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INCREASING THE COMPETENCY OF CASSAVA FARMERS AS A REVITALIZATION EFFORTS OF TAPIOCA INDUSTRIES FOR FOOD PRIVATE REALIZATION

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ABSTRACT: Agriculture as a food-producing activity must be able to adapt to existing climate change to achieve sustainable food self-sufficiency. Cassava (*Manihot utilissima*) as a basic ingredient in making tapioca flour needs to be increased by one of them by holding empowerment to cassava farmers. However, before conducting empowerment there is a need to assess the prospects of farmers' welfare which are seen based on income and decent living needs or Kebutuhan Hidup Layak (abbreviate: KHL) of each farmer's family. The purpose of the study: To study the improvement of farmers' welfare after empowerment, it is necessary to have an analysis of pre and post empowerment cassava farming conditions. Survey research coupled with action empowerment on the job training model uses quantitative comparative statistical methods with research locations in Pati Regency. The results of the study show that the income of most cassava farmers (more than 88.57%) has not been able to meet the KHL, even though in terms of land tenure it has exceeded the minimum land requirement, which is 0.97 hectares. After empowerment (2017/2018) on the use of UJ5 varieties of seeds applied to double row planting and single row methods, there was a 12.6% increase in productivity or 34.2%. By replacing the cassava farming technique into a system following the above pilot plot, the welfare of farmers can be improved. if the agricultural system that has been empowered to farmers is implemented, with the assumed production costs the same, farmers' income will increase 59% of initial income.

Keywords: Tapioca industry, KHL, Cassava land, Revitalization, Food self-sufficiency

1. INTRODUCTION

Cassava is one of Indonesia's main agricultural commodities that has a great opportunity to be cultivated. This is because cassava grows easily in any area and with maintenance costs that tend to be cheaper compared to other types of crops. Besides cassava also has the potential for low crop failure unless the crop is damaged due to external factors (other than pests). As it is easy to grow and cassava is also the second staple food after rice, making cassava popular among Indonesian farmers. Besides, the needs of various food products made from cassava continue to increase by 8.9% per year. This is influenced by the growth of the domestic market which is the highest in ASEAN [1]. However in reality, from 2011 to 2016 there was a decline in national cassava production by 2.38% [2]. This decline in agricultural production certainly affects the welfare state of cassava farmers. The low production and productivity of cassava have an impact on the decline in income earned by farmers and the level of welfare. One of the parameters that can be used is the Decent Living Needs (In Indonesia: *Kebutuhan Hidup Layak*, abbreviate: KHL) where ideally the income must be greater than the KHL number.

The development of cassava farming is also supported by the potential of upstream-downstream human resources such as cassava farmers, *gaplek* craftsmen, and tapioca industries. However, due to the low selling price of cassava and with a long planting period (10 months) and the decreased quantity and quality of cassava, farmers often experience losses. As a result, tapioca industry owners as cassava-based downstream industries often experience shortages of cassava or *gaplek* from farmers.

Data from the BPS series of Pati Regency [3], cassava production increased by 27.3% in 2012 from 19,696 hectares harvested area, but showed a downward trend due to a decrease in harvested land area of about 9.27% (in 2014), and in 2015 it reduced by 14.95% (15,200 hectares of harvested land) affected the production of cassava to 661,976 tons or 231,691.6 tons of *grosok* (wet tapioca). With the threat of decreasing land area, an effort is needed to increase land productivity to maintain the availability of cassava and the sustainability of the tapioca industry. One of the efforts is through

empowerment that has been conceptually designed so that it can provide satisfying results. If it is studied extensively, the increase will affect the availability of national cassava and minimize national tapioca shortages.

From the description above, it can be formulated that the purpose of this study is; minimum land area for tapioca industry revitalization: cassava farmers in the household scale, regency scale, and provincial scale, application of science and technology on plot experiment use of double row planting and comparison of farming efforts after empowerment.

2. METHODOLOGY

This study took a sample of 65.04 ha of cassava farmland which was managed by 35 farmers in Tayu District, Pati Regency. Primary data is taken by interviews, observations, and direct documentation on the farmer and his farm. Data were then analyzed using quantitative analysis of comparative inferential statistics. This analysis aims to conclude by comparing the conditions of two or more data groups. The data to be compared is the ideal land area needed by farmers to meet the KHL with the area of land cultivated by farmers today. The second is the income of farmers before and after empowerment. Primary data used in the form of data directly from farmers and secondary data from BPS and other similar research.

