Cost-Return Analysis of Sugarcane Cultivation of Farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province

Thitiporn Prapho[1], Sirirat Chengseng[2], and Kwannaree Klaprabchone[3]

[1] Faculty of Management Science, Kanchanaburi Rajabhat University, Thailand

[2] Faculty of Management Science, Kanchanaburi Rajabhat University, Thailand

[3] Faculty of Management Science, Kanchanaburi Rajabhat University, Thailand

amthi18@gmail.com, si.326@hotmail.com, and kwannaree2992@hotmail.com

Abstract

This research aimed at studying and comparing the cost and return on sugarcane cultivation of farmers and in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province. The sample consisted of 130 households and only one family member of each household participated in this study. A questionnaire was used as the research instrument, frequency distribution, percentage, and mean were used for statistical analysis, and paired sample t-test of inferential statistics was selected for hypothesis testing. The results showed that the cost on sugarcane cultivation was at 3,886.01 THB per rai (1,600 square meters), the cost on direct materials was at 515.58 THB per rai, the cost on direct labor was at 1,903.07 THB per rai, the manufacturing overhead was at 1,467.36 THB per rai, the net profit was at 2,231.05 THB per rai, and the net profit margin ratio was at 36.47%. In addition, the hypothesis testing pointed out a higher return compared to the cost of sugarcane cultivation, at the significance level of 0.05.

Keywords: Cost, Return, Sugarcane

Introduction

The sugarcane industry is one of the major agro-processing industries in Thailand. In each year, 430,000 households of sugarcane farmers earn a large amount of income. In the meantime, entrepreneurs and related industrial laborers gain 250,000 million baht (MB) of income. Up to the present time, the sugarcane industry of Thailand has been continually evolving and growing by domestic collaborations. The collaborations help create clear benefit allocation assisting in bridging the gap and maintaining bargaining power between farmers and sugar factories, and also help build contact-farming relationship assisting in marketing risk reduction in product distribution and raw material purchasing of sugar factories (Pricha et al., 2020). Fortunately, the sugar industry in Thailand is regarded as possessing a high potential in competitive advantage in the global market due to lower production costs. Besides, Thailand has gained advantages in terms of location—it is located in Asia, where the demand for sugar is very high. Consequently, Thailand gains advantages in the distance and lower transportation cost, especially exporting to China, Indonesia, India, and Japan; countries which increasingly demand large amounts of imported sugar (Chueasuwan, 2018).

Kanchanaburi province possesses 3,066,599 rai of an agricultural area or 25.18% of the entire area, agricultural revenue of the province is 17,206 MB per year, and major agricultural products of the province include sugarcane, cassava, and maize (National Statistical Office of Thailand - Kanchanaburi Province, 2019). In Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province, 192 households were sugarcane farmers (Department of Agricultural Extension, 2019) and the majority of farmers were smallholders possessing lower income from sugarcane production due to higher production cost per rai. Accordingly, this study aimed at studying the cost and return on sugarcane cultivation of farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province—the province possessed high potential in many aspects e.g., close distance to sugar factories and appropriate areas for field crops. According to the observation and interview, sugarcane farmers felt concerned about higher costs relative to labor, herbicide, transportation, and fuel, and the drawbacks directly influenced the cost of sugarcane cultivation. Therefore, this study was conducted to study the cost and return on sugarcane cultivation of farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province in order to assist farmers in cost reduction. Additionally, the data gained in this study would benefit sugarcane farmers and related parties in creating higher income leading to a better quality of life.

Research Objectives

1. To study the cost of sugarcane cultivation of farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province.

2. To study the return on sugarcane cultivation of farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province.

3. To compare the cost and return on sugarcane cultivation of farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province.

Conceptual Framework

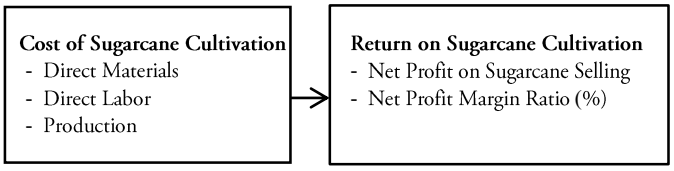

Fig.1 Conceptual Framework

Research Hypothesis

The research hypotheses including null and alternative hypotheses were formulated below.

H_o = The return on sugarcane cultivation was lower or equivalent to the cost of sugarcane cultivation.

H_1 = The return on sugarcane cultivation was higher than the cost of sugarcane cultivation.

By

μ_1 = The return on sugarcane cultivation.

