Partnership between sugar company and small farmer on sugar cane farming in dry climate area of Dompu District, West Nusa Tenggara Province, Indonesia

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Abstract. Dompu District locates in Province of West Nusa Tenggara that was characterized as dry climate. The climate change also contributed to exacerbating the effect of drought in that area. Sugar cane farming was introduced to this district on 2015 to supply sugar on east of Indonesia. This study aimed to describe the partnership between sugar company and small farmer on dry land sugar cane farming in Dompu District, West Nusa Tenggara Province. This research was conducted by interviewed informants of the officer of sugar cane farmer groups. The result shown that the type of partnership between sugar company and sugar cane farmer was pattern of plasma-nucleus. The sugar company as the nucleus of partnership gave a free technical assistant and sugar cane seed. Sugar cane farmer obligate to manage the farming according to instruction of technical assistant and financed sugar cane farming cost but seed, i.e. cost of worker, fertilizer, pesticide, transportation of sugar cane and cost of tractor rent. Sugar cane farming in dry climate land of Dompu District was able to contribute farmer family income.

1. Introduction
Indonesian sugar cane production in 2008-2017 tends to decline. In 2008 the national sugar cane production was 2,668,428 tons, in 2013 it decreased to 2,551,026 tons and again decreased in 2017 to 2,465,450 tons. The main factor that caused the decline in sugar cane production was the area of sugar cane production which did not experience adequate additions while productivity which still could not be improved. In 2017, the sugar cane planting area cultivated by state plantations, smallholder plantations and private plantations was 453,456 ha, while in 2008 it was 448,745 ha [1].

Sugar cane producers in Indonesia up to 2017 are still concentrated in Java, which was an area of 280,717 ha and Sumatra which was an area of 151,218 of the total national sugar cane production area of 453,456 ha. The main producer of sugar cane in 2017 is East Java Province, which accounts for 48.12% of Indonesian sugar cane production, then Lampung Province with a contribution of 31.19% and Central Java Province at 8.32% [1]. However, the development of land area in the main sugar cane producing areas, especially in Java, has decreased. East Java Province has decreased by 7.84%, Central Java Province has decreased by 21.11% [2]. This was caused by the area of sugar cane was cultivated in paddy fields that have to compete with rice commodity businesses.

To meet sugar needs, sugar cane plantations were developed on dry land. West Nusa Tenggara Province has plantation development potential of 665,314 ha, most of which have not been utilized, namely an area of 491,554 ha. West Nusa Tenggara Province is a region with a dry climate [3]. In 2015, sugar cane plantations began to be developed. In 2015 there was about 4,994 ha of sugar cane area in West Nusa Tenggara Province which was cultivated by 2,062 ha of community plantations and 2,932...
ha of private plantations [1]. Smallholder sugar cane farming in West Nusa Tenggara Province was developed in partnership with private companies. A study revealed farmers in relatively drier and hotter were currently abandoning existing crops as a response to climate change [4]. This study aims to describe the partnership between sugar cane farmers and private companies in dry climate land of Dompu District, West Nusa Tenggara Province and to analyze the farming profit and family income. It was expected that this study will provide consideration in re-allocating sugar cane planting areas in Indonesia in order to mitigate climate change especially in wet land area of Java.

2. Methods
Dompu District is an area of smallholder sugar cane farming development in West Nusa Tenggara Province. In 2015, smallholder sugar cane farming was cultivated by 2,325 farmers who cultivated sugar cane with an area of 2,062 ha [1]. In Dompu District a sugar cane processing factory has been established which is managed by a private company that partners with sugar cane farmers.

The data used was primary data obtained by interviewing to some informants and sugar cane farmers. The informants were administrators of sugar cane farmer groups, namely the Mada Oi mBai, Saringga, Kadindi Makmur, and Cempaka Sari Farmers’ Groups in Pekat Sub District, Dompu District. The data used was information relating to partnership between sugar cane farmers and sugar cane companies. Meanwhile the data of cost and revenue of sugar cane farming was taken by interviewing to 40 sugar cane farmers of the 4 farmer groups.

The calculation the farming profit was based on Moran [5]. Farming profit (\(\pi\)) was the total farming revenue (TR) minus total production cost (TC), \(\pi = TR - TC\). Total farming revenue was all receipts namely total sugar cane production (Q) multiplied by sugar cane price (P), \(TR = Q \times P\). While, the total cost (TC) was the fix cost (FC) plus variable cost (VC), \(TC = FC + VC\). Family income was the farming profit plus rents of farmer own land and wage of family labor.