The standard of living needs (KHL) of farmers is calculated from the minimum physical needs (KFM) plus additional living needs (KHT) of 150% KFM [4]. Based on the equivalent needs of one household rice. Meanwhile, to calculate the monthly income of farmers from cassava farming, namely by dividing the income 1 time of harvest with 1 time of cassava harvest (10 months).

3. RESULT AND DISCUSSION

Productivity figures are determined by land area and total cassava production produced by the land. Pricing is done by dividing total production in *Rupiah* with total production in tons so that the price of cassava per ton is obtained. This is done because of the dynamic nature of prices so the need for pricing based on data obtained.

Productivity in the land cultivated by 35 farmers as the research sample was 21,58 ton/hectar. This figure is not much different from cassava productivity in the Central Java scale, which is 23.673 ton ha^{-1} [5] (BPS, 2018a). According to Mashuri Cahyadi [6], Chairperson of the Cassava Pati Processing Association that for the Central and East Java areas, the area of land that can be planted by cassava plants is 18,259 hectares with a productivity level of 217.7 quintals per hectare.

Table 1. Production Conditions of Cassava Farmers in Pati Regency

Indicator	Unit	Value
Total Production	Ton	1,403.7
Total Area of land	Hectare	65.04
Productivity	Ton ha^{-1}	21.58
Total production in rupiah	IDR	1,168,683,000
Price of cassava per ton	IDR	832,600

Source: Primary Data Analysis, 2018/2019

3.1 Minimum Land Area for Tapioca Industry Revitalization: Cassava farmers in the Household scale, Regency Scale, and Provincial Scale.

3.1.1 Needs Fulfillment of the Area of the Household Scale

The decline in cassava production certainly affects the achievement of farmers' welfare, one of which is based on the standard of Living Needs (KHL). This standard was developed from the Minimum Physical Needs (KFM) figure, which was determined from the equivalent needs of rice per family and the price of rice that applies in units of time. KHL calculation results are used to place poverty and non-poverty criteria. Theoretically, it can be calculated using three approaches, namely the production approach, income approach, and expenditure approach.

The KHL calculation uses the rice exchange rate approach which according to Santosa [7], the minimum needs of the Indonesian people are 360 kg and 240 kg of rice-equivalent per person per year respectively for urban and rural areas. The estimation of the need for equivalent rice per person per year Pati Regency is taken from the middle value of the need for rural and urban equivalent rice which is 280 kg per year. According to Price and Commodity Information System in Pati Regency [8], an official website from the Central Java trade service shows that in July 2019, the price of rice in Pati Regency reached Rp. 10,000 per kg. Primary data obtained from 35 cassava farmers found that the number of family members spreads from 3 members to 6 family members per Head of Family (in Indonesia: *Kepala Keluarga*, abbreviate: KK)

Table 2. Sufficient Family Needs of Cassava Farmers in Pati Regency

Indicators	Unit	Number of family members			
		3	4	5	6
KFM per month	IDR	700,000	933,333	1,166,667	1,400,000
KHT per month	IDR	1,050,000	1,400,000	1,750,000	2,100,000
KHL per month	IDR	1,750,000	2,333,333	2,916,667	3,500,000
Minimum Land Area	ha	0.97	1.3	1.62	1.95

Source: Primary Data Analysis, 2018/2019

The amount of KHL is different in each family because the KFM calculation is greatly influenced by the number of family members. The more family members are supported, the greater the KHL that must be met. The KHL is also dynamic following the current price of rice. The minimum land area of cassava farmers is very dynamic from time to time because it is influenced by indicators that are also dynamic. The indicators are KHL, cassava price and productivity of agricultural land.

3.1.2 Minimum Land Area Regional Scale

According to the data, Pati Regency has 269 centers of processing cassava into tapioca flour. On average each industry can produce 900 tons of tapioca flour every day [9]. However, in reality, this is difficult to achieve due to a lack of cassava supply from farmers. This certainly affects the tapioca production and the supply of tapioca in Pati Regency. According to Muryani et al [10], revealed that each producing one ton of cassava produces solid waste in the form of 300 kg of cassava peels, 80 kg of pulp and 250 kg of tapioca flour. This means that only 25% of one ton of cassava can produce tapioca. In agriculture, the land is a major component as a medium for farming. To support productivity, the adequacy of the quantity of agricultural land must also be considered to meet the supply of raw materials in the downstream industry. As explained earlier, the shortage of cassava supply in the tapioca processing industry is also influenced by the lack of cassava farming in the Pati Regency. This can be proven by the following calculation.

