Strategy for Sustainable Livelihood of Communities Around Forest Area on Ternate and Hiri Island, North Maluku

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***Abstract*—Ternate and Hiri Island are located in North Maluku Province and their forest area is within the management of the Ternate-Tidore Protected Forest Management Unit (PFMU). Both are small islands that need to be managed properly because they have ecological and socio-economic potential that needs to be developed. Small island management can also be linked to the Sustainable Development Goals (SDGs) agenda which is a global commitment to improving people's welfare. This research was conducted to examine the livelihood assets that can be accessed by the community and analyze sustainable livelihood strategies for improving people's livelihoods. Data collection was carried out in two sub-districts on Ternate Island (Tubo and Maliaro sub-districts) and Hiri Island (Togolobe and Dorari Isa sub-districts) using quantitative and qualitative methods through structured interviews, in-depth interviews, and observation. The assessment of household livelihood assets uses indicators of natural, social, physical, financial, and human capital which are analyzed and described in the asset pentagon. The sustainable livelihood strategy uses intensification and extensification, diversification, and migration strategy indicators. The results showed that Ternate Island has greater assets (13.79) compared to Hiri Island (11.76). Communities on the two islands have good access to sources of capital needed for their livelihood, with the largest being financial capital and the smallest being natural capital. The strategies for sustainable livelihoods in the two islands are similar: intensification and extensification strategies through land-use utilization, diversification strategies through the marketing of agricultural products, and migration strategies by permanently migrating to other areas within and outside the province of North Maluku.**

***Keywords*—Livelihood assets, livelihood strategy, Ternate Island, Hiri Island**

I. INTRODUCTION

The Agenda for Sustainable Development Goals (SDGs) has been introduced since 2015 and is still being implemented in many countries around the world. SDGs are development that maintains sustainable community economic welfare, maintains environmental quality and development that guarantees justice, and governance that can maintain an increase in the quality of life from one generation to the next. The implementation of SDGs in Indonesia is related to the implementation of the National Development Agenda. In addition, this also shows Indonesia's support for achieving the SDGs Agenda in 2030 at the global level (Filho *et al.*, 2018).

Indonesia has 17,504 islands and about 80% of the total islands are categorized as small islands (area less than 2000 km2, referring to RI Law No. 27 of 2007). These islands have great potential if managed properly because the land contains biodiversity that supports the needs of living things that live on the island. The Ternate-Tidore Protected Forest Management Unit (PFMU) area is located in the North Maluku Province of Indonesia. The forest area is spread over an archipelago consisting of 14 (fourteen) small island clusters spread from North to South with a total area of 29,004.86 Ha. Ternate Island and Hiri Island are two islands whose forest areas are included in the management of the Ternate-Tidore PFMU. The Forest Area within the Ternate-Tidore PFMU area has its own uniqueness and high potential, both in the ecological scope in the form of biodiversity and socio-economically to support the sustainability of the communities living around the area. Biodiversity and ecosystems are also included in the SDGs agenda, for example, SDG 14 which highlights the importance of protecting oceans, seas, and marine resources to achieve sustainable development (Martin *et al.*, 2020).

The great potential of small islands can also be a source of problems if not managed properly. Problems related to policies, disparities in socio-economic development, and environmental degradation often arise in the management of small islands resulting in the emergence of illegal or legal exploitation activities that can threaten the ecology of small islands (Irauschek *et al.*, 2021). Forest management in the small islands of the Ternate-Tidore PFMU is to optimally utilize the potential of forest resources and human resources around the forest without reducing its sustainability.

A sustainable livelihood strategy is carried out by combining various resource assets. Every household as the smallest social unit in society is required to be able to face and adapt to various challenges, while at the same time maintaining its livelihood capabilities and assets by carrying out various livelihood strategies that can guarantee its livelihood and that of the next generation. Gaillard *et al.* (2009) classify various livelihood assets into five forms of capital: social capital, natural capital, physical capital, and human capital. The livelihood strategy describes the efforts made by the community in achieving a better life, relating to how the community manages or combines available or owned livelihood assets, responds to changes that occur, and determines priorities to maintain or improve livelihoods (Scoones, 2009).

