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Development Potential of Horticultural Agribusiness Areas for Sustainable Agriculture in Sumba Island, East Nusa Tenggara Province

Ernesta Leha[1] and Imaculata Fatima[2]
[1-2]Flores Univercity
Email: ernestaleha@gmail.com, imapampe@gmail.com

***Abstract*—This research was conducted on Sumba Island, East Nusa Tenggara Province. Sumba Island is a fairly large island in the East Nusa Tenggara region which consists of 4 districts, namely East Sumba, Central Sumba, West Sumba and Southwest Sumba. This research aims to determine the potential for developing horticultural agribusiness areas on Sumba Island so that the study provides recommendations regarding the implementation of horticultural agribusiness in the region. The research method used is descriptive qualitative through literature study. The data used is secondary data from related agencies such as the Central Statistics Agency and the Agriculture Service and the Food Security Service (Lata & Kumar, 2022). The analysis results show that Sumbe Island has the potential to be developed as a Horticultural Agribusiness Area. The potential of Sumba Island is land potential, water potential, human resource potential and production potential. By optimizing all of this potential, Sumba Island can be free from dependence on horticultural supplies from other islands outside East Nusa Tenggara Province.**

***Index Terms*— Potential, Development, Agribusiness, Horticulture.**

I. INTRODUCTION

The vision and mission of Indonesian agriculture in the 21st century is the realization of a sustainable agricultural-bioindustrial system that produces a variety of healthy foods and high added value products based on local resources for food sovereignty and farmer welfare (Kementrian Pertanian (Ministry of Agriculture), 2014). The vision and mission statement provides an illustration that the desired future condition in agricultural development is the realization of food sovereignty through a sustainable bioindustrial agricultural system in order to improve the welfare of farmers. This means that farmers are the government's main target in its efforts to optimize the use of diverse resources and market opportunities to create superior and highly competitive products.

One agricultural sub-sector that has the potential to be developed within an agribusiness framework is horticulture. Based on its literal meaning, horticulture is a combination of the Latin words hortus which means garden and colere which means to cultivate (Pekkerieta et al., 2015). So, horticulture can be defined as a method of cultivating plants that can be done in the garden or yard. Horticulture is grouped into 4 types of commodities, namely vegetables, fruit, ornamental plants and biopharma plants. Horticultural commodities, especially

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and fruit, are the leading commodities currently, but must be supported by suitable land and climate conditions and supported by potential resources and domestic and international market opportunities. Apart from being a superior commodity, horticulture also plays a role as a source of community nutrition, providing employment opportunities and supporting agro-tourism and agro-industry activities (Ashari 2006).

The development of Horticultural Agribusiness Areas (HAA) is one of the implementations of the Ministry of Agriculture's policy, where the development of superior commodities is directed at developing vertically and/or horizontally integrated areas with the consolidation of productive businesses based on highly competitive community economic institutions. Law No. 13 of 2010 concerning Horticulture (2010) states that a horticultural area is an expanse of horticultural business distribution that is united by certain binding factors, both natural, socio-cultural and artificial physical infrastructure factors. This definition was further elaborated by the Directorate General of Horticulture where a horticultural agribusiness area is described as a geographical space that has a similar ecosystem and is united by the same infrastructure facilities to form an area that contains various horticultural-based business activities including the provision of production facilities, cultivation, handling and post-harvest processing, marketing, as well as various supporting activities. The regional concept is the most appropriate approach in regional economic development (Wijaya & Amri, 2022).

Sumba is one of the large islands in East Nusa Tenggara Province which has great potential to be developed as a horticultural agribusiness area. With the enactment of Law No. 22 of 1999 on Regional Government (1999), there have been various changes to government institutions at the district level. In article 10 paragraph 1, regions have the authority to manage national resources in their territories and are responsible for maintaining environmental sustainability in accordance with statutory regulations. This decentralization policy will encourage each region, both provinces and districts, to produce various agricultural commodities within the framework of self-sufficiency at the regional level, or at least reduce dependence on other regions. This kind of policy can be very profitable both in terms of the use of domestic resources and trade between regions.

Sumba Island consists of 4 (four) districts, namely East Sumba, Central Sumba, West Sumba and Southwest Sumba. Efforts to develop horticultural areas in rural areas using an agribusiness approach are an absolute choice at this time considering that the majority of the population lives in rural areas (Cambon & Rachaputi, 2013; Leha et al., 2018). If we look at the GRDP structure in the 4 (four) districts on Sumba Island over the past few years, sectorally the conditions have relatively not changed. The agricultural sector is still the leading sector (prime mover) in driving the economy. However, the accelerated performance of this sector tends to be less than optimal. The agricultural condition of Sumba Island, which is highly dependent on rainfall, has resulted in the development of the horticulture sub-sector being relatively slow. Apart from that, the fertility level of agricultural land in this region is generally still classified as marginal. In fact, the majority of farmers still use traditional systems in running farming businesses, such as cultivating land using a slash and burn system (shifting cultivation) and still using local seeds which are susceptible to pests with low productivity (Riptanti et al., 2021; Saragih, 2007). This research aims to determine the potential for developing the Horticultural Agribusiness Area on Sumba Island because so far Sumba Island is more famous as a livestock area (Sodiq et al., 2019; J. A. C. Vel & Nugrohowardhani, 2012). Based on the results of the pre-research survey, it is known that the needs of the people of Sumba Island for horticulture are very high, be it vegetables, fruit, medicinal plants or ornamental plants. And so far, the largest supply of vegetables and fruit comes from outside Sumba Island, namely from Java and Bali Island and from West Nusa Tenggara Province, namely from Bima Island.