Table 3. Calculation of Minimum Land Area for Pati Regency Scale

Description	Formula	Number
Number of cassava processing industries in Pati regency (Unit)	A	269
Production capacity per industry unit (Ton)	B	900
tapioca production capacity in Pati Regency (Ton)	C = A*B	242,100
Tapioca production in 1 ton of cassava (Ton)	D	0.25
A Minimum cassava needs in Pati district (Ton)	E = C/D	968,400
Cassava Agriculture Productivity in Pati Regency according to BPS (Ton ha^{-1})	F	43.551
Minimum area of cassava farming in Pati regency (Hectare)	G = E/F	22,236

Source: Primary Data and Secondary Data Analysis, 2018/2019

If referring to the productivity figures of cassava released by BPS, which is 43.551 ton ha^{-1} [11], then the minimum area of regional scale in Pati Regency is 22,236 Ha.

If it is compared to the cassava harvest area according to BPS it is very different. According to BPS data [11], the harvested area of Pati Regency is only 15,200 ha. This area only covers 68.36% of the minimum land area of cassava agriculture to meet tapioca production in the district itself. This figure is obtained if the productivity per one hectare of land is 43.551 ton ha^{-1} [11].

3.1.3 Minimum Provincial Land Requirement

Central Java Province is one of the provinces with the largest cassava production in Indonesia. According to the National Cassava Outlook 2016 [2], Central Java Province ranks second by contributing 16.31% of the national cassava production. In the calculation of the provincial minimum land area, this study assumes that all residents in the area consume cassava, so the approach taken is through repopulation. The population of Central Java Province in 2017 in 17,023,243 people [5], and in the 2016 National Cassava Outlook states that the prediction of cassava per capita consumption for 2016-2020 is estimated to reach a per capita consumption rate of 2.82 kilograms per capita per year [2]. By calculation, the minimum land area scale in Central Java can be seen in the following table.

Table 4. Calculation of Minimum Land Area Scale in Central Java Province

Description	Formula	Number
the total population of Central Java Province 2017	A	17,023,243
Consumption of cassava / capita / year (kg)	B	2.82
Consumption of cassava in Central Java (Ton)	C = A*B	480,055.5
Cassava Productivity in Central Java (ton ha^{-1})	D	23.673
The productivity of empowerment results (ton ha^{-1})	E	34.2
Minimum land area for cassava farming in Central Java	F = C÷D	20,778.6

Source: Primary Data and Secondary Data Analysis, 2018/2019

Theoretically, based on the population approach, the Central Java province needs 480,055.5 tons of cassava per year to meet the cassava consumption of its population. If using the productivity figures of cassava released by BPS is 23.673 ton ha^{-1} [5], then the minimum land area of the regency scale is 20,778.6 Ha.

Furthermore, if productivity is increased, the Minimum Land Requirement will also be less. When compared with the harvested land area of Central Java Province, which is 150,874 hectares, this figure is much smaller than the actual situation. Central Java Province according to the mathematical calculations that have been done has met the minimum land requirements to produce cassava in meeting the consumption needs of cassava residents.

3.2 Application of Science and Technology on Plot Experiment Use of Double Row Planting

This study was conducted in Margoyoso District, Pati Regency. One of the cassava varieties originally cultivated by farmers is the Margona variety using dense planting (70 x 80 cm) and the number of seedlings which is 18,000 plants/ha. From this variety, farmers can only produce 18-22 ton ha^{-1} [12]. Moving from this number, it is expected that through empowerment it can improve the productivity and welfare of cassava farmers. The material for empowerment is one of the cultivation techniques that can be a solution for increasing the productivity of cassava by using a double row planting system.

Empowerment was done by replacing seedlings into UJ 5 (Cassesart) and with a double row system. It was predicted that this variety can reach 30-45 ton ha^{-1} with a total of 1,150 seedlings per 0.1 hectares of land. Planting in a pilot plot was carried out in early October 2018, harvested in July 2019. Quantitative experiments with one treatment (single) was applied to estimate how far the difference in double row planting patterns compared to the single pattern in land plots in increasing production with assuming the age (cycle) of cassava or harvested after 10 months, continued processing for 1 month, then the next planting time remains at the beginning of the rainy season.

