE, MUARA TAMI DISTRICT, JAYAPURA CITY, PAPUA PROVINCE, INDONESIA

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Abstract: The interactions between humans and the natural environment need to be balanced and sustainable. The current water and energy crises show that the use of natural resources does not take sustainability into account. An assessment of the patterns and ways in which people use natural resources is now important as a basis for considering and developing appropriate strategies by considering the ecological, social and economic aspects and their impacts on the environment. This study aims to measure the relationship between community interactions in utilising resources in the village of Skouw Mabo, Muara Tami district, Jayapura City. Data collection was carried out through surveys and interviews using the Community Sustainability Assessment questionnaire. A total of 10 people were deliberately selected for the interviews, namely an indigenous community leader, a religious leader, a woman leader, two youth leaders, a village government official, two farmers and two fishermen. The results showed that the assessment of community sustainability on social (341 > 333+) and spiritual (350 > 333+) aspects was far better compared with the ecological aspects (248 < 333+). Social and spiritual aspects are key in developing appropriate target programmes to improve community welfare and protect and care for the environment in Skouw Mabo, Muara Tami district, Jayapura City, Papua Province, Indonesia.

Keywords: Sustainability, ecological, social, economic, society.

Introduction

Population growth and development that ignores the preservation of natural resources and the environment have led to the scarcity of natural resources, environmental damage and pollution (Alikodra, 2012). Demand has also been increasing, leading to the decline in natural resources. The use of chemicals to produce chillies turns out to be far more prevalent compared with the use of organic fertiliser, as many farmers pursue higher production, while disregarding the health hazards (Benchasri & Simla, 2017). Lifting the isolation between regions increases the flow of goods and services, leading to a crisis and scarcity of natural resources. The utilisation of natural resources is currently experiencing a high increase to meet human needs as a result of rapid population growth rates that are not evenly distributed. The crises of resources, such as food, water and energy, prove that management processes need to prioritise welfare, justice and, more importantly, sustainability. Sustainability is an effort (hereditary), and as an attribute that must be maintained against the inheritance of parents and family and needs to be preserved (Ibrahim *et al.,* 2013). The problem of flooding and drought time proved that there had been a very fundamental error in the use of natural resources, resulting in food shortages. According to Ruhimat *et al.* (2015), food management with agroforestry techniques can reduce food shortages for families. This can negatively impact the quality of human life, as well as the quality of education (decreasing the welfare of the community).

Indonesian people and communities in Papua in general have a high level of dependence on forest resources. Forests provide broad benefits to humans. For example, food, energy, air and water needs are provided by the forest. The performance of processed forests performance is lower, but their economic function as a source of additional livelihood for the community is still maintained. Local institutions that are trusted and adhered to by the community are effective in supporting good management of forest resources. This is indicated by the existence of management boundaries between processed forests, deposits and mutually agreed prohibitions, as there are rules for the use of authority and clear sanctions in upholding the Nagari rules (Hamzah *et al.,* 2015). A study have stated that the tenure problems in the South Lampung Forest Management Unit (FMU) occurred due to the occupation of the forest area by settlements, public or social facilities and shopping centres in the form of definitive villages (Sylvani *et al.,* 2014). It also added that the role of the parties in land tenure in the FMU area was crucial in determining where the central government that issued the policy not conduct an evaluation, especially in the area boundaries and permits that were no longer active.

Indigenous peoples are able to protect forests very well in the context of *adat* (cultural tradition) and their understanding of forests (Salosa *et al.,* 2014). The views of the state are in stark contrast to the views of indigenous peoples, as there are certain variables and measures that are understood by the state in the building of society. For example, a country's model of forest management is the Timber Legality Verification System, which is related to the synchronisation of rules, coordination, socialisation, financial support and guidance for small industries and assessment criteria for industries that have diverse sources of raw materials (Gultom *et al.,* 2014). People who live far from information sources and communication are considered marginal (untouched by development). From other research in southern African countries, it was found that conservation cannot be separated from human development (Lepetu, 2012). Therefore, any forest clearing for development in the form of road constructions, oil palm plantations or settlement constructions still involves the community to advance them. Government demands and desires are often not in line with the real conditions faced by the community, especially in terms of people's mental readiness to accept changes for the sake of change in their areas. The government's motivation to lift isolation by converting forests can psychologically impact long-standing intimate relationships between the people and the forests.

Sustainable forest management is inseparable from increasing the capacity and standard of living of the community. Cultural and linguistic diversity also needs to be considered in accommodating the concept of sustainable forest management. The relationship between the community and the forest should also be maintained by providing guarantees to create a balanced relationship between human and nature. Communities and forests continue to be seen as one item within one management unit. Managing forests means that people also participate in managing communities around the forest. The conflict resolution offered is building an effort to "turn conflict into an equal partnership", the following steps of 1) building trust, 2) developing inter-village forestry forums, 3) preparing expert teams, 4) effective communication and 5) mutually agreed regulations (Harun & Dwiprabowo, 2014).

Papua, with its many cultures and languages, is unique and, at the same time, can be a challenge for every stakeholder to participate together in paying attention to the forest and its ecosystem. Looking at natural events that occurred in Wasior, West Papua, lava spills and hot dust bursts in Yogyakarta and tsunami disasters in Mentawai, and flash floods in the Cycloop mountains, Sentani, Jayapura district can provide valuable lessons on human's relationship with nature. It is necessary to think as early as possible in managing our natural

resources, especially forests, and not only act after natural disaster has struck.