II. Literature Review

A. Definition of Development

Development is a process of sustainable growth that includes genuine stakeholders in the development process. Development can also be understood as a deliberate endeavor to enhance human capacity to shape future outcomes. Based on the two definitions provided, it can be inferred that development should have the ability to stimulate the maximum potential of individuals or society (Maolani, 2019). Development should promote the cultivation of community cohesion and equitable distribution of shared welfare principles that cultivate a sense of trust within the community (Lata & Mittal, 2023). Development encompasses the capacity to achieve self-sufficiency (sustainability) and should aim to decrease interdependence across areas or countries, while fostering a sense of mutual respect. So, regions in the context of regional linkages are defined as subnational geographic units taking into account the principle of homogeneity and the principle of functionality (Maolani, 2019).

The development of sustainable agribusiness areas is closely related to the processing of local natural resources. Therefore, agribusiness development must lead to sustainability which prioritizes meeting the needs of the present generation without sacrificing future generations (Bowler, 2002; Wezel et al., 2014). The development of

agribusiness-based rural areas has several concepts in common with Central Production Areas (KSP) because this concept was established and developed jointly between the Central and Regional Governments as an effort to empower the economy of regional communities (Kumar and Lata, 2022). Apart from that, this effort is also a form of regional development, which is also one of the national development agendas and is in line with the implementation of Law No. 22 of 1999 (Law No. 22 of 1999 on Regional Administrations, 1999).

B. Definition of Agribusiness

In 1955, the concept of agribusiness was first introduced in the United States by John H. Davis in his paper delivered at the Boston Conference on Distribution. After that, John H. Davis wrote a book to popularize agribusiness with the title A Conception of Agribusiness at Harvard University and provided the following definition of agribusiness: "Agribusiness is the total sum of all operations involved in the manufacture and distribution of farm supplies, production operations on the farm, and storage, processing and distribution of farm, commodities and items made from them" (Borsellino, 2020). This definition is translated into Indonesian as, agribusiness is the sum total of production facilities from all activities relating to the manufacture and distribution of agricultural production facilities, activities carried out by farming businesses as well as the storage, processing and distribution of agricultural products and other products produced from agricultural production. Agribusiness is a comprehensive business system that encompasses all activities involved in the cultivation of plants and animals, such as agricultural commodities, livestock, fisheries, and forestry. It is focused on the market and aims to not only fulfill one's own needs but also generate additional value. Agribusiness is based on a fundamental logical concept (Saragih, 2007). Thus, it can be said that Agribusiness is a comprehensive concept that encompasses various components, including a trading sub-system, agricultural production facilities, an agriculture output sub-system, an agricultural product processing and distribution sub-system, agricultural product marketing sub-system, and an institutional sub-system that supports agricultural activities.

C. Horticultural Concepts

Literally, horticulture, which comes from the Latin "hortus" can be interpreted as the word garden and "cultura/colere" means cultivation, so horticulture can mean cultivating garden plants (Narayana & Ramadevi, n.d.). Moreover, horticulture is employed extensively, encompassing not only the growing of plants in gardens but also the various categories of plants that are grown. Horticultural work encompasses several activities such as seeding, nursery management, tissue culture, plant cultivation, pest and disease control, harvesting, packaging, and distribution. Horticulture is a contemporary method of agricultural cultivation. Horticultural plants underwent a transformation and evolved into cultivated plants that were grown on a huge scale in plantations. However, the point is that this plant is suitable for cultivation in gardens and home gardens. The plants or fruit can provide direct benefits to the people who cultivate them. Judging from their function, horticultural plants can fulfill physical needs as a source of vitamins, minerals and protein (from fruit and vegetables) as well as fulfill spiritual needs, because they can provide a sense of peace, tranquility and aesthetics (from ornamental plants/flowers). Horticulture plays a crucial role in a) enhancing individuals' nutritional status, b) boosting the country's foreign currency reserves, c) creating more job opportunities, d) augmenting farmers' income, and e) fulfilling the demand for aesthetics and environmental sustainability (Loizou et al., 2019).

III. Research Methodology

A. Location and Time of Research

This research was conducted on Sumba Island, which is one of the large islands in East Nusa Tenggara (NTT) Province. Sumba Island consists of 4 (four) districts, namely East Sumba, Central Sumba, West Sumba and Southwest Sumba. Sumba Island was determined purposively, based on considerations of having great potential for the development of sustainable horticultural agribusiness. The research was conducted from August to December 2023.

