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# A Cost-Benefit Analysis of a New Product Development from Organic Broken-milled Rice in Thailand

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## Abstract

This paper aims to carry out a cost-benefit analysis of a new product development from a by-product. In this case, the by-product is organic broken-milled rice and the new product development is organic rice pudding. Data was obtained from multi supply chain of a primary data, for instance, farmers, retailer, and entrepreneurs on a rice supply chain and a secondary data from the published literature. The study found that the payback period (PB) of the investment is 2 years and 7 months (940 days) with the net present value (NPV) is 3,008,099 Thai Baht (assuming that the discount rate is 8%) and 22.73% of internal rate of return on investment (IRR). The results indicate that investment in the organic rice pudding product could be profitable in the long run.

**Keywords:** Cost benefit analysis, New product development, Organic broken-milled rice

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## 1. INTRODUCTION

At present, Thailand organic rice production is increasing. This is mainly due to the Thai government policy relating to this production which includes the expansion of the plantation area, organic rice productivity, infrastructure knowledge transfer, and organic plant product market driven. In 2013, Thailand had one hundred and two thousand hectare area for growing organic rice and it increased to two hundred and three thousand hectare area in 2014 (Green Net, 2014). Most of the rice fields, approximately 80 percent, are located in many provinces in the Northeastern region such as Surin, Yasothon, Ubon Ratchathani, Udon Thani, Khon Kaen, Maha Sarakham, Roi Et, etc., and the rest of 20 percent is located in Northern provinces such as Chiang Rai, Phayao, and Chiang Mai (Green Net, 2014).

The important rice field for jasmine organic rice production in Thailand is in Thung Kula, particularly in the area around "Plubpla watershed", which covers several provinces in the Northeast such as Surin, Maha Sarakham, Roi Et, and Yasothon (Green Net, 2014). The present study was conducted in four provinces: Roi Et, Khon Kaen, Maha Sarakham and Kalasin provinces, which are known as "RoiKaenSarnSin". In these four provinces, the organic rice planting area covers around 1.9 thousand hectares, which is 6.21 percentage of the country area. Furthermore, in this area, there is a provincial strategic cooperation to support the organic rice market and other kinds of agricultural products (Provincial Bureau of Statistics, 2014).

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In the rice production process, the ratio between a main product (i.e., white rice) and by-products (e.g., broken-milled rice, bran, and husk) is 4:6 (see Table 1). As can be seen in Table 1 the quantity of production of the by-products is close to the main product. Therefore, it is interesting to investigate on how to add value to them. The broken-milled rice is sold at a very low price. It could be valuable to develop new products from rice's by-products and to extend their production from a laboratory scale to an industrial scale. Specifically, in this study, it aims to examine the feasibility of producing organic rice pudding from the organic broken-milled rice that is tested and meets customers' satisfaction. This purpose leads to a research question of what a cost-benefit of organic rice pudding product is.

Table 1. Component of 1,000 kg of rice

Components	Quantity (kg)	Percentage
White grain whole rice	423.17	42.3%
Small broken A1	173.21	17.3%
Small broken C1, C3	66.68	6.7%
Rice bran	101.88	10.2%
Husk and other	<u>235.06</u>	<u>23.5%</u>
Total	1,000.00	100.0%

The rest of the paper is organized as follows; literature reviews, methodology, results, conclusion and discussion, and future research.

## 2. LITERATURE REVIEWS

### 2.1 New Product Development

A new product development means the product contains any of the following characteristic: 1) a first invention product, 2) product development, 3) product modification, or 4) creating new brand products. The new product development process is divided into eight steps: 1) idea generation, 2) idea screening, 3) product concept development and concept testing, 4) marketing strategy development, 5) business Analysis, 6) product development, 7) market testing, and 8) commercialization.