μ_2 = The cost of sugarcane cultivation

Null Hypothesis: $H_o = \mu_1 - \mu_2 \leq 0$

Alternative Hypothesis: $H_1 = \mu_1 - \mu_2 > 0$

Literature Review

This section consisted of concepts, theories, and related studies, as described below.

The Concept of Cost

Cost refers to expenses paid in exchange for products or services in forms of cash or other assets, equity, service, debt, and any loss relative to the exchange. Horngren et al. (2009) mentioned that cost referred to the value of resources a firm spent on achieving the goal of business operation. The cost was generally measured in forms of the amount of money spent on products or services. Suphattharakun and Phadoongsit (2016) classified the costs in three aspects, as described below.

1. Direct materials, popularly known as direct material cost as defined by the Subcommittees of Coinage Provisions in Accounting, The Institute of Certified Accountants and Auditors of Thailand, refers to the value of raw materials directly used in production and is an important factor that could be easily allocated as the cost of the production unit. Therefore, the direct materials could be regarded as a key factor of the product or service that could be easily allocated or assigned to the cost calculation unit. Whereas, the cost of materials that could not be allocated to the cost calculation unit or is not a key factor of the product, is called indirect material cost. The indirect material cost is generally measured in forms of an insignificant amount of cost. Therefore, the benefit gained from the cost allocation to the cost calculation unit is not worth comparing to the allocated cost.

2. Direct labor cost refers to the direct cost of labor in production and could be easily allocated or assigned to the cost calculation unit. Whereas, the labor cost that could not be allocated to the cost calculation unit or the benefit gained from the cost allocation to the cost calculation unit which not worth comparing to the allocated cost, is called indirect labor cost, and the cost is classified as manufacturing overhead.

3. Manufacturing overhead refers to all expenses in production excluding direct material cost and direct labor cost. The manufacturing overhead could not be clearly allocated to the cost calculation unit or the benefit gained from the cost allocation to the cost calculation unit is not worth comparing to the allocated cost.

The Concept of Return

The ultimate goal of business is seeking for profit, and analysis of cost, quantity, and profit is highly significant for profit planning—this analysis is called a break-even analysis. The break-even analysis refers to the consideration of the sales that makes total income equivalent to total cost or profit is equivalent to zero. This condition shows no profit and no loss when the sales are equivalent to the break-even point. A key factor in break-even analysis is the cost, and the costs essential for break-even analysis include variable cost and fixed cost. Quantity refers to the sales that make the profit equivalent to zero and the profit planning is based on the break-even quantity to determine further profits (Krootboonyong et al., 2015). Miamphon (2007) stated that a study of return could be conducted using multiple techniques of break-even analysis. Some popular techniques include profit to cost ratio and net profit margin ratio. Additionally, Komarathat (2011) proposed that a study of return could be conducted using profitability ratio e.g., gross profit margin, operating profit margin, return on equity, and net profit margin.

The Concept on Sugarcane

Sugarcane is a perennial grass of great importance, especially in terms of food. Sugarcane ranks fourth among the most important crops planted in the world after wheat, corn, and rice, respectively. By considering the dry weight of harvested products per area per year, sugarcane ranks first due to its higher efficiency in the utilization of sunlight, water, air, and nutrients. In addition, sugarcane is very easy to grow and additionally provides multiple harvest times. Naturally, sugarcane could grow faster in hot and humid weather— consequently it could be cultivated in 70 tropical countries where it has long been cultivated for more than 10,000 years. In cultivation, sugarcane needs to be cut into short pieces before burying in soil, and weed and insect pests need to be regularly eliminated. Normally, sugarcane is cultivated only for household consumption. It is believed that the change from home-grown plants to field crops of sugarcane had first begun in India. Currently, there are two varieties of sugarcane cultivated for commercial purposes including chewing cane and industrial cane (Thai Encyclopaedia for Youth by His Majesty the King, 2020).

1. Chewing cane has soft peel and bagasse with a medium–high level of sweetness. It is commonly cultivated for direct consumption or fresh molasses. There are several varieties of chewing cane cultivated nowadays. Singaporean sugarcane or Samli (Cotton) sugarcane possesses very soft bagasse, yellowish-green stem, and nice molasses. Mauritius sugarcane possesses magenta stem inappropriate for squeezing molasses but suitable for direct consumption. Badila sugarcane possesses a black purple stem, very slow growth rate, and very short stem. Which makes it not popular for cultivation. These three varieties of sugarcane were classified as primitive varieties originating in New Guinea Island. Besides, it was found that Honey sugarcane and Khakai (Chicken feet) sugarcane were cultivated in some areas.

