# Diversification of products derived from maize for the sustainable welfare of the people in Gorontalo province, Indonesia

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**Abstract.** Processing industry contribution in each commodity can add value for forward linkages and backward linkages. The economic condition of Gorontalo province is as follow: contribution of regional GDP in education service is 9%, financial and insurance services' contribution is 8%, and agricultural sector's contribution is 4%. This shows an economic growth anomaly, where the agricultural sector as a leading sector has yet significantly contributed toward the gross regional domestic product of Gorontalo province. Our gross regional domestic product per capita is only IDR. 9,544,583 with 17.30% of poor population workforce productivity are in the 30$^{th}$ rank. Maize is a commodity potential to be developed into various derivative products with high economic value. This is study expected to contribute to the local government in increasing the competitive advantages and economic motor for the community in the region, as well as contribute to the private sector in developing various derivative products from maize commodity. This study uses quantitative descriptive method which constitute of desk study and secondary data analysis, workshop, and meeting with related stakeholders, development of study design for value chain actors, presentation, and result discussion to formulate the master plan and development model for various maize commodity products.

## 1.  Introduction

The only way to win the tight competition today is by producing competitive advantage products. Economic welfare growth depends on the capacity to innovate, to produce sustainably high value-added products which cannot be easily imitated by others. This should be supported by the progressing target, implementation of appropriate technology, developing better quality products and better production process as the foundation for the regional even international economy in this modern era.

Agriculture sector plays significant role in the country's economic development, as Indonesia is an agricultural country. Economic development heavily relied on agricultural and agricultural-based

industry or agroindustry. Within the agribusiness system, agroindustry is one of the sub-systems which together with other sub-systems shaped the agribusiness. One of the efforts to develop the production from agricultural sector is by increasing the added value of its products. This can be done by linking the agriculture with industry/processing industry or services in economic sector [1, 2].

Gorontalo province is currently trying to boost its maize commodity, from cultivation to development of its processed products. The maize production in Gorontalo province increases by 7.58% in 2014 compared to the previous year which was only 719, 787 tons [3]. As the featured product from Gorontalo, the added value of maize into various processed products is needed through involvement of small and medium scale industries. Processing industries of agricultural product will increase the economic value of the products.

One of the popular agricultural product processing industries is corn-based processing industry. There are quite several small-scale corn-based processing industries, such as corn chips, corn flour, popcorn, corn crackers, and fried corn. This corn processing industry process locally produced corn with limited market coverage. In addition, there are also several large companies which produce the maize flour, corn-based noodle, and corn-based snacks such as corn flakes, tortilla chips, and popcorn [4, 5].

The result of economic development in Gorontalo compared to other six provinces in Sulawesi can be described as follow: 1) the gross regional domestic product is the smallest among six other provinces by 3.25% of the total gross regional domestic products of the six provinces combined, 2) the gross regional domestic product per capita based on the basic implemented pricing is only IDR. 9,562,694 compared to the average national which is 29.9 million rupiah and even among the smallest (PDRB Gorontalo Province, 2013), 3) the proportion of poor population is 17.30% to the total population (Gorontalo in Figures, 2013), 4) economic development is only 7.71%, the lowest among the six provinces; 5) productivity of workforce is only 0.513 (unproductive) even the percentage is the lowest among other 5 provinces in Sulawesi [6, 7].

The contribution of nine economic sectors toward the regional GDP of Gorontalo province is widely dominated by farming sector (food plants, horticulture, plantation, animal husbandry, fisheries) of 28.95%. Meanwhile, the contribution of the processing industry is among the smallest three by only 4.89%. Thus, this leading commodity's contribution toward the regional GDP needs to be maximized as well as increasing the income and welfare of the people. Here, the role of higher education through its empirical and scientific research is needed.

## 2. Method and Transfer of Technology Mechanism/Social intervention

### 2.1. Method
The method used in this study is quantitative descriptive method which encompasses desk study, secondary data analysis, workshop and meeting with related stakeholders, develop the design of the study for each value chain actor, field visit and in-depth interview, focus group discussion, presentation and findings discussion to formulate the master plan and the model for the development of corn commodity.