### 2.2 Cost-Benefit Analysis

A Cost-Benefit analysis is a tool for the investment that helps to decide the effectiveness of the allocation of social resources (Boardman, 2006). This tool is used to analyse in term of a financial dimension and benefits to investors. Many new business projects use this tool to determine and forecast both profitability and economic dimensions of investments. This composes of payback period, net present value, and internal rate of return. The formulas used are shown in the methods section.

## 3. METHODS

### 3.1 Study Design and Sample Size

A cost-benefit analysis of organic rice pudding production was performed by using primary data, cost production and consumers' needs. The primary data was collected using a questionnaire. Meanwhile the secondary data was gathered from previous studies on rice products. The participants for the survey are 80 farmers from four provinces (i.e., 20 farmers from each province), 20 retailers, and 2 processed entrepreneurships.

### 3.2 A Cost-Benefit Analysis

To calculate cost and benefit, the payback period, net present value, and internal rate of return were computed. The formula are as shown below.

#### 3.2.1 Payback Period (PB)

Payback Period (PB) is a way to find out how much it takes to pay back the investment (Garrison et al., 2010). The formula of payback period is as follows:

$$\text{Payback Period} = \frac{\text{Total investment}}{\text{Annual net cash inflow}}$$

The investment project is acceptable when the payback period is less than the project life span. On the other hand, the investment project is not acceptable when the payback period is greater than the project life span.

### 3.2.2 Net Present Value (NPV)

Net Present Value (NPV) is the total of present value of net cash flow (Garrison et al., 2010). The formula of net present value is as follows:

$$NPV = \sum_{t=1}^n \frac{CF_t}{(1+k)^t} - C_0$$

where  $CF_t$  is net cash flow at time  $t$ ;  
 $k$  is required rate of return or discount rate;  
 $C_0$  is initial investment of the project; and  
 $n$  is the project life span.

The investment project is acceptable when the net present value is positive, which means that the return of this project is greater than the required rate of return. The Positive NPV means that the investment would add value to the firm. If the net present value is negative, then the project is rejected because its rate of return is less than the required rate of return. If the net present value is zero, it should be indifferent in the decision whether to accept or reject the project. The return of the project is equal to the required rate of return, so the project adds no monetary value. The decision making should be based on other factors not explicitly included in the calculation

### 3.2.3 Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is a rate of return that investors get by investing in projects where the average per year over the life of the investment (Garrison et al., 2010). The IRR is the rate of return, that is required to bring the net present value to zero. The formula of internal rate of return is as follows:

$$NPV = 0 = \sum_{t=1}^n \frac{CF_t}{(1+r)^t} - C_0$$

where  $CF_t$  is net cash flow at time  $t$ ;  
 $C_0$  is initial investment of the project;  
 $n$  is the project life span; and  
 $r$  is the internal rate of return.

The investment project is acceptable when the internal rate of return is greater than the required rate of return. Any project whose internal rate of return is less than the required rate of return is rejected.

## 4. RESULTS

### 4.1 Cash Flow Forecast

The cash flow projection for the new business plan which includes 5 annual periods was firstly forecasted. The cash flow projection was based on a number of default assumptions that were specified by the researches. The cash flows projection is presented below:

Table 2. Business Plan-Cash Flow Projection

Year	T	T+1	T+2	T+3	T+4	T+5
<b>Cash Inflows</b>						
Cash receipts from customers <sup>a</sup>	-	11,025,000	11,576,250	12,733,875	14,007,263	16,108,352
Collection of receivables <sup>a</sup>	-	4,205,250	4,935,263	5,402,801	5,943,081	6,804,528
Other operating revenue received	-	-	-	-	-	-
<b>Total Cash Inflows</b>	-	15,230,250	16,511,513	18,136,676	19,950,344	22,912,880
<b>Cash Outflows</b>						
<b>Operation Activity<sup>b</sup></b>						
Direct material	872,263	6,647,625	7,329,007	8,465,003	9,777,078	11,805,822
Direct labor	-	828,000	896,400	1,187,640	1,292,004	1,406,804
Factory overhead	-	750,500	788,025	856,958	932,290	1,050,370
Marketing expense	-	1,786,000	1,976,350	2,385,585	2,666,064	3,001,267
Administrative expense	-	1,818,434	1,964,754	2,147,556	2,328,681	2,527,752
Income tax <sup>f</sup>	-	-	482,356	496,901	420,250	403,640
<b>Capital Expenditure<sup>b</sup></b>						
Purchase of PPE	6,548,300	-	-	-	-	-
Pre-operating expense	388,000	-	-	-	-	-