Community interactions with natural resources need to be assessed so that it can be seen how close the use of natural resources by the community is to their daily needs. The Global Ecovillage Network (GEN) introduces the Community Sustainability Assessment (CSA) method to assess community sustainability. The method assesses how people manage their natural resources optimally and efficiently from their natural environment by reducing the consumption of their daily needs from outside, such as food, clothing and shelter. GEN explained further that reducing or suppressing environmental damage is beneficial for humans, so it does not get worse and society is expected to be able to simplify its lifestyle, including consumption patterns. Furthermore, it was also explained that there needed to be a better way, where humans lived very economically and efficiently in harmony with nature (Widyarti & Arifin, 2012). According to Purwaningsih and Haryo (2015), community sustainability is strongly influenced by the culture and local wisdom of the local community. Ningsih *et al.* (2015), in their study, stated that the echo of the concept of green productivity was first introduced by the Asian Productivity Organisation (APO) in 1992. This concept offers a middle ground for industry players who consider that environmental management efforts will engender additional costs, which are a burden to the industry, especially for small- and medium-scale industries that have limited resources. Sustainable development is a stage to increase the opportunities of individuals and communities to fulfill their aspirations and their full potential in a supportive period of time by maintaining the resilience of the economic, social, environmental, and institutional systems and their behaviour (Ibrahim *et al.,* 2013) .

Land use for gardens and agricultural business activities are developed by various tribes in Indonesia in various ways. The use of plants in Papua for consumption, such as for food, tends to be subsistence. On the other hand, the facts also show that the diversity of plants in Papua, which is very abundant in nature, has not been maximally utilised because there are still many plants with uses and benefits that are not yet fully known. In addition, there has been an increase in community activities in Papua involve forest and land use, both directly and indirectly for various needs. On a small scale, the forest and land are used as a yard to plant various kinds of crops that have a certain value. The yard meant here is an open land located around a dwelling, as well as lands managed by the community for generations, which are inherited based on lineage and are recognised by *adat* institutions. A yard involves land ownership, but is closely related to the distribution of crops that have economic benefits that are intentionally planted and developed by local communities. The biodiversity of plants and their potential are used by traditional communities with local wisdom. Food and food security are the main issues plaguing the country when food there is no proper independently management. There is still a lot of management of community plots in Papua involving a variety of tribes and cultures that have not been studied in depth, including those cultivated on plots by local communities.

Although is the coastal areas are more dominant in Indonesia, most Indonesians depend on land agriculture. Agricultural activities as part of community contributions to food have not been able to answer the problem of food as a whole and independent food fulfillment is still lacking in the country. Community land is intensified for food cultivation activities that can meet community needs from carbohydrates, animal and vegetable protein sources, to vegetables and fruits (horticulture). Research have shown that among the Bedouin tribes, where customary rules are quite strict, conservation measures in the use of natural resources are very prominent (Widyarti & Arifin, 2012). As an archipelagic country with diverse tribes and cultures, Indonesia certainly has different characteristics, patterns and forms of land management in terms of sustainable

agriculture so that people can be sovereign and independent in terms of food sufficiency.

The land of Papua is divided into different geographical types, namely islands, lowlands to hills, highlands, and mountainous peaks. This geographical condition shapes the community with patterns and cultural diversity. Approximately 275 cultural tribes live in these areas, so that it has implications for land-use models of different types (Kartikasari *et al.,* 2012).

Farming techniques adopted by local farmers are still in the form of shifting cultivation and few develop permanent agriculture. This shifting cultivation system is still applied in most parts of Papua. The main purpose of farming is mainly to meet the basic needs of households that are adaptive. Land-clearing activities in Papua are developed by two main characteristics, namely to meet needs, and to expand access to land ownership. Therefore, the understanding of land in Papua is strongly influenced by Papuan culture and customs. Papuans are still developing a system of agricultural activities with subsistence characteristics still far from market orientation, where products that are not consumed are usually sold in very small quantities. In Ethiopia, its agroforestry techniques were significantly able to increase income, compared with monoculture farming developed by the community (Linger, 2014). Farming techniques with distant agro-forestry approaches have been carried out by Pupuans on the islands, the coast, the lowlands to the mountains.

On the other hand, certain groups of people in Papua who use the shifting cultivation system participate in development by opening new lands or cutting down forests designated as agricultural land. In general, this shifting field system will damage the natural forest ecosystem and increase the area of critical land, erosion, floods and landslides. This farming culture is very difficult to change because the nomad lifestyle has a fairly high level of mobility so that the process of land clearing continues. Generally, land that has been cleared is then fenced off to protect crops from being disturbed and damaged by wild boars. The contextual physical environment mainly represents the conditions of agro-climate, and edafic factors (source of parent material) are known together with the wet agro-climate zone to have more diverse species (Arifin *et al.,* 2008).

After land clearing is carried out, branches and other plant residues are cleaned and burned. The land is then processed in the traditional way by using torches to make holes in the soil for planting seeds. Maintenance of the cultivated plant is hardly carried out and the plant is allowed to grow without supervision. This farming system is still being carried, so changing Papua's farming culture requires considerable time, energy and patience. But what needs to be considered is improving superior varieties. The varieties have been passed down from generation to generation, so the quality of production is not up to contemporary expectations. Introducing agroforestry techniques will probably be far more better, where the community does not need to clear the land completely. Ahmad *et al.* (2017) stated that agroforestry techniques allow the natural environment to be maintained so that farmers can continue their agricultural production, while maintaining the natural environment at the same time. Furthermore, the other benefit of developing the technique is that the community can enjoy clean air from the natural environment without having to damage the environment and maintain soil fertility.

