

Proceeding

# INVESTING IN FOOD QUALITY, SAFETY & NUTRITION

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ISBN: 978-979-16216-8-7



**SEAFAST  
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Southeast Asian Food & Agricultural Science & Technology (SEAFAST) Center  
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## Industrialization (MOCAL/MOCAF) from Opportunity

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One of the best potential crops, especially starch as the major product of modified cassava flour, called MOCAL/MOCAF, is modified cassava flour, called MOCAL/MOCAF, which is similar to wheat flour. However, the industrialization of MOCAL/MOCAF faces several problems in such areas of technology, production continuity. Those problems are a major concern for the community. Accordingly, the industrialization of MOCAL/MOCAF through a cluster industrial concept, in which a central mill is followed by a central mill, could generate income for the community. This presentation outlines the underlying concept of industrialization from opportunity to market development.

## Introduction

Food security is an individual's ability to access nutritious food. In Indonesia (No. 7, 1996) about 10% of households and families in rural areas lack safety, availability, and ease of access to food.

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## **Industrialization of Modified Cassava Flour (MOCAL/MOCAF) through Cluster Industrial Concept: from Opportunity Identification to Market Development**

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### **Abstract**

One of the best potential crops for food diversification is cassava with carbohydrate, especially starch as the major component. We have successfully developed original modified cassava flour, called MOCAL or MOCAF which is applicable for substitution of wheat flour. However, the industrialization of MOCAL/MOCAF involves tackling problems in such areas of technology, productivity, marketing price stability, and production continuity. Those matters are influenced by the socioeconomic condition of community. Accordingly, the MOCAL/MOCAF industry has been developed in a cluster industrial concept, in where some small factories of cassava chip are established following a central milling factory. Through this method, MOCAL/MOCAF industrialization could generate economic activity based on local potential to increase the community's income. This, indeed, can be achieved by encouraging the integration of local government, food industry business, farmers, and researchers it's self. This presentation outlines the underlying methodological framework of this MOCAL/MOCAF industrialization from opportunity identification to market development.

### **Introduction**

Food security is internationally defined as the possibility of each individual to access nutrition, healthy, and safe food, which enables everyone able to run their optimal activities and life. The Regulation of Republic Indonesia (No. 7, 1996) about food security defined it as a condition where all households and families in Indonesia have sufficient food (quantity and quality), safety, availability, and easy accessibility.

Indonesia is rich in natural resources. One of the most promising agricultural products in Indonesia is cassava. According to the statistic, the production of cassava is the highest among the other secondary crops (Table 1). On 2002, the national cassava production reached 16.9 million tons, and increased significantly more than 20 million tons at 2008. However, the use of cassava as foods is very limited, since most Indonesians consider cassava as food for those of low social-economic status. The consumers switch to consume rice instead of cassava when their income increases. Therefore, development of cassava into products which could reduce the "cassava feel" is necessary. Through application of fermentation technology, cassava is processed into MOCAL/MOCAF, which may have many advantages in food application. Mocal is like a new hope to strengthen national food security in Indonesia through food diversification.

**Table1.** Production of Secondary Food Crops in Indonesia (BPS, 2008)

Year	Production (ton)					Sweet Potatoes
	Maize	Soybean	Peanuts	Mung-beans		
2002	9,654,105	673,056	718,071	288,089		1,771,642
2003	10,886,442	671,600	785,526	335,224		1,991,478
2004	11,225,243	723,483	837,495	310,412		1,901,802
2005	12,523,894	808,353	836,295	320,963		1,856,969
2006	12,495,742	783,554	851,133	311,623		1,868,994
2007	13,287,527	592,534	789,089	322,487		1,886,852
2008*	14,854,050	723,535	771,536	315,502		1,906,222

\* Second forecast

### What is Mocal/Mocaf?

MOCAL/MOCAF is flour product derived from cassava (*Manihot esculenta* Crantz) which is processed by modifying cassava plant cells using fermentation. Lactic acid bacteria (LAB) play a big role in this fermentation process. These bacteria also produced enzymes that hydrolyze starch into sugar

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Based on Codex S ... can be classified as a ... composition is not so diff ... specific physicochemical ... MOCAL/MOCAF is lower ... because protein can caus ... MOCAL/MOCAF is bright ... taste and aroma which ... aroma. The MOCAL/MOC ... of starch granules yieldin ... especially lactic acid, whi

The changing of ... SEM (Figure 1). At 1,000 ... starch granules of con ... meanwhile MOCAL/MOC ... Bacteria grown during f ... enzymes, which can des ... granules are released. ... magnification) were zoo ... surface were occurred in ... of the light, resulting in a ... to the common cassava ... rougher, in where some ... that the LAB may pr ... fermentation, and the e ... granule because some ... processes affected to t ... enhancing pasting temp ... decreasing in swell cap ... puffing-up.