2. Industrial cane is a hybrid sugarcane bred by breeders around the world. The varieties of this hybrid sugarcane have been imported to several countries, and 220 varieties have been imported to Thailand for a long time. Presently, only 20 varieties have been cultivated in all regions of Thailand for commercial purposes.

Related Studies

Ngokwilai and Puangchomphu (2015) reported that the total cost on industrial cane cultivation using a sugarcane harvester was at 17,079.10 THB per rai, average product sales price was at 1,089.98 THB per ton, sweetness value was at 12.85 C.C.S., and net profit of industrial cane cultivation using a sugarcane harvester was at 2,115.40 THB per rai. Financially, industrial cane cultivation using a sugarcane harvester demanded high cost due to multiple steps of planting-pot preparation. However, the return was found to be very high—this cultivation method was therefore regarded as the best solution in solving problems relative to a labor shortage. Unfortunately, many smallholder farmers could not afford to use a sugarcane harvester due to high cost. In this case, the government sector and related organizations should support farmers by providing sugarcane harvester rental service at a low price and low-interest investment loan rates.

Chamneansuk (2019) reported that a sample group of farmers cultivated sugarcane in two aspects including new cultivation and ratoon maintenance. The findings showed that the average cost of new

cultivation was at 9,713.61 THB per rai, and the average cost of ratoon maintenance was at 4,847.42 THB per rai. There were five aspects of cost of harvesting and transportation including 1) the average cost of harvesting and transportation of fresh sugarcane (by farmers) was at 3,582.31 THB per rai, 2) the average cost of harvesting and transportation of fresh sugarcane (by employment) was at 3,520 THB per rai, 3) the average cost of harvesting and transportation of burnt sugarcane (by farmers) was at 2,388.74 THB per rai, 4) the average cost of harvesting (by farmers) and transportation of burnt sugarcane (by employment) was at 3,102.83 THB per rai, and 5) the average cost of harvesting and transportation of burnt sugarcane (by employment) was at 2,647.19 THB per rai.

Research Methodology

This research was conducted as applied research.

Population and Sample

The population in this study consisted of 192 sugarcane farmers residing in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province (Department of Agricultural Extension, 2019). A sample was selected using convenience sampling based on Yamane's formula of sample size (Yamane, 1973) gaining 130 households—where only one family member of each household participated in data collection.

Research Instrument

The research instrument consisted of questionnaires.

Statistical Analysis

In this study, descriptive statistics including frequency, percentage, and mean were used for data analysis, and paired sample t-test of inferential statistics was selected for hypothesis testing.

Results and Discussion

The conducted research possessed four sections of results, as demonstrated below.

Section 1: General Information of Sugarcane Farmers

There were 130 sugarcane farmers participated in this study. The majority of participants were male—72 persons (55.38%), aged above 40 years—105 persons (80.77%), completed Junior High School Program—76 persons (58.46%), worked as sugarcane farmers—108 persons (83.08%), sugarcane farmers possessed experience in sugarcane cultivation—11-15 years (72.31%), gained knowledge relative to accounting from training programs—118 persons (90.77%), spent private money on cultivation—87 persons (66.92%), cultivated by employment—72 persons (55.38%), possessed 10-20 rai of area for cultivation—66 persons (50.77%), and owned private land—117 persons (90.00%).

Section 2: Information on Sugarcane Cultivation Cost

The information on the average cost of sugarcane cultivation per rai classified by the cost of a manufactured product consisted of direct materials, direct labor cost, and manufacturing overhead, as demonstrated in Table 1.

According to Table 1, it was found that the average cost of sugarcane cultivation was at 3,886.01 THB per rai. The cost consisted of direct materials—515.58 THB per rai, direct labor cost—1,903.07 THB per rai, and manufacturing overhead—1,467.36 THB per rai. In addition, direct labor cost was found to be higher than other costs (48.97%), following by manufacturing overhead (37.76%), and direct materials (13.27%), respectively.

