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Application of activity-based costing to the logistics cost system of organic vegetables in Nakhon Pathom, Thailand

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Abstract The research finding indicated that the logistic costs based on the activity-based costing of organic vegetables in Nakhon Pathom had averaged the costs of logistic system of 38,568 baht per rai, and the order quantity costs or total production order was 17,753 baht per rai (46.03%) including total transportation costs of 20,500 baht per rai (53.15%), total warehouse costs was 300 baht per rai (0.78%) and the information process costs was 15 baht per rai (0.04%). It is involved with the guideline of the logistic cost reduction by gathering the network members of organic vegetable growers with the producing plan under the supporting agency including the setup for the production distribution center.

Keywords: Activity-based Costing, Logistics cost system, Organic vegetables

Introduction

According to the trend of organic product markets in the world, it has gradualy grown (Adhikari 2011). Moreover, the information of Institute for Small and Medium Enterprises Development (2020) stated that organic products had approximately expanded for three point five trillion baht (20%) per years. The organic food in the markets had higher grown than the common food while the Asian markets has grown about 10 % per year in Singapore, Malaysia, Philippines, and Thailand (Institute for Small and Medium Enterprises Development, 2020). Although there are currently only 213,183 Rai or 7% of Thailand's total agricultural land, the country's organic agriculture sector has steadily increased due to the country's growing organic consumer base. The Thai government has implemented measures to improve support for organic agricultural producers. However, the majority of the nation's organic

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farmers are connected to networks for sustainable farming (Kerdsriseam and Suwanmaneepong, 2015).

With a market value of US$25.5 mn and a per capita expenditure of US$0.37 in 2021, organic products in Thailand account for just 0.04% of the world's demand, demonstrating that they are a niche product supported by a relatively limited number of wealthy consumers. Thailand ranks in the top 10 for forecast growth despite having a small market and low per capita income compared to other countries, with an expected value compound annual growth rate of 8.8% for the years 2021-2026 (Global Organic Trade, 2021). This shift towards organic vegetable consumption has successfully motivated many firms to enter the growing organic vegetable market.

Nowadays, the customers are caring for their own health increasingly with realizing on the consuming importance to be beneficial for their bodies. Then, the organic products can be the suitable choice for the manufacturing procedures with environment conservation to avoid of plant chemical, so it has the expanding trend for the organic product markets more than the past. However, the growers of organic vegetables are still facing with the costs problem with the good management due to the lacking of knowledge with suitable production costs management and logistic costs management including of lacking for the effective operational plan procedures, product flow control, moving and product storing and other fields (Dong and Li 2007). Accelerating the spread of organic vegetables will significantly boost the number of casual customers and boost sales. As a result, taking a closer look at the process by which organic veggies spread could help providers of organic vegetables become more profitable and sustainable. As a result, taking a closer look at the process by which organic veggies spread could assist providers of organic vegetables become more profitable and sustainable (Wu *et al*., 2019).

Thus, the important costs for the growers are based on the suitable management that are logistic costs and involved logistics management from the upstream process, such as growing expenditures, procurement of inputs and transportation including of the management in production process (Karot *et al.,* 2018). Thus, the logistic cost management has contributed to the good potential for the agriculturist competition including of the involved people in agriculture product supply chains (Taylor and Fearne 2006). With this case, it brought the concept idea of logistic cost reduction to create the good competitive advantages for gaining the good potential of costs management. Manufacturers, transportation firms, third-party logistics service providers, shipping carriers, and a range of other vendors are compensated for their logistical costs along the entire supply chain for organic vegetables. Additionally, the key worry for the stakeholders is the expense of the logistics. The majority of food is sold through