### 2.2. Institutionalization of industrialized strategy to build nation's character
The characteristics of industrialization or social intervention in an effort to strengthen and build character through this study are: 1) the existence of development of innovation and technology through acknowledgement of local culture, corn commodity, as hereditary job that has been passed down for generations among the people of Gorontalo, thus, it is often said as the cultural commodity, as there is a local variety of corn called *Motoro Kiki* (the best option for various corn-processing products); 2) maximum utilization of locally available resources based on the local wisdom in increasing the income and welfare of the people of Gorontalo province; 3) the characteristic of the developed industrialization or social intervention are the development and processing-industry for corn-based products in Gorontalo and Pohuwato regencies in partnership with regional and national industry based in Manado and Makassar; 4) the main component to be developed in this cluster is through diagnostic study to collect

the scattered knowledge and fragmented socio-economic condition of this cluster through development of the available potentials.

## 3. Results and Discussion

### 3.1. Cost analysis and break even point

*3.1.1. Cost and benefit calculation of corn chips production.* The chips are produced an average of 8 times a month, with 80 kgs of raw corn machine capacity, which produce 48 kg of products, divided into five types of packaging based on (package A price Rp. 1,800, package B price Rp. 5,000, package C price Rp. 10,000, package D price 18,500 and package E price is Rp. 75,000).
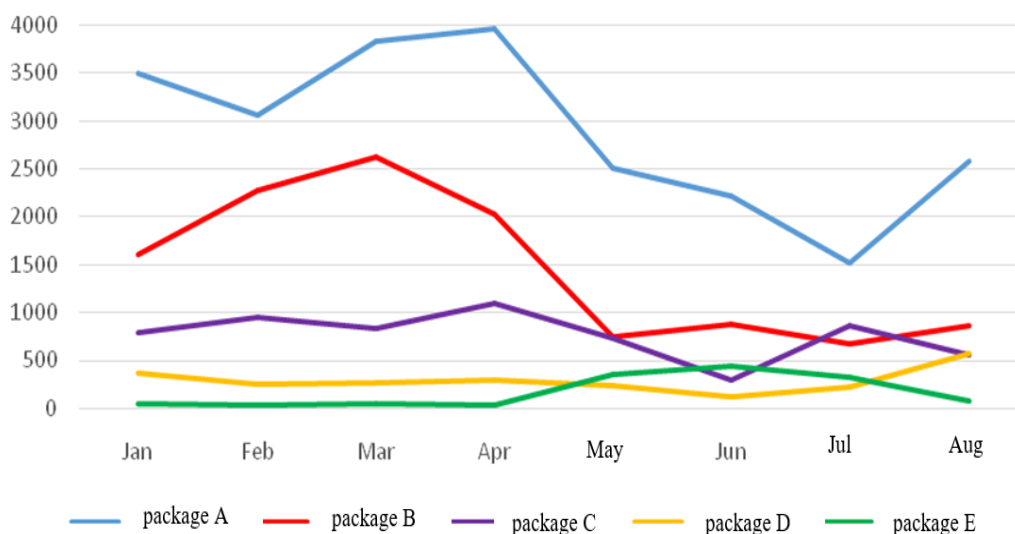


**Figure 1.** Corn Chips Sales based on types of package (2018)

Based on the graphic above, demand for package A is higher than other packages. The demand for this package reaches 4000 demands. This graphic also shows that demand for package E, the bottled package also increases in July, which may due to Id Al-Fitri, the highly celebrated festivity in the Islamic population.

This cost analysis shows that corn chips products sales increases on the first month of production, however, the demand significantly dropped on the third month (April). Several suspected factors for this decrease on demand are:
− Lack of labors.
− Product esthetic.
− Promotion.

Regardless to the described things above, this corn chips production has yield high profits. This can be seen in the detail of production cost and the BEP presented in Table 1. Further, to gain information on the profit and Break Even Point (BEP) for each packaging, the fixed cost and variable cost are calculated to see the profit for this sale, and on what month of the production process will gain profit and the BEP for each packaging of different price.

