Management strategies for leading sectors of fisheries, livestock and agriculture resources in supporting the economic of border household in the border between Indonesia and Timor Leste

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Abstract. The economic contribution in Belu Regency is dominated by fisheries, livestock and agriculture sectors. The purpose of this research is to find business contribution from the leading sectors of agriculture, livestock, and fisheries so as to provide economic benefits for the community, especially in the border area. The results of this study showed that the contribution and average percentage and income of each agricultural commodity was as follows: (1) corn (36%; IDR 3,365,500±567,948.52), (2) green beans (18%; IDR 1,725,250±481,375.43), (3) cashew nuts (16%; IDR 1,478,250±443,583.72), (4) sweet potato (13%; IDR 1,236,750±280948.93), (5) horticulture (9%; IDR 889,500±246,666.73), and (6) other plants (8%; IDR774,075±157,144.7), respectively. The contribution and average percentage and income of each livestock commodity as follows: (1) beef cattle (56%; IDR 10,478,750±5,097,956.73), (2) pigs (33%; IDR 624,4250±2,016,287.81), (3) goats (4%; IDR 765,750±12,812.87), (4) native chicken (3%; IDR 618,500±362,077.70), (5) other livestock (3% and IDR557,000±310,107.79) respectively. The contribution and average percentage and income of each fishery business as follows: (1) capture fisheries (66%; IDR 9,988,750±1,373,826.65), (2) fish processing (18%; IDR 2,715,500±1,482,630.04), and (3) other fisheries services (17%; IDR 2,513,500±1,180,551.94), respectively. It can be concluded that the superior agriculture commodities in the Belu Regency, livestock commodities and fisheries business commodities.

1. Introduction
National program in Indonesia for village strengthening and economic independence by mobilizing strategic domestic economic sectors has become a spirit for regional governments in planning their region's development by optimizing agricultural resources to improve the economy and prosperity of rural
communities [1]. Belu regency, as one out of 22 regencies in East Nusa Tenggara (ENT) Province, has nationally strategic value because it is a border regency that still faces various complex problems. It has a low human development index of 60, and the percentage of poor people reaches 15% in 2018. Belu regency's economy is still dominantly contributed by the agriculture, livestock, fisheries development of processed diversification of superior commodities such as corn, peanuts, cassava, and bananas and forestry sectors, namely 25% of the total GRDP of Belu [2]. This regency owned a lot of natural resources such as fisheries, agriculture plantations, livestock, and tourism, but the utilization of the potential of this area by the community is not optimal [3]. The high rate of poverty in the rural areas of the regency is not only caused by a scarcity of resources but also because the pattern of available resource management is not optimal, so the productivity of these resources is still low and has not encouraged the improvement of the welfare of rural communities [4]. Although the community had access to these resources, it did not have a significant effect on the welfare of the community; for this reason, efforts to optimize natural resources management are needed [5]. The challenge of development in the border area is to find a model for more optimal use of agricultural resources to provide economic benefits to the community, especially in border and rural areas. This research aims to find the management strategies through the leading sectors of agriculture, livestock, and fisheries resources to provide economic benefits for the community, especially in supporting the economy of border households in the border between Indonesia and Timor Leste in Belu Regency, ENT Province, Indonesia.

2. Materials and methods

2.1 Study area
The study was conducted in the Kakuluk Mesak sub-district, Belu Regency, ENT Province, Indonesia, for five months from March to July 2019. The geographical position of Belu Regency in the mainland of Timor is in the easternmost part and borders direct land along 149.1 kilometers and is on international crossing lines between Republik of Indonesia (RI) and Republik Demokratik Timor Leste (RDTL) [1].

