THE EFFICIENCY OF MELINJO (*Gnetum Gnemon L.*) CHIP SUPPLY CHAIN IN BANTUL REGENCY, PROVINCE OF YOGYAKARTA

Efisiensi Rantai Pasok Emping Melinjo di Kabupaten Bantul Daerah Istimewa Yogyakarta

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ABSTRACT

Melinjo chip is one of the typical foods in Yogyakarta made of melinjo nuts. The production center of melinjo chip is located in Banguntapan and Pajangan Sub Districts, Bantul District. The purpose of this study is to determine the efficiency of the supply chain measured with transportation model analysis. The number of respondents in this research was 50 producers of melinjo chip in Bantul District, taken by simple random sampling method. While the snowball sampling method was used to get 5 (five) collector traders, 5 (five) large traders and 26 (twenty six) melinjo chip retailers that taken by following melinjo chip sales distribution from the producer to Market of Piyungan, Demangan, Kotagede, Sentul, Beringharjo, Bantul, Legi, and Magelang. The supply chain actors of melinjo chip are melinjo farmers, melinjo chip producers, collecting traders, large traders, retailers, consumers, packaging producers, production workers, haulers, and firewood providers. The analysis of transportation model with minimum cost illustrates that Wirokerten Village from Banguntapan Sub District allocate the production of melinjo chip to Market of Beringharjo and Piyungan, while Potorono Village allocates the to Market of Demangan. Sendangsari and Triwidadi Village from Pajangan Sub District allocate the production of melinjo chip to Market of Beringharjo, while Guwosari Village allocates to Market of Beringharjo, Bantul, and Legi.

Keywords: efficiency, supply chain, and transportation.

INTISARI

Emping melinjo merupakan salah satu makanan khas Daerah Istimewa Yogyakarta berbahan baku biji melinjo. Sentra produksi emping melinjo berada di Kecamatan Banguntapan dan Kecamatan Pajangan, Kabupaten Bantul. Tujuan penelitian ini adalah menentukan efisiensi rantai pasok dilihat dengan model transportasi. Pengambilan responden dalam penelitian ini dilakukan secara simple random sampling sebanyak 50 produsen emping melinjo di Kabupaten

Bantul. Metode snowball sampling digunakan untuk mendapatkan lima pedagang pengepul, lima pedagang besar, dan 26 pedagang pengecer emping melinjo dengan cara mengikuti alur penjualan emping melinjo dari produsen ke Pasar Piyungan, Demangan, Kotagede, Sentul, Beringharjo, Bantul, Legi, dan Magelang. Pelaku rantai pasok emping melinjo meliputi petani, pedagang melinjo, produsen emping melinjo, pedagang pengumpul, pedagang besar, pedagang pengecer, konsumen, produsen kemasan, buruh produksi, buruh gendong, dan penyedia kayu bakar. Berdasarkan analisis model transportasi dengan biaya minimum, maka hasil yang didapat adalah Kecamatan Banguntapan dengan sumber Desa Wirokerten mengalokasikan hasil produksi emping melinjonya ke Pasar Beringharjo dan Pasar Piyungan sementara Desa Potorono mengalokasikan ke Pasar Demangan. Kecamatan Pajangan dengan sumber Desa Sendangsari dan Desa Triwidadi mengalokasikan hasil produksi emping melinjonya ke Pasar Beringharjo, sementara Desa Guwosari ke Pasar Beringharjo, Bantul, dan Legi.

Kata kunci: *efisiensi, rantai pasok, dan transportasi.*

INTRODUCTION

Indonesia as a developing country where most of the economy growth is supported by Small and Medium Enterprises (SME). Based on data from the Central Bureau of Statistics, states that 90% - 95% of companies in Indonesia are classified as SMEs. This shows that Indonesia's economic growth is driven and dominated by SME activities (Aisyah et al., 2013).

One of the horticultural crops that has great a potential to develop is Melinjo (Gnetum genemon, L.). Melinjo plants in some areas as vegetable crop. Melinjo is also a basic ingredient to make melinjo chip. Melinjo chip is one of snacks, besides having high nutrition, it also has a distinctive taste and liked by lot of society. Melinjo chip is a special food from Indonesian (Aliudin & Anggraeni, 2012).

executing product's flow from producent to costumer is one of many factors that cannot be ignored. It is necessary to choose the right distribution channel to be used in the distribution of goods. Moreover, it will helps the distribution especially in term of prices adjustment in different markets (Cristoporus & Sulaeman, 2009).

Harjanto (2008) explains that the supply chain is a set of interrelated activities and decisions designed to integrate suppliers, manufacturers, warehouses, transportation services, retailers and consumers efficiently. Thus, goods and services can be distributed with the best quality, quantity, time and location so that it can minimize costs in fulfilling the need of the consumers.

