

Livelihood Assets of Maize Farmers in Flood Prone Areas on Sumbawa Island

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ABSTRACT

Land use change is increasing in West Nusa Tenggara province, especially in Bima district. This condition occurs because people who make land use change patterns that are utilized as agricultural areas for corn commodities. The limited agricultural land in Bima Regency with the potential for good selling prices of corn commodities is a major factor in land use change, this has an impact on flood disaster vulnerability. This study aimed to determine the condition of the livelihood assets of seasonal corn farmers in the Bima district. The research method used a descriptive presentative statistical approach. The sample in this study amounted to 97 respondents who were taken in 8 districts with flood vulnerability, namely Sanggar, Madapangga, Palibelo, Woha, Belo, Monta, Sape, and Lambu. Random sampling was used to determine the respondents. The results showed that the condition of the livelihood assets of seasonal corn farmers in Bima District from 8 flood-prone villages is dominated by human resources, where the average percentage value is 83%. This is followed by physical assets at 81% and natural and financial resources at 71%, while the lowest is social assets with a percentage value of 69%. The farmer livelihood assets with high percentage values in each flood-prone area are human resources in Sanggar, natural resources in Palibelo, financial and physical in Sape, and social assets in Palibelo and

Woha. The pentagon of livelihood assets does not form a triangle, so it can be concluded that there is inequality between assets. The lack of agricultural land owned by farmers encourages the use of land cover as corn farmland. This can be seen from the use of land by farmers that is not their own, resulting in environmental damage that causes flood vulnerability.

Keywords: Land use change, Livelihood assets, Flood Disaster

INTRODUCTION

Land use change is increasing in the province of West Nusa Tenggara, especially in Bima Regency. This condition occurs due to people who make land use change patterns used as agricultural areas for corn commodities. Community activities to develop these farms because they have a relatively high and stable selling value and easy marketing of products and are sought after by industries engaged in corn products^[1]. The NTB government's PIJAR programme triggered the widespread land use change in Bima Regency for Maise farming^[2]. The programme is a factor in the shift in land use in Bima District. This programme directly encourages the community to develop maise farming. However, not all residents own agricultural land. Those who do usually have a minimal land area^[3].

The limited agricultural land in Bima District, which has the potential for a

reasonable selling price of maize commodities, is a significant factor in land use change. The topographical condition of district Bima is that 70% consists of highlands with a mountainous texture, while the remaining 30% are plains. Of the lowland proportion, around 14% is rice fields, but most is dry land. One of the actions taken by the government should be to utilise forests for agricultural activities, also known as agroforestry, to encourage people to participate in preserving the environment, especially forests, and generate economic benefits for the community^[4]. Existing conditions and corn farming activities in Bima District are not by the designation because most of the locations or agricultural land areas used are conservation land.

Uncontrolled land use changes to corn crop agriculture may have caused floods in Bima District. The pattern of land use change has an impact on reducing infiltration capacity. Excessive land efficiency causes a decrease in hydrological functions^[5]. Land utilisation with business use patterns has economic and social effects. However, inappropriate use often results in environmental damage. Land use change is inevitable due to the increasing needs of life. The price of maize commodity is a factor that influences the interest in land use change, thus impacting the livelihood assets of maize farmers. The assets required to organise livelihoods are not just one type, but a combination of assets is required^[6]. The types of assets that support each person's livelihood vary from individual to individual.

Livelihood assets include natural, human, financial, social and physical capital^[7]. Limited agricultural land makes people utilise conservation land without considering flood vulnerability; this condition is driven by the need to earn a living. Maize farmers who use non-agricultural land are highly dependent on nature. Farming is only done during the rainy season, so irrigation depends on rainwater. This leads to other vulnerabilities, such as crop failure. Therefore, this study

focuses on seasonal maize farmers who only farm during the rainy season. This study aims to determine the condition of farmers' livelihood assets in flood-prone areas in Bima District.

MATERIALS & METHODS

Research Location

The research location is Sumbawa Island, West Nusa Tenggara province, with samples taken from Bima Regency with eight districts, namely Sanggar, Madapangga, Belo, Monta, Palibelo, Woha, Sape and Lambu. The location was chosen based on the level of flood disaster vulnerability. Figure 1 below is a map of flood disaster vulnerability as follows:

Population and Sample

The population in this study is the maize farming community, which is a representative of farmers who use land to farm maize crops in the Bima District. The population is unknown, so the number of samples will be determined using the Cochran formula, namely $N = Z pq/e^2$.