Labour that is used in farming activities generally comes from households. Workers from outside the household are very difficult to find. This is generally for farming land that is cultivated only on a small scale to meet household needs. In such conditions, each farming household will use workers from within the household optimally. Papuan women's activities in the fields and gardens include cleaning small trees and shrubs, cultivating land, and planting crops. Women dominate farming activities more than men. This happens because in Papuan *adat*, an adult woman generally receives a high-value dowry, and women who are married are expected to be responsible for

household affairs. Customs like this are very influential on the productivity of agricultural labour. Women working alone are not very effective in conducting farming activities and most are unable to provide adequate output to support the needs of their families. On the other hand, men, in general, spend their free time lazing or hunting (in the past), and this status quo has been very difficult to change.

The food needs of farmers can self-produced and sourced from outside their farming business. In addition to consuming locally produced tubers, which are a main staple, local farmers also consume rice. Rice is mostly obtained from the market. They are also obtained through *Raskin* (Rice for Low-Income Earners Programme), and government aid to every village office in Papua. Families rice is consumed when families have the means, but a variety of food is consumed.

In addition to food crops, farmers in Papua are plant commercial crops, such as coffee, cocoa, oil palm, and rubber, which are developed by local communities in a limited area. Freshwater meat and fish, meanwhile, is obtained from rivers and lakes by people residing on the coastal lands, and in swamp and river areas. The demand for meat, such as pork, beef and chicken, is increasing. Livestock can be left in grazing areas and freshwater are cultivated in lakes with sprouts stepping and or floating net cages. Arifin *et al.* (2008) said that free-range chicken, goat, and sheep and cattle raised for meat and milk are the most common livestock raised in yards, by 38%, 23% and 7% as well as 19% and 6%, respectively. Fish, goats, cows and ducks are also pets that are most often found in villages.

Skouw Mabo Village in Muara Tami district is approximately 8 km from the city of Jayapura. The village is located on the border of Indonesia and Papua New Guinea. Skouw Mabo is a coastal village, so that the majority of the villagers are fishermen. Some of them are also farmers. The sustainability of life in Skouw Mabo depends on the managing of natural resources. The rate of utilisation of natural resources needs to be measured by conducting an assessment of household farms in the village.

The level of community sustainability in relation to the utilisation of natural resources is assessed. In sustainable settlements, there are several aspects that need attention, namely spatial planning, transportation and infrastructure, availability of jobs, gaps, and trends that can damage the carrying capacity of the environment and the community (Dyah & Yuliastuti, 2014). To measure the level of sustainability, people's behavior in relation to their natural environment needs to be assessed. This study aims to obtain the value of community sustainability in Skouw Mabo based on community perceptions through an assessment of the ecological, social and spiritual aspects leading to sustainable management.

Materials and Method

This research was conducted in Skouw Mabo, Muara Tami district, Jayapura City, Papua Province, Indonesia for approximately two months (Figure 1).

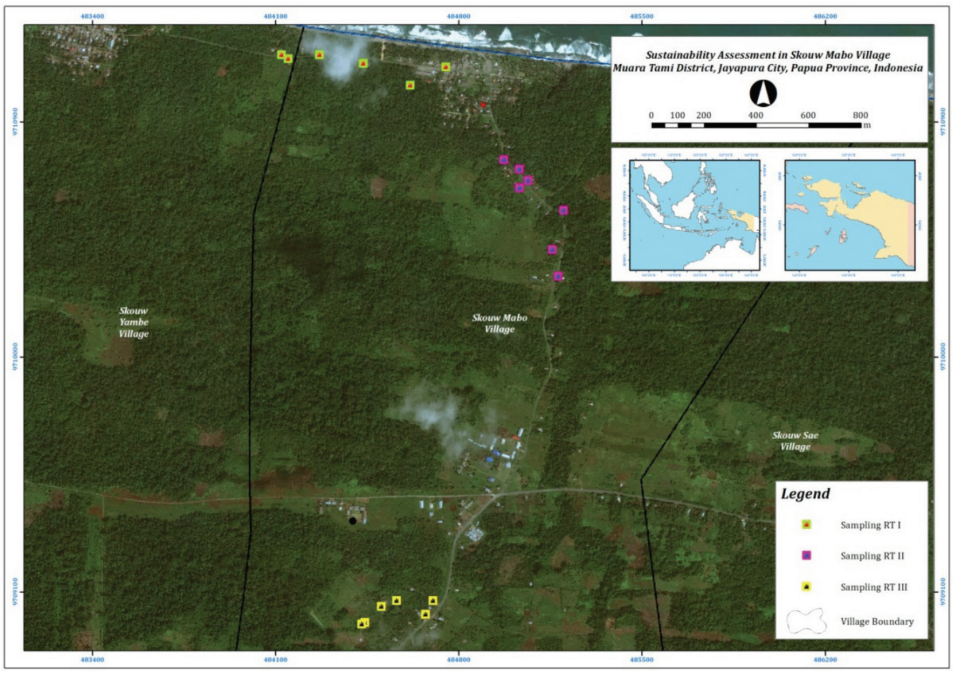

Figure 1: Location of data collection in Skouw Mabo village, Muara Tami district, Jayapura City, Papua Province, Indonesia

Data collection was carried out through surveys and interviews using the Community Sustainability Assessment (CSA) questionnaire. A total of 10 respondents were deliberately selected for the interviews, namely an indigenous community leader, a religious leader, a woman leader, two youth leaders, a village government official, two farmers and two fishermen. Respondents were invited into a room and were asked to answer the given questionnaire to obtain data and information. This technique is used so that each respondent can provide their own comments and explain so that a more detailed answer is obtained. In addition, the location and coverage of the field are observed through photo documentation. The measured community sustainability is related to the ecological, socio-cultural and spiritual aspects (Table 1).

