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THE COST BENEFIT ANALYSIS OF THE NEW DEVELOPING PRODUCT FROM ORGANIC RICE

ANÁLISIS DE BENEFICIOS DE COSTOS DE NUEVO PRODUCTO EN DESARROLLO: ARROZ ORGÁNICO

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Abstract

This study conducts the cost-benefit analysis of a new product developed from by-product of organic rice. The raw material is organic broken-milk rice and the new developing product is organic rice pudding. The primary data for cost benefit analysis were obtained from multi sector of rice supply chain, for instant, farmers, retailers and processed entrepreneurs. In addition, secondary data from literature review were included. The cost benefit analysis carried out under several assumptions on the life span of the project, for example, growth hypothesis, capital structure, cash collection and payment period. The result of the study revealed that payback period (PB) is 2 years and 7 months (940 days), net present value (NPV),based on 8% of discount rate, is 3,008,099 Thai Baht (95,500 dollar) and internal rate of return on investment (IRR) is 22.73% that the organic rice pudding has possibility and potential for new product investment. This research is helpful on a practical of significant economic for new product development (NPD).

Keywords

Cost benefit analysis – New product development – Organic broke-milled rice

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Introduction

From the past to the present, Thailand is a key producer and exporter of rice, ranked at the top position of the world rice exporters. Thai people produce rice for both consumption and export. As such, rice is an important product for Thai people to earn incomes. However, about 10 years ago, the Thai government had launched a rice pledging policy, resulting in higher price rice compared against the market price, with the expectation that Thai exporters could cope with the price competition. Especially, in 2016/2017 the price of Thai rice was much more expensive than that of other countries such as India, Vietnam, and so on. During that time, Thai exporters had faced with a critical rice cost since the cost of Thai rice was higher than the world market price, while the yield of rice production of the competitor countries was increasing[1]. In 2016, the average cost to grow jasmine rice was 8,177 baht per ton

.This was an increase of 1.7 percent from the year 2015. In contrast, the average price of jasmine rice was 9,500 baht per ton. The prices of jasmine rice decreased 10.8 percent, respectively compared against those of the previous year. Therefore, farmers as the producers and exporters were affected and could not earn enough incomes[2].

The changing global economic condition had considerably affected the rice market and increased the competition among rice farmers. Thai farmers are forced to adapt themselves to survive by implementing two main strategies: reducing the cost and producing different products. These two strategies can help increase Thai farmers' competitiveness level to expand and add values to rice for higher capability competition. This is one way out of poverty and as an incentive to farmers to sustainably produce crops. Considering the cost of production, Thai farmers still rely substantially on the use of fertilizers and chemicals, which cost them approximately 2,024 baht per acres or 24.75 percent of the total cost. The report of the Bureau of Agricultural controls displayed that Thailand imported many kinds of chemicals and pesticides used in crop production such as fertilizers and plant growth regulators. Especially, the imports of pesticides, herbicides, and fungicides was considerably high in the year of 2015, with the import of 149,546 tones, costing 19,326 million baht, in 2016, with the import of 160,824 tones costing 20,618 million baht, and in 2017 with the import of 198,317 tons costing 27,922 million baht, respectively[3]. These figures showed the unbalance between the yield of the agricultural crops and the use of chemicals. Hence, this issue is an important problem of the agricultural production food system in the world.

The two strategies (i.e., cost reduction and new product development) are in line with the healthy trend of the world. Many people are increasing more concerned about their health. People increase their exercise and are more aware of healthy food[4].Thai

[1] Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand Foreign Agricultural Trade Statistics 2017. 2018. Retrieved from. www. oae.go.th/view/1/Home/EN-US, on 28 August 2018

[2] Department of Foreign Trade, Thai rice cost and yeild 2016. Retrieved from http://www.thairiceinfo.go.th/?page=DataL3.ShowData&codeData=A1008 on 20 August 2017; Thai Rice Mills Association [TRMA], Price Rice (September, 2016). Retrieved from http://www.thairicemillers.com/images/ on 20 August 2018.

[3] Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand Foreign Agricultural…

[4] P. Kantatasiri, "Future of functional foods and nutraceutical products: The challenge and potential of Thailand to ASEAN", GMSARN International Journal, num 6 (2012): 87-96.

farmers start to produce organic crops such as vegetables and rice, which are main ingredients of cooked food. Organic farming has received a lot of interest, which is one result from the health promotion policy of the Ministry of Public Health that aims to raise people's awareness on chemical using in farming. Thus, an organic farming system is a motivating area in Thailand's.

Agricultural system

Furthermore, organic farming is increasingly well accepted all around the world, especially in Southeast Asia, as part of the effort to promote an organic agriculture system for sustainable society, health, and ecology. The organic system is based on natural system and it does not use the chemical synthesis, such as fertilizers, herbicides, fungicides, pesticides, and the growth regulators. Hence, the organic method is helpful to minimize the cost of plant cultivation. Therefore, this system has been adopted in developed countries as rapidly as in developing countries[5].