A study of household livelihood assets and sustainable livelihood strategies can help assess the availability of assets and the vulnerabilities faced by the community (Wijayanti *et al.*, 2016). Communities living on small islands have more limited resources

and are more vulnerable, such as those on the Ternate and Hiri Islands. Therefore, a study of sustainable livelihood strategies on the two islands was carried out to assess household livelihood assets that can be accessed by the community and assess asset-based sustainable livelihood strategies in improving community livelihoods.

II. Material and Methods

The research was conducted in January - June 2022 on two islands in the Ternate-Tidore PFMU area: Ternate Island and Hiri Island. Two sub-districts were sampled on each island: Tubo and Maliaro sub-districts on Ternate Island and Dorari Isa and Togolobe sub-districts on Hiri Island. The population in this study were community households living around areas that interact with the Ternate-Tidore PFMU area and were selected based on social forestry groups. The variables and data measured in this study are presented in Table 1.

Table 1. Research objectives, indicators, and variables

Objectives	Indicators	Variables
Household Livelihood Assets	Natural	Land ownership; land use; ownership of bathing, washing, and toilet facilities; production capacity of farmers, utilization of water resources
	Social	Organization, social justice, harmony, social conditions, kinship
	Financial	Income, savings, number of family dependents, business capital, loans
	Physical	House, transportation, workplace, village environment
	Human	Education, family work, family health, skills, employment
Livelihood Strategy	Intensification and extensification	Utilization of land use, agriculture/plantation, use of vacant land, the addition of arable land
	Diversification	Other agricultural activities (livestock, etc.), trade sector, service sector, marketing of agricultural/plantation products
	Migration	Permanent migration and mobility

Primary data was obtained from structured interviews, observation, and in-depth interviews. The respondents of this study were 57 respondents who were selected based on random sampling techniques (29 respondents on Ternate Island and 34 respondents on Hiri Island). Selection of a minimum sample size of 10% of the population for research (Hill, 1998). Secondary data were obtained from literature studies and documents published by the government. The data obtained were then analyzed qualitatively and quantitatively. Each variable is assessed with a score of 0 to 4. The data is then analyzed using the pentagon asset technique.

III. Results and Discussion

Household Livelihood Assets

The condition of household assets belonging to the community around the Ternate-Tidore PFMU area varies greatly. This was influenced by the value of each capital owned by the society, namely human capital, natural capital, social capital, physical capital, and financial capital. The relationship between each capital is described in the asset pentagon. The pentagon shape with lines connecting each capital to a central point illustrates the variation in the level of community ownership and access to resources (Solesbury, 2003).

The value of household livelihood assets in the study locations was 13.79 on Ternate Island and 11.76 on Hiri Island (Table 2). In general, the values for each capital are higher on Ternate Island. Financial capital has the highest value on Ternate Island (3.13) and Hiri Island (2.75).

Table 2. Value of household livelihood assets on Ternate Island and Hiri Island

Assets	Ternate Island	Hiri Island
Natural	2.45	1.90
Social	2.73	2.32
Financial	3.13	2.75
Physical	2.69	2.67
Human	2.78	2.12
Total	**13.79**	**11.76**

The value of livelihood assets is illustrated by an asset pentagon which can provide a clearer picture regarding the level of community accessibility to livelihood assets. The level of accessibility is different for each household and community, as well as the value of the benefits of its assets for life. Many factors affect the level of accessibility. On the asset pentagon, the position of the midpoint or deepest point of the pentagon indicates that the level of individual or household access to resources or capital = 0, or has no access at all. The outermost part of the pentagon is an ideal condition, in which individuals or households have optimal access to the capital resources they need. This pentagon analogy can describe various conditions of changing levels of accessibility to livelihood resources/capital.

