

ANALYSIS OF MOCAF SUBSTITUTION CAPABILITY TO WHEAT FLOUR AND IT'S BUSINESS FEASIBILITY

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ABSTRACT

This research aims to investigate the substitution capability of Modified Cassava Flour (mocaf) toward conventional flour – it is wheat flour, and its business feasibility, by using the Anova and Duncan test. These statistical analysis tools are used to discover mocaf flour characteristics to wheat flour whether there are significant difference in terms of: taste, aroma, appearance, and texture among mocaf and wheat flour. The result of Anova analysis found that there is significant difference in aroma (0,039). In advance, more information about its dominant characteristic, gathered using Duncan test under two groups of mocaf subset. The first subset characterized of the 100% standard and premium mocaf flour, and the second subset characterized by the 100% premium and 50% standard mocaf. The Duncan findings is the closest characteristic of mocaf in wheat flour substitution is the second subset, the 100% premium and 50% standard mocaf. This closes characteristic of mocaf to wheat flour drive to increase business feasibility potential; because of its economical contribution lessen the total cost production to 77% compared with the 100% in wheat application.

INTRODUCTION

Indonesia is a country blessed with natural resources, with it decreasing non-renewable natural resources by the years gone by. It requires the counterbalance for the development of renewable natural resources industries, especially in agriculture and plantation as the sources of basic ingredient for national food endurance, despite of keep on exploiting the un-renewable natural resources. Agriculture's value-added commodities and plantation are the national potential in providing the national food self-sufficient for the communities.

Indonesian's food products are flour based, wheat flour application. The halted of local diversification for food product will boost the government policy to prolong the wheat import activities since it can grows well under Indonesia's tropical climate. Meanwhile, Indonesia is the largest producer of cassava in Asia, reaching a surprise 28 tons in 2012 (Serikat Petani Indonesia, 10 January 2013) but under many circumstances are still importing cassava starch. This controversial situation seems to hold cassava farmer to produce. Indonesia should use those 28 tons of cassava to meet its food needs through modification of cassava.

According to *Asosiasi Pengusaha Tepung Terigu Indonesia* (APTINDO), wheat flour consumption in 2011 exceeded 4.6 million tons, which is higher to the consumption in 2010

that was 4.3 million tons. The increasing consumption of wheat flour is caused by the very low capacity of national wheat production, that approximately only 10% of the total need for overall domestic wheat flour productions. Actually, Indonesia's dependency on imported wheat flour commodities can be reduced by using "mocaf (modified cassava) flour" as a derivative product of cassava made through fermentation process.

In South Kalimantan, the central for cassava plantation is the District of Tanah Laut, which geographically between 114⁰30'20" WL – 115⁰23'31" WL and 3⁰30'33" SL – 4⁰11'38" SL. The total land's area of Tanah Laut, according to the Decree of the Governor of South Kalimantan, is about 3,631.35 km² that covers about 9.71% of overall South Kalimantan Province's land area (BPS, 2011). The hilly Tanah Laut has abundant mineral deposits including iron ores and coals. The fertile soil condition of Tanah Laut brings the agricultural and plantation sectors are able to cover the domestic needs and also the needs of its surrounding regencies.

Under such conditions, Tanah Laut has a great potency in terms of production development plant, specifically for cassava plantation. *Statistik Perkebunan Indonesia* for the year of 2007-2009 measures the cassava' potency in Tanah Laut about 45,772 tons meanwhile the land used for cassava plantation is only 3,210 tons or only 7% of the total potency. National cassava production in 2012 was only reach for 25million tons (Subagio, 2013). Farmers interest for cassava farming is low, because its low prices. The cassava-based products itself still in a few so the demand became lower compared to several other plantation commodities. This condition, of course, holds the farmers from growing more cassavas.

Considering the national capability of national food endurance by suppress the national imported conventional flour, it is urgent to utilize the domestic natural resources. Tanah Laut natural potential for cassava plantation is the good opportunity to develop the conventional flour substitution product, which is mocaf flour. So, it increases the importance to find out the business feasibility of mocaf flour production industry, that the feasible business will draw multiple benefits for the society. This research addresses the questions of:

- 1) What is the result for capability analysis of mocaf-based products to substitute wheat flour-based products?
- 2) How its business feasibility for South Kalimantan?