supply networks managed by sizable wholesalers and supermarket chains, including organic fruits and vegetables. A portion is sold via regional marketing channels, including niche retailers, food subscription services, farmers' markets, and community-supported agriculture (Milford *et al.,* 2021). Then, it is essential to know the actual logistic costs clearly into the logistic activity level (Bokor and Markovits-Somogyi 2015) including of finding the guideline of logistic cost reduction to be in the lower level for creating the competitive advantages with organic vegetable growers from the upstream one effectively (Zang *et al.,* 2008). Thus, it enables to make the differences for increasing values with the most level of customer requirements. According to the literature review, it was found that it is still lacked the logistic cost analysis, especially for the agriculture section (Khuptawatin *et al.,* 2016). Then, it has seen that the involved logistic costs are based on the high level of activity-costs as becoming to be the research objective for the logistic cost analysis of organic vegetables by using the Activity Based Costing: ABC) (Stock and Lambert, 2001; Baykasoglu and Kaplanoglu, 2008; Zakic and Borovic, 2013).

Costing models are crucial instruments for decision-support. Especially complex costing models and systems, such activity-based costing methods, which have been touted as more efficient and effective than traditional costing methods (Kaplan and Bruns, 1987). Due to the high number of cost pools needed, the requirement for ongoing evaluation, and the high costs associated with design and implementation, Activity Based Costing systems are often seen as being too complex for most cases (Duran and Afonson, 2020). Entrepreneurs that took part in Activity Based Costing implementations discovered that there were additional benefits beyond only more accurate cost calculations, such as the capacity to better manage expenses and operations. From a conceptual standpoint, ABC offers several intriguing qualities. It is appealed to managers since it can provide essential information for decision making (Gosselin, 2006). The creation and implementation of effective strategic cost management solutions is required to promote more consistent decision making (Santana *et al.,* 2017). Finally, it can be noted that this tool is suitable for logistic activity analysis by searching for the actual costs in activities with costs measurement method. Importantly, the operational result was from the applying of resources in activities to be achieved with goals as the solving guideline in each production activity. Finally, it can increase for the cost reduction values and add the incomes to the organic vegetable growers in Nakhon Pathom province with the logistic costs reduction in each activity actually.

Logistic activity and activity-based costing

According to the concept idea of Stock and Lambert (2001), the study used the method step by calculating the unit cost of activities with bringing the total costs of each activity to be divided with handling volumes from six steps: first step that is the analysis and activity determination for specifying important activity classifying into minor ones clearly to inform about the applying of resources, second step is the study about total activity costs classifying into activity costs with applied resources and total logistic costs for determining the activity push under the activity-based costing by using accounting documents and interviewing to calculate with the real costs, third step is the determination with distribution term by bringing the costs in the resources from the second step to be analyzed with each activity, fourth step is the calculation of total cost in each activity from the first step and the resource cost for making expenditure analysis from third step by using total cost analysis for each activity, fifth step is the study of work quantity in each activity including of operation numbers with real work into the logistic management, sixth step is the calculation of divided unit cost by bringing the overall to use in each activity (Stock and Lambert, 2001).

It showed that the work quantity become as the activity-based costing according to the study of concept idea for activity-based costing of Stock and Lambert (2001). Therefore, it has explained about the cost analysis according to the original one of logistic works with the goals emphasizing on cost reduction more than in each activity. In this case, it is focused on the cost reduction in only one activity affecting to other activity costs as the higher level with the upstream level to study for the relevant operation with providing, transportation and collecting for producing factors and delivering products. With this case, there are six categories of logistic activities as customer service cost, transportation cost, inventory cost, size cost or purchasing quantity, order management procedure cost and news system, and inventory maintenance cost.

It is congruently supported the concept idea of Cooper (1988) with the activities-based costing in theory and practices dividing into the organization operation and time in each activity including activity analysis, specifying of activity cost, specifying of work measurement with gaining unit cost and time proportion as quality, specifying about relevance of result in each activity to push cost as the controlling information with cost reduction to calculate activities, and specifying of the activity-based costing as the correct product one with general accounting system