Figure 3.1 Map of Sumba Island

B. Types and Sources of Data

The data used in this research is secondary. Secondary data collected from various sources includes data from the Central Bureau of Statistics (BPS) at Regency and Provincial levels, the Department of Agriculture, Bappeda, BKP3, the Department of Industry and Trade and the Department of Cooperatives in 4 (four) districts on the Sumba island.

C. Data Analysis Methods

The data analysis method used in this research is a qualitative descriptive method or literature study using data from previous research and data from related agencies such as BPS, the Department of Agriculture and the Food Security Service of each district, including data obtained from East Nusa Tenggara Province.

IV. Results and Discussion

A. Land Potential

Sumba Island, like other areas in East Nusa Tenggara Province, is still dominated by dry land characterized by low annual rainfall, less than 2,000 mm/year. However, low rainfall does not always have a bad effect. According to Riptanti et al. (2021), low rainfall in dry climate areas causes the soil not to experience intensive leaching so that the bases in the soil are quite high, the cation exchange capacity (CEC) and base saturation (KB) are high and the level of soil fertility is also relatively high. tall. This is an advantage of dry land compared to wet climate areas where washing is very intensive so that the soil becomes nutrient poor and acidic.

Another advantage of Sumba Island is its fairly high level of soil fertility which is characterized by neutral pH and high KB and CEC. Based on the research results of Mulyani et al. (2014), Mulyani and Suwanda, (2020), it is known that the soil parent material in East Nusa Tenggara Province has the widest distribution, namely sediments and volcanoes which reduce the dominant soil Inceptiso (Haplustepts) which is associated with Alfisols (Haplustalfs) and Entisols (Ustorherts) with an area of around 2.1 million ha. . The highest rainfall on Sumba Island is in Central Sumba Regency with an average rainfall of ≥2,000 mm/year so that nutrient leaching is higher than in other areas so that the Haplustepts soil sediment parent material in this area has an acidic pH of around 4.1 – 4 .3 with low CEC and KB. Meanwhile, soil pH in East Sumba Regency is 6.0 with a CEC of 40.80 and a KB>100%. West Sumba Regency with the same rainfall as Central Sumba, namely ≥2,000 mm/year, has a pH of 5.2 and a CEC of 20.91 and a KB of 73%, while Southwest Sumba Regency has a pH of 6.2 and a KB of 40.08 and a CEC of >100 %.

Still referring to Mulyani & Suwanda (2020) research, if assessed from the potential and suitability of land for agriculture, then 54% or 4.5 million ha of the land area in Eat Nusa Tenggara Province is included in the category suitable for agriculture, while the remaining around 2.0 million ha not suitable for agriculture with various limiting factors, namely shallow solum, many rocks on the surface and in cross-section (lithic) as well as the shape of the area being too extreme such as hilly and mountainous with slopes that are too steep. This area is only suitable for conservation forests with plant types that are adaptive to land conditions (Mulyani et al. 2014) Apart from soil type and fertility, land potential in terms of land area also still allows for the development of horticultural agribusiness areas. The largest land area is in East Sumba Regency, then Central Sumba, followed by Southwest Sumba and the smallest is West Sumba. An overview of land use on Sumba Island is presented in Table 1.

TABLE I. POTENTIAL LAND USE ON SUMBA ISLAND IN 2016

Regency	Land Use (ha)				
	Ricefield	Garden/ Gortifield	plantations/forests	Residential	Others
East Sumba	26.292	80.156	86.448	126.333	380.821
Center Sumba	7.601	14.274	28.318	38.900	97.825
West Sumba	9.530	22.472	16.316	6.065	18.357
Southwest Sumba	7.692	51.560	26.471	35010	23.799

Source: Central Bureau of Statistics (2023)

Types of land that still have the potential to be developed as horticultural land are dry land/fields and other land. Other land consists of dry land that has not been cultivated, grasslands and ponds or swamps. Ponds or swamps only exist in certain areas with high rainfall, such as Central Sumba and West Sumba. Judging from other land areas, areas that have the potential to experience rapid land shrinkage and are likely to be depleted are West Sumba and Southwest Sumba. Based on the simulation results, it can be seen that in 2023 - 2030 other land in the West Sumba region will be depleted if the growth of upland fields is not controlled. Likewise in Southwest

Sumba, land is experiencing drastic shrinkage due to high population growth which causes increased use of land for settlements and logging fields (Leha et al., 2018).
Horticultural land, namely fruit and vegetables on Sumba Island, has not experienced a significant increase from 2018 to 2022, and even tends to fluctuate. The average percentage of horticultural land area to upland land area over 5 years was 4% in East Sumba Regency, 16% in Central Sumba Regency, 13% in West Sumba Regency and 6% in Southwest Sumba Regency. This condition shows that the area of horticultural land is still very limited even though demand is very high. The high demand for fruit and vegetables is the impact of the population continuing to increase, which means that people's consumption needs will also increase (see Table 2.)

