Social and economic analysis of food crops and beef cattle sub systems in the dry land area of Kupang Regency, East Nusa Tenggara Province, Indonesia

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Abstract. This study aims to analyze the system properties of food crop and beef cattle sub-systems in dry land area. The properties analyses are divided into two factors, namely the social and economic factors of both sub-systems. The study was conducted in Pakubaun Village in East Amarasi Sub District and Pukdale Village in East Kupang Sub District, Kupang Regency. The method applied was a survey method and the data was analyzed by using 5 (five) agro-ecosystem properties. Results of the research were the economic properties namely productivity of both subsystems were low to moderate, while, the stability of rice farming was low and the stability of the beef cattle enterprise was high. The sustainability of the two subsystems was high. Based on the social properties analysis, it was found that the equitability of food crops sub-system was low; on the contrary, the equitability of the beef cattle sub-system was high. From autonomy point of view, the results of this study indicated that the autonomy in both sub-systems was high. Based on agro-ecosystems properties, in general, the performance of both sub-systems was low, out of five properties only two properties described the high conditions.

Keywords – social economic analysis, food crops, beef cattle, dry land area, Kupang, East Nusa Tenggara.

1. Introduction

From the time of the new order to the reform era, the Indonesian government continued to pay important attention to the agricultural sector with the intention that villagers could achieve food and meat self-sufficiency. Self-sufficiency in food and meat programs in East Nusa Tenggara is approached with various development policies such as the development of food crops through the establishment of NTT as a corn province, and the development of livestock, especially beef cattle through the province's livestock program as a regional superior commodity [1]. However, these efforts have not been able to achieve the self-sufficiency program in this area. If explored further, it turns out that various factors are suspected to be obstacles to the development of the agricultural sector. Physical factors such as (1) geographic characteristics such as topographic patterns and climate behavior, (2) natural resource potential, and (3) procurement, utilization and development of natural resources. While non-physical factors such as (1) human resources, (2) institutional functions, and (3) farming technology.

Physical factors can be a driving factor in increasing farm productivity, but they can also be a factor inhibiting agricultural development in an area. On the other hand, non-physical factors, especially economic and social factors, knowledge and technological skills determine the choice of
organizing a farming system. A combination of physical and non-physical factors determines the type of land use. While the selection of the farming system that will be carried out is determined by non-physical factors.

The above factors are also limiting factors which cause various problems in the development of dryland farming systems, especially the development of food crops, and livestock sub-systems in the dry land area of West Timor. Kupang Regency as a part of West Timor experiences problems that are identical to the problems of the farming system in West Timor based on dry land with short and uneven rainfall patterns. In accordance with the existing physical conditions, in Kupang Regency, there are three types of dominant farming sub-systems, namely the rice field sub-system, the upland system, and the livestock farm sub-systems [2] [3].

The problem is each subsystem has different social and economic characteristics. In terms of the concept of agroecosystem, these differences are thought to have an effect on the characteristics of the farming system, in this case, the productivity, stability, sustainability, and equitability of each farming sub-system. So far, existing studies are still partial and there were no integrated and comprehensive studies to assess the nature of the system in the dryland area.

2. Research objectives

This study aimed at determining and analyzing (1) the economic properties such as productivity, stability, and sustainability of food crops (rice enterprise) and livestock farm (local beef cattle enterprise) and (2) the social characteristics of the two dominant farming sub-systems (rice field and local beef cattle subsystems) in Kupang Regency of West Timor.

3. Research methods

This research was carried out in Pakubaun Village, East Amarasi Sub District, and Pukdale Village, East Kupang Sub District, Kupang Regency. Determination of sample farmers was done purposively, in this case, farmers who at least have operated two types of sub-systems from the three predominant predetermined sub-systems. The number of sample farmers in this study was 40 households in Pakubaun village and 45 families in Oenesu village.

Data collection methods for cultivation techniques and economics are carried out by interview techniques based on the questionnaire. Whereas, social aspects of data and information are obtained by interviewing key informants who are considered to understand and know it in each village. The data was then analyzed using the agro-ecosystems approach through the analysis of system properties (emergent properties) namely Productivity; Efficiency, Sustainability, Stability (those are categorized as economic systems), Equitability, and Autonomy (both are social systems properties) [4] [5] [6]. This analysis was applied to both sub-systems namely rice field subsystem and livestock (beef cattle) subsystem in the study area.