**Table 1.** Production cost, sales price and gross profit of the corn chips from January to August 2018

| Month | Production cost | Sales price | Gross profit |
|---|---|---|---|
| January | 18,466,744.00 | 32,739,200.00 | 14,272,456.00 |
| February | 18,867,400.00 | 33,230,900.00 | 14,363,500.00 |
| March | 21,107,202.00 | 36,769,400.00 | 15,662,198.00 |
| April | 20,925,688.00 | 36,385,900.00 | 15,460,212.00 |
| May | 21,628,328.00 | 49,969,800.00 | 28,341,472.00 |
| June | 20,770,981.00 | 42,975,400.00 | 22,204,419.00 |
| July | 19,551,148.00 | 43,311,900,00 | 23,760,752.00 |
| August | 15,993,138.00 | 30,285,600.00 | 14,292,462.00 |
| TOTAL | 157,310,629.00 | 305,668,100.00 | 148,357,471.00 |
| Average | 19,663,828.63 | 38,208,512.50 | 18,544,683.88 |

**Table 2.** Fixed Cost of Corn Chips

| Type of cost | Unit | Total price | Total |
|---|---|---|---|
| BOX | 6 | 175,000.00 | |
| Storage Rack | 4 | 1,950,000.00 | |
| STEAMER | 4 | 340,000.00 | |
| STOVE | 4 | 625,000.00 | |
| COOLING RACK | 4 | 1,000,000.00 | |
| NAPKIN | 12 | 15,000.00 | |
| LIME STRAINER | 1 | 10,000.00 | |
| DUST STRAINER | 4 | 10,000.00 | |
| HAMMERMILL | 1 | 29,350,000.00 | |
| FRYING MACHINE | 1 | 5,225,000.00 | |
| OVEN | 1 | 2,565,000.00 | |
| SEALER MACHINE | 1 | 8,100,000.00 | |
| ADDITIONAL EQUIPMENT | 1 | 2,000,000.00 | |
| BUILDING | 1 | 62,000,000.00 | 148,365,000.00 |

**Table 3.** Variable Cost of Corn Chips

| Month | Production cost | Sales price | Gross profit |
|---|---|---|---|
| January | 18,466,744.00 | 32,739,200.00 | 14,272,456.00 |
| February | 18,867,400.00 | 33,230,900.00 | 14,363,500.00 |
| March | 21,107,202.00 | 36,769,400.00 | 15,662,198.00 |
| April | 20,925,688.00 | 36,385,900.00 | 15,460,212.00 |
| May | 21,628,328.00 | 49,969,800.00 | 28,341,472.00 |
| June | 18,928,850.00 | 39,926,400.00 | 20,997,550.00 |
| July | 19,551,148.00 | 43,311,900.00 | 23,760,752.00 |
| August | 15,993,138.00 | 30,285,600.00 | 14,292,462.00 |
| TOTAL | 155,468,498.00 | 302,619,100.00 | 147,150,602.00 |
| Average | 19,433,562.25 | 37,827,387.50 | 18,393,825.25 |

From the production and sales data above, the average monthly production cost is 19,433,829 IDR with the sales price of 37,827,387 IDR. This result indicates that on the 9th month based on the production cost of the corn chips and its sales, the net profit will be of 18,393,825 IDR.

This calculation shows that during the production process of these corn chips, on the initial months, just like other industry, the profit has yet to be reached as it has to be deducted by production cost and other costs. Thus, the corn chips production will gain profit on its 9th month. In detail the profit calculation is presented in Table 4 below:

**Table 4**. Description of the gap between fixed cost and variable cost and sales price

| | | | |
|---|---|---|---|
| 1st Month | FIX COST | 148,365,000 | |
| | VARIABLE COST | 19,433,562 | |
| | | 167,798,562 | |
| | SALES PRICE | 37,827,388 | |
| | | 129,971,175 | (-) |
| 2ND Month | FIX COST | 129,971,175 | |
| | VARIABLE COST | 19,433,562 | |
| | | 149,404,737 | |
| | SALES PRICE | 37,827,388 | |
| | | 111,577,350 | (-) |
| 3RD Month | FIX COST | 111,577,350 | |
| | VARIABLE COST | 19,433,562 | |
| | | 131,010,912 | |
| | SALES PRICE | 37,827,388 | |
| | | 93,183,524 | (-) |
| 4th Month | FIX COST | 93,183,524 | |
| | VARIABLE COST | 19,433,562 | |
| | | 112,617,087 | |
| | SALES PRICE | 37,827,388 | |
| | | 74,789,699 | (-) |
| 5th Month | FIX COST | 74,789,699 | |
| | VARIABLE COS | 19,433,562 | |
| | | 94,223,261 | |
| | SALES PRICE | 37,827,388 | |
| | | 56,395,874 | (-) |
| 6th Month | FIX COST | 56,395,874 | |
| | VARIABLE COST | 19,433,562 | |
| | | 75,829,436 | |
| | SALES PRICE | 37,827,388 | |
| | | 38,002,049 | (-) |
| 7th Month | FIX COST | 38,002,049 | |
| | VARIABLE COST | 19,433,562 | |
| | | 57,435,611 | |
| | SALES PRICE | 37,827,388 | |
| | | 19,608,223 | (-) |
| 8th Month | FIX COST | 19,608,223 | |
| | VARIABLE COST | 19,433,562 | |
| | | 39,041,786 | |
| | SALES PRICE | 37,827,388 | |
| | | 1,214,398 | (-) |
| 9th Month | FIX COST | 1,214,398 | |
| | VARIABLE COST | 19,433,562 | |
| | | 20,647,960 | |
| | SALES PRICE | 37,827,388 | |
| | | (17,179,427) | (+) profit |

The gap between the fixed cost and variable cost with the sales price on the 9th month shows that the corn chips production process yields the benefit of 17,179,427 IDR. This means that the corn chips industry can increase the people's economy. The profit value on this 9th month can increase on the following months. This profit is obtained from the corn chips sales of various packages types. The Break Event Point (BEP) for each type of packaging is obtained in certain sales number. In detail the BEP for each packaging types of corn chips is presented in Table 5.

**Table 5**. Break Even Point (BEP) calculation of Corn chips for each packaging types

| | |
|---|---|
| 1.   1,800 IDR each package with the production cost of 1,638 IDR | |
| BEP UNIT        FIXED COST | |
| Sales price – production cost | |
| 915,833.33 | Unit or packages |
| 2.   5,000 IDR each package with the production cost of 2,768 IDR | |
| BEP UNIT        FIXED COST | |
| Sales price – production cost | |
| 66,471.77 | Units or packages |
| 3.   10,000 IDR each package with the production cost of 4,929 IDR | |
| BEP UNIT        FIXED COST | |
| Sales price – production cost | |
| 29,257.54 | Units or packages |
| 4.   18,500 IDR each package with the production cost of 8,236 IDR | |
| BEP UNIT        FIXED COST | |
| Sales price – production cost | |
| 14,454.89 | Units or packages |
| 5.   75,000 IDR each package with the production cost of 28,024 IDR | |
| BEP UNIT        FIXED COST | |
| Sales price – production cost | |
| 3,158.31 | Units or packages |

From the BE P description for each unit of packaging above, it shows that the higher the sales price per unit package sold, the lower the number that should be sold to achieve the BEP. For instance, for the 1,800 IDR each unit, it needs 915,833 packages to attain the BEP value, whereas for the 75,000 IDR each unit, it only needs 3,158 packages to be sold to achieve BEP value. This should be considered that each package unit has their own consumers, hence this BEP value should be adjusted with the target market and production target.

*3.1.2. Analysis of production cost correlation with the sales of corn chips product.* Correlational analysis is carried out to investigate whether there is a correlation between the production test and the level of sales of these corn chips product. This test is administered using the Pearson *product moment* correlation test, where different annual financial data are used. This test is to ensure the significant correlation between production cost and sales of the corn chips product. The result of this test is presented in Table 6.