Description:

N = number of samples required

Z = the confidence level needed for a 95% sample, with a value=1.96

P = 50% chance of being correct = 0.

q = 50% chance of being wrong = 0.5

e = Sample Error Rate (sampling error), in this study using 10% = 0.1

So, the total sample of 97 respondents was taken from flood-prone areas. A *random sampling* technique was used.

Data collection techniques

The data collection technique used in this research is a quantitative approach. Data collection tools, such as questionnaires, are arranged based on the problems in the study. The questionnaire used is a structured (closed) questionnaire, which is the primary data collection tool for researchers and is addressed to the object of research. Likert measurement scale will be used to determine

the short length of the interval so that it will produce quantitative data.

Data Analysis

Data analysis was carried out using presentative descriptive statistical methods. Data should be presented as minimum, maximum, number, average, standard deviation, and percentage values. The data is interpreted and described descriptively to be more meaningful. To calculate the percentage of data from the questionnaire using the formula $DP = f / n * 100\%$

Description:

DP = Percentage Description.

F =frequency of each category (Highest Value)

N =Sample size

Statistical analysis was carried out by calculating the respondents' scores for each indicator. Then, the next step is to recap the values and calculate the score. To find out the category or level of each indicator and variable, then the score obtained (in %) is consulted with the scale criteria as follows:

Table 1. Analysis criteria

No.	Value Interval	Criteria
1	75%-100%	Very High
2	50%-75%	High
3	25%-50%	Low
4	0%-25%	Very Low

RESULT

Farmers' livelihood assets include Human Resources, Natural Resources, and Financial,

Physical, and Social Indicators. Assets include the availability and accessibility of resources that can improve and support living conditions. Livelihood resources can be seen as the primary asset of the various livelihood resources to be built by each individual, as the ability to acquire livelihood strategies depends on the ownership of the asset itself. Therefore, the scale of priority the community gives to the availability of resources as assets will vary from region to region. Areas include subdistrict Sanggar, Madapangga, Palibelo, Belo, Woha, Monta, Lambu, and Sape. Indicates that each asset indicator is prioritised. The following is a table of the livelihood assets of maize farmers in each flood-prone subdistrict area.

Table 2. Livelihood Assets in Flood-Vulnerable Areas

Subdistrict	Livelihood assets				
	Human	Nature	Financial	Physical	Social
Sanggar	88%	65%	54%	56%	81%
Madapangga	78%	75%	78%	77%	73%
Palibelo	84%	78%	74%	85%	65%
Woha	82%	72%	67%	82%	65%
Belo	91%	80%	61%	96%	79%
Monta	79%	72%	75%	88%	60%
Sape	85%	60%	89%	94%	62%
Lambu	74%	68%	71%	72%	69%
Average	83%	71%	71%	81%	69%

Source: Primary Data (2024)

The formula $DP = F / N * 100\%$ obtains the percentage value. After obtaining the percentage value, the criteria that have been determined can be given. The data obtained results from the answers of 97 respondents from flood-prone areas in Bima Regency. The results show that in the human resources indicator, subdistrict Sanggar has

a high percentage value of 88% and the lowest in the Lambu area. Then, the indicator of natural resources in subdistrict Belo is the highest at 80%, the weakest in the subdistrict Sape area. Financial indicators show that the highest value is in the Kacamatan Sape area at 89%, while the lowest is in the Sanggar area, with a

percentage value of 54%. Physical indicators show that subdistrict Belo is the highest at 96% and the weakest in the subdistrict Sanggar area at 56%. Finally, the social indicator, where subdistrict Sanggar got a percentage value of 81%, was the highest, and the lowest was in the Monta subdistrict area, which was 60%.

DISCUSSION

Farmer Livelihood Assets

Assets represent people's availability and accessibility to resources supporting and improving quality of life. Ownership of natural, physical, social and economic resources affects the ability to develop livelihood strategies. Therefore, livelihood resources can be considered as the primary assets of the various livelihood resources

that each individual will build. As such, the availability of resources as assets in the community in one region will differ from that in the other areas.

a. Human Resources

There are five categories of assets: human resources, natural resources, physical assets, financial assets and social assets. These assets can be used by farmers to recover from vulnerability or to continue their livelihoods. Human capital indicators include knowledge, skills, experience, health, and labour. Human capital combines people's ability, health, and expertise to implement livelihood strategies to achieve their goals.