2.2 Data collection and analysis
The study was conducted using survey methods through interview and observation techniques. The selection of respondents adapted to environmental conditions and the number of respondents to be taken, namely respondents who represent and understand the problems in the field. Determination of the respondents using the expert survey method [6]. Ninety respondents were taken purposively with the criteria of respondents are farmers, fishe rs, and breeder households that undertake economic activities. All data were collected and analysed by the mean, standard deviation, and standard error of the mean (SEM), then performed a descriptive-qualitative analysis to explain the phenomenon found in this study. The standard deviation formula is STDEV = \(\sqrt{\text{average}/(n1)}\), while the standard error of the mean (SEM) = \(\sqrt{(\text{SD}/n)}\) [5].

3. Results and discussion
The potential of natural resources in the border area, both inland and sea areas, is quite large, but so far, the management efforts have not been carried out optimally. Foreign exchange that can be extracted from border areas can be obtained from interstate trade activities. The efforts to optimize the potential of natural resources must be based on superior regional commodities. Belu regency has three leading sectors, namely agriculture, animal husbandry, and fisheries. Each sector has a large business contribution to the economy of the border regions of Indonesia and RDTL.
3.1 Business contribution of the leading sectors of agriculture, livestock, and fisheries

3.1.1 Agriculture sector. The agriculture sector in Belu Regency from 2013 to 2017 experienced an increase in agricultural production of 58.49% with the highest contribution from food crops such as corn, rice, cassava, peanuts, green beans, sweet potatoes, and soybeans. Types of fruits consist of bananas, mangoes, oranges, guava, papaya, jackfruit, and others. Horticulture plants are dominated by types of vegetables such as shallots, tomatoes, mustard greens, cayenne pepper, garlic, eggplant, long beans, spinach, spinach, cucumber, cabbage, and so on. The highest food crop production in Belu is corn, which reached 20,200 tons in 2018, while rice production was 20,111 tons; however, this number does not mean that corn productivity is higher than rice because the difference in production is fragile but the area of land planted is very far proportional. The planting area of corn in the Belu Regency is 8,133 Ha, while the paddy is only 5,280 Ha [2]. The contributions and average revenues of each agricultural commodity in the Kakuluk Mesak sub-district are presented in Table 1.

| Type of commodity | Corn  | Green beans | Sweet potato | Cashew nut | Horticulture | Other plants | Total revenue |
|-------------------|-------|-------------|--------------|------------|--------------|--------------|---------------|
| Contribution (%)  | 0.36  | 0.18        | 0.13         | 0.16       | 0.09         | 0.08         | 1.00          |
| Average           | 3,365,500 | 1,725,250 | 1,236,750    | 1,478,250  | 889,500      | 774,075      | 9,469,325     |
| STDEV             | 567,948.52 | 481,375.43 | 280,948.93   | 443,583.72 | 246,666.73   | 157,144.78   | 971,464.52    |
| SEM               | 126,997.15  | 107,638.82  | 62,822.09    | 99,188.33  | 55,156.36    | 35,138.64    | 217,226.07    |

Data in Table 1 showed that the dominant agricultural commodities contributing to farmer income from corn, green beans, cashew nut, and sweet potato are 36, 18, 16, and 13%, respectively. The high contribution of corn commodity to the revenue of farmers as a staple food after rice followed by green beans and cashew nut as they all well adaptive with dry land agroecosystems and become a potential source of nutrition for dryland communities in dryland conditions in the border between the RI-RDTL. The economic development of border communities can optimize the development of some agricultural commodities that are adaptive to dry land agroecosystems through improved management and technological innovation. This is in line with [6], who reported that the development of food crops is the main recommendation to improve food security that is still low, which is shown by cases of malnutrition (food insecurity), in addition to improving the welfare of people in rural areas with low purchasing power. Therefore, it is necessary to introduce superior seeds on time, including the procurement of agricultural production facilities (known as "saprotan") supported by the application of cultivation technology that optimizes the role of field extension agents (FEA) as a step to adopt agricultural technology. This is following [1] that the community itself can provide agricultural production equipment and facilities through the cooperative of the farmer's group (known as "Kelompok Tani").