At present, Thailand's government encourages the production of organic rice by launching a policy to expand plantation areas, organic rice productivity, infrastructure knowledge transfer, and organic plant product market. In 2014, Thailand had fifty-two thousand hectare area for growing organic rice and it went up to sixty-six thousand hectare area in 2015[6]. Most of the rice fields, approximately 80 percent, are located in provinces in the Northeastern region such as Surin, Yasothon, Ubon Ratchathani, Udon Thani, Khon Kaen, Maha Sarakham, Roi Et, etc., and the rest is located in Northern provinces such as Chiang Rai, Phayao, and Chiang Mai[7]. The important rice field for jasmine organic rice production in Thailand is in Thung Kula, especially in the area around "Plubpla watershed", which covers several provinces in the Northeast such as Surin, Maha Sarakham, Roi Et, and Yasothon[8]. 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[9].

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 seen, the ratio displays that in the process, the amount of the by-product is close to the main product. It is, therefore, interesting to investigate how to add value to them. Also, the broken-milled rice is sold at a very low price. It is valuable to create innovates which are new products from rice by-products and to extend their production from a laboratory scale

[5] S. Chouichom & M. Yamao, "Comparing opinions and attitudes of organic and non-organic farmers towards organic rice farming system in North-Eastern Thailand", Journal of Organic Systems, Vol: 5 num 1 (2010): 25-35; U. S. Borisova & G. M. Parnikova, "Methodological Approaches and Pedagogical Conditions of the Educational Autonomy Formation in Students-Natives of Yakutia", International Electronic Journal of Mathematics Education, Vol: 11 num 10 (2016): 3397-3403.

[6] Green Net, The Organic Thailand 2014-2015. 2016. Retrieved from, http://www.greennet.or.th/sites/default/files/Thai%20OA%2016.pdf on 30 December 2017.

[7] Green Net, The Organic Thailand 2014-2015…

[8] Green Net, The Organic Thailand 2014-2015…

[9] Provincial Bureau of Statistics. National Statistical Office, Search by name's province. 2016. Retrieved from http://www.nso.go.th/ on 20 June 2015.

to an industrial scale. Specifically, in this study, it aims to transform the organic broken-milled rice to organic rice pudding, which is tested and produced to meet customers' satisfaction. This purpose leads to a research question of this study "what is a cost-benefit of organic rice pudding product?"

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	235.06	23.5%
Total	1,000.00	100.0%

Table 1
Components of 1,000 kg of rice

Moreover, although Thai farmers have knowledge in a product development, they never calculate a cost

– benefit before launch a new product. This is a gap between the scientific side and economic side. Finally, this research is helpful and fulfill on a practical and an economic of a product development because a cost – benefit of a product after finish a product development process helps an entrepreneur making a decision to invest this product or not. Furthermore, this research wills an influencing on the Thai farmers in Thailand that aware the new economic pass a product development.

Literature review

New Product Development (NPD)

The definition and factors of the new product development (NPD) have been proposed over 40 years. Specifically, today the technology of production and processing have been more advanced, so many enterprises have to develop they product to meet the need of consumers[10]. Typically, the NPD composes of research and development (R&D) and marketing personnel to establish objectives for a new product[11]. In this present study, the concept of the new product development refers to the following characteristic of a new product: 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 or technicalities, 7) market testing, and 8) commercialization[12]. Each step is explained in details below.

[10] W. D. Hoyer; R. Chandy; M. Dorotic; M. Krafft & S. S. Singh, "Consumer cocreation in new product development", Journal of Service Research, Vol: 13 num 3 (2010): 283-296.
[11] W. E. Souder; J. D. Sherman & R. Davis-Cooper, "Environmental uncertainty, organizational integration, and new product development effectiveness: A test of contingency theory". Journal of Product Innovation Management, num 15 (1998): 520-533.
[12] P. Kotler & K. L. Keller, Marketing management (New Jersey: Pearson Education, Inc.: Prentice Hall, 2012).

Step 1: An idea generation refers to the survey of a new idea to find the opportunity or a new possible product to sell. Based on the concept of marketing, it is important to define customers' needs and wants in defining new idea products[13].

Step 2: An Idea screening refers to scrutinizing ideas about new products by selecting a good idea from step one. The company can motivate its employees by giving them rewards to encourage them to offer new ideas. Three ideas that can benefit the company include: 1) Promising ideas 2) Marginal ideas, and 3) Rejects ideas[14].