Table 3. Distribution of Human Resources Indicators

Indicators	Min	Max	Average	Percentage	Category
Education Level	1	4	3.27	82%	High
Knowledge and Skills	1	4	2.68	67%	Medium
Health History	1	4	3.15	79%	High
Health Check	1	4	2.25	56%	Medium
Health Centre Access	1	4	3.25	81%	High
Working Time	1	4	3.16	79%	High
Role of Family Members	1	4	3.18	79%	High
Farmer Type	1	4	3.19	80%	High

Source: Primary Data (2024)

The table above shows the distribution of human indicators on farmers' livelihood assets in Bima District. The education level of maize farmers in 8 (eight) flood-prone villages is a high percentage of 83%. Education is the effort of individuals or communities to improve their knowledge and abilities^[8]. The government sets the level of education based on a person's level of development. These results show that farmers' education level is relatively high, with 62.9% of respondents (farmers) graduates (S1/equivalent). The high school level is 17.5%, the junior high school level is 3.1%, and the primary school level is 16.5%. In general, maize farmers' livelihood assets in the human resources indicator have a high percentage of 78%, one of the influences being the level of education.

In addition, the health condition of farmers is also essential, as 28.9% of farmers stated that they rarely get sick, and 48.5% have a good health history. Also, 12.4% claimed to be often ill, and only 10.3% had poor health or had congenital diseases. The agricultural sector has a very high health risk due to exposure to pesticides, plants, insects, sunlight, heat, and other infectious agents that cause skin diseases^[9]. A person's health is significant for the sustainability of the farmer. In addition, having a good health status can also increase productivity^[10]. Farmers are generally active from morning to night without adequate rest time, as maize farming requires farmers always to be vigilant against pests such as wild boar. Access to health services has a high percentage value, with 81%. Health facilities in Bima District consist of 1

hospital, two polyclinics, 21 community centres, and 61 pharmacies. The availability of health facilities is well accessible to maize farmers. 53.6% of farmers stated that access to health services is excellent, 23.7% good, 16.5% do not know, and 6.2% stated very bad. The community generally receives good service from community health centres or other health facilities without auxiliary health centre facilities in Kabupaten Bima. In addition, many people still maintain traditional medicine to maintain their health. Organising work time is also one of the strategies for promoting health. In practice, seasonal maize farmers in Bima District showed that 55.7% highly organised their working time, 16.5% sometimes organised their working time, and 11.3% did not organise their working time. So, the percentage value of the high working time indicator is 79%. Farmers know the workload on hilly fields that require good body condition. Managing work time can minimise the workload. The more work a person has to do, the less time is needed to complete the job so as not to get tired quickly or experience health problems^[11]. In addition to organising work time to reduce the workload, other family members also light the workload. Each family member must be skilled in performing roles according to their position, including the roles of husbands and wives based on socio-cultural, social, and religious constructions^[12]. The role of maize farmer families in Bima District is 79%. A total of 55.7% of farmer families play a role in all maize farming processes, 20.5% play a role in a large part of maize farming, 9.3% help a small part of the maize farming process, and

14.4% have no role at all. The majority of growers have a role in the maize farming process. Family members who cannot help are influenced by members who already have their own social lives and those who have migrated for work or education.

Another factor that influences the high human indicator is the type of farmer. The percentage value of 80% is influenced by the fact that most maize farmers are sharecroppers, 51.5%. 25.8% tenant farmers, 12.4% tenant farmers and 10.3% farm labourers. Tenant farmers are people who cultivate land for agriculture as their primary source of income, whether they own or do not own their land^[13]. The land used by tenant farmers is covered land and not part of the farmer's property, which is problematic due to the negative environmental impacts caused by Maise farming activities.

b. Natural Resources

Natural resources are significant capital for farmers because the success of agricultural activities depends on nature. Natural resources are needed by every individual who does activities on them. Good utilisation of natural resources can provide additional and fulfilling needs for each individual. The limited natural resources farmers own when conducting corn farming are a significant factor in land conversion that impacts flood disaster vulnerability in Bima District. The human resources indicator generally has a percentage value of 71%. Natural resource indicators include land area, land status, and the type of land farmers use. The table below provides an overview of land tenure by farmers.

Table 4. Distribution of Natural Resources Indicators

Indicators	Min	Max	Average	Percentage	Category
Land Area	1	4	2.88	72%	High
Land Status	1	4	3.08	77%	High
Land Type	1	4	2.40	60%	Medium

Source: primary data (2024).