The results of this study illustrate that in increasing the role of adaptive agricultural commodities in the border region, it must be done with land suitability (fertility), diversification of agricultural commodities, and improvement of cultivation technology. Input dryland cultivation technology through amelioration measures to improve soil quality by utilizing local resources that are in-situ and the priority of diversification of leading dryland commodities must be following the conditions of the regional agroecosystem, which is acceptable to the local community and can provide added value to farm income [1].
3.1.2 Livestock sector. One of the leading sectors for Belu regency is cattle livestock known as PRUKAB. The local people in Belu, who are generally farmers, are also supported by conditions conducive to raising livestock, making this sector a concern of the regional government of Belu Regency. Many programs and activities have been carried out during 2017 in order to develop this sector, including the procurement of pigs and cattle, vaccinations, paronization, and so forth. The types of livestock developed in Belu regency are divided into three types, namely large livestock consisting of cattle, buffalo and horses, small livestock consisting of pigs, goats and sheep, and poultry. The livestock sector in Belu regency contributed 141,863 spread across 12 sub-regencies. The largest livestock population is dominated by cattle amounting to 69,621 tails, followed by 56,712 pigs [2].

Cattle are dominated in the Belu livestock population and supported by vast natural grazing fields spread in 12 sub-districts. Pigs occupy the second-largest position of the livestock population because these omnivorous animals are indigenous in Belu, and they are the customary practices of indigenous peoples, and thus, the market demand for pigs is always increasing. Contributions and average revenues of each livestock commodity in Kakuluk Mesak sub-district are presented in Table 2

| Type of commodity | Beef cattle | Pig | Goat | Native Chicken | Other livestock | Total revenue |
|-------------------|-------------|-----|------|----------------|----------------|--------------|
| Contribution (%)  | 0.56        | 0.33| 0.04 | 0.03           | 0.03           | 1.00         |
| Average           | 10,478,750  | 6,244,250 | 765,750 | 618,500        | 557,000        | 18,664,250   |
| STDEV             | 5,097,956.73| 2,016,287.81 | 512,812.87 | 362,077.70   | 310,107.79   | 5,106,211.46 |
| SEM               | 1,139,937.78| 450,855.66   | 114,668.44 | 80,963.04    | 69,342.21    | 1,141,783.59 |

The results in Table 2 showed that beef cattle commodity provided the highest contribution to the livestock sector, especially in the household income of livestock farmers by 56% then followed by pigs of 33%. The high contribution of beef cattle in the border economy of the household indicated as a superior commodity and has been cultivated by the community hereditary and provable to adapt well to the dry land agroecosystem. In general, the contribution of beef cattle business on the island of Timor, especially in Kupang regency, ranged from 30-70% [6].

The research found that livestock commodities that were feasible to be developed in the border area were pigs as the commodity provable to provide the second-largest contribution after beef cattle. Indeed, pigs have great potential to be developed at the scale of farmers/breeder/fishermen households. Pigs in most areas of ENT Province, especially in rural areas, are very popular because the commodity of pigs has a role as traditional animals at various custom events [7]. The advantage of pigs as a choice of a business that can be developed, especially in rural households, including fishers because of their prolific, fast growth, and can use feed (feed conversion) is better than other livestock. Although technically, the pig business is efficient, it still faces capital constraints, disease, and lack of counseling, so that the efficient use of resources is needed [8].

The economic acceleration of border communities can be done through optimal management of cattle and pigs businesses as supported by [8] that the development of beef cattle and pigs is an appropriate alternative in increasing family income as well as a buffer for the household economy. The utilization of large pasture lands still opens opportunities for the development of livestock populations, as well as increasing the capacity of farmers' knowledge in livestock technology innovation. The integration of livestock and crops is an appropriate recommendation in improving the carrying capacity of feed, and on the other hand, compost can be used to improve soil fertility or the efficiency of using artificial fertilizers.
3.1.3 Fisheries sector. Industrialization of the marine and fisheries sector according to MMAF Regulation No.27/MEN/2012 is the integration of upstream and downstream production systems to increase the scale and quality of production, productivity, competitiveness, and added value of sustainable marine and fisheries resources. Fisheries production must have added value to meet market demand and be competitive. For this reason, innovation in the fisheries business is needed. Factors influencing the success of an innovative fishery business are the existence of derivative products, product processing innovations, product price competitiveness, the marketplace, and promotion.