Step 3: Product concept development and concept testing are to develop products that manufacturers have created and translated their concept onto products and them to consumers. Concept development is the company's effort to generate ideas about products from their consumers. The question is concerned with the valuation and various opportunities of new product outcomes. Furthermore, product and brand positioning are to be considered along with the product concept. Concept testing is the testing of the product in the target consumer group to measure whether the product can attract and meet the needs of consumers. The aim is that the customer must easily understand the product and see the benefit they will receive through the use of the product. After the concept testing, the quality of the product will be better improved. Also, at this stage, if the result from the testing shows that most consumers do not accept the product, the next step should not be proceeded[15].

Step 4: Marketing strategy development is a step following concept testing. This strategy is implemented as the new product is introduced into the market. Thus, this step concerns with market's size, market structure, product positioning, market share, and so on, and these are factors to success[16].

Step 5: Business Analysis follows the marketing strategy development step. At this stage, the manager can manipulate the business attractiveness, which includes sale volume, cost, and profit. This step will help the manager to estimate the business success or failure[17].

Step 6: Product development or Technicalities refers to the step following the business analysis. The objective of this step is to produce a pilot product which meets customers' requirements. Furthermore, in this step, many kinds of disciplines must be employed to develop a product prototype such as engineering, art, and biotechnology or food technology[18] .

Step 7: Market Testing is a step to test a product prototype in the real market. In this stage, the product must be ready to be sold, which means other components such as brand, logo, and packaging must be ready[19].

Step 8: Commercialization is the final step of the new product development that is a full stream of production and marketing. The company has to be aware of timing to go into the market and has to prepare many strategies for the new product. The manager has

[13] P. Kotler & K. L. Keller, Marketing management...
[14] P. Kotler & K. L. Keller, Marketing management…
[15] P. Kotler & K. L. Keller, Marketing management…
[16] P. Kotler & K. L. Keller, Marketing management…
[17] P. Kotler & K. L. Keller, Marketing management…
[18] P. Kotler & K. L. Keller, Marketing management…
[19] P. Kotler & K. L. Keller, Marketing management…

to plan about the new-product campaign relying on mixed market strategies which also include market communication tools[20].

In this present research, only the results from the first five stages (idea generation, idea screening, product concept development and concept testing, marketing strategy development, and business analysis) will be presented. As such, it is expected to obtain the information concerning the awareness of consumers and producers to understand their ideas about the new product.

In this paper, the NPD concepts and the stages of new product development will be applied to develop a new product from by-products of organic Thai rice, which is organic broken-mill rice. As mentioned, the organic broken-mill rice has a lower value than the whole grains. It is expected that the NPD concept will help add value to this by-product from the rice production process as well as to meet with health-concerned consumers' needs. Therefore, the organic broken-mill rice, belonging to the NPD concept, has an opportunity for enterprises to earn higher incomes.

New Product Development from Organic broke-milled rice

Organic rice production

The organic rice production is rice produced in a non-chemical growing system that avoids the use of synthetic chemical fertilizers, pesticides, herbicides, fungicides, and many kinds of growth regulators. In Thailand, the organic rice production is actually not a new knowledge for old Thai farmers, but it has been a conservative tradition of Thai farmers over 50 years ago. However, as known Thailand farmers have also used the chemical synthesis for a long period of time, over 50 years. As such, it is challenging to promote the local organic agricultural system to new generations. Therefore, it can be said that the organic rice production in Thailand is at an early developing stage[21]. In addition, Thai farmers have to follow the rice planting season. When the young generation farmers grow the organic rice, they also have to follow the traditional season. The comparison among two kinds of planting is shown in table 2.

Month	**Activities**	
	Conventional	**Organics**
January	- sell paddy rice	- sell paddy rice
	- select and store rice seeds	- select and store rice seeds
	- grow vegetables or cash crops	- grow vegetables or cash crops (organically)
	- work in off-farm sectors in Bangkok or	- grow green manure crops

[20] P. Kotler & K. L. Keller, Marketing management…
[21] S. Chouichom & M. Yamao, "Comparing opinions and attitudes of organic…

	cities	- prepare organic fertilizers and compost
February	- grow vegetables or cash crops	- grow vegetables or cash crops (organically)
	- work in off-farm sectors in Bangkok or	- grow green manure crops
	cities	- produce organic fertilizers and compost
March	- grow vegetables or cash crops	- grow vegetables or cash crops (organically)
	- work in off-farm sectors in Bangkok or	- grow green manure crops
	cities	- produce organic fertilizers and compost
April	- harvest cash crops	- grow vegetables or cash crops (organically)
	- work in off-farm sectors in Bangkok or	- grow green manure crops
	cities	- harvest and collect seeds of green manure crops
		- produce organic fertilizers and compost
		- repair rice field fences and dykes
		- apply compost and manure on farmland
May	- harvest crops and repair dykes	- harvest crops
	- first plough	- till the soil to cover green fertilizer plants
	- buy manure and chemical fertilizers	- first plough and repair dykes
	- prepare seedling bed and apply fertilizer	- grow green manure crops
		- prepare seedling bed and apply fertilizer
		- training on organic standards and plans
		- organic inspection
June	- second plough and leveling the soil	- apply compost and manure on farmland
	- broadcasting and/or transplanting	- till the soil to cover green fertilizer plants