The land area used by maize farmers varies, but the most dominant area used is >5 hectares at 45.4%. Meanwhile, 13.4% use

4-5 hectares, 24.7% use 3-4 hectares and 16.5% use 1-2 hectares. The farmland's size affects the farm's scale, which affects how

efficient the farm is. The larger the land area used, the less efficient the farm is^[14]. The land area significantly affects the income of maize farmers, so the land area is a determinant of the amount of production and revenue of maize farmers. The land area cultivated by farmers affects income because the more significant the land area cultivated by farmers, the greater the production^[15]. Based on the idea that the larger the land area, the less effort there is to perform efficiency measures due to a) Lack of control over the use of production materials such as seeds, fertilisers, pesticides, and labour; b) Limited Number of labourers; c) Little capital owned by farmers to finance their agricultural businesses on large land areas^[16].

Then, the following indicator of land status used by farmers is the highest percentage value in natural resource capital, which is 77%. Factors affecting the high indicator of land status are because the land used by farmers is vacant land whose owners are unknown, with a percentage value of 43.3% and communal land 30.3%. Land that is not known to the owner and land that is considered communal land, as most of it is covered land. Therefore, many farming activities are considered illegal, which impacts environmental damage. The conversion of forest to agricultural land changes the physical condition of the forest, which affects the surrounding community, animals, plants, and the environment as a whole^[17]. Then the rented land is 16.5%, and the owned land is only 9.3%. Farmers' land tenure status directly impacts income, which in turn can improve farmers' welfare^[18].

The last indicator in natural capital, the type

of land used by farmers, with a percentage value of 60%, is the lowest in natural capital. 32.0% of farmers do maize farming not on agricultural land, and 28.9% cultivate agriculture in vegetated areas. Then, farmers who grow maize on non-vegetated land are 8.2%, and farmers who use dryland farmland are 30.9%. The PIJAR programme encourages the community to develop maize even more rapidly. The community's desire has led to a lot of land conversion, such as the conversion of forest to agriculture or agriculture to non-agriculture, resulting in fewer forests.

c. Financial

Financial capital is one of the indicators that influence the livelihood strategies of maize farmers, as respondents are farmers with uncertain incomes. Sources of income, savings, and debt are part of farmers' strategies to maintain financial capital. Financial capital describes farmer households' control over access to finance from savings, wages, credit, and debt or goods of economic value. The demand for maize commodities affects the market price. Maize is one of the most important agricultural commodities in the industry. Due to the rapid growth of the livestock industry, maize is a significant component, about (60%) of the feed ration. Only about 30% of maize is consumed as food; the rest is used for seeds and other industrial needs^[19]. This encourages farming communities to engage in maize farming and requires financial strategies to deal with vulnerability. The following descriptive analysis results are an elaboration of the economic capital indicator analysis;

Table 5. Distribution of Financial Indicators

Indicators	Min	Max	Average	Percentage	Category
Main Source of Income	1	4	2.68	67%	Medium
Savings Ownership	1	4	2.47	62%	Medium
Savings Target	1	4	2.71	68%	Medium
Loans	1	4	2.70	68%	Medium
Form of loan	1	4	2.26	56%	Medium
Loan considerations	1	4	1.90	47%	Low

Source: primary data (2024).

The percentage result of the indicator of farmers' primary source of income is 67%. This is influenced by farmers' income, not only from maize farming. Sources of income outside of maize farming are the primary income of 24.7%. Meanwhile, income from other sources is more significant at 17.5%. The balance of income from different sources, such as maize farming, is 22.7%, and the primary source of income from maize farming is 35.1%. These results illustrate that maize farming is not a primary job but a seasonal job that is only done during the rainy season. One strategy for managing income to meet needs is to manage savings. In this case, related to farmers' trust in financial institutions, the value obtained in the savings ownership indicator is 62%. Farmers' decision to open savings in financial institutions by 33.0%. Then, farmers who decided to share some of the income entrusted to financial institutions by 10.3%, and farmers who chose to save their own income by 27.8%. For farmers who do not have savings, it is 28.9%. Related to the ownership of savings, each individual has a target in managing savings. Savings is one type of banking service. Banks continue to innovate to attract customers to save at the bank. However, many farmers are still less interested in keeping at the bank^[20]. Various reasons underlying farmers' decision to save in the bank can be taken without passing the administrative process and the target of farmers in saving. The target for the cost of needs has a percentage value of 29.9%. Then, for following next year's planting costs with a percentage of 27.8%, the target for unexpected funds is 25.8% and those who do not have a target of 16.5%. If converted, the percentage value of the savings target indicator is 68%. These financial institutions encourage customers to save money by charging interest on their deposits. Banks will lend the funds back to individuals or organisations that need them. The bank is the primary choice when making loans. The percentage value of 68% illustrates that farmers who do not

make loans 37.1% choose to make loans to relatives or relatives 6.1%, then farmers who make loans to cooperatives 6.2%. One of the choices of the farming community, where the percentage who borrowed from the bank was 50.5%, was when faced with a capital shortage in maize farming.