LITERATURES REVIEW

Husein (2007) explains that business feasibility study studies the business plan, which does not only pay attention to the business feasibility, but also to the analysis of the maximum profit within unlimited time period is possible when the business is operated on regular basis. It's applicable for investors, creditors, company managements, government, communities, and other parties who may need the study to provide a source of consideration to review their business plans. He also mention that the several steps taken in the study aims to establish the business for real, includes: discovering idea, researching, evaluating, arranging appropriate suggestions, planning, and executing the plan. In the research phase itself, several aspects to consider are market situation, company's internal aspect, market competition, and other external aspect. Under such theme, internal aspects marketing aspect, technical and technological aspect, human resources, managements, and finance requires a smart conscious thought (Husein, 2007).

Defining Mocaf

Modified cassava flour (Mocaf) is a modification products derives from cassava (*manihod esculenta crantz*) in forms of flour through fermentation phase. The fermentation process is the phase that made the difference from mocaf to tapioca flour and *gaplek* flour (local dried cassava flour in Jokjakarta), the other form of cassava derived flour. Time period of fermentation process defines the type of mocaf flour, that the more time of fermentation process will produce the premium quality while the average time of fermentation will produce the standard quality. There is no specific type of cassava that eligible to be fermented as mocaf flour, because basically every tuber group of crops is *flour-able* commodity. Under these circumstances, seems that Indonesia possessing the potential to be an independent country in fulfill its national flour supply, since the cassava crops is easily grows and there are a lot of variant of tuber group of crops in Indonesia. Actually, mocaf already been applied in food production but not as comprehensive as wheat flour in Indonesia. People are not yet accustomed with the term of mocaf itself, *simod* (term in middle Java), *motekap* flour (*modifikasi tepung ketela*) and MOCAL (from *Manihot Esculenta Crantz*, but the community refuse to use this term because in Javanese terms it means: impossible to do). Application of mocaf flour as wheat flour substitution usually as ingredient for food products, such as noodles, bakeries, cookies, and some other (Bambang *et.al*, 2011:p.3).

Growing microbes in cassava fermentation processes change the characteristics of mocaf flour in which cause the increasing of viscosity, gelational ability, rehydration ability, and degree of solubility. The microbes also produce organic acids, specifically lactic acid, which can blend well into other ingredients. When the ingredients are processed into edible food, the acids will boost distinctive aroma and taste which cover the original aroma and taste of cassava that tend to be unpleasant to customers. During the fermentation process, color changing component and protein causing brownies color in drying process are eliminated so that Mocaf-T1 produced is lighter in color compared to regular cassava flour.

Characteristics of Mocaf

Bogor Agricultural Institute research findings that there are several advantages of mocaf flour (IPB, 2010), such as: the mocaf aroma and taste are better, also whiter than common cassava flour; it has the economic price than rice/ wheat flour. Adry (2013) in Food Crops and Horticulture Department of Riau Islands - Indonesia describes that mocaf can be categorized as “edible cassava flour” by the special quality of: 1) higher soluble fiber than tapioca flour; 2) higher mineral (calcium) paddy and; 3) Oligosaccharides which cause the flatulency have been hydrolyzed in mocaf flour; 4) Mocaf’s expandability on par with wheat flour type II (medium protein content); and 5) Digests easier than tapioca flour.

General Benefits of Mocaf Industrial Development

The primary benefits of mocaf industrial development is the reinforcement of national food endurance as previously mentioned. Its economic price is widening the poor’s access to food availability, as well as the creation of business and employment opportunities. Mocaf industrial development program engaged with farmers and cooperatives, as it use ability as ingredient for homemade, medium, and the larger industry. Increasing demand of cassava will improve the farmer’s welfare. Cassava development plant is empowering the marginal lands are in Indonesia; since there is neglected area of marginal land suffers from erosion, fire, and reduction of land’s fertility. Cassava is a highly adaptive plant which can grow even in dry land.

RESEARCH METHODOLOGY

Both primary and secondary research data collected using the combination the techniques of: In-depth interview as the direct collecting information to mocaf's producer in Tanah Laut district; Experiments in making flour based product combines with mocaf flour application of 100% and 50% composition under the certain standards;. Observation of the real activity and the real situations of cassava farms and mocaf's manufacturer in Tanah Laut; and Documentation of gathering secondary data such as income per capita, consumption pattern, and surrounding community conditions based on occupations of community members.