The selected varieties in this empowerment are UJ-5 (Cassesart) which according to Radjit [13] this type with starch content of 23.27%, while according to Lampung Research and Development reach around 45-60%. The climate in the tropical Pati District is type Am (tropical monsoon = a climate with only a short dry season) based on the Köppen-Geiger system. The average temperature is 27.1 °C and the average precipitation is 1,876 mm. Therefore, the variety of UJ-5 is suitable to be planted in Pati Regency.

Source: Primary data, 2019

Fig. 1. Cassava Harvesting from Pilot Plots

3.3 Comparison of Farming Efforts After Empowerment

In the upstream Human Resources (cassava farmers) implementation was continued through the use of UJ 5 (cassesart) seedlings which applied the double row planting method to a pilot plot of 0.1 ha plot. The area of land produced 3.42 tons of cassava. Referring to the initial productivity of cassava farmers, which was 21.58 ton ha^{-1} has now increased to 34.2 ton ha^{-1}. That is an increase in the production of every 0.1 hectares by 1,262 tons or has been increasing by 40%. The increase occurred because of seedlings replacement, planting methods, and the number of seeds used.

Table 5. Cassava Harvesting on Pilot Use Plots Cassava Seeds (UJ5) in Pati Regency

Application of Science and Technology	Initially	Empowerment
Seeds	Margona	Cassesart (UJ5)
How to plant	tight planting with a spacing of 70 x 80 cm	*the double row* that is 80 cm dan 160 cm
Number of seeds	18,000 seeds/ha.	1,150 seeds/ 0.1 ha.
Land area	0.1 ha	0.1 ha
Production	18-22 ton ha^{-1}	34.2 ton ha^{-1}.

Source: Primary Data Analysis, 2018/2019

Changes in land productivity will certainly affect the income of farmers, wherewith increasing productivity, income will also increase. With the same land area and price and it is assumed that production costs are the same, then the change in income can be seen in the following table.

Table 6. Comparison of Farming Business Conditions Before and After Empowerment

Indicators	Unit	Values	
		Before	After
Productivity	ton ha^{-1}	21.58	34.2
Land area	ha	65.04	64.05
Production	IDR	1,403.7	2,190.51
Price	IDR	832,600	832,600
The income per household 1 planting season	IDR	21,350,800	52,109,104
The income per household per month	IDR	2,135,080	5,210,910

Source: Primary Data Analysis, 2018/2019

Judging from the total production, there was an increase of 56% of the total initial production so it also affected the income of farmers. With the production costs assumed to be the same, the farmers' income, which was IDR 2,135,080 at first, increased 1.4 times to IDR 5,210,910. If the income is compared with the KHL that must be met, the farmers have been able to meet the KHL and can invest with the remaining money. By replacing the cassava farming technique into a system following the above pilot plot, the welfare of farmers can be improved

4. CONCLUSION

The average productivity of cassava from 64.05 hectares of land managed by 35 farmers is 21.58 ton ha^{-1}. This figure is not much different from cassava productivity in the Central Java scale, which is 23,673 ton ha^{-1} [5]. The 35 farmers have some of the family members from 3 to 6 people where in mathematical calculations, the KHL of each farmer is different. The more supported family members, the greater the KHL that must be met. The KHL is also dynamic following the current price of rice. The minimum land area of cassava farmers is very dynamic from time to time because it is influenced by indicators that are also dynamic. The indicators are KHL, cassava price and productivity of agricultural land.

Referring to cassava productivity figures released by BPS, which is 43.551 ton ha^{-1} [11], then the minimum area of regional scale in Pati Regency is 22,236 ha and the harvested area of Pati Regency is only 15,200 ha. This area only covers 68.36% of the minimum land area of cassava agriculture to meet tapioca production in the district itself. Based on the population approach, the Central Java province needs 480,055.5 tons of cassava per year to meet the cassava consumption of its population. If using the productivity figures of cassava released by BPS is 23.673 ton ha^{-1} [5], then the minimum land area of the regency scale is 20,778.6 Ha.

Empowerment was done by replacing seedlings into UJ 5 (cassesart) and with a double row system with a total of 1,150 seedlings in 0.1 hectares of land. Of the area of land produced cassava is 3.42 tons. Judging from the initial productivity of cassava farmers, which is 21.58 ton ha^{-1} has now increased to 34.2 ton ha^{-1}. That is an increase in the production of every 0,1 hectares by 1,262 tons or an increase of 40%. With assumed the production costs to be the same, the farmers' income, which initially was IDR 2,135,080, increased 59% to IDR 5,210,910. If this income is compared to the KHL

that must be met, the farmers have been able to meet the KHL and can invest with the remaining money.

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