In obtaining capital for maize farming, loans are not only made to banks. However, other financial institutions such as cooperatives and relatives are also used. So, the form of loan is not only in the form of money but also in the form of goods. Concerning the loan form, the percentage value is 56%, with details that have not made loans to financial institutions or relatives, around 38.1%. Meanwhile, the loan in the form of goods only has a value of 2.1%. Then, those who make loans in the form of money make up 55.7%. And loans in the form of goods and funds only have a percentage of 4.1%. Financial institutions should consider the diversification of lending to avoid risks that lead to bad debts or problems^[21]. Farmers must also consider the risks of loans to financial institutions such as banks. Overview of the level of consideration of farmers to make loans to economic development has the lowest percentage value of 47%. The low indicator of consideration of farmers in making loans is 40.2% of farmers do not make loans, and then those who choose to make loans to relatives or relatives 35.1%. Farmers who consider the ease of collateral is 19.6%, and farmers who make loans considering the ease of instalments are 5.2%.

d. Physical

Physical capital is a description of the ease of access in the form of facilities and infrastructure that support farmer households in their lives, and physical capital consists of basic infrastructure and ownership of equipment that can produce goods/services to encourage the growth of livelihoods. Physical capital in this study is described in terms of house ownership status, type of house, vehicle ownership, and type of agricultural equipment owned.

The results of the description analysis below are a table describing the analysis of physical capital indicators, as follows;

Table 6. Distribution of Physical Indicators

Indicators	Min	Max	Average	Percentage	Category
Home Ownership Status	1	4	3.55	89%	High
House Type	1	4	3.14	79%	High
Vehicle Ownership	1	4	1.93	48%	Low
Type of Agricultural Equipment	1	4	1.79	45%	Low

Source: primary data (2024).

Physical capital is capital in the form of facilities and infrastructure that support farmers' activities in conducting farming. The homeownership status of maize farmers in Bima District has the highest value of physical assets at 89%. This is influenced by 78.4% of farmers owning a house, about 7.2% living in rented houses, farmers who live in 5.2% aid houses, and those who live together with family 9.3%. According to the Central Bureau of Statistics (2015), in a study conducted by Prasetyaningtyas, one of the indicators used to determine the level of welfare is the condition of the residence and living facilities^[22]. The condition of corn farmers' houses in Bima District has a percentage value of 79%. Where the majority, or 59.8%, of farmers, live in permanent homes. In general, many Bima people still have traditional stilt houses made of wood, and around 20.6% of corn farmers have wooden houses. Meanwhile, among those who live in semi-permanent houses, around 7.2% and 12.4% of farmers do not know their house type.

In addition to the condition of the place, vehicle ownership is one of the accommodations for supporting farmers' activities. The vehicle ownership indicator

for maize farmers in Bima Regency received a percentage value of 48%. Bima Regency occupies the sixth position as a motorbike user in West Nusa Tenggara Province, totalling 85,234 units^[23]. As many as 16.5% of farmers do not own a vehicle, and the majority of farmers, 77.3%, own a motorised vehicle. Then ownership of commercial vehicles and cars is only 3.1% of farmers. Another physical capital in facilitating farmers to farm maize is the ownership of agricultural tools. This indicator is relatively low, with a value of only 45%, because the majority (67.0%) of farmers only have pesticide sprayers, and 27.8% do not have agricultural tools. Furthermore, 3.1% of farmers own a grass cutter, and only 2.1% own a corn flattener. Land and its environment, labour, capital, and equipment are the main components of farm production^[24].

e. Social

Social capital shows how farmer households interact with the community in their social environment. This study describes membership indicators in a farmer group and easy access to seeds, fertilisers, and pesticides.

Table 7. Distribution of Social Indicators

Indicators	min	Max	Average	Percentage	Category
Farmer Group	1	4	1.38	35%	Low
Seeds	1	4	2.36	59%	Medium
Fertiliser	1	4	1.22	30%	Low
Pastisida	1	4	2.78	70%	Medium

Source: primary data (2024).