This experimental research intends to figure out the effect of mocaf substitution toward wheat flour. Experiment is one of the ways used to find out causal-effect relationship between two factors raised by the researcher through the elimination of other disturbing variables. The independent variables in this research consist of two groups of mocaf combination of 50% and 100% substitution of regular mocaf and 100% substitution of premium mocaf while the characteristics of experimental result products that have been compared to wheat flour-based products in four aspects of comparisons: taste, aroma, appearance, and texture as the dependent variables. The making process of mocaf-based substitution products has been carrying out in the same way as it is on other flour-based products. Composition of ingredients and utilities used are following the standard of those in the process of regular wheat flour-based products making.

The assessment resulted from 88 respondents on mocaf-based products in terms of flavor, aroma, appearance and texture found that there is no significant difference on the flavor, aroma, appearance and texture of the product made of mocaf and the one made of wheat flour. In general, the product made of 50% mocaf has the closest characteristics to the product made of wheat flour, except for its texture. By comparing the characteristics of the product made of 100% premium quality mocaf to the product made of 100% standard quality mocaf, the product made of premium quality mocaf has the closest proximity level of characteristics to the product made of wheat flour.

The Flavor of Mocaf-Based Product

It is expected that the mocaf-based product flavor is similar to the wheat flour-based product. The comparison of flavor of 100% premium quality mocaf-based product, 100% standard quality mocaf-based product, and 50% standard quality mocaf-based product is using one-way Anova test.

TABLE 1 ONE WAY ANOVA OF THE FLAVOR OF MOCAF-BASED PRODUCT ON DIFFERENT SUBSTITUTION LEVEL

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|-------|
| Between Groups | 7.66 | 2 | 3.834 | 2.721 | 0.072 |
| Within Groups | 9 | 85 | 1.409 | | |
| Total | 119.78 | 87 | | | |
| | 6 | | | | |
| | 127.45 | | | | |
| | 5 | | | | |

Source: Data processed, 2013

The findings is that there is no significant difference on the flavor of the products made of either 100% premium quality mocaf or 100% standard quality mocaf and 50% standard quality mocaf.

The Aroma of Mocaf-Based Product

The table below shows the comparison of the aroma of mocaf-based product and wheat flour-based product by using one-way Anova.

TABLE 2 ONE WAY ANOVA OF THE AROMA OF MOCAF-BASED PRODUCT ON DIFFERENT SUBSTITUTION LEVEL

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|-------|
| Between Groups | 6.89 | 2 | 3.447 | 3.361 | 0.039 |
| Within Groups | 4 | 85 | 1.026 | | |
| Total | 87.18 | 87 | | | |
| | 5 | | | | |
| | 94.0 | | | | |
| | 8 | | | | |

Source: Data processed, 2013

The finding is that the aroma of the products is different depends on the amount and the quality of the mocaf flour used. The Duncan test is used to figure on which level of mocaf substitution that satisfied the respondents the best.

TABLE 3 DUNCAN TEST OF THE PROXIMITY OF MOCAF-BASED PRODUCT AROMA ON DIFFERENT LEVEL OF SUBSTITUTION

Duncan^{a,b}

Source: Data processed, 2013

| Tingkat Substitusi Mocaf | N | | |
|--------------------------|----|-----|-----|
| | | 1 | 2 |
| 100% Mocaf | 41 | 3.0 | 3.5 |
| 100% Mocaf Premium | 42 | 7 | 5 |
| 50% Mocaf | 5 | 3.5 | 4.0 |
| Sig. | | 5 | 0 |
| | | .25 | .27 |
| | | 3 | 5 |

There are two groups to compare in this analysis. the 1st group is content of 100% standard quality mocaf and 100% premium quality mocaf, and 2nd groups content of 100% premium quality mocaf and 50% standard quality mocaf. It turns to the 2nd group provides the closest to the aroma of wheat flour-based product.

The Appearance of Mocaf-Based Product

The comparison of appearance for the mocaf-based product to flour-based product using One-way Anova to see whether there is a significant difference among the three levels of substitution.

TABLE 4 ONE WAY ANOVA OF THE APPEARANCE OF MOCAF-BASED PRODUCT ON DIFFERENT LEVEL OF SUBSTITUTION

| | Sum of Squares | D f | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|-------|-------|
| Between Groups | 2.48 | 2 | 1.242 | 1.278 | 0.284 |
| Within Groups | 4 | 85 | 0.972 | | |
| Total | 82.60 | 87 | | | |
| | 7 | | | | |
| | 85.09 | | | | |
| | 1 | | | | |

Source: Data processed, 2013

The finding is that there is no significant difference on the product appearance of the three levels of substitution. Thus, Duncan test is not needed to see the level of proximity of the mocaf-based product to the wheat flour-based product.