TABLE II. HORTICULTURAN LAND AREA ON SUMBA ISLAND IN 2016

Regency	Horticultural land area (ha)				
	2018	2019	2020	2021	2022
East Sumba	5.771	2.177	2.254	2.844	1.279
Center Sumba	4.529	658	563	741	308
West Sumba	3.896	1.650	1.900	1.919	1.289
Southwest Sumba	3.180	2.521	2.889	2.365	2.302

Source: Central Bureau of Statistics (2023)

Based on statistical data, it is known that the comparison of the area of dry land/fields and horticulture is not significant. This can be seen from the very small percentage of horticultural land area. The average area of dry land for 5 years in East Sumba was 79,260 ha, while the average area of horticultural land was only 2,865 ha. The average area of dry land in Central Sumba is 12,415 ha and the area of horticultural land is only 1,360 ha. The average area of upland land in West Sumba is 19,043 ha and horticultural land is 1,131 ha, whereas in Southwest Sumba, with an average area of upland land of 48,990 ha, only 2,652 ha is horticultural land. A comparative description of the area of horticultural land on Sumba Island is presented in Figure 1.

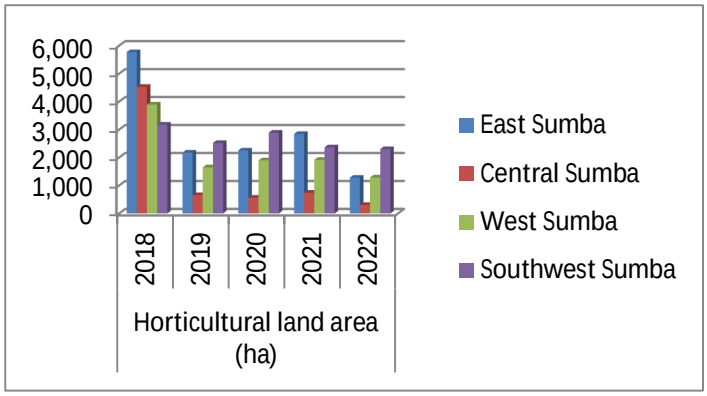

Figure 1. Horticultural Land Area on Sumba Island 2018-2022
Source: Central Bureau of Statistics (2023)

B. Water Resource Potential

Most areas of Sumba Island have a dry climate with low rainfall, so in some areas the main source of water is rainfall. However, there are also quite a lot of surface and ground water sources in this region. The most numerous rivers are in Southwest Sumba Regency but the longest is in East Sumba Regency. West Sumba and Central Sumba districts have limited river lengths but rainfall in this area is quite high, more than 2,000 mm/year. The water problem on Sumba Island is actually starting to be resolved gradually. One of the areas that received water network installation assistance in collaboration with Bappenas and Pro Air is West Sumba and Southwest Sumba Regencies. Assistance in installing water networks and building water storage tanks makes it easier for people to collect water for daily needs and for horticultural cultivation. The results of the water installation assistance are very visible, although not all people are aware of how to use existing water for horticultural farming purposes. Assistance in installing water networks in West Sumba and Southwest Sumba to utilize the potential water resources in the region. The river flow that crosses the two districts comes from water sources (springs) whose capacity is large enough to meet the water needs of most of the population. An overview of river flows in 4 districts on Sumba Island is presented in Table 3.

TABLE III. NAMES AND LENGTH OF RIVERS ON SUMBA ISLAND

No	Regency	Name of Rivers	Length of Rivers (km)
1	East Sumba	Payeti	70
		Wangga	50
		Kakaha	55
		Kambaniru	1.171
2	Center Sumba	Bewi	8
		Pamalar	6
3	West Sumba	Wanokaka	80
4	Southwest Sumba	Pola Pare	18
		Wai Ha	9
		We Wagha	10
		Wee Lambora	10
		Wee Kalowo	7
		Loko Kalada	16

Source: Central Bureau of Statistics (2023)

C. Human Resource Potential

The potential of human resources when viewed from a quantity aspect is not a significant problem for the development of horticultural agribusiness on Sumba Island. With a total population for one island of 768,824 people and a workforce of 317,962 people, the employment issue is actually not a significant problem. However, if seen from the quality aspect, the employment conditions on Sumba Island are quite worrying. This is because the majority of the population's graduates are elementary, middle school, some are high school and very few are college graduates. Existing conditions show that the percentage of labor absorption on horticultural land in each district is different. Data for 2024 shows that in 2023 the average proportion of labor absorption to the total population in East Sumba will only be 8%, meaning that only 8% of the total population will be absorbed in horticultural land. The average proportion of labor absorption to population in Central Sumba is only 5%, West Sumba is 6% and Southwest Sumba is only 2%. This condition shows that labor absorption in horticultural land is very small, while the number of unemployed is quite high. Until 2023, the number of unemployed in East Sumba Regency is 3.24% of the total workforce (112,963) or 3,547 people, in Central Sumba it is 3.81% of the 26,541 workforce or 1,010 people, in West Sumba it is 1.80% of the 50,505 workforce or 907 people and Southwest Sumba as much as 2.87% of the 127,953 workforce or 3,676 people. An overview of labor absorption on horticultural land and its average percentage of the total population and workforce is presented in Figure 2.