Other cash inflows	-	-	-	-	-	-
<b>Total Cash Outflows</b>	7,808,563	11,830,559	13,436,892	15,539,643	17,416,367	20,195,655
<b>Net Cash flows</b>	- 7,808,563	3,399,691	3,074,621	2,597,033	2,533,977	2,717,225
Add: Cash balance at the begin	-	500,000	3,003,691	5,233,512	7,036,946	8,828,524
Total cash	- 7,808,563	3,899,691	6,078,312	7,830,545	9,570,923	11,545,749
Add: Owner equity <sup>c</sup>	5,108,563	-	-	-	-	-
Loan <sup>c</sup>	3,200,000	-	-	-	-	-
Less: Paid principles <sup>d</sup>	-	640,000	640,000	640,000	640,000	640,000
Paid interests <sup>e</sup>	-	256,000	204,800	153,600	102,400	51,200
Cash balance at the end	500,000	3,003,691	5,233,512	7,036,945	8,828,523	10,854,549

Assumptions:

- <sup>a</sup> Sales data are primary data from farmers, retailers, and entrepreneurs. 30% of sales are on account and the company collects these credit sales in the month following sale.
  - <sup>b</sup> Production cost, operating expense and capital expenditure data is primary data as cost production from farmers, retailers, and entrepreneurs.
  - <sup>c</sup> The company has an agreement with the bank that allows the borrowing of 3.2 millions bath at the beginning of this project.
  - <sup>d</sup> The company would repay the loan plus accumulated interest during 5 years at the end of each year.
  - <sup>e</sup> The interest rate on these loans is 8% per year.
  - <sup>f</sup> Thai corporate tax on these company is 20%.
- Factory overhead excludes depreciation expense.  
PPE is property, plants and equipments.

#### 4.2 A Cost-Benefit Analysis

Table 3 shows that the payback period of the by-product project, the organic rice pudding, is 2 years and 7 months.

Table 3. Payback period of organic rice pudding

Year	Cash Flow )Bath(	Collected Cash Flow )Bath(
0	-8,308,562	-8,308,562
1	3,399,691	-4,908,871
2	3,074,620	-1,834,250
3	2,597,034	762,783
4	2,533,978	3,296,761
5	2,717,224	6,013,986

In addition, the NPV is positive (3,008,099 Bath) when the discount rate used was 8%. Meanwhile the IRR of the project is equal to 22.37%. The results indicate that the project is a profitable and feasible investment.

#### 5. CONCLUSION AND DISCUSSION

The estimated cost of investment in organic rice pudding production is 8,308,563 baht. The capital structure consist of 3.2 million baht (38.51%) of loan and 5,108,563 baht (61.49%) of contribution from the owner. Total net sales in the first year was estimated to be 7.875 million baht. The product growth rate is 5% in the second year, 10% in third year, 10% in fourth year, and 15% in the fifth year. These indicate that profit is increasing from year to year.

The result of the cost-benefit analysis indicates that the PB of the project is 2.7 year which is less than 5 years. In addition, the NPV is positive and the IRR value is high. This indicates that the investment in this product is interesting and profitable.

For information about investing as inside-out planning (Shrimp, 2003), the analysis between resources and production planning is conducted. The manager should be cautious of this risk because the organic broken-milled rice has limited quantity in the organic rice production process. Thus, the manager must have a good plan for the production of organic rice pudding product in the future.

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