In this case, the activity-based costing or ABC is the management tool in characteristic of value-based management connecting with organization

management into daily life management by considering with responsible roles of each agency including of cross function to view activities as integrated one. Then, it is the activity cost system to be managed as the share cost classifying into two steps as same as the concept idea of Lamber *et al.* (1998) by specifying of cost driver in each activity to be the controlling factors of cost reduction with calculation in the high or the low level depending on activity quantity from prime cost calculation. Similarly, it is including with the study of Junkrajai (2011) to apply for the activity cost system with Portuguese coffee production company, and it was found that this system is suitable for the organization reflecting of working method in daily life correctly with the beneficial information to the organization. In this case, it is as same as the concept idea of Onsanit (2012) to apply with activity-based costing method and the theory of limitation in knitted shoe industries for solving problems of labor scarcity with environmental problems. Then, finally it can make for Green Production Decision Model (GPDM) to be found that this concept idea can assist the knitted shoe company for controlling the cost with good effectiveness.

The objective was to study the logistic costs of organic vegetables in Nakhon Pathom bu applying application of activity-based-costing from logistics cost system with share cost.

Materials and methods

Sample size

The purposing sample with total of thirty people were selected as the organic agricultural groups based on the selection criteria of organic vegetables in Nakhon Pathom province over three years.

Research tool

A questionnaire and an in-depth interview are both sorts of research instruments that consist of a series of questions or other forms of prompts aimed at gathering information from respondents.

According to the analysis of logistic costs by using activity-based costing of organic vegetables in Nakhon Pathom province, it used the costs system in activities of organic vegetables. Besides, the researcher has used the research method of both quality and quantity ones with standardized or structured interview tool and the depth interview of the agriculturist groups for organic vegetables including of the checking for with the developed research tool prior

to present to the three experts and check for IOC index values between questions and objectives.

Data collection

It used the questionnaires and the depth interviews to gather information of logistic costs for the agriculture group sampling to plan the organic vegetables in Nakhon Pathom province in production year of 2020-2021. Then, it can gather for the relevant information from the planning of material providing before planting, harvesting, and packaging until the product transportation to the customers.

According to the concept idea of activity-based costing analysis, it used to be adapted with the applying of expenditure analysis for each growing activity of the involved agriculturists from the planning of material providing before planting, harvesting, and packaging until the product transportation to the customers. Thus, the expenditures from applying resources of each activity would be calculated with the analysis method of activity-based costing for logistic with the concept idea of logistic management from Stock and Lambert (2001) as the method steps.

Data analysis method

According to the quantitative data, we used the data analysis as the basic detail of the group samplings by using of descriptive statistics consisting of frequency, percentage, mean and standard deviation.

According to the data analysis of logistic activities, it is involving with organic vegetables. Thus, the researcher has checked for the triangular for the data collection from the interviewing of the group sampling.

Moreover, according to the expenditure costs data in each operational step, it is including with the applying of resources in each activity based on the logistic costs analysis. In this case, it has brought the costs system analysis of activity based costing to be the tool for making understanding about the costs behaviors from total organic vegetables by using four steps of analysis procedure; namely, the first step that is to determine for the main and the minor activities , the second step that is to study for total costs with the classifying of applied resources and determining for the terms of costs distribution , the third step that is to calculate for total costs of each activity and the fourth step that is to study about the numbers of work in each activity with calculating for the unit costs.

Formula for total cost of activities (baht per rai) and average costs (baht per rai) = total costs of agriculturists with averages of thirty people ÷ Total production quantity, Formula of finding percentages of total logistic costs and percentages of total logistic cost = (expenditures with money) ÷ Total expenditures with money) X 100, Formula of finding percentages with total logistic costs per incomes and percentages of total logistic costs = (total activity costs (baht per rai) x 100) ÷ selling prices of averages production (baht per rai), Formula of finding expenditures with money including of expenditures with money = total activity costs (baht per rai) x total production quantity per year, Formula of finding car depreciation values = (buying prices for each agriculturist - ten percentages of buying prices) ÷ lifetime from interviewing before collecting for all of them in each list.