D. Horticultural Production Potential

Apart from land, water resources and human resources, the potential for horticulture development can also be seen from the production aspect. The existence of the production aspect shows that this commodity is suitable for development on Sumba Island. Even though production results tend to fluctuate, commodity sustainability needs to be maintained because the supporting factors are sufficient. Apart from that, people's need for this product is also high because fruit and vegetables are part of the basic needs components.

The horticultural commodities most widely developed on Sumba Island are fruits and vegetables. From the production aspect, fruit is a type of horticulture with higher production quantities compared to vegetables. Based on data for 5 years of analysis, namely 2018 – 2022, it is known that each district has advantages in certain types of fruit and vegetables. However, the fruits most widely grown on Sumba Island are bananas, mangoes and papaya. Meanwhile, the vegetables most widely developed are petsay, kale and spinach.

Based on research data, it can be seen that the fruits with the highest production over the past 5 years are bananas, jackfruit, papaya and mango. The highest banana production is from Southwest Sumba Regency, while the highest jackfruit production is in East Sumba. The highest papaya production is West Sumba while the highest mango production is Southwest Sumba. Avocados are also one of the favorite fruits but are quite rare on Sumba Island. Most avocado production comes from Central Sumba. Apart from avocados, oranges are also fruits that are popular with the people of Sumba, but their production is very small and most of them come from East Sumba.

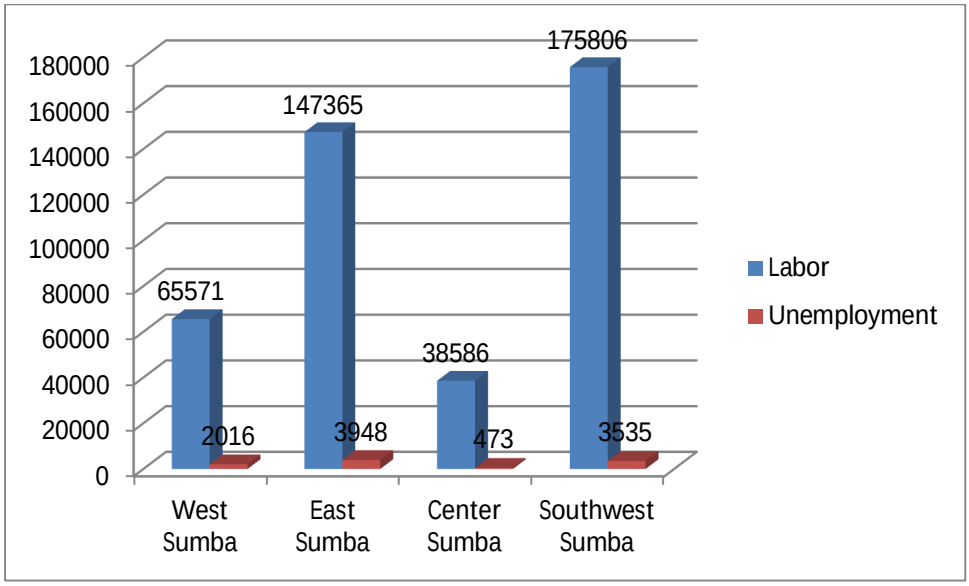

Figure 2. Population, Labor Absorption and Labor Force in Sumba Island
Source: Central Bureau of Statistics (2023)

Vegetables are the type of horticulture with the lowest production on Sumba Island. Even though the need for vegetables is quite high, production is very low. This is caused by farmers' limited knowledge and skills in terms of vegetable cultivation, inadequate technology and the absence of intense assistance from the government. Existing farmer groups are only formed for the interests of certain parties, they are even used for political interests, they are not utilized optimally for the interests of farmers (J. Vel & Makambombu, 2019). The development of vegetables and fruit in the form of agribusiness areas is an absolute choice to increase the amount of production. A horticultural area is an expanse of distribution of horticultural businesses that is united by certain binding factors, both natural, socio-cultural and artificial physical infrastructure factors.

This definition is outlined in Law Number 13 of 2010 concerning Horticulture. Furthermore, the horticultural agribusiness area is described as a geographical space that has a similar ecosystem and is united by the same infrastructure facilities to form an area that contains various horticultural-based business activities including the provision of production facilities, cultivation, post-harvest handling and processing, marketing, and various supporting activities (Saragih, 2007). The Directorate General of Horticulture began introducing horticultural development through the Horticultural Agribusiness Area (KAH) approach since 2007. This concept was designed based on the suitability of regional potential and is multi-commodity in nature. Apart from that, the suitability and feasibility of agro-ecosystems and inter-regional linkages are priorities in developing horticultural agribusiness areas. This aims to increase the income and welfare of farmers and society in general (Wijayanti et al., 2019).