The value of community sustainability obtained from the assessment is then summed to obtain a value. The summed parts are the value of the component aspects or variables, the value in one aspect, and the total value of three aspects to obtain the value of community sustainability in Skouw Mabo.

The assessment of community sustainability is obtained based on the sum of scores calculated through interviews and then summed based on parameters per aspect and total aspects. The data analysis method in this study involves the concept of ecovillage and the condition of community sustainability based on CSA criteria (Widyarti & Arifin, 2012). Evaluation is carried out by adding up the values of each variable according to the criteria of the CSA and can be classified into three groups. The first group are those with scores of 50 and above (showing very good progress), the second group are those with scores of 25-49 (showing a good start towards sustainability) and the third group 0-25 (indicating that action must be taken to be sustainable). After all the values are obtained, the sum of the values from each aspect is added up. On the assessment of the ecological, social and spiritual aspects, the first group assessment

Table 1: Community Sustainability Assessment variables

	Variables	Weight
	Ecological Aspects	
1.	The meaning of the place of residence	0-50+ (*)
2.	Food availability (production and distribution)	0-50+ (*)
3.	Infrastructure (buildings and transportation)	0-50+ (*)
4.	Pattern (consumption and management of solid waste)	0-50+ (*)
5.	Water (source, quality and usage patterns)	0-50+ (*)
6.	Management (liquid waste and water pollution)	0-50+ (*)
7.	Energy (source and use)	0-50+ (*)
	Total A	333+< (**)
	Socio-cultural aspects	Nilai
1.	Openness (Trust and security; shared space)	0-50+ (*)
2.	Communication (ideas and information flow)	0-50+ (*)
3.	Network (achievements and services)	0-50+ (*)
4.	Social sustainability	0-50+ (*)
5.	Education	0-50+ (*)
6.	Health services	0-50+ (*)
7.	Economic sustainability (health of the local economy)	0-50+ (*)
	Total B	333+< (**)
	Spiritual aspects	Nilai
1.	Cultural sustainability	0-50+ (*)
2.	Arts and recreation	0-50+ (*)
3.	Spiritual sustainability	0-50+ (*)
4.	Community related	0-50+ (*)
5.	Community resilience	0-50+ (*)
6.	New holographic (world or global view)	0-50+ (*)
7.	Global peace and thought	0-50+ (*)
	Total C	333+<C (**)
	Total A+B+C	999+ (***)

Source: Widyarti and Arifin, 2012

*= 50+< **=333+< ***=999+

*=score of 1 variable, **=score 1 aspect, ***=score of total 3 aspects.

are those with scores of 333 and above (showing very good progress towards sustainability), the second group 166-332 (showing a good start towards sustainability) and the third group 0-165 (indicating action must be taken to be sustainable).

The total value obtained from the sum of the values of each aspect parameter will reveal the level of sustainability of the community. According to GEN, with the CSA method, a society is said to continue in accordance with the reference values for the ecological, social and spiritual aspects. Sustainability assessment based on the parameters of the ecological, social and spiritual aspects is further aggregated. The first aggregate value is 999 and above (shows

Table 2: Parameters for evaluating community sustainability

Rating Level	Score	The condition of community sustainability
Variable/ (*)	50^{+}	Demonstrated very good progress towards sustainability
	25-49	Shows a good start Continuity
	0-25	Indicates action must be taken to be sustainable
Aspects (A,B,C)/ (**)	333^{+}	Demonstrated very good progress towards sustainability
	166-332	Shows a good start Continuity
	0-165	Indicates action must be taken to be sustainable
Total of each Aspects (T)/ (***)	999^{+}	Demonstrated very good progress towards sustainability
	500-998	Shows a good start Continuity
	0-449	Indicates action must be taken to be sustainable

Source: Widyarti and Arifin, 2012

*=score of 1 variable, **=score of 1 aspect, ***=score of total 3 aspects

very good progress towards sustainability), the second 500 - 998 (indicates a good start towards sustainability) and the third 0-449 (indicates that action must be taken to be sustainable).

Results and Discussion

The results of the assessment of community sustainability in Skouw Mabo, Muara Tami district, Jayapura City, were measured by the level of sustainability with respect to the ecological, social and spiritual parameters (Table 1).

The assessment of community sustainability involves how the current conditions are related to the neighborhood. Interaction with the natural environment is measured through three aspects, namely ecological, social and spiritual aspects, which will be discussed next.

Ecological Aspect

The ecological aspect is one of the aspects in the CSA. To measure this aspect, seven factors are examined to assess the community's relationship with their natural environment (Figure 2).

The results of the CSA for the ecological aspect of the seven factors that influence and contribute to the value of sustainability do not show results of more than 50 for all factors. For the assessment of water, in terms of the source of its quality and patterns of utilisation, the factor had a score of 24, meaning that action must be taken. Clean water management relied on dug wells, and clean water needed for drinking, cooking and cleaning in Skouw Mabo is obtained from the well.