Social capital has the lowest percentage value among other capitals in the livelihood assets of maize farmers in Bima District.

This is due to farmers' lack of participation in farmer groups. The percentage value of farmers' membership of farmer groups is

only 35%, where only 8.2% of farmers are members, while 82.5% are not. Farmer groups can benefit from many advantages, including joining other farmer communities and sharing experiences in farming [25]. One container is usually open due to interaction and communication as part of developing the farming experience. Those who did not know about farmer groups were 5.2%, and those who knew about farmer groups but did not join them were 4.1%.

Another indicator that affects the low percentage value of social capital is the ease of obtaining fertiliser, which only has a percentage value of 30%. Almost all areas in Bima District experience scarcity during the planting season; fertiliser scarcity is still a problem that farmers often face; farmers often face fertiliser scarcity during the planting season. As many as 89.7% of farmers admitted that it was complicated to get fertiliser, and only 4.1% found it very easy to get fertiliser. Maize commodity development at both local and national levels still suffers from fertiliser scarcity [26]. In contrast to fertilisers, farmers find it easy to obtain seeds and pesticides because small and large-scale agricultural shops are scattered in almost all Kabupaten Bima areas.

Livelihood Assets of Maize Farmers in Bima District

The ownership of resources, the ability to manage, and various other activities a community requires to survive. Livelihoods will be sustainable if parts of the community allow them to survive and improve the resources and their management for present and future well-being without diminishing the value of natural resources. Therefore, the scale of priority that communities give to the availability of resources as assets will vary from region to region. Research conducted among respondents in Sanggar, Madapangga, Palibelo, Belo, Woha, Monta, Lambu, and Sape regions shows that the maize farmers' livelihood assets pentagon shows the relationship between human capital, natural capital, financial capital,

social capital, and physical capital. The condition of each region's livelihood assets is different, and the ownership of capabilities and accessibility influences the factors underlying these differences. Each lives their life by using active strategies to maximise their potential. The following figure illustrates the assets owned by maize farmers in flood-prone areas.

a. Livelihood assets of farmers in Sanggar and Madapangga regions

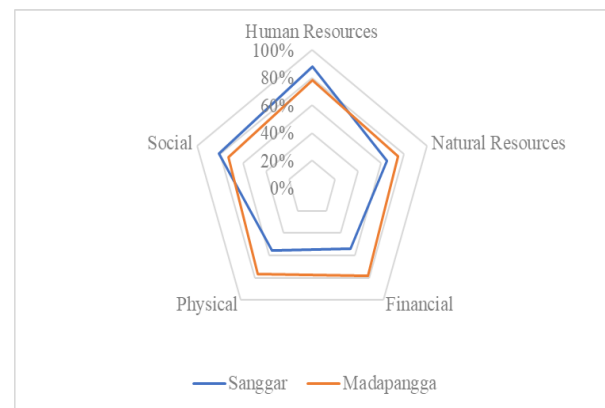


Figure 1. Condition of farmers' livelihood assets in Sanggar and Madapangga sub-districts

The difference can be seen in these two areas. In Sanggar village, there is inequality in the assets owned by farmers. So that it is depicted in a pentagonal shape, not forming a triangle. The use of human capital is 88% of the total. Tambora sub-district and Sanggar sub-district are the development areas of Tambora National Geopark. The Tambora Mountain area not only has the potential for extraordinary geological diversity but also the potential for biological diversity and cultural diversity, which, if appropriately managed, will benefit the community [27]. Then, social assets 81%, natural resources 65%, physical 56%, and financial 54%. Unlike the condition of assets in the Madapangga region, it can be seen that the pentagon forms a triangle. This indicates that there is no inequality between assets. The percentage value in the Madapangga region is highest in human and financial capital, with a value of 78%. This was followed by physical capital at 77%,

natural resources at 75%, while social capital was the lowest at 73%. Both regions are more dominant in using human capital assets.

b. Livelihood Assets of Farmers in Woha and Palibelo Regions

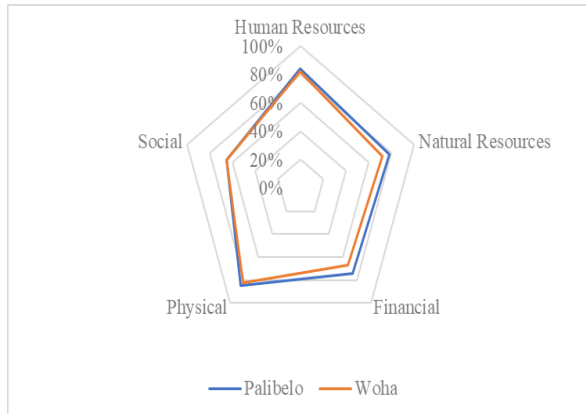


Figure 2. Condition of farmers' livelihood assets in Palibelo and Woha sub-districts