3. Results and discussion
The partnership between sugar company and sugar cane small farmers was a plasma-nucleus partnership pattern. The plasma-nucleus partnership pattern was a relationship between farmers, farmer groups or partner groups with company that this company provided freely sugar cane seeds, technical guidance, tractor loans and transportation. Meanwhile, the partner group of farmers was tasked with fulfilling the other sugar cane farming inputs with accordance to the agreed conditions.

Free sugar cane seed was provided by company according to the area of land farming. The company provided technical assistance of sugar cane land management that was carried out by field assistant. The company guaranteed to purchase of sugar cane that met the quality standards, i.e.: age of sugar cane, stem height, stem quality, sugar cane variety, and free from sugar cane pests. The company provided some facilities such as tractor and trucks rent according to the technical guidance of field assistant. The use of this facility was charged to farmers and will be billed when the farmers deposit sugar cane to the company.

Nitrogen fertilizers, Composite fertilizers, Phosphate fertilizers must be purchased in cash to the sugar cane company according to the technical guidance of field assistant. Fertilizing labor was provided by the company and must be paid in cash together on fertilizer purchasing. Harvesting and transportation labor was also provided by the company, but was charged to farmers and will be billed when the farmers deposit sugar cane to the company.

There were differences in the implementation of partnerships in Dompu District with other places. The involvement of farmers in the management of sugar cane farming in Dompu District was less than in North Lampung District [6], and moreover to a developed trade pattern on shallot farmers in Majalengka District [7]. In managing sugar cane farming, farmers in Dompu District were in charge of preparing the land and paying for the cost of fertilizers and fertilizing labor costs. Sugar cane farmers were not involved in making decisions on the implementation of sugar cane farming. This was different to sugar cane farmers in North Lampung District, which were involved on farming plan, land processing,
planting, maintenance, and harvesting of sugar cane production [6]. This was related to Dompu farmer experience on sugar cane farming of 2-3 years, while farmer of North Lampung of over 30 years.

The production facilities that be used in partnership of sugar cane farming consisted of seeds, ZA fertilizer, SP36 fertilizer, NPK fertilizer, and pesticide such as Lindomin and Amigros. Other inputs were labor that consists of the family and nonfamily labor and fuel input, namely gasoline. Sugar cane farming costs can be divided into fixed costs and variable costs [5]. Variable costs of sugar cane farming in Dompu District include seed costs, ZA fertilizer, SP36 fertilizer, NPK fertilizer, pesticides, nonfamily labor, and transportation costs. While the fixed cost included the cost of family labor, depreciation of equipment, owned land rent, and tractor rent. The amount of the cost component of sugar cane farming in Dompu District is presented in Table 1.

Table 1. Total cost of production in sugar cane farming of 0.88 ha in Dompu District

| Kinds of production facilities        | Amount of cost (IDR) | Percentage (%) |
|--------------------------------------|----------------------|----------------|
| Fixed cost                           | 3,867,966            | 25.88          |
| Family labor                         | 40,833               | 0.27           |
| Depreciation of equipment            | 72,353               | 0.48           |
| Cost of land rent                    | 2,839,780            | 19.00          |
| Cost of tractor rent                 | 915,000              | 6.12           |
| **Variable cost**                    | **11,077,233**       | **74.12**      |
| Seeds                               | 808,000              | 0.00           |
| ZA fertilizer                        | 840,000              | 5.62           |
| SP36 fertilizer                      | 1,610,000            | 10.77          |
| NPK fertilizer                       | 1,400,000            | 9.37           |
| Pesticide                           | 170,400              | 1.14           |
| Non Family labour                   | 2,891,833            | 19.35          |
| Transportation                       | 4,165,000            | 27.87          |
| **Total cost**                       | **14,945,199**       | **100.00**     |

Note: a) is provided freely by the company, and be excluded from cost of production

Table 1 showed that the amount of the cost of sugar cane farming in Dompu on 0.88 ha was IDR 14,945,199 or IDR 16,983,180 ha⁻¹. Cost sugar cane partnership farming in dry climates in Dompu was lower than the cost of sugar cane farming in dry land non-intensive systems in Purbalingga which reached IDR 26,666,025 ha⁻¹ [8]. The cost of partnership sugar cane farming in Dompu District was also lower than the cost of partnership farmer of sugar cane farming in Deli Serdang District which amounts to IDR 20,747,422 ha⁻¹ [9].

The low cost of partnership sugar cane farming in Dompu District was due to the low rent of land, which was IDR 2,839,780 of 0.88 ha or IDR 3,227,022 ha⁻¹ and was also caused by the cost of seeds which was provided freely by the sugar company. If the cost of land rent and seed costs was included, the cost of sugar cane farming in Dompu was amount to IDR 13,754,422 ha⁻¹ were also lower than the costs of farming in Purbalingga that amount to IDR 15,166,025 ha⁻¹ [8]. The results of this study indicated that partnerships in dry climate land of Dompu District require lower costs.