Water management towards sustainability is determined by its quality and quantity. The quality needs to meet the health standards according to the World Health Organisation and Indonesia's Ministry of Healtha. Quality standards include physical quality (odour, taste and colour), as well as chemical quality, such as the Chemichal Oxygen Demand (COD) test and the minerals that a water source contains. This is in line with Virgawast*i et al.* (2014). One aspect of sustainability that greatly affects the village is clean water treatment. The aspect of openness in building clean water facilities is important as water is a basic need for everyone, including household farms in Skouw Mabo (Peth *et al.,* 2018).

Table 3: Results of community sustainability assessmentin Skouw Mabo village

	Variables	Weight
	Ecological Aspects	50<
1.	The meaning of the place of residence	46
2.	Food availability (production and distribution)	43
3.	Infrastructure (buildings and transportation)	28
4.	Pattern (consumption and management of solid waste)	26
5.	Water (source, quality and usage patterns)	24
6.	Management (liquid waste and water pollution)	41
7.	Energy (source and use)	40
	Total A	248
	Socio-cultural aspects	50<
1.	Openness (Trust and security; shared space)	43
2.	Communication (ideas and information flow)	28
3.	Network (achievements and services)	49
4.	Social sustainability	**52**
5.	Education	**59**
6.	Health services	46
7.	Economic sustainability (health of the local economy)	44
	Total B	**341**
	Spiritual aspects	50<
1.	Cultural sustainability	**72**
2.	Arts and recreation	28
3.	Spiritual sustainability	39
4.	Community related	37
5.	Community resilience	**54**
6.	New holographic (world or global view)	**54**
7.	Global peace and thought	**66**
	Total C	**350**
	Total A+B+C	919

Information:

*Bold= can continue

To improve the clean water management system, it is necessary to build a pipeline system and the quality of water sources that have been used by the people in Skouw Mabo needs to be measured in a laboratory. Irrigation development is a good start for the development of an agro-ecosystem programme in North Sumatra, which would help the community increase their yields (Zahri *et al.,* 2018). Clean water can guarantee human health, and it is also important to meet basic human needs. But the water management system in the village is largely determined by the economic conditions of the local village community. This is in line with Pasci *et al.* (2017), who stated that water management is largely determined by the economic conditions of local residents.

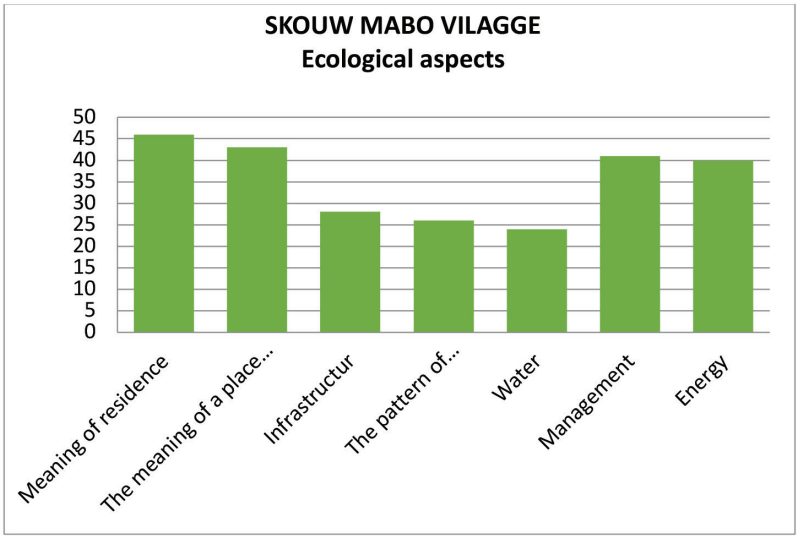

Figure 2: The ecological aspect of the community sustainability assessment

Other factors that have low scores are the pattern of consumption and treatment of solid waste (26) and infrastructure (28). For solid waste treatment, the community still uses conventional methods, namely burning dry waste and used food waste. Garbage produced by the community is also thrown into the sea. According to Alikodra (2012), the quality of water can deteriorate due to the increasing amount of wastes generated by households, industries, and agricultural and fishery activities, livestock or mining. He also added that the support system for environmental sanitation is inadequate and awareness is needed for a good waste treatment and management system. The score underlines that the local community still do not have an understanding on how to manage wastes. For transportation, there is no public transportation that serves from the villages from their village to the city and vice versa. Transportation becomes an obstacle and has an impact on the cost of selling agricultural produce or conducting agricultural marketing activities of Skouw Mabo in the city.