	- control water level	- second plough and leveling the soil
		- broadcasting and/or transplanting
		- control water level
		- organic inspection
July	- apply chemical fertilizers	- apply organic fertilizers and manure
	- broadcasting and/or transplanting	- broadcasting and/or transplanting
	- control water level and maintain dykes	- control water level and maintain dykes
		- organic inspection
August	- control weeds and pests (by manual or using	- control weeds and pests (by manual or
	chemicals)	using bio-herbicide and bio-pesticide)
	- control water level and repair dykes	- control water level and repair dykes
	- apply chemical fertilizer	- apply organic fertilizer and manure
		- organic inspection
September	- control weeds and pests (by manual or using	- control weeds and pests (by manual or
	chemicals)	using bio-herbicide and bio-pesticide)
	- control water level	- control water level and repair dykes
	- apply chemical fertilizers	- apply organic fertilizer and manure
October	- control weeds and pests (by manual or using	- control weeds and pests (by manual or
	chemicals)	using bio-herbicide and bio-pesticide)
	- control water level	- control water level and repair dykes
	- apply chemical fertilizers	- apply organic fertilizer and manure
		- organic inspection

November	- harvesting, threshing and drying	- harvesting, threshing and drying
	- sell paddy	- sell paddy
	- store paddy in granary for consumption	- store paddy in granary for consumption
	- select and store rice seeds	- select and store rice seeds
		- till soil to cover rice straw
		- grow green manure crops
		- organic inspection
December	- harvesting, threshing and drying	- harvesting, threshing and drying
	- sell paddy	- sell paddy
	- store paddy in granary for consumption	- store paddy in granary for consumption
Month		**Activities**
	Conventional	**Organics**
	- select and store rice seeds	- select and store rice seeds
	- collect rice straw for cattle	- collect rice straw for cattle
	- grow vegetables or cash crops	- grow vegetables or cash crops (organically)
		- till soil to cover rice straw
		- grow green manure crops

Table 2
Comparison of annual activities in organic and conventional rice cultivation
Source: adapted from Woranoot[22].

By-product of organic rice production

The stages or processes of rice and organic rice production are identical. For the milled rice, two products (i.e., main product and a by-product) are obtained; they are

[22] I. Woranoot, Implications of organic farming in development: experiences from organic rice farms in Northeastern Thailand. Poverty Studies and Policy Analysis (POV). 2009. Retrieved from http://hdl.handle.net/2105/6582 on 20 June 2015.

different in sale value. The main product is whole grain rice and the by-product is broken-milled rice. Typically, the whole grain rice has more value than broken-milled rice. Thus, after the production, when there is a lot of the broken-milled rice, farmers will earn less income[23].

Organic rice pudding process

Organic rice pudding is made from organic rice powder. It is baked with many kinds of ingredients such as sugar, water, egg, and so on. After that, it is wrapped and packed for sale.

A Cost-Benefit Analysis

A Cost-Benefit Analysis is a tool for the investment that helps decide the effectiveness of the allocation of social resources[24]. This tool is used to analyze financial dimensions and benefit of investment[25]. Many new business projects employ this tool to determine and forecast profitability, both investment and economic dimensions[26].

Research method

Data collection

For the first four stages (idea Generation, idea screening, product concept development and concept testing, and marketing strategy development), the data were collected from consumers and producers to elicit their ideas about the new product[27]. To review the product concept, the data were collected by using a questionnaire with two groups: 1) 620 consumers and 2) 108 operators. In regards to business analysis, a cost-benefit analysis of organic rice pudding usage was performed by using the primary data of cost production and consumers' needs collected using a questionnaire. The secondary data about rice products were collected from previous research. The participants included 80 farmers from four provinces (i.e., 20 farmers from each province), 20 retailers, and 2 processed entrepreneurships.

A Cost-Benefit Analysis

To calculate cost and benefit, payback period, net present value, and internal rate of return were included in the formula, which is shown below.

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[23] Rice Knowledge Bank, Organic rice processing. 2015. Retrieved from http://www.knowledgebank.irri.org/step-by-step-production/postharvest/rice-by-products/ on 20 June 2015.

[24] A. E. Boardman; D. H. Greenberg; A. R. Vining and D. L. Weimer, Cost-benefit analysis: Concepts and practice (3rd ed.) (City: Prentice Hall, 2006).

[25] V. Rainne, Effective cost analysis for the financial services sector. 2015. Retrieved from http://www.ey.com/Publication/vwLUAssets/EY-effective-cost-analysis-for-the-financial-services-sector/%24FILE/EY-effective-cost-analysis-for-the-financial-services-sector.pdf/ on 20 June 2015.

