



Clustering Patterns of Food Crops to Increase Community Income in Papua Province

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Abstract. Sweet potato is a potential commodity in Papua Province, but so far, it has only provided traditional benefits and has not been able to contribute significantly to the agricultural sector and the economy. To address this, a pilot model for the development of the sweet potato processing industrial cluster is needed. This model will help interested parties to see the development model being applied, and it will provide optimal benefits. The development of industrial clusters for superior sweet potato products in Papua Province has the potential to diversify the economy and increase the selling value of the community. The two clusters that have been formed are small-scale, farmer-level based sweet potato industry clusters and medium-scale sweet potato industrial clusters. Both clusters need the support of policymakers, banks, and the assistance of researchers and extension workers to support the process from cultivation, post-harvest to processing into sweet potato flour. To increase sweet potato production, it is necessary to extend the land and increase public interest in planting sweet potatoes. Farmers should also receive fair prices so that they do not experience losses. The Department of Trade and Agriculture should monitor market prices, especially for sweet potato commodities, to ensure that farmers receive fair prices. In summary, the development of sweet potato processing industrial clusters has great potential in Papua Province to diversify the economy and increase the selling value of the community. However, it requires the support of policymakers, banks, and the assistance of researchers and extension workers to achieve optimal benefits.

Keywords: Clustering Patterns, Food Crops, Increase, Community Income.

1 Introduction

Local food in Indonesia has an important role in realizing national food security [1], but Indonesia is not a country that produces wheat which is the raw material for making wheat flour. Therefore, the government through the Regulation of the Minister of Home

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Affairs Number 9 of 2014 concerning guidelines for the development of regional superior products, encourages the growth of regional superior products [2], which are products in the form of goods and services, produced by cooperatives, small and medium scale businesses. Small and medium-scale businesses have the potential to be developed by utilizing all the resources owned by the region, both natural resources, human resources, and local culture based on innovation interaction [3], [4] and startups [5]. Small and medium-scale businesses have the potential to bring in income for the community [6], [7] and the government which is expected to become an economic force for the region and the local community as potential products that have competitiveness [8]–[11], marketability [8]–[10], [12]–[16], and impetus towards and can enter the global market. In line with this, Presidential Regulation Number 22 of 2009 concerning the Policy for Accelerating Diversification of Local Resource-Based Food Consumption emphasizes the importance of developing food products that are more diverse both in terms of production and supply as well as consumption. The operation of the Presidential Regulation was then followed up with the regulation of the Minister of Agriculture Number 43/Permentan/OT.140/10/2009 concerning the Movement to Accelerate Diversification of Food Consumption Based on Local Resources. These efforts can be carried out through a diversification program both in terms of commodity production, product development, consumption, and its ability to increase farmers' income. Then the development policies and directions implemented in Papua Province refer to the policies and development directions handed down by the central government nationally. One of the breakthroughs made by the central government towards the regional government of the Province of Papua was the issuance of the regulation of the Minister of Industry of the Republic of Indonesia Number 140/M-IND/PER/10/2009 concerning the roadmap for the development of leading industries for the Province of Papua, one of which is the sweet potato processing industry into flour batatas, biscuits, instant noodles, and snacks.

Sweet potato (*Ipomoea batatas* (L.) Lam) [17]–[21] is a strategic food commodity because it contains a source of starch, and is a staple food in Papua. Sweet potato is a traditional special food to meet food needs, to the development of special foods. However, agricultural [16], [22] development has been going on for quite a long time, and traditional agricultural activities (subsistence and concoction) are still dominant among indigenous people who inhabit coastal areas, river mouths, swamps, valleys, and mountains in Papua.

Papua, which is a central region and the second largest producer of sweet potato commodities in Indonesia, also plays an important role, namely economic and social value. Even though it is the province with the largest producer of cassava products, the potential for sweet potato in Papua Province to date has only provided traditional benefits as the second staple food after rice/sago and has not yet provided benefits for improving the economy [8], [10], [16] of the people of Papua. To obtain optimal benefits, a pilot model is needed for the development of the sweet potato processing industrial cluster [23] so that all parties interested in the development of this commodity have a direct reference to the sweet potato development model. The development of regional superior commodities is a strategy that is expected to be the main driver for economic

growth. Efforts are made through an industrial cluster approach which is a comprehensive/cross-sectoral/holistic study with a pattern of sustainable development and development based on capacity and capability [24].