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(BPS, 2008)

Sweet Potatoes
1,771,642
1,991,478
1,901,802
1,856,969
1,868,994
1,886,852
1,906,222

cassava (*Manihot*  
plant cells using  
is fermentation  
starch into sugar

and thus change it into organic acids which most of them are lactic acid. This causes characteristic changed of the resulting flour, such as increased viscosity, gelatinized ability, rehydration capacity, and solubility. Therefore, it has an impact on MOCAL/MOCAF taste which becomes neutral; thus the original cassava taste is covered as much as 70%.

Based on Codex Standard, Codex Stan 176-1989 (Rev. 1 - 1995), MOCAL can be classified as an edible cassava flour product. Even though the composition is not so different to the original cassava flour, MOCAL/MOCAF has specific physicochemical and sensory characteristics. Protein content of MOCAL/MOCAF is lower than common cassava flour, which is advantageous because protein can cause darken color when it is dried or heated. The color of MOCAL/MOCAF is brighter than cassava flour. MOCAL/MOCAF has specific taste and aroma which can cover the unfavorable cassava flour taste and aroma. The MOCAL/MOCAF taste and aroma changed occurs due to hydrolysis of starch granules yielding monosaccharide as material producing organic acids especially lactic acid, which is then absorbed.

The changing of starch granule could be very well observed by using SEM (Figure 1). At 1,000 times of magnification photograph it was seen that the starch granules of common cassava flour are surrounded by cell wall; meanwhile MOCAL/MOCAF's starch granules are not surrounded by cell wall. Bacteria grown during fermentation may produce pectinolytic and cellulolytic enzymes, which can destroy the cell walls of cassava, so that cassava starch granules are released. When the bright parts of granule (2,000 times of magnification) were zoomed, it was found that the damages of starch granule surface were occurred intensively. The damage on the surface caused reflection of the light, resulting in appearance of bright parts. Furthermore, by comparing to the common cassava flour, the surfaces of MOCAL/MOCAF granule were rougher, in where some holes presented distinctively. These results suggested that the LAB may produce amylase that hydrolyzed the starch during fermentation, and the easier part to be hydrolyzed is on the surface of starch granule because some holes were produced in the surface of granule. These processes affected to the functional properties of MOCAL/MOCAF, such as enhancing pasting temperature, delaying gelatinization, increasing in viscosity, decreasing in swell capacity, and improving stability, cooking quality, and puffing-up.