Processing development is also expected to increase the value-added and create a variation of products to broaden the market and absorb labor. Fish processing can be done in various ways: salting, drying, smoking, fermentation, processing in low and high temperatures, and by-products processing [9]. The fisheries sector commodities in Belu Regency consisted of inland fisheries, pond aquaculture, and marine fisheries. The contribution of marine fisheries of 1,514 tons dominates fishery production in Belu Regency [2]. The capture fisheries commodities in Belu are dominated by large pelagic fish and small pelagic fish, followed by demersal fish, crustaceans, and mollusks; whereas inland fishery commodities consist of milkfish, catfish, tilapia, carp, tawes, etc.

The products from this sector, which are still in the form of raw products are sold to Atambua and sent to RDTL, while the processed products are done by groups of coastal communities that are fostered by the regional government of Belu Regency. In addition to processed shredded fish, coastal community groups dominated by women who work as housewives also make tuna jerky, presto milkfish, and also fish-based smoked meat [2,8]. The contributions and average revenues of each fisheries commodity in the Kalkuluk Mesak sub regency are presented in Table 3.

Table 3. Contributions and average revenues of each fisheries commodity (IDR/year)

| Type of commodity          | Capture fisheries | Fish processing | Other fisheries services | Total revenue |
|----------------------------|-------------------|----------------|-------------------------|---------------|
| Contribution (%)           | 0.66              | 0.18           | 0.17                    | 1.00          |
| Average                    | 9,988,750         | 2,715,500      | 2,513,500               | 15,217,750    |
| STDEV                      | 1,373,826.65      | 1,482,630.04   | 1,180,551.94            | 1,948,106.69  |
| SEM                        | 307,196.98        | 331,526.16     | 263,979.44              | 435,609.90    |

The highest contribution of the fisheries sector in Table 3 was obtained from the capture fisheries business, which reached 66%, followed by the fish processing industry of 18%. The high contribution of capture fisheries businesses can be understood because these businesses are the main livelihoods of fishermen in coastal areas. The source of income for fishermen households in Belu is fishing as the main livelihood, and another alternative business is grilled fish, shredded fish, and sea salt making [9]. The contribution of fish processing businesses is still low.

The low contribution of the fish processing business is due to the fact that the fish processing business is still carried out on a limited scale that is influenced by the availability of capital. The provision of capital, technical assistance and capacity building for fishermen organizations is needed in running a fishing business is in line with [10] that the institution that has the role of providing capital and production facilities in Belu is a community cooperative, while the company partners play the role of investment business capital [2,9]. On the other hand, coastal communities are known to prone to vulnerability arising from their nature of work. As they are mostly working as fishermen, natural hazards, isolation, and climate variabilities are often constraining their ability to obtain sufficient income to support their livelihood. Hence, finding a sustainable alternatives source of income is a sensible way to cope with such uncertainty and vulnerability [12].
The strategy of empowering coastal communities in improving their welfare must be carried out by encouraging alternative business programs (non-capture fisheries) in accordance with the condition of coastal area resources. The contribution of non-fishery business during the non-fishing season is needed to maintain the stability of fishermen's household income [9,10].