On the other hand, the agriculture products of the village are able to meet the needs of the people in Skouw Mabo. This is supported by the score of food availability factor (43), which means that the community can sufficiently meet its food needs through food sources in the village. Food, such as bananas, vegetables, fruits and herbs, is readily available at the village. Cameron *et al.* (2012), in their literature review, stated that mixed gardens have benefits of meeting daily needs, but can also reduce excessive energy consumption through the reduced use of motor vehicles, provide food for wildlife, reduce household gas emissions, reduce the use of chemical fertilisersand excessive use of water. It can also be developed to have a high economic value. The community has also opened a garden not far from where they reside to provide food and other necessities. To increase the income of the community in Skouw Mabo, they sell garden products. The crops that they sell include tubers, vegetables, and fruits, and they are grown on a small scale. Areca nuts (*Areca catechu L.*) planted at household gardens are also sold to the market at varying prices. However, in some places in Papua, areca nut (*Areca Cathecu.L*) are only consumed by the community as it is tied to the culture of the local community. The prices of areca nut range from IDR50,000 to IDR500,000 for one bunch. The aeca nut are usually consumed together with grounded sea lime shellfish finely and betel nuts (*Piper bettle L.*). During the rainy season, the nut is harvested abundantly, so the price goes

for only IDR50,000, whereas in the summer, the scarcity of the nuts drives the price up to IDR500,000. The community planted areca nuts in almost each of their yards. In addition, community income comes from tuber farming. However, the sales are not too large as the crops are mostly planted to meet household food needs. The tubers are sold in small quantities due to abundant production, with a selling price of IDR50,000 per stack, which approximately weighs two to three kg, in the Jayapura City area. However, rice cost IDR10,000 per kilogramme and this lead to people preferring rice over cassava or taro at the market. Previous research have shown that farming behaviuor is very real with the level of participation in environmental management. Furthermore, high community participation in planting trees contributes to protecting the environment (Ernatje *et al.,* 2015). Local food sources owned by the community include sago, banana, cassava, taro and corn (a source of carbohydrates). According to Antoh *et al.* (2018), to fulfill the community's need for food, most of it is produced in its territory or at a capacity of 60%, And food supplies can be produced from their gardens (agricultural land). Research have shown that gardens operated by the people in Papua are not only for their own consumption, but also to feed pigs (Antoh & Raunsay, 2019).

The opening of gardens by the community is also supported by the high participation of the community. A favourable climate, such as rainfall, greatly impacts the production of adequate food so that plants around the yard can be grow properly. Another research stated that although Indonesia's climate change adaptation policies have a positive value, there are some basic weaknesses that are very influential that originated from policy planning and implementation (Utomo, 2017).

The needs for protein sources are met through saltwater fish, pigs and chickens, which are reared in the yards of the residents of Skouw Mabo. Other research has been carried out with the agropastoralist approach, namely agriculture and animal husbandry combined, where plants grown can be used as livestock feed, and livestock manure can be used to increase community agricultural production (Rasmussen, 2018). The concept of land use and reforesting is a form of building green infrastructure (Cameron *et al.,* 2012). The government can cooperate with the community through village fund management, but for agricultural commodities, it can be under the Jayapura city Agriculture and Food Service Department. Anik *et al.* (2014) stated that Bangladesh, through government policy intervention under the agricultural department, supported farmers with superior varieties in terms of agricultural development. A survey by Guuroh (2014) showed that 43% of farm households developed agriculture, livestock and planted trees around their homes . Other studies also conclude that if agroforestry techniques are developed, four key factors are involved, namely the existence of farmer groups, the role of government, the availability of technology packages and the role of agricultural extension workers (Ruhimat, 2015). For the factor of the meaning of the place to residence (46), the meaning is quite good because it is supported by a harmonious pattern of relations with the residence and the population density is minimal. There is a high number of families with four to seven children. Another thing that makes their value not optimal in the scope of the family is that their understanding of the need to protect the flora and fauna is as minimal and very lacking. For this reason, there needs to be an increase in public understanding of conservation and protection of wildlife habitats. According to Alipiah *et al.* (2020) more conservation scenarios in the wetlands are chosen compared with other activities and intensive aquaculture activities are the least desirable.

For energy needs, both sources and uses (40) are considered quite good. The electricity supply in the village is available 24 hours. The score not reaching >50 is influenced by their energy-saving culture. People still leave the lights on during the daytime, exhibiting an attitude of energy waste. In addition, diesel engines that are not friendly to the environment are utilised. The use of alternative energy,

such as wind power through windmills, can be implemented at Skouw Mabo. This is supported by windy near the coastal area, and the wind are consistent and can be used for the construction of a power plant.

The ecological aspect scored a total of 208, indicating a good start towards sustainability (333 >). Therefore, in this aspect, it is necessary to improve the overall factors to improve the ecological aspect, with a focus on management of good water sources and the development of a good pipeline network. In addition, it is necessary to increase public awareness in managing solid waste (solid waste) in their neighborhood. According to Sariffudin and Retno (2011), housing development needs to pay attention to the solid waste treatment system. Proper and correct management of solid waste is one of the factors that can improve the assessment score of the ecological aspect.

Social Aspect

For the social aspect, a sustainability assessment of its seven factors is carried out. These factors are evaluated to observe the current conditions of these social parameters (Figure 3).

The scores for the seven factors of the social aspects are described as follow. For the factor of communication, which involve ideas and information flow, the score (28) showed that village has a good start towards sustainability. The information flow is bottlenecked by the village leader and is less distributed to community members. This is very much determined by the ability of the village head to communicate the problems of the village to the villagers. The lack of meetings between residents in the village is one thing that prevents the village from progressing and developing. Kartodihardjo (2017) said to avoid separation and uncoordinated activities, village development needs to be linked to a broader vision. Many village development initiatives currently tend to be separate from the vision of land use on a broader scale, so there are limitations to achieving medium- and long-term goals, including those that are linked to wider resource potential.