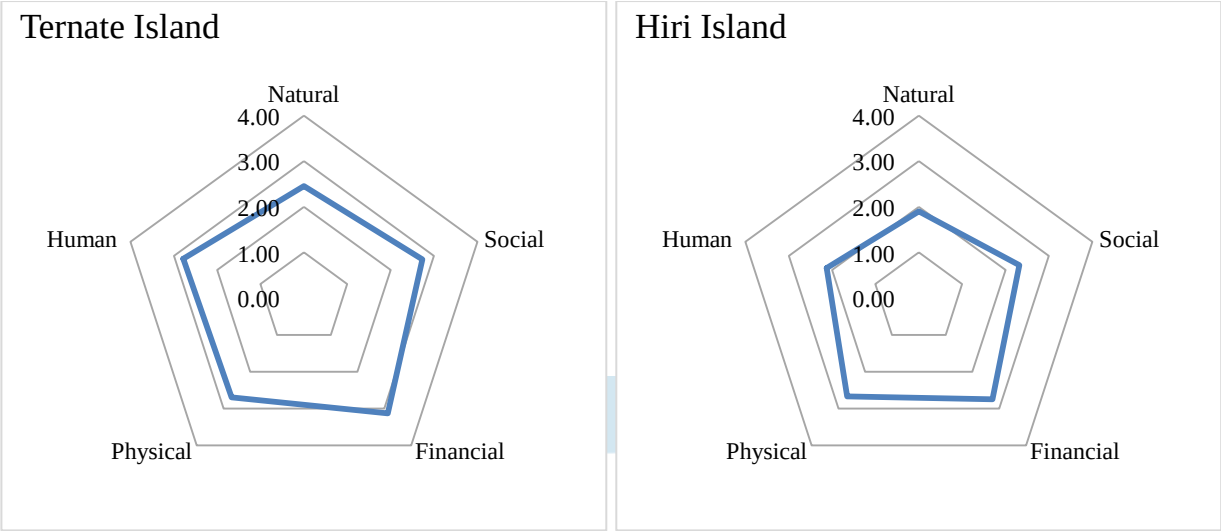

Figure 1. Pentagon community assets in the Ternate-Tidore PFMU area on Ternate Island (left) and Hiri Island (right)

The pentagon of community assets on Ternate Island and Hiri Island (Figure 1) shows that the communities on the two islands have good household livelihood assets because the point on each capital is away from the midpoint of the pentagon. The Pentagon's community assets on Ternate Island tend to be stable in all angles, except for the financial capital angle which protrudes slightly. Thus, this means that financial capital is the strongest capital owned by the community on Ternate Island.

The pentagon of community assets on Hiri Island is smaller than on Ternate Island (Figure 1). Human and natural capital is the smallest when compared to the other three capitals. The strongest capital is financial capital. In general, the communities on the two islands have quite optimal access to the sources of capital they need for their livelihood. A more detailed explanation regarding indicators of community livelihood assets on Ternate Island and Hiri Island is as follows:

a. Natural Capital

Natural capital relates to land tenure, the use of water resources, and other environmental services. Households on Ternate Island have a higher average total value of natural assets (2.45) than households on Hiri Island (1.90) (Table 3). The variable with the highest value in both locations is toilet facilities ownership. This variable is included as part of natural capital because it is closely related to the availability of clean water which is a very important natural resource for households on small islands. Most of the households in both locations already have access to proper toilet facilities.

Small islands are very vulnerable to drought because their catchment area is limited. In addition, small islands also experience threats of seawater intrusion and pollution which can affect the availability and quality of water sources (Marganingrum & Sudrajat, 2018). The Ternate-Tidore PFMU manages a forest area of 8499 Ha, including forest areas on Ternate Island and Hiri Island. The existence of forests in these two areas can provide a source of water for the community for agricultural and household needs. Therefore, the water resource utilization variable also has a high value on Ternate Island (3.59) and Hiri Island (2.25).