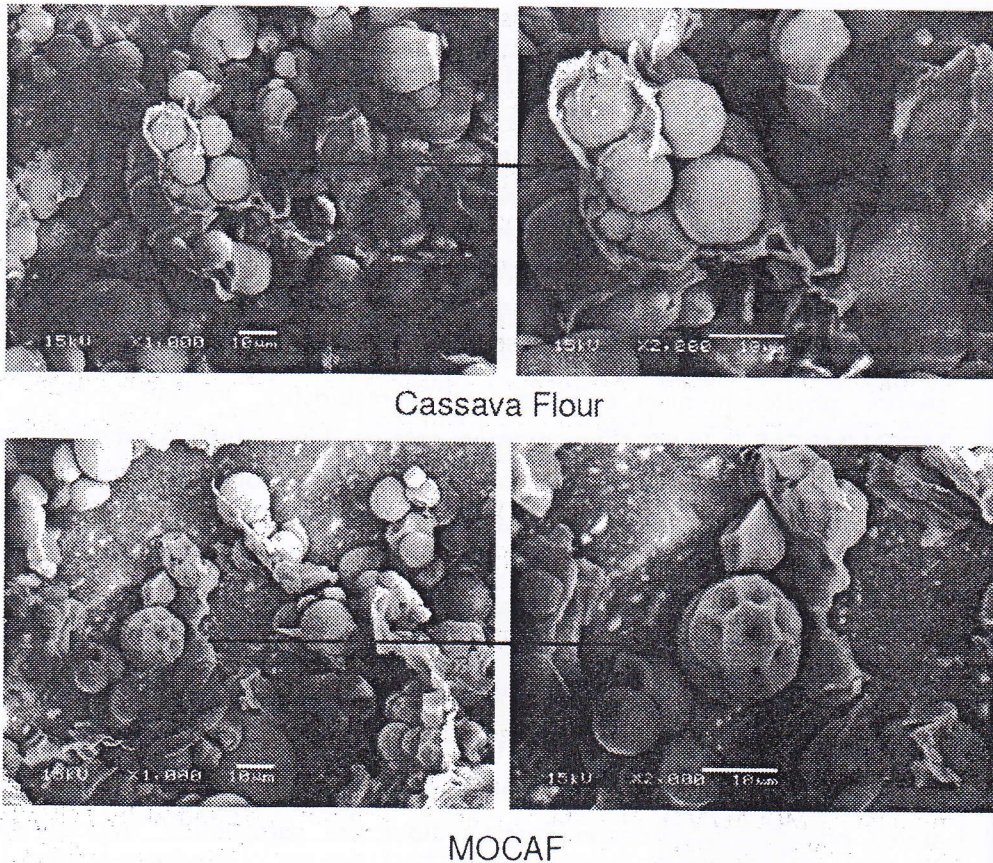


Figure 1. Granules structure of common cassava flour and MOCAL/MOCAF by scanning electron microscope

Up to now, the utilization of cassava flour in food ingredients is very limited, for example as 5% substitution of wheat flour in instant noodles which resulted in low quality, and in cookies. However, the flour has been widely used as non-food industry raw material, i.e. as glue. With all the characteristics explained above, MOCAL/MOCAF has the potential to be widely used as a food ingredient. Former research showed that MOCAL/MOCAF could be used as raw material in the making of many kinds of food, from noodles and baked goods to intermediate moist food. Brownies, steamed cakes, and sponge cakes can be made by using MOCAL/MOCAF as 80% mixed flour in the ingredients. It can be also used as ingredient for variety of cakes, e.g. cookies, *nastar* (pineapple cream filled cake), and *castengle* (cookies with shaved cheese). For steamed

cakes, the use of MOCAL/MOCAF based products, or whe...

### Clustering Industri...

Food security e... economic activity based... be achieved by encoura... business, farmers, and... industrial cluster, espec... of indigenous commo... skewed land and farm-s... influence the seasonal a... the MOCAL/MOCAF pr... made a top-down pr... MOCAL/MOCAF.

In this concept, process. The first stage i... in clusters established... processing dry chips into... owned by farmers' joint... second stage then beco... wheat flour, and which... The MOCAL/MOCAF ind... in Trenggalek-Central Jav...

cakes, the use of MOCAL/MOCAF can be applied in the making of rice flour-based products, or wheat flour added to tapioca.

### **Clustering Industrial Concept In Mocal/Mocaf Production**

Food security empowerment should also be directed to generate economic activity based on local potential to increase people's income. This can be achieved by encouraging the integration of local government, food industry business, farmers, and researchers to encourage the establishment of food industrial cluster, especially in rural areas, which can increase the added value of indigenous commodities and improve local people's income. Moreover, skewed land and farm-size distribution, plus climatic fluctuations, also strongly influence the seasonal availability of cassava root, and thus the performance of the MOCAL/MOCAF processing units. To establish this integration, we have made a top-down program to develop clustering industrial concept of MOCAL/MOCAF.

In this concept, MOCAL/MOCAF production is divided into two-stage process. The first stage is the processing of cassava into dry chips, which is done in clusters established by several farmers' groups. The second stage is processing dry chips into MOCAL/MOCAF done in main factory, which could be owned by farmers' joint group or privately owned. Products resulting from this second stage then become ingredients for the food industry, substituted for wheat flour, and which can then be processed further to other food products. The MOCAL/MOCAF industry adopting clustering concept has been established in Trenggalek-Central Java, and the model is shown in Figure 2.