The goal to be achieved in this study is to get an overview of sweet potato superior products in Papua Province, in an industrial cluster. The target that is expected to be achieved is through the application of this development model, the community will benefit from the potential economic benefits of sweet potatoes in various products and have sales value to improve the community's economy.

2 Method

The description of this study is to formulate policy recommendations for the development of industrial cluster models for sweet potato products in Papua Province based on a qualitative approach through Focus Group Discussions. Assumptions with Focus Group Discussion [25] target to a) explore important and more in-depth information; b) stimulate new ideas and concepts; c) interpret evaluation results better; 4) study the behavior and desires of society. The locus of study was carried out in Keerom Regency, Papua Province, Indonesia with the argument that there are ten hectares of land for planting sweet potatoes, and there is already a machine unit for processing sweet potatoes. The analysis was carried out by describing the results of observations and observations at the study locus. The sweet potato handling mechanism is based on the sweet potato development roadmap concept.

3 Result and Discussion

3.1 Development of Sweet Potatoes as a Local Food Source

In efforts to diversify food by utilizing local food ingredients, sweet potatoes are one of the solutions to reduce dependence on rice and wheat. About 89% of sweet potato production in Indonesia is used for food, the rest is for animal feed and industrial raw materials. Sweet potato agro-industry development has good prospects. Processing technology into various products, both for household businesses [25]–[27], and small and large businesses, is available. Apart from being economically profitable, some of the processing can utilize small tubers that have not been utilized so far. The development of sweet potato processing can be carried out with a partnership system [28] between small/medium scale industries (SMEs) [8], [10], [12], [13], [29]–[33] and large industries by involving all stakeholders from farmers to processors to obtain raw materials and processed products that are guaranteed quality [34], [35] and can compete in the market.

Character and potential of sweet potato (*Ipomoea batatas* L.), One of the food crops that can be used as a substitute for flour is sweet potato. Sweet potato (*Ipomoea batatas* L.) is a type of tuber that has many advantages compared to other tubers and is the fourth largest source of carbohydrates in Indonesia, after rice, corn, and cassava [36]. Besides being able to be processed into various kinds of processed food, sweet potatoes

are also a source of foreign exchange for the country and Indonesia is one of the main exporters of sweet potatoes in the international market. Sweet potato plants can be cultivated both in lowland and highland areas [37]. Sweet potato has enormous potential as a raw material for the food industry.

Sweet potato has a big role in agricultural development so the prospects are very bright if it is managed and developed with an agribusiness pattern. In developed countries, sweet potato is used as a raw material in various industrial activities such as the fermentation industry, the textile industry, the cosmetic industry, the pharmaceutical industry, the food industry, and the manufacture of syrup. Sweet potatoes can be processed into various products such as flour, candy, chips, snacks, and fructose sugar. Sweet potatoes can also be used as a raw material for processed foods such as noodles and bread. Sweet potatoes can also be packaged in the form of a paste which is used as a raw material for the food and beverage industry.

Sweet potato is a tuber commodity that is easy to cultivate in Papua because this commodity has been hereditary and related to the customs of the local community [38] so for some local people, sweet potato cultivators call this plant a "mama" plant [39]. Sweet potato is easy to cultivate, supported by land resources and skilled human resources so in the future sweet potato has bright prospects to be developed to support the regional economy.