Table 3. The value of natural capital variables on Ternate Island and Hiri Island

Variable	Ternate Island	Hiri Island
Land Ownership	2.21	2.06
Land use	1.41	1.43
Ownership of bathing, washing, and toilet facilities	3.59	2.45
Farmer's production capacity	1.47	1.31
Utilization of water sources	3.59	2.25
Average Value	**2.45**	**1.90**

Ternate Island has a larger area (17.39 km^2) than Hiri Island (6.69 km^2 area) (BPS, 2019), so the availability of land for agriculture is also higher. The production capacity of the farmers also tends to be better. Unfortunately, the limited area on a small island can have a negative impact on farmers in the future because the conversion of agricultural land into settlements is increasing from year to year.

Common agricultural commodities developed by communities on Ternate Island and Hiri Island are nutmeg and cloves. The nutmeg business has been run for generations by the community. The location of nutmeg plantation on Ternate Island is currently concentrated in areas bordering protected forest areas on the slopes of Mount Gamalama. Meanwhile, the gardens on Hiri Island are still widespread throughout the island.

b. Social Capital

Social capital is related to the quantity and quality of social interaction that is formed based on the organization, relationships, and norms found in society (Worldbank, 2011). The variables in social capital on Ternate and Hiri Islands are the organization, social conditions, harmony, social position, and kinship. Good social capital can encourage the increased performance of an organization and better income (Syamni, 2010; Saheb *et al.*, 2013). The value of social capital and its variables can be seen in Table 4.

Table 4. The value of social capital variables on Ternate Island and Hiri Island

Variable	Ternate Island	Hiri Island
Organization	3.10	2.31
Social circumstances	2.88	2.74
Harmony	3.59	2.45
Social status	1.47	1.31
Kinship	2.87	1.80
Average Value	**2.78**	**2.12**

The average value of social capital on Ternate Island is 2.78 and on Hiri Island is 2.12. The variable with the highest score in both locations is the harmony variable, this indicates that good relations are established between communities regardless of social differences, be it ethnicity, religion, or race. The indigenous people who live on the two islands come from the Ternate tribe who are open to other community groups (Suh & Awal, 2019). Community groups on Ternate Island are even very heterogeneous, the residents are not only from the Ternate tribe or other tribes in the North Maluku Islands, but also people from outside North Maluku such as the Bugis, Javanese, Padang, etc. Nonetheless, this heterogeneity is seen as the diversity that can still unite all communities on Ternate Island. This is also possible because the kinship relationship between the two islands is still high, with an average score on Ternate Island of 2.87. Social capital in many rural areas is indeed supported by high kinship relations between neighbors, relatives, and friends who can be relied upon during a crisis in a farming household (Wijayanti, *et al.*, 2016). Harmony and good kinship relations have an impact on the realization of a good social condition, this is reflected in the high value of the social condition variable on Ternate Island (3.60) and Hiri Island (3.43).

The organizational variable value is 3.10 on Ternate Island and 2.31 on Hiri Island. This value is quite high because the respondents in both locations are part of a group of farmers who are members of a social forestry group. This group is an institution that becomes a forum for farmers to organize. Even though the organizational variable is high, in general, the social position variable on both islands is quite low. This is because more respondents act as members of village institutions than those who occupy strategic positions and high social positions.

The farmer groups are in the Village Forest Management Institution which runs the social forestry program. This program is an effort to optimize sustainable forest management by involving the community to realize community self-sufficiency through the utilization of forest resource potential. The groups that are formed receive continuous assistance so they can organize themselves to achieve the goal of increasing welfare and awareness in preserving environmental functions (Kamaluddin & Tamrin, 2019). Through this program, empowerment is also carried out by increasing the capacity of farmers and empowering the local economy (Dewi, 2018). Thus, community involvement in the organization is a good social capital for the livelihoods of the people in the research location.

c. Financial Capital

Financial capital is financial resources used by the community to achieve their livelihood goals. In this study, financial capital is composed of the variables of income, savings, family dependents, business capital, and loans. Based on the results of the analysis, the average value of community financial capital on Ternate Island (2.85) is higher than on Hiri Island (2.42). Details of the value of financial capital and its constituent variables are presented in Table 5.