The Texture of Mocaf-Based Product

One-way Anova is used to compare the products texture resulted as follows.

TABLE 5 ONE WAY ANOVA OF THE TEXTURE OF MOCAF-BASED PRODUCT ON DIFFERENT LEVEL OF SUBSTITUTION

| | Sum of Squares | Df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|-------|
| Between Groups | 1.686 | 2 | 0.843 | 0.693 | 0.503 |
| Within Groups | 103.393 | 85 | 1.216 | | |
| Total | 105.079 | 87 | | | |

Source: Data processed, 2013

Of all the substitution levels - 100% premium quality, 100% standard quality, and 50% standard quality - there is no significant difference on the appearance of the products. Thus, advanced test is not needed. The data distribution of mean relative scale of each substitution group described as follow.

TABEL 6 STATISTIC DESCRIPTIVE OF THE MOCAF SUBSTITUTION LEVEL BASED ON THE CHARACTERISTICS OF PRODUCT

| Characteristics | Substitution Level | | | |
|----------------------------------|--------------------|------------|-----------|--------|
| | 100% Mocaf Premium | 100% Mocaf | 50% Mocaf | Total |
| Flavor | 3,31 | 3,10 | 4,40 | 3,27 |
| Aroma | 3,55 | 3,07 | 4,00 | 3,35 |
| Appearance | 3,26 | 3,29 | 4,00 | 3,32 |
| Texture | 3,21 | 3,15 | 2,60 | 3,15 |
| Mean | 3,3325 | 3,1525 | 3,75 | 3,2725 |
| Mean value relative to the scale | 0,6665 | 0,6305 | 0,7500 | 0,6545 |

Source: Data processed, 2013

Table 6 above shows that the product made of 50% mocaf has the closest proximity to the product made of wheat flour since its mean value relative to the scale of five is 0.75. Meanwhile, the mean value relative of the product made of 100% premium quality is 0.66% and the product made of 100% standard quality is 0.63%.

TABLE 7 WHEAT FLOUR CONSUMPTION AND THE SAVING OF MOCAF SUBSTITUTION

| | Yea | | | |
|--|----------|----------|----------|----------|
| | 2009 | 2010 | 2011 | 2012 |
| 1. Wheat Equivalent (000 MT) | 5.224 | 5.793 | 6.210 | 6.668 |
| 2. Growth* (%) | 12,54 | 10,91 | 7,12 | 7,06 |
| 3. Average substitution | 0,68 | 0,68 | 0,68 | 0,68 |
| 4. The amount of wheat | 3.564,5 | 3.952,7 | 4.237,2 | 4.549,8 |
| 5. The value of wheat substituted | 26.733,8 | 29.645,6 | 31.779,6 | 34.123,4 |
| 6. The value of mocaf (in trillion Rp) | 23.169,3 | 25.692,9 | 27.542,3 | 29.573,6 |
| 7. Saving, 5 – 6, (billion Rp) | 3.564,5 | 3.952,7 | 4.237,2 | 4.549,8 |

*Source: *= Aptindo, 2013, data processed in 2013*

Above table shows the increasing wheat flour consumption in 2009, 2010, 2011 and 2012 released by Asosiasi Produsen Tepung Terigu Indonesia (2012). The average substitution score for different mocaf substitution levels is 0.68. By taking the price of wheat flour and mocaf into account, it is predicted that Rp 3.56 trillion could have been saved in 2009, Rp 3.95 trillion could have been saved in 2010, Rp 4.23 trillion could have been saved in 2011, and 4.55 trillion could have been saved in 2012.

Business Feasibility Analysis

The feasibility analysis in this research focuses on the amount of cost that can be saved by substituting wheat flour to mocaf flour. The result, afterwards, is used to identify the effect towards the Net Present Value (NOV), Internal Rate of Return (IRR), Payback Period (PP), Profitability Index (PI), and Modified Internal Rate of Return (MIRR).

The first step on the feasibility analysis was conducted by calculating the obtained saving ratio by considering the proximity level, price and the mean value relative to the scale of five in order to determine the proportional price difference and mean relative price of the total. As the result, the cost saving ratio obtained is 14.22%, as can be seen on the followed table.