Table 1. Average Cost of Sugarcane Cultivation per Rai

Cultivation Cost	Product Sales Price per Rai (THB)	Percentage (%)
1. Direct Materials	**515.58**	**13.27**
2. Direct Labor		
Labor Cost of Soil Preparation	716.57	18.44
Labor Cost of Cultivation	142.25	3.66
Labor Cost of Harvesting	905.57	23.30
Labor Cost of Weed Elimination	138.68	3.57
Total Direct Labor	**1,903.07**	**48.97**
3. Manufacturing Overhead		
Cost of Fertilizer	385.91	9.93
Cost of Herbicide	17.17	0.44
Cost of Agricultural Equipment	86.06	2.21
Cost of Land Lease	646.19	16.63
Cost of Equipment Deterioration*	106.82	2.75
Cost of Fuel	47.48	1.22
Cost of Product Transportation	121.51	3.13
Cost of Equipment Maintenance	56.22	1.45
Total Direct Labor	**1,467.36**	**37.76**
Total Production	**3,886.01**	**100%**

Note. Average Cost of Sugarcane Cultivation per Rai
*Fixed Cost

Section 3: Information of Return on Sugarcane Cultivation

The return gained from sugarcane cultivation showed that inventories were not found causing an equivalent amount of cost of sales shown in earnings statement and production cost. Besides, selling expenses were not spent on since farmers directly transported sugarcane to sugar factories, as demonstrated in Table 2.

Table 2. Return on Sugarcane Cultivation

Return on Sugarcane Cultivation	Product Sales Price per Rai (THB)	Percentage (%)
Income from Sugarcane Selling	6,117.06	100.00
Cost of Sales	3,886.01	63.53
Gross Profit	2,231.05	36.47
Selling and Administrative Expenses	-	-
Net Profit	**2,231.05**	**36.47**

According to Table 2, it was found that sugarcane farmers possessed net profit at 2,231.05 THB per rai (36.47%), gained income from sugarcane selling at 6,117.06 THB per rai (100.00%), spent on the cost of sales at 3,886.01 THB per rai (63.53%), and obtained gross profit at 2,231.05 THB per rai (36.47%).

Section 4: Hypothesis Testing Results

According to Table 3, it was found that hypothesis testing by two conditions was true based on the rejection region of H_o. Therefore, it could be concluded as the rejection of H_0 and acceptance of H_1 showing that the return on sugarcane cultivation was higher than the cultivation cost, at the significance level of 0.05.

Table 3. Comparison between Cost and Return on Sugarcane Cultivation by Hypothesis Testing

Comparison	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2- tailed) (P)
Cost and Return	57,140.30	56,130.20	6,524.00	**6.68**	42	.000

P (Probability) = .000, α (Significance Level) = 0.05
∴ P<α (Significance Level) (= Sig.) reject H_0, accept H_1
Hypothesis Testing Conditions
Condition 1: The value of Sig. (2-tailed)/2 < 0.05
The result showed the value of Sig. 0.000/2 = 0.000 < 0.05
Condition 2: t > 0
The result showed the value of t = 6.68.

The costs of sugarcane cultivation consisted of direct materials at 515.58 THB per rai, direct labor cost at 1,903.07 THB per rai, and manufacturing overhead at 1,467.36 THB per rai. According to the results, it could be said that the sugarcane cultivation of farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province demanded high production cost. The similar result was reported by Ngokwilai and Puangchomphu (2015) in which industrial cane cultivation using a sugarcane harvester demanded high cost due to multiple steps of planting-pot preparation, and many smallholder farmers could not afford to use a sugarcane harvester due to high cost. Likewise, Baohin and Tulasombat (2019) reported a similar result that a sample group of farmers cultivated sugarcane. The findings showed that the total production cost is 26,370.79 THB per rai and there are five activity-based costing for production cost: 1) harvesting cost, 2) maintenance cost, 3) land and soil preparation cost, 4) planting and replanting cost, and 5) seed cost of sugar cane of total production cost. In addition, net profit is 8,711.38 THB per rai, and the total income is 25,278.62 THB per rai. In summary, the production cost of sugarcane cultivation was found to be very high.

According to the data analysis, the return on sugarcane cultivation in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province showed that the net profit was at 2,231.05 THB per rai (36.47%). The similar result was reported by Ngokwilai and Puangchomphu (2015) that the net profit of industrial cane cultivation using a sugarcane harvester was at 2,115.40 THB per rai.

Conclusion

This research was conducted as applied research. The population consisted of 192 sugarcane farmers residing in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province. A sample included 130 households—only one family member of each household participated in data collection. All data gained from the participants were calculated to determine the average cost per rai and return on sugarcane cultivation. The research instrument used for data collection consisted of a questionnaire. In statistical analysis, frequency, percentage, and mean were used for data analysis, and paired sample t-test of inferential statistics was selected for hypothesis testing.

According to data analysis, 130 sugarcane farmers participated in this study. The majority of participants were male—72 persons, aged above 40 years—105 persons, completed Junior High School Program—76 persons, worked as sugarcane farmers—108 persons, possessed experience in sugarcane cultivation—11-15 years, gained knowledge relative to accounting from training programs—118 persons, spent private money on cultivation—87 persons, cultivated by employment—72 persons, possessed 10-20 rai of area for cultivation—66 persons, and owned private land—117 persons.