The results of the study [40], that some sweet potato cultivars are intended for food sources, especially those that have high yield, have a high dry matter content with good taste and as a source for animal feed contain low dry matter and taste bad because of high water content. relatively high. The results of other studies concluded that the Papua Pattipi cultivar gave the highest tuber yield, reaching 20.78 t/ha. The other best cultivars are Papua Sollosa, Sawentar, Dosak-2, BB-20413.13, Ungu, Cangkuang, Helaleke, Numfor-4, and Aerani-3 with a tuber yield range of 11.9–18.8 t/ha, recommended as a food source [39]. Furthermore, the local cultivar (Bramwamrum) from Manokwari had the highest dry matter content of 36.5%, followed by cultivars Helaleke (36.1%), Dosak-1 (35.9%), Papua Patipi (35.9%), Dosak- 2 (35.6%), Cangkuang and Ayamurasaki (35.5%), Ungu (35.2%) and the Papua Solosa cultivar (34.6%). Therefore, cultivars with high yields have the potential to be used as a source of raw materials for sweet potato flour. Sweet potatoes, next in [41] generally contain 59-69% water, 0.26-1.42% fat (DK), ash 0.68-1.69% (WW), protein 3.71-6.74% (WW), and carbohydrates 91.42-93.45% (bk). This composition proves that sweet potato is classified as a very potent energy source to be developed in a variety of food functions. 100 g of sweet potato contains various vitamins namely vitamin B1 (0.08 mg), vitamin B2 (0.05 mg) vitamin A (7100 IU), vitamin C (20 mg), and vitamin B3 (0.09 mg). Purple sweet potato contains anthocyanin of 61.85 mg/100 g and the anthocyanin content in purple sweet potato can be reduced when it is processed, but the resulting product still contains anthocyanin as a source of antioxidants [42]. Yellow sweet potato has a high beta carotene content of 2900/100 gr tubers [43] and the beta carotene content functions as a source of provitamin A for eye health.

Sweet potato flour has several advantages, including 1) it is more flexible in the development of food products and nutritional value, 2) it has a longer shelf life so it is useful as a provider of industrial raw materials, and is considered important because it

causes more stable prices, 3) creates industries at the village level and provide added value to income [44], [45] and improve product quality [34], [35]. Some research results state that sweet potato flour can be used as a mixed ingredient in the manufacture of various food products including noodles, vermicelli, various pastries, cakes, and plain bread. Processing sweet potatoes into flour is one way that can be done to reduce the use of wheat flour. Some preparations derived from sweet potato flour, among others, are white bread, steamed cakes, buns, sweet potato noodles, sweet potato jam, sweet potato sticks, sweet potato ice cream, and sweet potato sauce.

To increase the protein content, sweet potato flour can be mixed with legume flour (composite flour). Sweet potato agro-industry development has good prospects. Processing technology into various products, both for household businesses, and small and large businesses, is available. Apart from being economically profitable, some of the processing can utilize small tubers that have not been utilized so far. The development of sweet potato processing can be carried out with a partnership system between small/medium scale industries (SMEs) and large industries by involving all stakeholders from farmers to processors to obtain raw materials and processed products that are guaranteed quality [34], [35] and can compete in the market.

Based on an explanation of the potential of land resources, potential human resources, and available technology or innovation [13], [14], [46], there is an opportunity to make sweet potato commodities as raw materials to support "the development of industrial clusters of regional superior products in Keerom Regency.

3.2 Industry Cluster for Main Products of Sweet Potato

Agricultural development is an integral part of national development with one of the objectives being to increase farming productivity and the added value of agricultural commodities to increase farmers' income to create a prosperous society. The role of the agricultural sector in terms of providing food, industrial raw materials, increasing foreign exchange earnings, creating jobs, and increasing farmers' income has demonstrated the ability of this sector as a leading sector as well as the foundation of national development.

The development policies and directions implemented in Papua Province always refer to the policies and development directions handed down by the central government nationally. One of the breakthroughs made by the Central Government to the Regional Government of the Papua Province was the issuance of the Regulation of the Minister of Industry of the Republic of Indonesia Number 140/M-IND/PER/10/2009 concerning the Guide Map for the Development of Leading Industries in the Province of Papua, one of which is Industry Processing of Sweet Potatoes/Batatas into batatas flour, biscuits, instant noodles and snacks in Keerom Regency.

Keerom Regency is part of the community's economic development which has the potential for land that can be developed, especially the development of sweet potatoes with fertile soil structure and availability of groundwater that can support the development of these sweet potato plants, and farmers' cropping patterns have been carried out for a long time with production that has been enjoyed by farmers because sweet potato plants are one of the foods that are commonly consumed and become an initial potential

before government regulations are issued, therefore it can be said that with this Regulation of the Minister of Industry it will spur farmers to be more and more in cultivating sweet potato plants so that the income of sweet potato farmers is increasing.