Results

The information survey from the questionnaires and the in-depth interviews, including the areas of the agriculturists of organic vegetables in Nakhon Pathom province involved a total of thirty people. Most of them were males who were more than forty years old and graduated from junior high school as the owner of the house. Then, it can grow the organic vegetables from the government agency, and most of them have had the duration to produce the organic vegetables from good agriculture practices for more than six years, including using the water source from the pond or the well. In this case, it used an area of about 5–10 rai for producing organic vegetables with good agricultural practices.

Table 1. Information of agriculturist groups for organic vegetables in 2020-2021 in nakhon pathom province

List	Amount
1. Total Planting Area (rai)	325
2. Total Production Quantity (kilogram)	273,650
3. Average Production Quantity Per Rai (kilogram per rai)	942
4. Selling Prices of Average Production (baht per kilogram)	50
5. Sales Values from Production Quantity (Baht)	13,682,500

According to the logistic activity analysis for planting the organic vegetables, it was used from the upstream procedure to the downstream activities before delivering the products to the customers, which consists of four activities. The first activity was provided the materials, and prepared them before planting organic vegetables, and made the contacts to sell the products through communication channels by using mobile phones or line application.

Then, the head of enterprise groups or the owners of farmers had checked for the production from the member groups or the production in their own farms by specifying types with quantities for the organic vegetables as the customer orders. Second activity was started to grow the organic vegetables. Third activity was harvested organic vegetables consisted of removing, collecting, and selecting methods for the sizes as the customer orders. Forth activity was involved with transportation that the head of enterprise groups must deliver the vegetables to the customers.

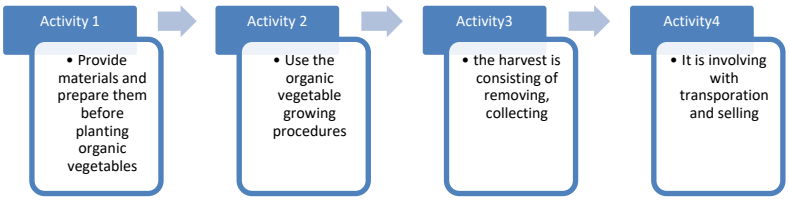

Figure 1. Logistic activity of organic vegetables in nakhon pathom province

The analysis of logistic costs in Nakhon Pathom province for the agriculturists with thirty people found that the total averaged costs per rai before classifying and analyzing the costs with many types as activity-based costing consisting of order quantity cost, transportation, inventory, order management procedure and news system are presented in Table 2.

Table 2. Labor costs in soil preparation

List	Average Costs (Baht per Rai)
Labor Costs of Soil Preparation	900
Equipment Costs	5,560
Material Purchasing Costs	9,090
Labor Costs of Planting	600
Expenditure Costs on Maintenance	403
Labor Costs of Harvesting	1,200
Labor Costs on Packaging	300
Packaging Values	4,710
Oil Values on Transportation	7,000
Depreciation Values on Transportation	3,333
Car Maintenance Values on Transportation	500

The results revealed that the highest average cost of material purchasing was 9,090 baht per rai (Table 2). Oil values on transportation were 7,000 baht per rai, equipment costs were 5,560 baht per rai. Packaging values were 4,710 baht per rai, and depreciation values on transportation were 3,333 baht per rai.

Labor costs of harvesting were 1,200 baht per rai, labor costs in soil preparation with average costs were 900 baht per rai, and total average labor costs in planting were 600 baht per rai. Car maintenance costs on transportation were 500 baht per rai, expenditure costs on maintenance were 403 baht per rai, and labor costs on packaging were 300 baht per rai, respectively.