[26] R. Rubens, How to prepare your business plan. United Nations, New York and Geneva. 2002. Retrieved from, http://unctad.org/en/docs/iteiia5_en.pdf on 20 June 2015.

[27] Nielsen, Looking to achieve new product success? Listen to your consumers. 2015. Retrieved from, http://www.nielsen.com/content/dam/nielsenglobal/dk/docs/Nielsen%20Global%20New%20Product% 20Innovation%20Report%20June%202015.pdf/ on 30 December 2015.

Payback Period (PB) is to examine how much it takes to pay back the investment[28].

The formula of payback period is as follows:

Payback Period	Total investment
	Annual net cash inflow

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

Net Present Value (NPV) is the total of present value of net cash flow[29]. The formula of net present value is as follows:

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

Internal Rate of Return (IRR) is a rate of return that investors receive by investing in the projects where the average per year over the life of the investment[30].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:

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 exceeds the required rate of return. Any project whose internal rate of return is less than the required rate of return is rejected.

[28] R. Garrison; E. Noreen & P. Brewer, Managerial accounting (13th ed.) (New York: McGraw Hill, Irwin, 2010).
[29] R. Garrison; E. Noreen & P. Brewer, Managerial accounting…
[30] R. Garrison; E. Noreen & P. Brewer, Managerial accounting…

Research result

Reviews of the new product concept

The product concept is that an organic rice pudding is made from broken organic rice and a mixture organic rice grains. The process of this product starts with mixing water with sugar to a viscosity. After that, the mixture is packaged and sealed. The appearance of the products is that it is delicate and soft, sticky tongue, and its color is similar to the color of rice. When cupped and sealed in a 100-150 g cup with a diameter of 5.5 cm and the height of 7.5 cm, the product can be stored at the room temperature for up to 18 months. It is easy to eat, whether chilled or at room temperature. The reviewed product concept is shown in table 3 and the marketing mix is shown in table 4.

Perception of organic rice pudding	**Mean (price)**	**S.D.**	**Results**
Ingredients from broken organic rice and a mixture of grains	4..3	2.8.0	Agree
Produced by organic broken rice, crushed into powder, boiling water mixed with sugar and water to a viscosity together and be packaged and sealed.	4..0	2.8.0	Agree
The product is fine, soft, sticky tongue, a similar color to the rice. Cupped sealed a 100-150 g (cup diameter 5.5 cm height 7.5 cm) can be stored at room temperature for up to 18 months.	4..3	2.80.	Agree
Sweet and easy to eat, whether chilled or at room temperature	4..3	2.838	Agree
A dessert, providing nutrition and health care in general.	4...	2.8..	Agree
The product is ideal for family members who are health conscious and are concerned about the benefits of the product to their health.	4...	2.8.0	Agree
The packaging of the product should be in a cup of ready-to-eat.	4..8	2.830	Agree

	)04.40(		
The packaging should be four cup per pack.	4.00)82.00(	2.8.4	Agree
The packaging should be six cup per pack.	4.00)804.88(	2.8..	Agree
The cup should be wrapped with opaque plastic cup with a spoon	4.48	8.222	undecided
The cup should be transparent; the pudding with a plastic lid and a spoon can be seen.	4.00	8.20.	Agree
The intention to buy organic rice pudding	4.00	8.2..	undecided

Table 3
Reviews product concept

The marketing mix	**Mean (price)**	**S.D.**	**Results**
Product			
Products are standardized that have been certified by a trusted organization.	4.88	2..8.	important
The label should clearly state expiration date and ingredients.	3.28	2..22	important
The packaging sizes suit characteristics of the consumers.	4.82	2.83.	important
The packaging of product should be environment friendly.	4..2	2.888	important
Products should be providing many health benefits.	4..0	2.802	important
Products should be easy to carry and eat.	4.8.	2.830	important

Products should contain a lot of nutrients.	4..4	2..3.	important
Products should also be coloring and flavoring to make products that are easy to eat.	4.04	8.20.	moderately important
Price			
Price should be reasonable compared to the quality of ingredients.	4..0	2.8.4	important
Price should be clear label.	4.8.	2.80.	important
The marketing mix	**Mean (price)**	**S.D.**	**Results**
Price should be more expensive than non-organic product.	4.43	2...8	moderately important
The exact price should be clearly stated.	4.88	2.80.	important
Price should be a multi-level of prices.	4..0	2.848	important
Place and distribution channels			
Selling places affect the image of products.	4..8	2.84.	important
Products are distributed in supermarkets and general stores.	4.08	2.88.	important
The distribution channels should be made through agencies.	4.40	2..2.	moderately important
The distribution channels should be made through online.	4.0.	2.8.8	important
Delivery products to the clients	4..0	2.8..	important
Promotion			
Advertising through television, magazines, radio, billboards are	4..4	2.880	important

attractive.			
Advertising through online media is accessible	4..2	2..2.	important
Sales-person should be advised to give information about the product and can answer customers' questions clearly	4..4	2..00	important
Sales-person is knowledgeable about products and health supplements to build credibility for consumers.	4.82	2.8.2	important
There should be a discount to customers who are members.	4..3	2.883	important
There should be a free demo and sample products to allow consumers to try before buying.	4...	2.8.3	important
Participation in government trade fairs makes a reliable brand.	4.08	2..3.	important
The list of discounted or free gifts during holidays as an incentive.	4.0.	2....	important
The reward point system should be attractive.	4.02	2...3	important