Table 5. Value of financial capital variables on Ternate Island and Hiri Island

Variable	Ternate Island	Hiri Island
Income	2.18	2.18
Savings	2.94	2.43
number of family dependents	3.81	2.18
Venture capital	1.31	1.31
Loan	4.00	4.00
Average Value	**2.85**	**2.42**

The loan variable has the highest value among other financial capital constituent variables, both on Ternate Island and on Hiri Island. The value of this variable on the two islands is 4.00, indicating that all respondents rely on loans as their financial capital. These loans come from close relatives or financial institutions that provide loan services.

The Respondent's income has a similar value on the two islands, namely 2.18. In general, the main source of finance for respondents is income from nutmeg and clove plantations. The business can support the daily life of the respondent's household. Family dependents are related to the number of family members. The more family members, the greater the household expenditure, this can be one of the causes of a household being poor, especially if the majority of family members are of non-productive age (Dewi *et al.*, 2018). However, this can also be an advantage for the family because the more family members who help carry out the work, the more income earned will also increase. Thus, family dependents are an important financial asset in people's livelihoods.

Respondents also have financial capital savings, the variable value for Ternate Island is 2.94 and for Hiri Island is 2.43. Savings are owned by respondents in the form of money savings in the bank. These savings are very important for farmers on both islands because farming has risks and uncertainties so savings can provide security guarantees for farmers in developing their businesses and living their daily lives.

Business capital has the smallest variable value on Ternate Island and Hiri Island, namely the value of both of them is 1.31. This happens because not all respondents have good access to obtain business capital. Agricultural business development requires venture capital so that its implementation takes place optimally. So far, respondents have relied more on funds from loans and savings as business capital.

d. Physical Capital

Facilities, infrastructure and other facilities built to support the community's livelihood process are physical capital (Wijayanti *et al.*, 2016). The availability of physical facilities and infrastructure in the village can support the acceleration of community development and the economy (Jamaluddin, 2015). Physical capital is composed of housing, transportation, workplace, and village environment variables. The value of physical capital and each variable is presented in Table 6.In general, the physical capital on Ternate Island is greater than on Hiri Island (Table 6). The variable that most influence these differences lies in the transportation variable, this is because public transportation is more available on Ternate Island, as well as the types of transport modes. Public land transportation facilities on Ternate Island are city transportation cars (Indonesian: angkutan kota - angkot), motorcycle taxis, and online-based transportation (motorcycle taxis and online taxis), while on Hiri Island there are only motorcycle taxis. In addition, respondents on Ternate Island have higher private vehicle ownership. Road infrastructure and village roads in both locations are good, making it easier to mobilize.

Table 6. The values of physical capital variables on Ternate Island and Hiri Island

Variable	Ternate Island	Hiri Island
House	3.46	3.40
Transportation	3.47	2.14
Workplace	2.65	2.56
Village environment	2.93	2.90
Average	**3.46**	**3.40**

Ternate Island and Hiri Island as small islands in the archipelago are very dependent on sea transportation. The availability of sea public transportation greatly helps people on both islands to connect with other islands, such as Halmahera Island as the main island in the North Maluku Islands, and other small islands around it. Ternate Island is the economic center of North Maluku so there are more choices for sea transportation modes and shipping destinations, in contrast to Hiri Island, where the choices are more limited.

Respondents in both locations already have decent private homes. The houses owned by respondents are generally permanent houses made of concrete or wood, most of which have large yards. The houses are in decent condition with good sanitation. Therefore, the value of the house variable is higher than the other variables, with a value of 4.32 on Ternate Island and 4.25 on Hiri Island. The village environment is also quite supportive of the community's physical capital, this is assessed by the availability of public facilities. Some types of public facilities available are roads and places of religious worship. The existence of these public facilities will help the community in mobilizing and improving social relations between communities.