Table 3. Logistic cost analysis by using of activity-based costing of organic vegetables in Nakhon Pathom province

Logistic Cost	Logistic Activity	Average Cost (Baht per Rai)	Percentage
Procurement of Raw Materials and Preparation before Planting	1. Labor Cost for Soil Preparation	900	3
	2. Purchasing of Tools and Agriculture Equipment	5,560	17
	3. Raw Material Procurement Cost	9,090	26
	Total	**15,550**	**46**
Planting Cost	1. Labor Cost in Planting	600	2
	2. Expenditures of Maintenance	403	1
	Total	**1,003**	**3**
Harvesting Cost	1. Labor Cost in Production Harvesting	1,200	6
	2. Labor Cost in Packaging	300	1
	3. Packaging Cost	4,710	12
	Total	**6,210**	**19**
Transportation Cost and Selling	1. Oil Cost in Transportation	7,000	21
	2. Car Depreciation Cost in Transportation	3,333	10
	3. Car Maintenance Cost in Transportation	500	1
	Total	**10,833**	**32**
Total Average Cost		**33,596**	**100**

The analysis of data and cost structure of organic vegetables in Nakhon Pathom province found that the total average cost was 33,596 baht per rai (Table 3). Raw material costs before planting was 15,550 baht per rai (46%), consisting of labor cost for soil preparation was 900 baht per rai (3%), purchasing of tools and agriculture equipment was 5,560 baht per rai (17%), and raw material procurement cost was 9,090 baht per rai (26%), Planting cost was 1,003 baht per rai (3%), consisting of labor cost in planting was 600 baht per rai (2%), and maintenance expenditures was 403 baht per rai (1%). Harvesting cost was 6,210 baht per rai (19%), consisting of packaging cost was

4,710 baht per rai (12%), labor cost in production harvesting was 1,200 baht per rai (6%), and labor cost in packaging was 300 baht per rai (1%). Moreover, the cost for transportation and selling was 10,833 baht per rai (32%), consisting of an oil cost of 7,000 baht per rai (21%), a car depreciation cost of 3,333 baht per rai (10%), and a car maintenance cost of 500 baht per rai (1%).

Discussion

The study used the concept idea of activity based cost for finding the logistic one of agriculturists with notices and depth interview as the cost reduction guideline from activities. It is involved with the procurement activities of inputs and planting preparation which had the most level of all expenditures with forty-six percentages by analyzing from the lists of important raw material cost factor to gain incomes. Besides, it is involved with expenditure reduction method to gather the agriculturist groups of organic vegetable growers with production planning and provided the co-production factors including the planning to use the co-vehicles in transportation, the route planning in material procurement and the sharing of agricultural equipment, such as tractors and labors to reduce the applying of resources in production procedures with reducing losses congruently with the study of Thaocharee and Chanwiang (2014). With this case, it was found that the most level of logistic cost structure was purchasing cost or the production orders and following by the returning of transportation cost, and the storage cost as the concept idea of Junkrajai (2011).

The results involved with the production planning activities and the vegetable planting from the expenditure reduction method with the marketing guideline for the customer requirements and planning selection of agriculturist groups network to harvest with machines and equipment for reducing of the external labor expenditures. Similarly, it is conformed to the study of Chitkamkhang (2008) for increasing the competition effectiveness with the wrapped lettuces producing management of the royal project to reduce the overall cost.

The findings are involved with the transportation activities to move the production quantities from the growing sources into the markets as the transportation expenditures with thirty-two percentages. It used the expenditure reduction method with gathering the network partner members between the producers in nearby areas to plan for collecting the products of the agriculturist groups including of coordinating to setup the transportation routes and vehicles or outsource management.

Then, it can make comparison to the expenditures and the effectiveness between transportation and external ones suitably with the most level. Similarly, it was similar concept of Termsombatbaworn (2015) who stated that the logistic cost in supplying chain for shallots in Sisaket Province with using the activity-bases costing method for the logistic cost in transportation classifying into two cases which were the agriculturists delivered the products to the inventory for the provincial traders, and receiving the products directly in the agriculturist farms.

Furthermore, it is involved with the collection and the inventory including of the expenditure reduction method for labor cost before delivery to the markets. In this case, the agriculturists must become the member groups which conformed to the concept of Zang *et al.* (2008); Thaowaree and Chanwiang (2014) and Wittayachareonpong (2017) who stated that it must reduce for the inventory cost.

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