Table 4
The marketing mix

Marketing analysis

The test of the product samples with consumers showed that three flavors were most popular: cocoa, coconut, and orange. The size of the organic rice pudding should be 85 grams at the price of 35 baht per cup. The production capacity depends on the capacity of the machine, which can produce up to 250 cups/hour/machine. The result suggests that 2-unit blenders should be used for the production and prevention of damages, which are assumed to occur when above a maximum capacity of 750,000 cups/year, is aimed. The assumption is the machine can be run 8 hours per day (preparation, production, storage, and rinsing for 1 hour, and 6 hours for actual production), 5 days a week (excluding 10-day holidays), with a total of 250 days. The cocoa flavor is most popular. As such, it should account for 50 percent of the production while the coconut flavor and orange flavor should be 25 percent. The details are shown in table 5.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Sale growth rates		5%	10%	10%	15%

1. Organic rice pudding, Cocoa flavor					
Number of units	225,000	236,250	259,875	285,863	328,742
Price/unit	35	35	35	35	35
Peak-time (7 months, bag)	131,250	137,813	151,594	166,753	191,766
Off-peak (5 months, bag)	93,750	98,438	108,281	119,109	136,976
predicted Peak (baht/year)	4,593,750	4,823,438	5,305,781	5,836,359	6,711,813
predicted off-Peak (baht/year)	3,281,250	3,445,313	3,789,844	4,168,828	4,794,152
Total (sales, baht)	**7,875,000**	**8,268,750**	**9,095,625**	**10,005,188**	**11,505,966**
Item	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Sale growth rates		5%	10%	10%	15%
2. Organic rice pudding, Coconut flavor					
Number of units	112,500	118,125	129,938	142,931	164,371

Price/unit	35	35	35	35	35
Peak-time (7 months, bag)	65,625	68,906	75,797	83,377	95,883
Off-peak (5 months, bag)	46,875	49,219	54,141	59,555	68,488
predicted Peak (baht/year)	2,296,875	2,411,719	2,652,891	2,918,180	3,355,907
predicted off-Peak (baht/year)	1,640,625	1,722,656	1,894,922	2,084,414	2,397,076
Total (sales, baht)	**3,937,500**	**4,134,375**	**4,547,813**	**5,002,594**	**5,752,983**
3. Organic rice pudding, Orange flavor					
Number of units	112,500	118,125	129,938	142,931	164,371
Price/unit	35	35	35	35	35
Peak-time (7 months, bag)	65,625	68,906	75,797	83,377	95,883
Off-peak (5 months, bag)	46,875	49,219	54,141	59,555	68,488
predicted Peak (baht/year)	2,296,875	2,411,719	2,652,891	2,918,180	3,355,907
predicted off-Peak (baht/year)	1,640,625	1,722,656	1,894,922	2,084,414	2,397,076

Total (sales, baht)	**3,937,500**	**4,134,375**	**4,547,813**	**5,002,594**	**5,752,983**
Total of units	450,000	472,500	519,750	571,725	657,484
Total (sales, baht)	**15,750,000**	**16,537,500**	**18,191,250**	**20,010,375**	**23,011,931**

Table 5
Forecast sales of organic rice pudding products

The selling expenses to produce organic rice pudding are calculated based on the costs of fixed costs and variable costs. Fixed costs also take into account marketing manager, salesman salaries, traveling expenses, and advertising expenses. Variable costs depend on sales commission and transportation expenses, as shown in table 6.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Fixed Costs	1,561,000	1,740,100	2,125,709	2,380201	2,672,526
Variable Costs	225,000	236,250	259,876	285,863	328,741
Total marketing expenses (THB)	1,786,000	1,976,350	2,385,585	2,666,064	3,001,267

Table 6
Marketing Expenses

Manufacturing analysis

To conduct a manufacturing analysis for organic rice pudding production, we calculated the costs of investment with non-current assets (land, buildings, and equipment), the purchase cost of direct materials, direct labor and factory overhead, and cost of production as shown in tables7-9. The process for the production of organic rice pudding is simple, mainly by an automatic machine; as such the quality of production can be effectively controlled.