TABLE 8 THE RATIO OF PRODUCTION COST SAVING RATIO SEEN FROM DIFFERENT LEVEL OF MOCAF SUBSTITUTION

| Level of substitution | Wheat flour price (Rp) | Mocaf price (Rp) | Price difference (Rp) | Mean Relative Scale 5 | Price difference relative (Rp) | Mean Relative to 100% | Proportional price difference (Rp) | Relative price to 100% (Rp) |
|---|------------------------|------------------|-----------------------|-----------------------|--------------------------------|-----------------------|------------------------------------|-----------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 100% Premium | 11.000 | 7.500 | 3.500 | 0,6665 | 2.332,75 | 0,3256 | 759,54 | 3.581,58 |
| 100% Standar | 7.500 | 6.500 | 1.000 | 0,6305 | 630,50 | 0,3080 | 194,20 | 2.310,09 |
| 50% Standar | 7.500 | 6.500 | 1.000 | 0,7500 | 750,00 | 0,3664 | 274,79 | 2.747,92 |
| Total | | | | | | | 1.228,53 | 8.639,59 |
| Saving ratio (Sv) = Total (7)/Total (8) | | | | | | | | 0,1422 |

Source: data processed, 2013

Thus, the amount of cost saving obtained by substituting wheat flour to mocaf flour is predicted as below:

$$S - C = \text{EBIT}$$

Due to cost saving, the formula turns into:

$$S - (C - (C \times S_v)) = \text{EBIT}$$

$$S - (C(1 - S_v)) = \text{EBIT} \dots\dots\dots 1)$$

Because $\text{EBIT} - i = \text{EBT}$, where i = interest, then:

$$S - (C(1 - S_v)) - i = \text{EBT} \dots\dots\dots 2)$$

Because $\text{EBT} - \text{Tax} = \text{EAT}$, then:

$$(S - (C(1 - S_v)) - i) - \text{Tax} = \text{EAT},$$

$$((S - (C(1 - S_v)) - i)) (1 - T) = \text{EAT} \dots\dots\dots 3)$$

If the tax (T) is 10% = 0,1, and based on the calculation of saving (S_v), obtained $S_v = 0,1422$, then:

$$((S - (C(1 - 0,1422)) - i))(1 - 0,1) = \text{EAT}$$

$$(S - C(0,8578) - i)(0,9) = \text{EAT}$$

$$0,9S - 0,9(0,8578C) - 0,9i = \text{EAT}$$

$$0,9S - 0,77C - 0,9i = \text{EAT}$$

If $S = 2$; $C = 1$ and $i = 1$, then:

Mocaf-based product will earn net profit as much as:

$$\text{EAT}_{\text{mocaf}} = 1,8 - 0,77 - 0,9 = 1,8 - 1,67 = 0,13$$

While wheat flour-based product will earn net profit as much as:

$$\text{EAT}_{\text{wheat}} = 1,8 - 0,9 - 0,9 = 1,8 - 1,8 = 0$$

Or in the other words, the focus of the calculation is the cost variable since other variables are quite similar. The lower cost is the result of the saving due to the substitution of wheat to mocaf, and reduction of tax of the needed cost.

$$\text{NCF} = \text{EAT} + \text{Depreciation}$$

Since the depreciation of wheat flour-based product and the mocaf-based product is similar, the depreciation can be excluded, or in the other words Cash Flow (CF) = EAT. Where: S = Sales; C = Cost; Sv = Savings; EBIT = Earnings Before Interest and Tax; EBT = Earnings Before Tax, EAT = Earnings After Tax

The lesser the cost, the higher the profit is. As the result, the net cash flow earned in the next periods will be more than the amount earned at the current state. NPV earned by the existing business will be bigger if the business earns bigger profits and net cash flow without adding more cash to the investments and to other components. The increasing value of NPV is possible since the cost decrease to $(0.8578(1 - \text{Tax rate}))$. Furthermore, due to the same reason, Payback Period will be faster, Internal Rate of Return will be bigger, and Modified Internal Return will also be bigger. By referring to the result of feasibility analysis, it can be concluded that a business that has already been run well will earn more profit if the business substitutes wheat flour to mocaf flour.

CONCLUSION

The value of mocaf substitution to wheat flour is approximately 0.68 or 68%. By considering the high number of wheat flour consumption in Indonesia in 2012, around Rp 4.55 trillion can be saved by substituting wheat flour to mocaf flour. Industries or businesses that use mocaf flour as their main raw material will have lower production costs which lead them to have bigger net cash flows per period. In addition, by considering various investment assessment methods, the businesses that have been run will be more feasible through the saving of cost after tax as much as 0.77 as the result of the substitution.

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