The discussions on the roles of women and children are also lacking. Village issues need to be managed by involving the participation of all parties in the village. Community participation from various villages can provide input and solve the problems in Skouw Mabo. For example, with the development of agrotourism in community-based villages, the community in the village will enjoy many benefits, and urban communities can enjoy the village as one of the attractions as well. According to Budiarti *et al.,* (2013), when the concept of agro-tourism was introduced to

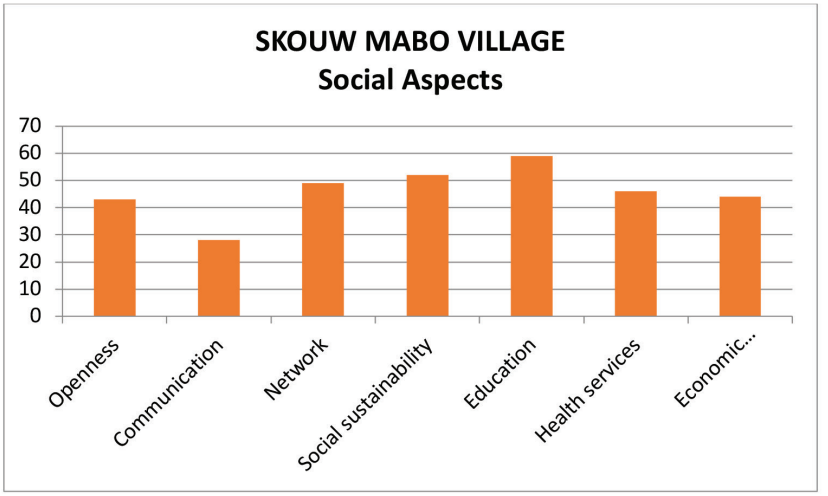

Figure 3: The social aspect of the community sustainability assessment

the people of Cikahuripan and their opinions on community-based tourism were asked, most expressed their agreement with the concept. This is a positive value that the community wants to add to its agricultural system through the development of agro-tourism. A study also concluded that communities in rural areas in Romania accepted the budget they can use for agricultural development, such as agro-tourism (Galluzzo, 2017). Providing understanding to the community on the concept of agro-tourism can be an option for the people of Skouw Mabo, so that they can exploit their natural resources to increase household income and developing environmental services can increase their income.

The factors that gave weight to overall the community's overall social aspect is social sustainability (52) and education (59). Social sustainability is supported by the high value of tolerance and diversity. In Skouw Mabo, there are three neighborhood units (RT). RT 1 and RT 2 are occupied by indigenous Protestant Christians, whereas RT 3 is occupied by migrant tribes, such as Butonese, Bugis, Makassarese and Javanese. These tribes are mostly made up of Muslims, and have built a relationship of high tolerance with each other. Another thing that supports the decision-making process is that it is quite transparent and open and there is no conflict in Skouw Mabo. Wildayana and Armanto (2018) stated that new thoughts have emerged as a result of interactions between local residents and transmigrants in improving land use.

The factor of education also has a high score. The availability of education, from early childhood education, elementary school, junior high school, high school and vocational school, is an important factor that affects community sustainability in Skouw Mabo. Education services in the form of schools and teachers have an impact on the the assessment, showing perfect progress towards sustainability. The availability of teachers and school infrastructure is not a guarantee for community members in the village, but student participation in formal education is quite important to measure community understanding. Education, at a minimum, have a strong influence on how the community uses its natural resources. Economic problems are caused by poor community knowledge in managing their natural resources. Training, guidance and assistance in Papua is important for indigenous people. Its implementation can be realised by developing cooperation between the government, customs and religious bodies Kamruzzaman and Shaw (2018) stated that the government needed to take a large role in involving leaders or parties in building collaboration outside the official structure, such as roping in non-governmental organisations, in initiating cooperation towards sustainable agriculture. The involvement of religious leaders in Papua is very important in bridging the coordination to improve relations between institutions more harmoniously. Customary forests are now a hope and a form of guarantee for indigenous communities in the future. For this reason, indigenous communities need to be maintained and supported by the government and religious leaders through collaboration to improve development in Skouw Mabo. Puwanto *et al.* (2017) found that through the rehabilitation of forests and land in Meru Betiri National Park and planting of economic crops, the community can enjoy 14.49% in annual profits after 15 years. Another study conducted by Pinto *et al.* (2018) in the Brazilian Amazon on the payment of environmental services, the community are entitled to additional income to improve their welfare when they succeed in protecting their environment and not damaging the forest ecosystem. This can be considered for community development in Skouw Mabo from an economic standpoint to preserve its natural environment.

Besides formal education, informal education is also available, such as organising trainings and forming farmer groups. A study in Bulgaria found that the informal reception of knowledge through consulting services can be carried out by agricultural experts in the village (Dirimanova, 2018). In Indonesia, the government provides field agriculture instructors

and one agricultural extension worker for villages. They can provide understanding to community farmer groups in villages when there are problems with the management of farming activities. There are several groups that develop the cultivation of vanilla plants in Skouw Mabo village. The development of vanilla using agroforestry techniques was carried out by farmer groups in Skouw Mabo. Linger (2014) stated that the development of agroforestry in the yards yielded significant results and was able to increase the household income of farmers. Significantly, the size of the yards developed with economically valuable crops improved the farmers' household economy, but it also had an ecological impact on the farmers themselves. The group received guidance on how to cultivate these plants and develop them to improve the family income. Research have suggested that there needs to be certain policy interventions to strengthen farmers by increasing their capacity to be important (Hendrarini, 2018). The evaluation of resource use by calculating direct and indirect impacts on the use of natural resources can be done through economic valuation of biodiversity in terms of carbon sequestration (Jones *et al.,* 2018). Farmers in Skouw Mabo, in developing agricultural products, can contribute to environmental services, as well as carbon sequestration. Besides, they actually benefit directly from managing their agricultural products by developing superior commodities in Skouw Mabo.