Horticulture has been developed for a long time in many areas in East Nusa Tenggara, including on Sumba Island. However, development is still traditional, there is no network of cooperation between actors in a combination of regions with the same agro-climate. Apart from that, post-harvest commodity handling is also not optimal. Each farmer markets his agricultural products in traditional markets at very cheap prices. In fact, if seen from the production aspect, the potential for horticultural agribusiness on Sumba Island is very large.

Data collection on seasonal vegetable and fruit plants based on monthly reports from SPH-SBS in East Nusa Tenggara Province in 2023 (Central Bureau of Statistics, 2023b) provided data on 23 types of seasonal vegetable plants from the 25 types of plants surveyed. The data displayed is only limited to harvest area in hectares and production in tonnes. Of the 23 types of seasonal vegetable plants cultivated, there are 10 types of plants with the largest production, namely chayote, eggplant, cabbage, kale, tomatoes, cucumbers, cayenne pepper, spinach, green beans and shallots. Of the 10 types of vegetable plants, 3 types of plants were selected which were favored at the provincial level based on production, namely chayote with a total production of 25,379.1 tons, eggplant with 10,074.9 tons and cabbage with 8,654.4 tons.

E. Socio-Economic Conditions of Sumba Island

Sumba Island is one of the large islands in East Nusa Tenggara Province where the majority of the population works as farmers. The agricultural potential on this island is quite high both in terms of land, soil fertility level

and availability of human resources. Sumba Island consists of 4 districts, namely East Sumba, Central Sumba, West Sumba and Southwest Sumba. The districts with the largest land areas are East Sumba and Central Sumba. However, the highest population is in Southwest Sumba Regency. Until 2023, the population in Southwest Sumba will be 400,221 people, of which 30.66% will be poor. A comparative description of the number of poor people in 4 districts on Sumba Island is presented in Figure 3.

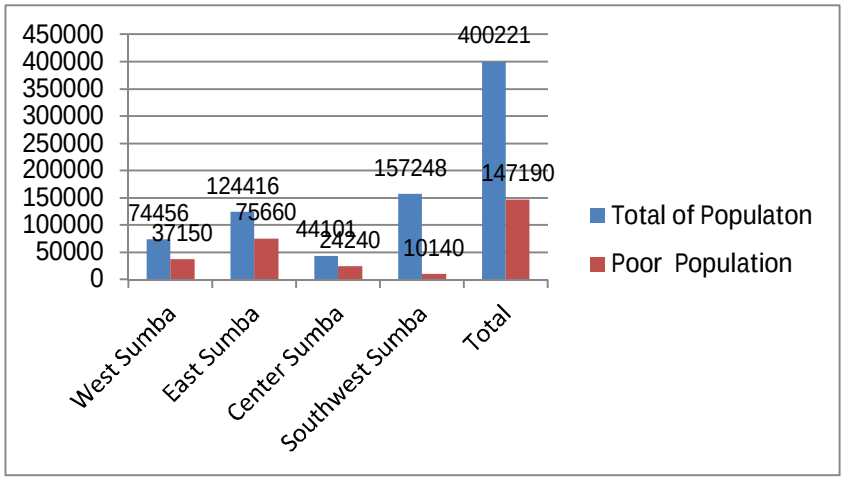

Figure 3. Total of Poor Population in Sumba Island
Source: Central Bureau of Statistics (2023)

Sumba Island is one of the areas in NTT that is still very rich in customs and many people still adhere to the original belief called Marapu (Ngongo & Ngongo, 2021). The Marapu belief places great emphasis on closeness to the Creator through living in harmony with nature. One form of harmony with nature carried out by followers of the Marapu belief is through certain rituals and taboos in farming activities. However, as time goes by, all these habits are starting to be abandoned, and more and more of the younger generation consider farming to be an uninteresting activity. The impact is an increasingly high level of poverty, the danger of food insecurity every year and the subsequent consequence is an increasing number of social problems that arise such as high levels of poverty and death, theft, robbery and even murder.

III. Conclusions and Recommendations

Based on the research results, it is known that the alternative policy that needs to be implemented in order to optimize the potential for developing horticultural areas on Sumba Island is to build a sustainable horticultural agribusiness area development model using a superior commodity approach. The big goal to be achieved in developing this model is to increase production value. Scenario interventions that must be carried out to increase production value are through expanding horticultural land, superior commodity land and increasing productivity. These three forms of scenario intervention in the development of sustainable horticultural agribusiness areas will be successful through agricultural mechanization efforts or the application of innovative technology. In a simple sense, agricultural mechanization can be interpreted as the use of agricultural tool and machine technology for various activities in agricultural production.

Agricultural mechanization is a broader science and technology domain than agricultural tools and machinery. Agricultural mechanization concerns all aspects of the application and development of techniques for food and fiber production for human welfare. The fields covered in agricultural mechanization are agricultural tools and machines (farm power and machienery), soil and water engineering, agricultural product processing (food engineering processing), waste and energy (agricultural waste and energy), agricultural buildings, agricultural electrification and instrumentation (instrumentation and electronics) as well as agricultural engineering systems.