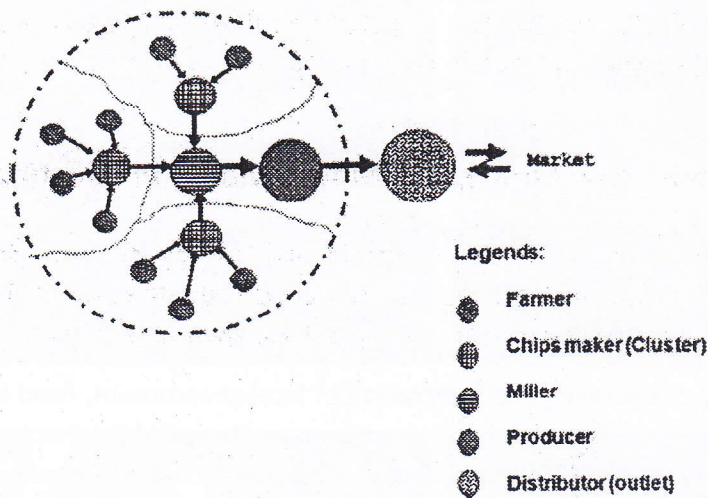


Figure 2. Model of clustering industrial concept in MOCAL/MOCAF production

### Market Development

The cassava cluster model describes the integration of downstream-upstream in the food production chain, starting from agricultural plantation, moving to continuous development of innovative and applicable technology linked to market demand and industrial need. It also shows the growth of agricultural production from laboratory to commercial scale. Business units, distribution, and marketing by investors (food industries) to consumers will be developed. Fortunately, recent food crisis give opportunities on the development of MOCAL/MOCAF market. The rising price of wheat flour to reach until Rp. 7,000,-/kg in local market give benefit on that costumers will to replace the wheat flour with the cheaper one. By the price of Rp. 4,000,-/kg and having good properties, MOCAL/MOCAF is in the right time! Furthermore, the strategy for MOCAL/MOCAF distribution is based on the condition that the most user of wheat flour is in SMEs, as shown in Fig 3. Unfortunately, this system needs a big fund for distribution and stocking activities. Therefore, recently the market is still focused in the big industries user which gives a good cash flow. However, for the market development, the main constraints remained the lack of skills in using MOCAL/MOCAF, due to different handling methods of MOCAL/MOCAF to wheat flour. Therefore, consultation workshop,

customer to customer  
conducted to create the m

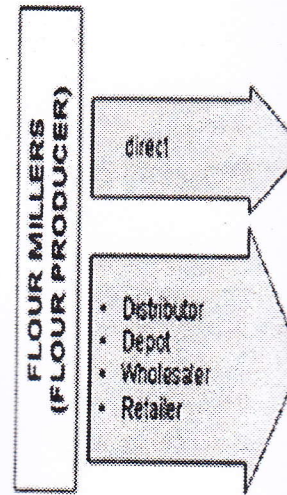


Figure 3. D

### Reference

Central Bureau of Statist  
Production of  
<http://www.bps.go>  
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customer to customer visits, and training courses are necessary to be conducted to create the market.

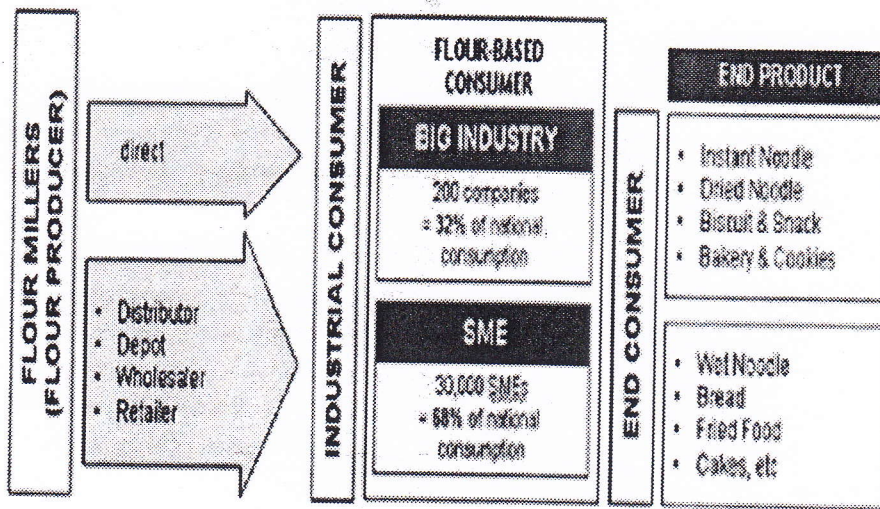


Figure 3. Distribution of national flour industry

## Reference

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