3.2 Management strategies for the leading sectors of agriculture, livestock, and fisheries

Table 4. Management strategies for the leading sectors of agriculture, livestock, and fisheries in Belu Regency

| Sectors             | Commodities          | Strategies                                                                                               | References |
|---------------------|----------------------|----------------------------------------------------------------------------------------------------------|------------|
| Agriculture         | Corn                 | 1. Expansion and improvement of the fertility of cultivated land                                         | [8,9]      |
|                     |                      | 2. Use of superior seeds                                                                               |            |
|                     |                      | 3. Corn processing in the form of corn chips                                                             |            |
|                     | Green beans          | 4. Expansion and improvement of cultivated land                                                          | [8,9]      |
|                     |                      | 5. Expansion of Belu Green Beans as an adaptive native variety of dry land                               |            |
|                     | Cashew nut           | 6. Expansion of cultivated land                                                                         |            |
|                     |                      | 7. Processing cashew nut                                                                                | [8,9]      |
| Livestock           | Beef cattle          | 8. Development of fattening and artificial insemination programs to produce quality beef cattle         | [6]        |
|                     |                      | 9. Utilization of local feed and agricultural waste as feed supplements/beef cattle concentrate at low prices |            |
|                     |                      | 10. Improvement and equity ownership of beef cattle the community                                      |            |
|                     | Pigs                 | 11. Improvement of local pig breeding through crossing with superior pigs                                | [7]        |
|                     |                      | 12. Development of an artificial insemination program using superior pig semen                           |            |
|                     |                      | 13. Development of the pork processing industry (known by the local name “Se’ i”)                       |            |
| Fisheries           | Capture fisheries    | 14. Provision of efficient fishing gear assistance for capture fishermen                                 | [8]        |
|                     |                      | 15. Capital facilities for developing business alternatives for non-capture fishermen                   |            |
|                     | Processing of fishery products | 16. Fish processing training for fisherman women for several processed products such as shredded, jerky, and smoked fish | [8] |
|                     |                      | 17. Capital facilities for fishery product processing businesses                                        |            |

In the mission of managing Indonesia's border areas, the national policies for developing of RI RDTL border areas are as follows: (1) increasing and maintaining security; (2) providing social and cultural border facilities and infrastructure for enhancing the socio-cultural relations of the two countries; (3) improving the socio-economic conditions of the community through community economic empowerment; and (4) increasing the availability of basic facilities and infrastructure for refugee and local communities; while the regional development strategy, namely (1) empowering border communities; (2) border institutional management; and (3) management of defense and security systems [1]. In realizing the improvement of the socio-economic conditions of the community through the empowerment of the border community economy, the acceleration of the rural economy can be done if all available potential resources are managed optimally through business diversification, the use of adaptive technological innovations, and growing productive economic efforts in the countryside as a locomotive of accelerating the independence of the rural and border economy.
The policy of the central and regional governments in developing the rural economy, including border areas, is to encourage the optimal management of local resources. This is in accordance with [9] that local economic development (LED) is basically an effort to make the most of resources, potential, and initiative in growing the economy and welfare of the people. In order to accelerate the implementation of LED, various instruments could be applied, one of which was a technology incubator with its main components being adequate and appropriate innovation support.

The strategies that need to be carried out in supporting the economy of border households in the border between Indonesia and RDTL in Belu Regency, require collaboration from various parties such as higher education institutions (universities/polytechnics), non-governmental organizations, community groups, cooperatives, banks, central and regional ministries/governments, technical institutions related to regional development [10]. Based on descriptive-qualitative analysis based on the results of in-depth interviews with respondents, there are 17 management strategies for superior commodities in Belu Regency summarised in Table 4.

4. Conclusions
The superior agriculture commodities in the Belu Regency: (i.e. corn, green beans, and cashew nut), livestock commodities (i.e. beef cattle and pigs), and fisheries business commodities (i.e. capture fisheries and fish processing). The contribution and average percentage and income of each agricultural commodity was as follows: (1) corn (36% & IDR3,365,500±567,948.52), (2) green beans (18% & IDR1,725,250±481,375.43), (3) cashew nuts (16% & IDR1,478,250±443,583.72), (4) sweet potato (13% & IDR1,236,750±280948.93), (5) horticulture (9% & IDR889,500±246,666.73), and (6) other plants (8% & IDR774,075±157,144.7), respectively. There are 17 management strategies for the leading sectors of agriculture, livestock, and fisheries in Belu Regency.

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