4. Results and discussion

4.1. The general background of the research area

Pakubaun village is one of 9 dry land villages located at an altitude of 419 m above sea level with a gentle slope. Administratively, this village is incorporated in the Amarasi sub-district. The total area of 11.91 km2 is accompanied by a sloping topography to wavy with a slope of 15-25 degrees and even part of a hilly area with a slope of more than 30 degrees [7]. While Pukdale village is a dryland village based on rice fields with a height of 15 m above sea level with a slope of <150. Pukdale Village is included in East Kupang Sub district with an area of 9.38 km2. The farming system in the two study areas is rice farming, dry field, and livestock enterprise, especially beef cattle [7]. In this study, only two subsystems namely rice farming and livestock especially beef cattle enterprise subsystem were taken into account.
4.2. Analysis of Rice Farming Systems

Generally, farmers in dryland areas operate several branches or sub-systems of farming in accordance with the capabilities and potential resources they control. Because working on more than one sub-system is highly needed high-level managerial skills from farmers to regulate the allocation of resources that have a certain combination pattern in order to provide better and more efficient results. The following is an analysis of each sub-system in the two study areas.

4.2.1. Sub-system rice field analysis

Rice fields cultivated by respondents in both study areas are rainfed so that they are only planted once a year. The average area of rice field per respondent in Pakubaun village is relatively small, namely 0.37 ha of the head of the family with an average planting area of 0.35 ha with an average production of 996 kg or 2.846 kg per ha. Meanwhile, in Pukdale Village, the average area of rice field ownership is 1.05 ha with an average planting area of 0.96 ha. The average production of rice per-farm was 1,490 kg or 2,021 kg per ha.

4.2.2. Livestock subsystem

Livestock raising activities, especially local beef cattle, cannot be separated from farming activities for people in rural areas in Kupang Regency. The activity of raising cattle is a hereditary activity or an inherited culture. The average ownership of cattle in Pakubaun village was 8.02 Livestock Unit (LU) while the average ownership of cattle in Pukdale Village was 12.02 LU. All respondents in both research areas are keeping cattle for breeding and fattening purposes.

4.3. Analysis of system properties

4.3.1. Economic characteristics

4.3.2. Productivity

Rice Farming Sub System. The results of the study showed the average rice production per ha in Pakubaun Village and Pukdale Village was 2,846 kg and 2,021 kg respectively. If the average selling price at the farm level in Pukdale was Rp 4,450, then the average revenue (Gross output) was Rp. 12,664,700 in Pukdale village. Meanwhile, the average price of rice at Pakubaun Village was Rp 3,500 per kg then the average gross income of farmer was Rp. 7,073,000. Looking at the results of rice production in both research villages, the level of productivity of lowland rice is low although most farmers, especially in Pukdale, have used superior variety of seeds. The low productivity of rice subsystems is considered to be influenced by several factors, among others, (1) types of rice fields which are rain-fed land, (2) unfavorable tillage systems, (3) the improper use of fertilizers and pesticides which are not in accordance with the recommended dosage, and (4) pest attracts and stem borer pests, especially in Pakubaun village.

Livestock Sub System. The beef cattle business in the research area is still categorized as a non-commercial business. Therefore, there is no plan to sale so the sale in the form of breeders or fattening animals is not planned on a planned basis every year. Sales occur when there is an urgent need from the owner. From the results of this study, the sale of cattle in the year 2017 in Pukdale village totaled 2.75 LU with net income obtained Rp. 11,174,000. The results show that the productivity of beef cattle per LU is IDR 4,063,000. While, the sale of cattle in Pukdale Village per year is 2.06 LU with a total net income of Rp 8,912,000 or productivity per LU of Rp 4,300,000. This productivity value explains that the level of productivity of local beef cattle business in the study area is classified as moderate. Because, the level of productivity is actually still able to be increased if the farmers make changes to the maintenance system towards semi-intensive. In addition to the maintenance system,
that factors to influence the low productivity of beef cattle in the study area include, (1) the environment of livestock keeping, (b) the carrying capacity of feed, (c) the lack of synchronization of government policies in the livestock sector [2] [8].

4.3.3. Stability

Stability is the consistency of products produced by a sub-system in this case how changes or fluctuations in production result from changes in environmental factors. Analysis of the stability of the sub-system of paddy farming is based on this classification. However, to know this, production data is needed in several time periods.

Rice Field Sub System. Data on rice production trends in the required timeframe is very difficult to obtain due to the low memory of respondents and the absence of good farming records in the two study areas. Therefore, the measurement of the stability of lowland rice farming in the two study areas was only based on the interview with respondents. During the interview, respondent farmers explained their experience about farm production.

Interviews with respondents indicated that the nature of rice farming in both Pakubaun and Pukdale villages was low. Rice production in both villages varies greatly every year and it depends on rainfall. When rainfall is good and timely, the production is quite high and vice versa if the rain is erratic causing low production.

Livestock subsystem. From the interviews with respondents, it was understood that the stability of livestock enterprise in the study area was quite high. As, the production obtained from the subsystems was not influenced by climate conditions and was more determined by the skills of farmers in managing the livestock enterprise.