The low value of horticultural production on Sumba Island is caused by low productivity and limited production land area. Therefore, the application of agricultural mechanization is expected to make a positive contribution to the expansion of horticultural land, superior commodity land and its productivity, which ultimately has an impact on increasing the growth of horticultural production. Horticultural production growth is reflected by the ability to increase total production of agricultural products in the form of physical quantity and economic value in one

period. Empirically, production in one period is shown by changes in the area of agricultural land that can be cultivated, the level of yield and the number of plantings in one year.

The role of technology in developing sustainable horticultural agribusiness areas on Sumba Island is related to increasing the coefficient of land area (ha), productivity (yield/ha) and n (number of plants per year). In this case, the expansion of horticultural planting areas (extensification) is expected to be achieved by expanding dry land, converting dry land to horticultural land and opening new agricultural areas. This is possible because the land on Sumba Island is still quite large. Meanwhile, increasing productivity is expected to contribute to agricultural technology in the form of land conservation techniques, fertilization, integrated pest control, efficient use through water management and micro water management techniques, efficient weld processing techniques, as well as harvest and post-harvest technology.

Apart from that, to increase the quantity and quality of intensification, water, seeds, fertilizer and other production inputs are the main factors. The development of horticultural agribusiness areas introduced by the Directorate General of Horticulture since 2007 is designed based on the suitability and feasibility of agro-ecosystems, linkages between development areas, similarities in economic infrastructure and is oriented towards increasing community income and welfare. This development concept must be carried out in an integrated manner through the application of innovative technology simultaneously and sustainably to guarantee production, product quality, continuity, supply, added value and competitiveness of horticultural commodities. For this reason, it is necessary to carry out an efficient and effective dissemination strategy to support the accelerated adoption of innovative technology in the region. The application of technology that will be carried out in the development of agri-horticultural areas on Sumba Island must be modified according to local socio-economic conditions to increase the usability of the technology.

Therefore, the development process requires the involvement of many related agencies to optimize overall technology performance. When providing technological support, it is necessary to pay attention to several aspects, including the type of technology to be developed, biophysical conditions, socio-cultural conditions, user communities, synergism of the agencies involved, and technology delivery systems. Information on all these aspects needs to be known and formulated in depth in order to develop strategies and plans for technology dissemination in the field. With systematic planning, the dissemination process can be carried out effectively and technology adoption can proceed quickly. Information on biophysical conditions is needed to determine the specifics of the land and agroclimate in the location that is the target for technology development.

Likewise, information about social culture is needed to determine the appropriate technology delivery strategy according to the habits and norms that apply in the target community. Meanwhile, information about aspects of institutional synergy is needed to make the technology delivery process effective and efficient according to the main tasks and functions of each agency through the use of natural resources available in each region.

REFERENCES

[1] Badan Pusat Statistik (Central Bureau of Statistics). (2023a). *Nusa Tenggara Timur dalam Angka (East Nusa Tenggara in Numbers)*. BPS Propinsi Nusa Tenggara Timur (BPS East Nusa Tenggara Province).

[2] Badan Pusat Statistik (Central Bureau of Statistics). (2023b). *Statistik Tanaman, Sayuran, dan Buah-buahan Nusa Tenggara Timur (Statistics of Plants, Vegetables, and Fruits in East Nusa Tenggara)*. S Propinsi Nusa Tenggara Timur (BPS East Nusa Tenggara Province).

[3] Borsellino, V. (2020). Agribusiness. In W. Leal Filho, A. M. Azul, L. Brandli, P. G. Özuyar, & T. Wall (Eds.), *Zero Hunger. Encyclopedia of the UN Sustainable Development Goals* (pp. 29–41). Springer International Publishing. https://doi.org/10.1007/978-3-319-95675-6_1

[4] Bowler, I. (2002). Developing sustainable agriculture. *Geography*, *87*(3), 205–212. https://www.jstor.org/stable/40573736

[5] Cambon, S., & Rachaputi, R. (2013). *Eastern Indonesia agribusiness development opportunities (EI-ADO)–analysis of legume value chains.*

[6] Law No. 22 of 1999 on Regional Administrations, (1999).

[7] Law No. 13 of 2010 concerning Horticulture, (2010).

[8] Kementrian Pertanian (Ministry of Agriculture). (2014). *Rencana Strategis Kementrian Pertanian 2015-2019 (Strategic Plan of Minisntry of Agriculture 2015 -2019).*

[9] Kumar, V. and Lata, M (Eds) (2022), "The Future of E-Commerce", Nova Science Publishers, USA, DOI: 10.52305/KMUB3774

[10] Lata, M., & Kumar, V. (2022). Security and privacy issues in fog computing environment. *International Journal of Electronic Security and Digital Forensics, 14*(3), pp. 289-307. https://doi.org/10.1504/IJESDF.2022.122588

[11] Lata, M., & Mittal, S. (2023). Social Media and Trust Management During the Pandemic. In *Pandemics in the Age of Social Media* (pp. 120-135). Routledge.