No.	Item	Value (Baht)	Lifetime (Year)	Depreciation per year
1	Land (factory)	1,000,000		
2	Building	1,000,000	20	50,000
3	Equipment	2,165,000	5	433,000
4	Vehicle pickup in factory	850,000	5	170,000
5	Office equipment in factory (desks, chairs, filing cabinets, telephones, printers)	50,000	5	10,000
Total		5,065,000		663,000

Table 7
Non-current assets (Factory)

Item	Year 1	Year 2	Year 3	Year 4	Year 5
1. Organic rice pudding, Cocoa flavor					
Number of units	225,000	236,250	259,875	285,863	328,742
Price/unit	14.31	15.03	15.78	16.57	17.39
Total Cost (baht)	3,219,750	3,549,774	4,099,989	4,735,488	5,718,101

2. Organic rice pudding, Coconut flavor					
Number of units	112,500	118,125	129,938	142,931	164,371
Price/unit	16.15	16.96	17.81	18.70	19.63
Total Cost (baht)	**1,816,875**	**2,003,105**	**2,313,586**	**2,672,192**	**3,226,672**
3. Organic rice pudding, Orange flavor					
Number of units	112,500	118,125	129,938	142,931	164,371
Price/unit	14.32	15.04	15.79	16.58	17.41
Total Cost (baht)	**1,611,000**	**1,776,128**	**2,051,427**	**2,369,398**	**2,861,049**
Total	**6,647,625**	**7,329,007**	**8,465,003**	**9,777,078**	**11,805,822**

Table 8
Direct materials cost

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Direct Labor	828,000	896,400	1,187,640	1,292,004	1,406,804

Factory overhead					
Fixed Costs	188,000	197,400	207,270	217,634	228,515
Variable Costs	562,500	590,625	649,688	714,656	821,855
Total (THB)	750,500	788,025	856,958	932,290	1,050,370

Table 9
Direct labor costs and factory overhead

Management analysis

The management analysis of a new product, or organic rice pudding, needs to be conducted when beginning a new business. The estimated cost is divided into three parts: cost before operation activity, cost of operating and management, and costs in the office (see tables10 and 11).

No.	Item	Value (Baht)	Lifetime (Year)	Depreciation per year
1	Land (office)	200,000		
2	Building	200,000	20	10,000
3	Equipment	187,000	5	41,400
4	Vehicle	750,000	5	150,000
5	Office equipment (desks, chairs, filing cabinets, telephones, printers)	146,000	5	29,260

Total		1,483,300		230,660

Table 10
Non-current assets (Office)

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries and Wages expenses	1,260,000	1,386,000	1,524,600	1,677,060	1,844,766
Utilities expenses	47,600	45,600	45,600	45,600	45,600
Insurance expenses	104,434	104,434	104,434	104,434	104,434
Office supplies expenses	60,000	60,000	60,000	60,000	60,000
Social Security	140,400	153,720	188,172	206,269	226,176
Auditor fee expenses	50,000	50,000	50,000	50,000	50,000
Maintenance expanses	36,000	36,000	36,000	36,000	36,000
Gasoline expenses	60,000	63,000	66,150	69,458	72,930
Other expenses	60,000	66,000	72,600	79,860	87,846
Total	**1,818,434**	**1,964,754**	**2,147,556**	**2,328,681**	**2,527,752**

Table 11
Administrative expense

Financial analysis

Finally, the financial analysis of the organic rice pudding product was conducted to predict cash flow projections for a new business plan. It includes 5 annual periods. The cash flow projection is based on a number of default assumptions that are specified by the researchers. The cash flows projection is presented in Table 12.

Year	t	t+1	t+2	t+3	t+4	t+5
Cash Inflows						
Cash receipts from a	-	11,025,00	11,576,25	12,733,87	14,007,26	16,108,35
Collection of receivables[a]	-	4,205,250	4,935,263	5,402,801	5,943,081	6,804,528
Other operating revenue	-	-	-	-	-	-
Total Cash Inflows	-	15,230,25	16,511,51	18,136,67	19,950,34	22,912,88
Cash Outflows						
Operation Activity[b]						
Direct material	872,263	6,647,625	7,329,007	8,465,003	9,777,078	11,805,82
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[f]	-	-	482,356	496,901	420,250	403,640
Capital Expenditure[b]						
Purchase of PPE	6,548,300	-	-	-	-	-
Pre-operating expense	388,000	-	-	-	-	-
Other cash inflows	-	-	-	-	-	-
Total Cash Outflows	7,808,563	11,830,55	13,436,89	15,539,64	17,416,36	20,195,65
Net Cash flows	-	3,399,691	3,074,621	2,597,033	2,533,977	2,717,225
Add: Cash balance at the	-	500,000	3,003,691	5,233,512	7,036,946	8,828,524
Total cash	-	3,899,691	6,078,312	7,830,545	9,570,923	11,545,74
Add: Owner equity[c]	5,108,563	-	-	-	-	-
Loan[c]	3,200,000	-	-	-	-	-
Less: Paid principles[d]	-	640,000	640,000	640,000	640,000	640,000

Paid interests[e]	-	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	10,854,54

Table 12
Cash Flow Projection

Assumptions:

[a] Sales data are primary data from farmers, retailers, and entrepreneurships. 30% of sales are on account and the company collects these credit sales in the month following sale.