Community participation in a variety of high training activities shows that community interaction is quite good because it is supported by good educational factors so that it can accept outsiders to advance their region. Human resources are an important factor in developing an area. According to Dhelia *et al.,* (2018) human resources in the Indramayu district are the main supporting factors for the increase of the milkfish industry and are supported by a large population in the pond area. Furthermore, it was informed in the study that human resources for the fisheries sub-sector were generally led by pond owners who all had received basic education, and about 76.02% of the population had completed secondary education, 60.81% upper education, and 12.43% tertiary level. The educational infrastructure in Skouw Mabo is adequate, starting from the levels of early childhood education, elementary, junior high to high school and vocational levels.

The social aspect had a total score of 277, meaning that it shows a good start towards sustainability (333+) and the Need to improve aspects towards sustainability by improving communication patterns and idea flows. Communication and idea flows certainly contribute to the assessment of the overall social aspect. In addition, openness, the network of health services and economic sustainability Skouw Mabo need improving. Community participation in Skouw Mabo mostly involves people from the age group of 40-50 years. Kujawska *et al.* (2018), in their study in Poland, stated that participation in the management of agricultural activities of around 35% is dominated by people in the age group of 40-50 years, with an impact on advanced agricultural output. Economic calculations also count labor in a production at the basic price for farming activities. This is rarely done in investments For agriculture (Humabtova *et al.,* 2018). Cooperation by promoting cultural values of mutual assistance in Skouw Mabo is still visible, where this is seen as an important social capital. For this reason, labour costs, in this case, are not calculated by them. This becomes a model in ensuring sustainable resource management.

Spiritual Aspect

The evaluation of spiritual aspects is an important parameter to measure the current conditions. The results obtained are important to know the value for community development strategies based on their potentials (Figure 4).

The evaluation of community sustainability in terms of spiritual parameters also involved seven factors. The art and recreation factor score (28) show that the village had a good start towards sustainability. Documentation and artistic creativity has almost faded in Skouw Mabo. Cultural and dance performances

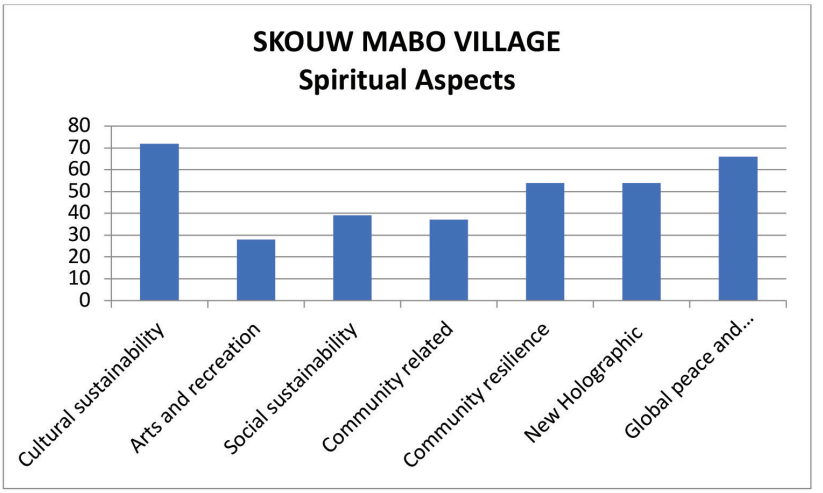

Figure 4: The spiritual aspect of the community sustainability assessment

are usually conducted seasonally during the cultural festivals in Jayapura City. The Humbolt Bay Festival organised by the Jayapura city government usually involves the Skouw Mabo village community. Their arts and cultural activities can serve as a tourist attraction and improve their lifestyles (Aziz, 2020).

Other factors that also need to be improved from the spiritual aspect are spiritual sustainability (39) and community relations (37). Spiritual sustainability is how the community is actively involved in religious activities, and this shows that contact with religious leaders in the context of fostering faith is considered lacking. Besides that, the engagement factor between the community needs to be built. For example, community involvement in religious activities between the government and customary parties in the community has not been seen and is still lacking. Partnership programmes to increase community participation through religious activities should always be improved. Protik *et al.* (2018), in their research in Rwanda, government openness to the community is an important factor of the success of a development programme.

The factors of cultural sustainability (72), community resilience (54), outside world views (54) and global peace and thinking (66) in Skouw Mabo village need to be strengthened. Therefore, these factors can be a reinforcement building building community development programmes, especially for agricultural products, but also the development of agrotourism. Plants, like fruits that contain lots of vitamins C and E, are good for increasing endurance. Perevozchikov *et al.* (2017) said vitamins C and E are important vitamins in maintaining endurance. Strengthening factors can be used to overcome things that are lacking in the spiritual aspect., But overall, it can improve the ecological aspects and social aspects that are interrelated.

Conclusion

Social and spiritual aspects are key in developing appropriate target programmes by protecting forests in a sustainable manner. They combat desertification, halt and reverse land degradation, prevent the loss of biodiversity and improve community welfare. Ecological aspects should be considered, namely by improving the quality of the environment through the development of agricultural products and agro-tourism in the village of Skouw Mabo, Muara Tami district, Jayapura City, Papua Province, Indonesia.

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