4.3.4. Sustainability

Sustainability is the ability of a subsystem to maintain a certain level of production in the long run. In other words, sustainability is the prolongation of the productivity of a sub-system in the long run from various disturbances in the form of pressure or shock.

Rice Field Sub System. In accordance with the concept of sustainability above, the nature of the sustainability of the rice farming sub-system in Pukdale and Pakubaun villages is high. Factors that support the nature of the sustainability of the rice farming sub-system are, (1) the average area of wetland land ownership, (2) the suitability of agrarian, and (3) the suitability of land with land use, and (4) the motivation of farmers to cultivate rice is quite good [9]. In addition to these three factors, namely (1) support from traditional factors, (2) the availability of supporting institutions for rice farming activities such as farmer groups, and (3) government policies on increasing rice production [10].

Livestock Business Sub-system. As in the rice farm sub-system, the nature of the sustainability of beef cattle business in both Pakubaun Village in East Amarasi Sub-district and Pukdale Village in East Kupang District was high. This is reasonable because of various supporting factors. The sustainability of cattle business was strongly supported by various factors such as, (1) Status and extent of land severity, (2) high adaptability of cattle to the environment, (3) carrying capacity of animal feed, (4) availability of agricultural waste as a source of feed, (5) customs and culture of the community, and (6) government policies in the livestock sector [2] [11].

4.3.5. Social characteristics

4.3.6. Equitability

Equitability refers to the distribution of production of certain sub-systems evenly or equitably. In other words, equitability shows the extent to which the results of an agroecosystem are evenly distributed to the community.

Rice Field Sub System. In general, the equitability of the rice farming sub-system is low because most of the populations in the two villages do not have paddy fields. However, the results of observations and interviews with respondent farmers in Pakubaun and Pukdale villages showed that
the equitability was quite high. Where 100 percent of respondent farmers in Pakubaun village own and cultivate their rice fields and 75 percent of sample farmers in Pukdale Village own and cultivate their paddy fields.  

Local Beef Cattle Sub Systems. Although the beef cattle enterprise subsystem is integrated with rice farming as a source of labor, a source of fertilizer and also a source of income [3][8][11]. The results of this study proved the equitability of the sub-system of cattle enterprise was relatively low because cattle business requires a large initial capital which is rarely achieved by small farmers who generally lack capital.

4.3.7. Autonomy

Although the beef cattle enterprise sub-system is integrated with rice farming as a source of labor, a source of fertilizer and also a source of income [3][8][11]. The results of this study prove that the sub-system of cattle enterprise was relatively low because farmers are generally lack of capital.

Rice Farming Sub System. Referring to the previous Autonomy terminology, wetland rice farmers in the study area have various roles, namely as managers, workers (cultivators) and sometimes as farm laborers. As a manager, especially in decision-making because farmers themselves decide and choose farming branches (plants and livestock) what will be sought in accordance with the availability of resources. Likewise, if there are technologies or innovations such as superior varieties, fertilizers, strains or breeds of livestock or other production technologies. Based on this concept of thinking, rice farming in Pakubaun Village is high.

Local Beef Cattle Sub Systems. In contrast to rice farming, cattle enterprise has a high degree of autonomy, such as in the selection of livestock, maintenance methods and the motive for raising livestock. When asked what prompted them to raise cattle, all respondents in Pakubaun and Pukdale villages stated that cattle raising was continuing the habits of their parents, inherited from parents, and following neighbors or friends from the village as well as from neighboring villages.

5. Conclusion

Analysis of the economic and social properties of the two subsystems of farming, namely rice farming and livestock enterprise using the agroecosystem analysis approach are as follows:

(1) Economic properties:

a. The Productivity of the rice farming subsystem in the Pakubaun village is low because the yields obtained are low at 2,846 kg and 2,021 kg per ha, respectively. While the productivity of cattle subsystems was moderate to high in all research areas in both villages.

b. The Stability of rice farming subsystems in the two villages was low. While, the stability of beef cattle subsystem in both study areas was high.

c. The sustainability property of rice farming subsystem in both study areas was categorized to be high. The sustainability category of livestock subsystems both in Pakubaun dan Pukdale was high as well.

(2) Social properties:

a. The equitability of the rice farming subsystems within the two villages was high. On the contrary, the cattle business subsystem in the two study areas was low. The low of stability occurred because the cattle husbandry system is extensive traditionally where the interventions the owner to their cattle husbandry is very limited.

b. The Autonomy category for rice farming subsystem in Pukdale was low, as the interventions of exogenous parties such as from agricultural extension worker and government policy through introducing inorganic fertilizers, exotic seeds, and other chemical matters.

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