Table 2. Revenue and benefits of dry climate land sugar cane farming of 0.88 ha

| Description                         | Amount   |
|-------------------------------------|----------|
| Amount of sugar cane production (kg)| 83,545   |
| Sugar cane price (IDR kg⁻¹)         | 250      |
| Total of revenue (IDR)              | 20,886,250|
| Total of cost (IDR)                 | 14,945,199|
| Farming profit (IDR)                | 5,941,051|
| Family income (IDR)                 | 8,821,664|

Note: Family income is farming profits plus family labor costs and land rent
Total production of sugar cane of 0.88 ha of dry climate land farming in Dompu was amount to 83,545 kg (Table 2) or 94,937 kg ha\(^{-1}\). The sugar cane production was higher than the sugar cane production of small farmer in the working area of PG Wonolangan in 2017, which amounted to 81,710 kg ha\(^{-1}\) and even found a large difference to production in dry land which was as much as 70,400 kg ha\(^{-1}\) [10]. Even so the production was lower than the production of sugar cane of wet land managed by PG Wonolangan, which is about 103 tons ha\(^{-1}\) [9], and also lower than the production of sugar cane in the wet land of farmer of PG Pakis Baru in Pati district, namely 97,826 kg ha\(^{-1}\) [11]. The sugar cane production was higher than the average production of Indonesia, even was higher than the average production of the world's main sugar producing countries [12].

The results of this study indicated that dry climate land sugar cane farming in Dompu District was able to produce more sugar cane than some other regions, especially those produced on dry climate land or dry land. Some of the factors that influenced sugar cane production include good farm management practices implemented by partnership farmers [13]. Local climatic conditions also affected to sugar cane production, unfortunately the sugar cane farming itself contributes quite high CO\(_2\) emissions, which is 2.4 tons equivalent to CO\(_2\) ha\(^{-1}\). The main contributors to the released CO\(_2\) of sugar cane farming were residue burning (44%), the utilization of synthetic fertilizers (20%), and fossil fuel combustion (18%) [12].

Sugar cane is an annual plant with a cultivating duration of around 11-12 months. In accordance with the partnership contract, sugar cane farmers in Dompu District sold all sugar cane produced to the sugar factory. The sale of sugar cane gave income of IDR 20,886,250 of 0.88 ha or IDR 23,734,375 ha\(^{-1}\). A different partnership model was applied by PG Pakis Baru Pati District, namely cooperation in processing sugar cane. In this partnership, the farmers obtained sugar and molasses sharing. It turned out that this partnership was able to provide better revenue, namely the partnership farmers of PG Pakis Baru obtained additional revenue of molasses amounted to IDR 3,228,258 ha\(^{-1}\) [11], even in PG Wonolangan farmers to obtain additional revenue amounted to IDR 3,801,600 ha\(^{-1}\) [10]. Due to production quantities lower than sugar cane production in Dompu, with partnership of processing of sugar cane in PG Wonolangan provided revenue of IDR 44,977,997 ha\(^{-1}\) [10].

Sugar cane farming in Dompu District had provided a family income of IDR 8,821,664 of 0.88 ha with a business period of around 1 year. When compared to the production of other annual crops that have been cultivated in Dompu District, the income of the sugar cane farming was higher than soybean farming income, which was amount to IDR 1,800,000 ha\(^{-1}\) for 4 months of cultivating [14], but lower than the corn farming income of IDR 5,149,094 ha\(^{-1}\) of 4 months cultivating [15]. To develop sugar cane farming in dry climate land in Dompu District, it can be suggested to improve the partnership model between farmers and sugar factory from the buying and selling partnership to the sugar cane processing partnership.

The West Nusa Tenggara Province region is an alternative to develop sugar cane plantations as substitute for the diminishing plantations region of Java. At the period of growth, sugarcane plants require a lot of water, while near to ripe and harvest period do not need a lot of water. As a hot and dry climate, sugar cane plantations in West Nusa Tenggara were necessary to adjust the planting period and system method to mitigate the impact of climate change [16].

4. Conclusion
The type of partnership between sugar company and sugar cane farmer was the pattern of plasma-nucleus. The sugar company as the nucleus of partnership gave a free technical assistant and sugar cane seed. Sugar cane farmers were obligated to manage the farming according to the instruction of technical assistants and financed sugar cane farming cost, i.e. cost of labor, fertilizer, pesticide, transportation of sugar cane and cost of tractor rent. Partnership sugar cane farming in dry climate land of Dompu District was able to provide alternatives to increase farmers’ income, but it still had the potential to be further improvement by change the cooperation model into partnership in processing sugar cane with the sharing of sugar products and molasses.
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