Thus, it can be supported by various things, namely assistance in procuring seeds, guidance and coaching for farmers in cultivating land, more productive cropping patterns, provision of fertilizers, distribution of agricultural production as well as knowledge and methods needed to determine regional potential and good policies in developing the community's economy [30] continuously. Therefore, it is appropriate that the development of sweet potato crops should be placed as one of the mainstay potentials of the community in Keerom Regency.

In this regard, the Provincial Government of Papua has provided ten hectares of land and provided a machine for processing sweet potatoes with a fairly large capacity in Keerom Regency since 2010, where the machine is capable of processing sweet potatoes into raw materials for various other products; noodle products. In connection with the availability of land and sweet potato processing machines, Keerom Regency was used as one of the areas that would serve as an example of clusters for the development of sweet potato product industries. This Jakar potato development cluster, considering that sweet potato has bright prospects because as a substitute for carbohydrate-producing food, this sweet potato can be developed into raw materials for various products. The sweet potato industrial development cluster is shown in the following Fig. 1.

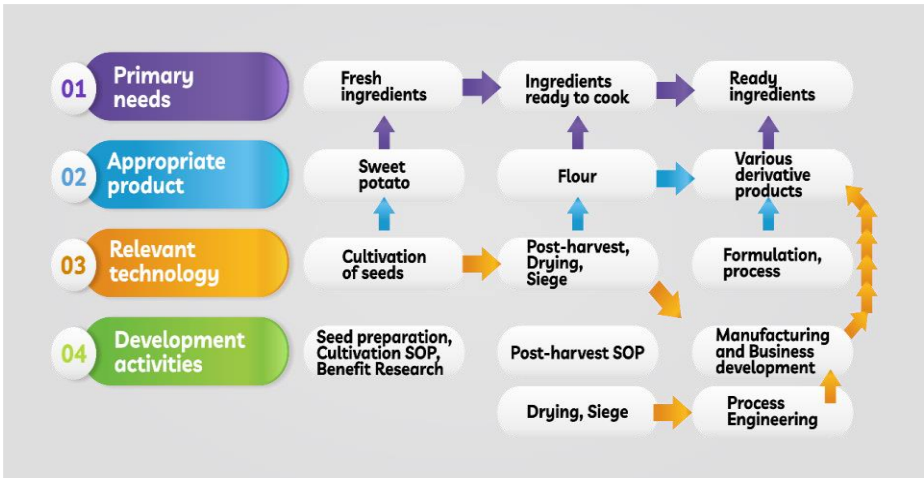


Fig. 1. Roadmap for Sweet Potato Development in Keerom Regency, Papua Province

Based on the Roadmap for the development of sweet potato leading product industry clusters in Keerom Regency, Papua Province, several industrial clusters for sweet potato superior products in Keerom Regency, Papua Province, can be formed, including:

- a. Small-scale sweet potato industry cluster, this cluster is based on the farmer level which is supported by non-formal institutions such as farmer groups and customary institutions as well as formal institutions such as agricultural extension and banking.

The output of this cluster is to produce sweet potato flour as a raw material to support derivative products at the Papua local level.

- b. Medium-scale sweet potato industry cluster, this cluster obtains sweet potato raw materials from farmers, then processed by competent third parties or private/agencies to produce flour ingredients to be exported outside the region.
- c. The first and second clusters that have been formed can involve policymakers, and banking and are accompanied by researchers and authorized agencies to work together to support the process from cultivation, and post-harvest to processing into sweet potato flour.

4 Conclusion

Industrial clusters for superior sweet potato products that can be developed in Keerom Regency, Papua Province, namely: a) Small-scale sweet potato industry clusters, this cluster is based at the farmer level and is supported by non-formal institutions such as farmer groups and customary institutions as well as formal institutions such as Agricultural Extension and Banking. The output of this cluster is to produce sweet potato flour as a raw material to support derivative products at the Papua local level; b) Medium-scale sweet potato industry cluster, this cluster obtains sweet potato raw materials from farmers, then processed to produce starch by competent third parties or private/agencies to then be exported outside the region; and c) The first and second clusters that have been formed can involve policymakers, banking and are accompanied by researchers and authorized agencies to work together to support the process from cultivation, post-harvest to processing into sweet potato flour.

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