Geographically, Woha and Palibelo districts are similar in terms of morphology and social and economic conditions, including their livelihood assets. The dominant assets used by farmers in the Woha region are human and physical assets, with a percentage value of 82%, natural resources at 72%, financial resources at 67%, and social assets at 65%. Similarly, in the Palibelo sub-district, the farming community uses physical assets with a percentage of 85% and human resources with 85%. Meanwhile, natural resources scored 78%, financial 74%, and social 65%. Being in the centre of the local government should provide many advantages for the agricultural sector in the Woha and Palibelo regions. In contrast, many farmers in remote areas experience limitations, especially in the face of agricultural modernisation^[28]. Despite being in the central government area of Bima Regency, these two areas still find it challenging to access fertiliser and still lack participation in farmer groups, so the percentage value of social assets is the lowest.

c. Livelihood Assets of Farmers in Belo and Monta Regions

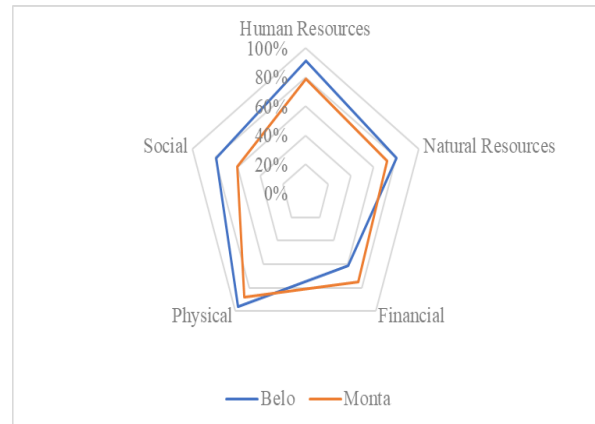


Figure 3. Condition of farmers' livelihood assets in Belo and Monta sub-districts

The asset condition of the Belo region is dominated by physical capital with a percentage value of 96%, followed by human resources at 91%, natural resources at 80%, social at 79% and financial at 61%. The low level of economic capital is influenced by the system built by farming families to manage family finances in fulfilling their needs and anticipating vulnerabilities that may be experienced. The more dependents a family has will usually affect the level of expenditure in farming^[29]. This involves the farmers' willingness to borrow and save money from financial institutions or independently. Meanwhile, livelihood assets in the Monta region are high in physical capital, with a value of 88%. Physical capital is influential in adding to the livelihood process of farming households^[30]. Agricultural assets generally have pesticide sprayers. Meanwhile, the community uses manual methods for planting and harvesting tools. This is followed by human capital 79%, financial 75%, natural resources 72%, and the lowest asset is social capital with a value of 60%. Almost all farmers in the Bima district experience fertiliser scarcity during the garden season.

d. Livelihood Assets of Farmers in Sape and Lambu Regions

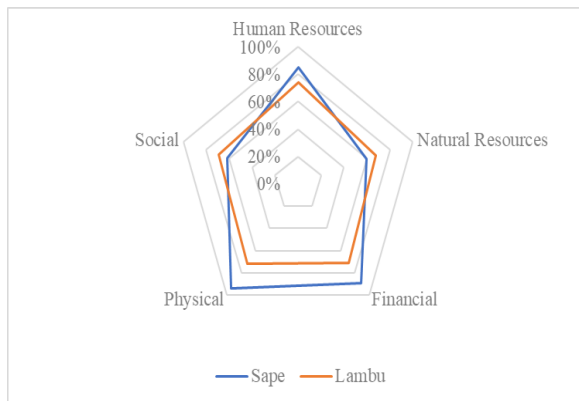


Figure 4. Condition of farmers' livelihood assets in Sape and Lambu sub-districts