[12] Leha, E., Sutjahjo, S. H., Nurmalina, R., Anwar, S., & Kurniawan, R. (2018). Sustainability Analysis of Superior Horticulture Agribusiness Development in East Sumba Regency, East Nusa Tenggara Province, Indonesia. *Journal of Resources Development and Management*, *49*(1), 56–67. www.iiste.org
[13] Loizou, E., Karelakis, C., Galanopoulos, K., & Mattas, K. (2019). The role of agriculture as a development tool for a regional economy. *Agricultural Systems*, *173*, 482–490. https://doi.org/https://doi.org/10.1016/j.agsy.2019.04.002
[14] Maolani, D. Y. (2019). Strengthening Village and Village Government Towards Sustainable Development in the Framework of Increasing Community Community Welfare. *JISPO Jurnal Ilmu Sosial Dan Ilmu Politik*, *9*(2), 36–49. http://journal.uinsgd.ac.id/index.php/jispo/article/view/5113/0
[15] Mulyani, A., Nursyamsi, D., & Irsal, L. (2014). Percepatan Pengembangan Pertanian Lahan Kering Iklim Kering di Nusa Tenggara (Acceleration of Agricultural Development in Dryland with Dry Climate in Nusa Tenggara). *Pengembangan Inovasi Pertanian*, *6*(1), 187–198.
[16] Mulyani, A., & Suwanda, M. H. (2020). Pengelolaan Lahan Kering Beriklim Kering untuk Pengembangan Jagung di Nusa Tenggara. *Jurnal Sumberdaya Lahan*, *13*(1), 41. https://doi.org/10.21082/jsdl.v13n1.2019.41-52
[17] Narayana, C. B., & Ramadevi, S. C. (n.d.). Technology For Advancement Of Horticulture And Increased Productivity. *New Trends in Bilogical Science*, 108–124. https://www.uijes.com/Files/Papers/v4si1/17.Ch.ramadevi (108-124).pdf
[18] Ngongo, Y., & Ngongo, M. (2021). Marapu and Farming: How Tourism Shape Rural Development and Ancient Tradition of Sumba Indigenous Community - Indonesia. *E3S Web of Conferences*, *316*. https://doi.org/10.1051/e3sconf/202131604004
[19] Pekkerieta, E. J., Van Henten, E. J., & Campen, J. B. (2015). Contribution of innovative technologies to new developments in horticulture. *Acta Horticulturae*, *1099*(November), 45–54. https://doi.org/10.17660/actahortic.2015.1099.1
[20] Riptanti, E. W., Masyhuri, Irham, Suryantini, A., Irianto, H., & Widiyanti, E. (2021). Relationship of coping strategy with income by households of farmers cultivating dry land (A case study in food-insecure regency of East Sumba in East Nusa Tenggara). *IOP Conference Series: Earth and Environmental Science*, *905*(1). https://doi.org/10.1088/1755-1315/905/1/012022
[21] Saragih, B. (2007). Integrated rural development based on agribusiness in East Nusa Tenggara. *Proceedings of a Workshop to Identify Sustainable Rural Livelihoods, Integrated rural development in East Nusa Tenggara, Indonesia*, 32–35. http://aciar.gov.au/files/node/3367/pr126_pdf_78826.pdf
[22] Sodiq, A., Yuwono, P., Sumarmono, J., Wakhidati, Y. N., Rayhan, M., Sidhi, A. H., & Maulianto, A. (2019). Improving production system of beef cattle agribusiness. *IOP Conference Series: Earth and Environmental Science*, *250*(1). https://doi.org/10.1088/1755-1315/250/1/012050
[23] Vel, J. A. C., & Nugrohowardhani, R. (2012). *Plants for Power: the potential for cultivating crops as feedstock for energy production in Sumba* (Issue April).
[24] Vel, J., & Makambombu, S. (2019). Strategic Framing of Adat in Land-Acquisition Politics in East Sumba. *Asia Pacific Journal of Anthropology*, *20*(5), 435–452. https://doi.org/10.1080/14442213.2019.1670239
[25] Wezel, A., Casagrande, M., Celette, F., Vian, J. F., Ferrer, A., & Peigné, J. (2014). Agroecological practices for sustainable agriculture. A review. *Agronomy for Sustainable Development*, *34*(1), 1–20. https://doi.org/10.1007/s13593-013-0180-7
[26] Wijaya, M., & Amri, P. (2022). Sustainable Agricultural Policy Strategies to Support the Existence of Subsistence Agriculture in Lingga Regency. *Journal of Governance and Public Policy*, *9*(2), 137–147. https://doi.org/10.18196/jgpp.v9i2.14301
[27] Wijayanti, F., Carolina, Karim, M. A., & Sudaryanto, A. (2019). Coffee-based appropriate technology implementation for community empowerment: Lesson learnt from rural community in Sumba Barat Daya. *IOP Conference Series: Earth and Environmental Science*, *374*(1). https://doi.org/10.1088/1755-1315/374/1/012026