The workplace variable is the least important on both islands. These variables relate to access and distance to work locations and workplace conditions. Accessibility to workplaces in both locations is quite good because roads are available and there are public transportation or private vehicles that can be used. It's just that the distance from home to the work location is considered a bit far. The road to the work location also tends to have gentle to steep slopes. Even though the working conditions are not fully optimal, they can still support physical capital for the livelihoods of the communities on the two islands.

e. Human Capital

Human capital is related to the quality of human resources that can support individual production functions and can contribute to national economic development (Anwar, 2017). The variables that make up human capital are education, family work, family health, skills, and employment. The value of each variable and the value of human capital on Ternate Island and Hiri Island are presented in Table 7.

Table 7. Value of human capital variables on Ternate Island and Hiri Island

Variable	Ternate Island	Hiri Island

Education	2.86	2.80
Family work	2.01	2.25
Family Health	4.00	4.00
Skills	2.24	2.30
Employment	2.36	2.00
Average	**2.86**	**2.80**

Human capital in Ternate Island and Hiri Island tends to be similar, with the average values being 3,036 and 3,010, respectively. The average values of family health and education variables were the highest on the two islands. The availability of adequate educational and health infrastructure and facilities can support human capital. In addition, optimal quality education and health support will improve the community's quality of life. Education and health aspects can also contribute to regional economic development and growth (Anwar, 2017; Mahulauw *et al.*, 2016)

Variables of family work, skills, and employment on both islands are in the range of 2.01 – 2.30. All three are in moderate condition but can be considered as support for human capital for the communities on Ternate and Hiri Islands. Thus, the quality of human capital on the two islands can be considered quite optimal and supports the livelihoods of the community. The participation of local governments in improving the quality of human resources can have implications for increasing the level of social welfare which results in increased economic growth at the macro level (Anwar, 2017). Family work is related to the number of working family members. The more family members who are of productive age and have an income, the better the livelihood of the family's household.

Sustainable Community Livelihood Strategy

Sustainable community livelihood strategies are based on an analysis of the resources owned by the community. In this case, the resources referred to are natural, physical, financial, human, and social capital. Scoones (1998) classifies the community's livelihood strategies into three, namely agricultural intensification-extensification, diversification, and migration.

a. Agricultural Intensification and Extensification Strategy

Agriculture plays an important role in the livelihoods of the people on Ternate Island and Hiri Island. Communities on these two islands are still dependent on natural resources. The intensification and extensification strategies consist of land use utilization, agriculture, vacant land use, and increasing the area of agricultural land. In general, the condition of the area for agriculture and plantations has a good indicator related to soil conditions. The analysis of intensification and extensification strategies is presented in Table 8.

Table 8. Intensification and extensification strategy activities in Ternate and Hiri Islands

Activity	**Ternate Island**	**Hiri Island**
Land use utilization	17%	14%
Agriculture/Plantation	54%	48%
Vacant land use	13%	21%
Increasing the area of agricultural land	16%	14%

The intensification and extensification strategy on Ternate Island and Hiri Island focuses on the utilization of agricultural/plantation land, with values of 54% and 48%. Respondents generally use their agricultural land to plant various species of plants, especially nutmeg, cloves, and coconut. The commodities planted were annual plant species that can produce yields every year. The plants were already producing fruit so there is not much maintenance that needs to be done. Respondents assessed that this strategy was still possible to implement. The strategy of using yards was also carried out by 17% of respondents on Ternate Island and 14% of respondents on Hiri Island. Yard land is generally used to grow vegetables or fruits for family consumption.