The Sape and Lambu regions are located on the east coast of Sumbawa Island. The same sub-district is the central area of the connecting route between Sumbawa Island and East Nusa Tenggara province. The presence of a ferry port and inter-provincial transport traffic has improved the economy of the Sape sub-district community in general. This also affects the condition of farmers' livelihood assets in the area, where physical capital is the highest at 94%, and financial capital is the second highest at 89%. This indicates that the economic condition of farmers in the Sape area is good. Meanwhile, other assets, such as human resources, were 85%, and social capital was 62%. Meanwhile, the Lambu region is dominated by human resources, with a percentage value of 74%. Physical capital came second with 72 per cent, followed by financial capital with 71 per cent and social capital with 69 per cent. Both regions have diverse topographies ranging from hills to lowlands, including coastal areas. The impact of the diverse topography then affects the livelihoods of the community^[31]. For example, people who live in hilly areas are pretty dependent on food products in their gardens, such as corn and people who live by the coast and dominantly rely on the natural resources around them, namely the sea, to fish and catch fish so that they are classified into maritime communities. This also affects the

percentage value of natural resources, namely Sape 60% and Lambu 68%.

Flood Vulnerability

The cultivation of maize is the most significant contributor to forest destruction. Farmers open new fields on steep land. This condition is becoming increasingly worrying as some farmers clear land for maize crops in state forest cover. This is triggered by people who utilise forest areas as agricultural fields for corn commodities, because corn has good sales results. Through the development of available resources, there is an opportunity to change livelihood conditions^[32]. Agriculture, human settlements, exploitation of forest resources, changes in land use and land cover, and human-animal conflict cause forest destruction^[33]. Most of the locations or areas of the fields are basically forest areas that are converted into agricultural land, resulting in land degradation, lack of water absorption, and groundwater reserves, which will cause flood disasters during the rainy season and drought during the dry season.

Land use is a parameter that is easily changed due to the influence of human intervention on the land, so land use becomes an important factor in influencing flood vulnerability in an area. The lack of agricultural land with promising corn prices significantly impacts land use change in Bima district. The frequent exploitation of land converted into corn farming has resulted in flood vulnerability that occurs almost yearly. This is not matched by appropriate preventive measures such as selective logging and reforestation programmes. Between 2016 and 2024, there were 73 floods in Bima Regency^[34]. Based on this data, in 2023, there were 18 floods the lowest recorded in 2022. The disaster vulnerability that occurs in this study also displays data related to the impact. The table below shows the effect of flood disaster vulnerability as follows:

Table 8. Impact of Flood Vulnerability in Bima District

Victims	Year									Total
	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Casualties										
Died	1	2	2			2		3		10
Wounded					1					1
Suffer	6,000	4,000	8,371	1,550	2,322	30,660	7,045	21,137	4,166	85,251
Evacuate		2,000	50						24	2,074
Facilities										
Home	138	1	1,808	265	1	5,005		40	7	7,265
Education	4		5	4	2	23		9		47
Health			1			16				17
Worship	1					6				7
public facilities	13		5	1	3	22				44

Source: Indonesia's National Disaster Management Agency (2024)

In the table above, for 2016 to 2024, the impact of flood disaster vulnerability totalled 85,251 people suffering, and 2,074 were displaced. One person was injured, and ten people died. In comparison, the most affected housing facilities are 7,265 houses, 47 education facilities, 17 health facilities, seven worship facilities, and 44 public facilities. The impact of flood disasters causes losses from various infrastructure sectors because they can hamper the development and progress of an area^[35]. The impact of flood disasters is divided into two, namely direct impact and indirect impact. The direct impact of floods is physical losses after a disaster occurs in the form of destruction or damage. Indirect impacts on flood disasters are losses caused by direct damage, resulting in sustainable losses such as livelihood disruptions, economic losses, and environmental damage^[36].

CONCLUSION

The condition of the livelihood assets of seasonal maize farmers in Bima District from 8 flood-prone locations is dominated by human resources, with an average percentage value of 83%. This is followed by physical assets at 81% and natural and financial resources at 71%, while social assets are the lowest at 69%. The farmer livelihood assets with a high percentage value in each flood-prone area are human resources in Sanggar, natural resources in Palibelo, financial and physical resources in

Sape, and social assets in Palibelo and Wohu. When viewed in the pentagon of livelihood assets of seasonal corn farmers, all regions are dominated by human capital. The pentagon of livelihood assets does not form a triangle, so it can be concluded that there is inequality among assets. Land use is a parameter that is easily changed due to the influence of human intervention on land, so land use is an important factor in influencing flood vulnerability in an area. The lack of agricultural land owned by farmers encourages the use of land cover as corn farmland. This can be seen from the use of land by farmers that is not their own land, resulting in environmental damage that causes flood vulnerability.

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