**Table 6.** Average value and Deviation Standard

| Variables | Total | Average | Std. deviation |
|---|---|---|---|
| Production cost | 36 | 8425112.97 | 3856708.430 |
| Sales | 36 | 7.1399 | 0.32043 |

The average value of production cost for corn chips product is compared against the deviation standard value. As seen in Table 6, the average value 8425112.97; whereas the standard deviation value is 3856708.430. This average value is higher than the standard deviation value, hence, it can be said that the data is appropriate to be analyzed. Similarly, the average value of sales variable is 7.1399 with the standard deviation value of 0.32043. The average value is larger than the deviation standard value, thus, worthy of analysis.

**Table 7.** Summary of the Correlational test result

| | r-count (t$_{table}$ = ± 1,975) | *Sig. (p-value)* | Notes |
|---|---|---|---|
| Production cost* sales | 0.775 | 0.000 | Significant |

The result of correlation test of the production cost and the sales yields the r-count of 0.775 with the significance level of 0.000. The r-count 0.775 describes that there is a strong and positive correlation between the production cost and sales of corn chips product. This increase on corn chips production is also followed by the positive increase of sales. This is statistically proven that there is a significant correlation between production cost and sales, where the *p-value* 0.000 is smaller than alpha 0.05. Therefore, it also indicates that the production cost of corn chips also influences the increase of sales of the product, and impacts on the increase of income. This result indicates that production cost and the sales of the corn chips are promising for the community to utilize this corn commodity and turn it into corn chips. The corn commodity as the leading commodity in Gorontalo can be utilized into corn chips, which have been done by these small-scale industries to increase their economic welfare.

*3.1.3. Normality data test of the production cost and sales variables of corn chips*. Normality test is to test whether data or the investigated variables or the developed model has normal or abnormal distribution. In linear correlation, the data distribution is expected to have to have normal distribution. The normality test is conducted using the *Kolmogorov-Smirnov* test, where the test is carried out and proven with the *asymptotic significance. Asymptotic significance* value which larger than 0.05, shows that the variables or observed data have normal distribution, and vice versa. The *Kolmogorov-Smirnov* test result is presented in Table 8 below.

**Table 8.** The result of data normality test

| Variables | *Asymptotic Sig.* | Alpha (α) | Notes |
|---|---|---|---|
| Production cost | 0.200 | 0.05 | Normal |
| Sales | 0.200 | | Normal |

Table 10 above shows that the *asymptotic significance* value of production cost and marketing is more than alpha 0.05 (> 5%). Therefore, it can be said that the variables used in correlation model meet the normal assumption and appropriate to be used.

*3.1.4. Linearity test of production test variable and sales price of corn chips product*. The linearity test is conducted to see whether there is a linear correlation pattern between the variable or insignificant. The test is carried out using the *Test for Linearity* with the significance level of 0.05. Two variables can be said to have linear correlation when the significance level is less than 0.05. the linearity test of the variable is shown in Table 9 below.

**Table 9.** Linearity test of the variable

| | *Linearity* | | Alpha (α) | Notes |
|---|---|---|---|---|
| Production cost * sales price | 0.000 | < | 0.05 | Linier |

From Table 9 above on the linearity test result above, it is known that the significance value on the linearity is 0.000. The significance value of test for linearity is smaller than the alpha value (0.000 < 0.05). Therefore, it can be concluded that there is a linearity correlation between the production cost and sales price.

*3.1.5. Correlation analysis*

**Table 10.** Correlations

|  |  | Production cost | Log_ sales price |
|---|---|---|---|
| Production cost | Pearson Correlation | 1 | .775** |
|  | Sig. (2-tailed) |  | .000 |
|  | N | 36 | 36 |
| Log_ Sales price | Pearson Correlation | .775** | 1 |
|  | Sig. (2-tailed) | .000 |  |
|  | N | 36 | 36 |

**. Correlation is significant at the 0.01 level (2-tailed).

## 4. Conclusions

The conclusion of this study are benefit of chips very depending on the type of packaging; the advantages of chips are increasingly increasing; based on the results of the organoleptic test seen from the aroma, taste, texture and the most preferred color is Balado.

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