The vacant land utilization strategy ranks second for Hiri Island (21%) because there are still undeveloped and usable locations. It's different from Ternate Island, where vacant land is more limited because a lot of it has turned into settlements. Most of the land on Ternate Island that could be used for new plantations is located in areas with high slopes making it quite difficult to access. The Social Forestry Program with the Village Forest scheme provides flexibility for communities around the Ternate-Tidore PFMU area to utilize forest areas to improve people's livelihoods. Thus, the community can develop their business in the area.

b. Diversification Strategy

Communities on Ternate Island and Hiri Island are not only farmers but also carry out various activities that can support the livelihood of their households. These activities also not only affect the household economy but also the village economy. Details of activities in the diversification strategy are presented in Table 9.

Table 9. Activities of the diversification strategy on Ternate Island and Hiri Island

Activity	**Ternate Island**	**Hiri Island**
Agricultural activities other than farming	44%	43%

Trade sector	34%	23%
Service sector	22%	34%
Marketing of agricultural/plantation products	85.22%	66.30%

The marketing of agricultural products is the most frequently used strategy by respondents in Ternate Island (85.22%) and Hiri Island (66.30%). In general, respondents processed their plantation products and then marketed them. Products marketed are nutmeg and cloves that do not require special complicated processing, they only need to be peeled (for nutmeg) and dried in the sun. Meanwhile, coconut products are only harvested and then marketed. These three commodities are marketed without the need for special packaging. Marketing is generally carried out by respondents directly to traders/middlemen and consumers.

The strategy of diversifying agricultural activities apart from farming was also carried out by many respondents on Ternate Island (44%) and Hiri Island (43%). The activities that are mostly carried out are raising livestock and fishing. The livestock kept is chickens and goats in the area around settlements and gardens. Fishing activities are carried out quite often because the two islands are surrounded by the sea which is still rich in fishery products. The fish caught are usually consumed alone or marketed.

The trade and service sector is the least activity carried out by respondents on both islands (Table 9). Trading activities include trading in markets, food stalls, grocery stores, or trading online. While the service sector includes working as employees, day laborers, and motorcycle taxi drivers.

c. Migration Strategy

The migration strategy relates to moving places for work purposes. The activities are permanent migration and circular mobility (Table 10). The migration strategy that was mostly used by respondents on Ternate Island and Hiri Island was circular/commuter mobility. The form of activity is a trip made from the settlement to the place of work. In general, the distance from the respondent's house to his place of work ranges from 10-30 minutes by road. Mobility by sea is also often carried out by respondents on both islands to go to other islands in the vicinity. Sea traffic in the North Maluku archipelago is indeed quite busy because sea transportation is needed to connect people who live spread across many islands.

Table 10. Migration strategy activities on Ternate Island and Hiri Island

Activity	Ternate Island	Hiri Island
Permanent migration	12%	16%
Circular/commuter mobility	32%	30%

The permanent migration strategy was also carried out by 12% of respondents on Ternate Island and 16% of respondents on Hiri Island. Permanent migration means a permanent change of place of residence. In general, the family members of the respondents migrated because they were married and worked elsewhere. They moved to other islands or regencies within the Province of North Maluku and outside the province.

IV. Conclusion

The livelihood assets of community households on Ternate Island and Hiri Island are natural, social, financial, physical, and human capital. The assets owned by Ternate Island (13.79) are greater than those of Hiri Island (11.76). The highest capital on the two islands is financial capital with a value of 3.13 on Ternate Island and 2.75 on Hiri Island, while the capital with the lowest score is natural capital with a value of 2.45 on Ternate Island and 1.90 on Hiri Island. In general, the five capitals are capable of supporting the livelihoods of the people on both islands.

Asset-based sustainable livelihood strategies undertaken to improve people's lives include intensification and extensification, diversification, and migration strategies. In general, the strategies used on the two islands tend to be similar. For the intensification and extensification strategies, the community mostly uses the agricultural/plantation land they own. The diversification strategy used is the marketing of agricultural/plantation products and the migration strategy is permanent migration.

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