[b] Production cost, operating expense and capital expenditure data is primary data as cost production from farmers, retailers, and entrepreneurships.

[c] The company has an agreement with the bank that allows the borrowing of 3.2 million baht at the beginning of this project.

[d] The company would repay the loan plus accumulated interest during 5 years at the end of each year.

[e] The interest rate on these loans is 8% per year.

[f] Thai corporate tax on these company is 20%.

Factory overhead excludes depreciation expense.

PPE is property, plants and equipments.

A Cost-Benefit Analysis

The PB result of organic rice pudding showed that this product would take about 2 years and 7 months to pay back the cost as shown in table 13 below.

Year	Cash Flow (Baht)	Collected Cash Flow (Baht)
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

Table 13
Payback period of organic rice pudding

For the NPV calculation, it was found that the value is positive when the discount rate is 8%. When the NPV value is 3,008,099, the IRR equaled 22.37%. This project would be interesting for investment.

Sensitivity Analysis

The sensitivity analysis examines the impact of both a 5% and a 10% drop and up in sale revenues on the PB, NPV and IRR of this project. The same assumption was adopted. The results of the Recast PB, NPV and IRR are shown in Table 14:

Change in Sales	Drop 10%	Drop 5%	0%	Up 5%	Up 10%
PB Period	3 years and 8.78 months	3 years and 1.52 months	2 years and 8.48 months	2 years and 4.68 months	2 years and 1.70 months
NPV (Baht)	348,484	1,678,292	3,008,099	4,337,907	5,667,715
IRR (%)	9.85	16.53	22.73	28.57	34.13

Table 14
Recast PB, NPV and IRR of organic rice pudding

The return on the investment of this project is reduced dramatically by moderate revenue shortfalls based on the adopted assumptions. A mere 5% drop in revenues can reduce the IRR by one-fourth (27%), while a 10% drop in revenues can reduce the IRR by one-half (57%). The most interesting change occurs in the IRR, which drops significantly with reduced revenues. This project still has better project return. The sensitivity analysis also examines the impact of both a 5% and a 10% drop and up in raw materials on the PB, NPV and IRR of this project. The same assumption was adopted. The recast PB, NPV and IRR are shown in Table 15:

Change in Raw Material	Drop 10%	Drop 5%	0%	Up 5%	Up 10%
PB Period	2 years and 1.83 months	2 years and 4.76 months	2 years and 8.48 months	3 years and 1.42 months	3 years and8.82 months
NPV (Baht)	5,801,230	4,404,665	3,008,099	1,611,534	214,969
IRR (%)	34.7	28.86	22.73	16.22	9.15

Table 15
Recast PB, NPV and IRR of organic rice pudding

The return on investment of this project is reduced dramatically by a moderate cost of production cost up under our assumptions. A mere 5% up in production cost can reduce the IRR by one-fourth (28%), while a 10% up in production cost can reduce the IRR by one-half (58%). This was more highly significant with an increased cost of raw materials; this project still has better project return.

Conclusion and discussion

Based on the financial analysis, the results showed that the cash flow increases when the cash balance at the end in every year is rising. Furthermore, the investment in organic rice pudding production is 8,308,563 baht. The capital structure contains a loan of 4.0 million baht (48.08%) and the owner equity of 5,108,563 baht (.8.3.%). From the first year of the organic rice pudding forecast, it was found that the total net sale in the first year was..8.0 million baht. The product growth rate is 5% in the second year, 10% in the third year, 10% in the fourth year, and 15% in the fifth year. These show that the profit constantly increases each year. For the cost-benefit analysis, it was found that the PB is 2.7 years, which is less than 5 years. Finally, the NPV is positive; the IRR value is high. As such, it can be concluded that the investment for this new product is promising. For information about investing as inside-out planning[31], 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 production process. Thus, the manager must have a good plan for the production of organic rice pudding product in the future.

Implication and future research

This research is helpful and fulfills on a practical and an economic of a product development because a cost-benefit of a product after finish a product development process helps an entrepreneur making a decision to invest this product or not. Furthermore, this research wills an influencing on the Thai farmers in Thailand that aware the new economic pass a product development. This research is a model for a cost-benefit of the new product that part of a new product development (NPD) process concept. The limitation of this research is a lack of a real investment step because step 1-7 of a new product development (NPD) process is a lab scale. Thus in the future should be continuing the last step (step 8: a real investment step).

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