The results showed that the cost of sugarcane cultivation was at 3,886.01 THB per rai. The costs consisted of direct materials—515.58 THB per rai, direct labor cost—1,903.07 THB per rai, and manufacturing overhead—1,467.36 THB per rai. Additionally, it was found that sugarcane farmers possessed net profit at 2,231.05 THB per rai (36.47%), gained income from sugarcane selling at 6,117.06 THB per rai (100.00%), spent on the cost of sales at 3,886.01 THB per rai (63.53%), and obtained gross profit at 2,231.05 THB per rai (36.47%). The hypothesis testing result showed that the return on sugarcane cultivation was higher than the cultivation cost, at the significance level of 0.05.

Recommendations

1. Factors affecting the return on sugarcane cultivation should be included in further studies.
2. Environmental costs of sugarcane cultivation influencing sustainability should be included in further studies.

Acknowledgment

The study had been conducted in support of sugarcane farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province. Heartfelt thanks were extended to the President of Kanchanaburi Rajabhat University—Dr. Narongdech Rattananonsathien, and the Dean of Faculty of Management Science—Dr. Banchobporn Indee for being of great assistance in research conduction. We would like to express our deep gratitude to sugarcane farmers in Rangwai Subdistrict, Phanom Thuan District, Kanchanaburi Province, and related organizations and persons for sacrificing your valuable time and providing kind assistance in data collection and all steps of research procedures. Without your kind assistance, this research would not have been possible. Last but not least, we truly hope that this research would benefit all researchers and interested persons, particularly in terms of academic development.

References

Bao, P., & Tulasombat, S. (2019). Analysis of Activity Based Costing of Sugar Cane Farmers Phu Khiao District Chaiyaphum province. The 6th National Sustainability in Business Conference & Journal 2019, 704-720.

Chamneansuk, S. (2019). Analysis of Costs for Complying with Voluntary Sugarcane Production Standard. Graduate School, Kasetsart University.

Chueasuwan, C. (2018). *Business Trends/Sugar Industry.* Retrieved February 1, 2019, from https://www.krungsri.com/bank/getmedia/52084452-70af-45c4834d1c34e49d5241/IO_Sugar_2018_TH.aspx.

Department of Agricultural Extension. (2019). *A list of Sugarcane Farmers.* Retrieved September 1, 2019, from http://www.sceb.doae.go.th/

Horngren, C. T., Datar, S. M., Foster, G., Rajan, M., & lttner, C. (2009). Cost Accounting: A Managerial Emphasis, International Version, 13/E. Pearson Higher Education.

Khrutbunyong, C. (2015). Managerial Accounting. Bangkok: SE-EDUCATION Public Company Limited.

Komarathat, D. (2011). Cost Management. 3rd Edition, Bangkok: Chulalongkorn University Printing House.

National Statistical Office of Thailand - Kanchanaburi Province. (2019). *A Report on Situational Analysis of Spatial Data in Kanchanaburi.* Retrieved September 1, 2019, from http://os thailand.nic.go.th/masterplan_area/userfiles/file%20Download /Report%20 Analysis%20Province/

Ngokwilai, W., & Puangchomphu, S. (2015). Study on Costs and Returns of Smallholder Farmers Using Agricultural Mechanization for Sugarcane Production for Smallholder Farmers at Nongrua District Khonkaen Province: Case Study Sugarcane Harvester Machinery. The National Conference on Business Management and Innovation 2015 (NCBMI 2015).

Miamphon, S. (2007). Managerial Accounting. 19th Edition, Bangkok: Info Mining Company Limited.

Pricha, R., Jungtrakul, M., Srikongphet, K., & Ratchatawetkul, W. (2020). *Step to the New Context of Sugarcane and Sugar Industries of Thailand.* Retrieved February 1, 2020, from https://www.bot.or.th/Thai/MonetaryPolicy/NorthEastern/ Doclib_Seminar60/41_Paper_SugarcaneIndust.pdf

Suphattharakun, S., & Phadoongsit, M. (2016). Managerial Accounting. 2nd Edition, Bangkok: Physics Center.

Thai Encyclopaedia for Youth by His Majesty the King. (2020). *Sugarcane.* Retrieved February 1, 2020, from http://saranukro mthai.or.th/sub/book/book.php?book=5&chap=3&page=t5-3-infodetail01.html

Yamane, T. (1973). Statistics: An Introductory Analysis. 3rdEd. New York: Harper and Row Publications.