In today's competition, business actors have to consider that the common competition is a competition between supply chain networks. Business actors in a supply chain must be able to deliver products that suit the consumers' desires in terms of quality, quantity, price, time and place (Furqon, 2014).

Network design is an important activity that must be done on supply chain management. Making decisions in

a network design has a very significant impact or influence. A performance in network design decision making will determine the composition of supply chain management. Hence, integerated supply chain management could increase the overall value generated by these networks (Budiman et al., 2015).

A competitive advantage can depend on long-term strategic relationships that are close to the number of suppliers. Employers should seek the integration of then chosen strategy with in the supply chain. A successful result does not denyv the perseverance of dedication, innovative, and the desire to move forward. Therefore, teamwork, integrity, mutual respect are prioritized in the work environment (Wuwung, 2013).

Kertiasih (2009) in her research about the use of transportation methods for the distribution of goods revealed that transportation methods are used to manage the distribution of sources that provide the same product to places that require optimum. The allocation of these products should be arranged in such a way, as there are differeces in cost from one source to another.

Kertiasih (2009) on transportation problems states that usually the number of goods supplied from each request location varies. The different shipping routes will result in different shipping costs. Furthemore, the solution of this case is by determining how many units of goods are streamed from each source to each destination so that the demand for each goal is met and the total shipping cost is minimum.

Mau (2018) in his research about patterns and determinant factors of arabica coffee's marketing margin in Ngada Regency shows that marketing margin is significantly influenced by marketing volume and marketing cost. Based on the result, marketing volume and marketing cost are the facrors which affected the arabica coffee's marketing as well. So the researcher in interested to do a research about melinjo chip marketing in Bantul District. The problem in this article is related to melinjo chip marketing in Bantul District which is not only marketed in Yogyakarta area but also outside the area such as Magelang market. But, marketing of melinjo chip out of area need higher cost in delivery of goods compared to market in Yogyakarta area. Based on the description above, the problem to be discussed in this research is whether the supply chain of melinjo chip in Bantul District has been efficient. The purpose of this research is to determine the efficiency of supply chain of melinjo chip.

METHODS

Location and Data

This research was conducted in Bantul District as it is the center of melinjo chip production in DIY. The selection of

this location was done purposively by considering that Bantul District is the industrial center of melinjo chip. The research sites located in two sub-districts, namely Banguntapan Sub District and Pajangan Sub District. The data collected consisted of primary data and secondary data. The number of respondents taken by the researchers was 50 who were the producers of melinjo chip located in Banguntapan Sub District and Pajangan Sub District using simple random sampling method. The respondents were collected by using a simple random sampling method because all the producers of melinjo chip in Bantul District are homogenous.

The sample of merchants was taken by applying a snowball technique (snowball sampling) by following the producers to sell melinjo chip. The researcher observed the process of melinjo chip selling from the producers to the consumers (Nurdiani, 2014).

This study uses a transportation model using scientific management application to determine the optimal melinjo chip distribution in minimum cost. In this research, there were five middlemen, five large traders and 26 retailers. Traders of melinjo chip retailers represent eight market destination of supply chain melinjo chip in Bantul District: Piyungan, Demangan, Kotagede, Sentul, Beringharjo, Bantul, Legi, and Magelang market.

Data analysis

Decision variable :

X_{ij} = Total of melinjo chip from source i to destination j

C_{ij} = Operational cost of melinjo chip distribution from source i to j where i = 1 (Wiroketen) and 2 (Potorono) , j = 1 (Beringharjo), 2 (Demangan), 3 (Kotagede), 4 (Sentul), and 5 (Piyungan) for Banguntapan Sub District

Function Purpose:

Minimizing : $Z = C_{1,1} X_{1,1} + C_{1,2} X_{1,2} + C_{1,3} X_{1,3} + C_{1,4} X_{1,4} + C_{2,1} X_{2,1} + C_{2,5} X_{2,5}$

Constrains : $X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} + X_{1,5} = a_1$ (supply market)

$X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} + X_{2,5} = a_2$ (supply market)

X_{ij} = Total of melinjo chip from source i to destination j

C_{ij} = Operational cost of melinjo chip distribution from source i to j where i = 1 (Sendangsari), 2 (Guwosari), and 3 (Triwidadi), j = 1 (Magelang), 2 (Beringharjo), 3 (Bantul), and 4 (Sentul) for Pajangan Sub District.

Function Purpose:

Minimizing : $Z = C_{1,1} X_{1,1} + C_{1,2} X_{1,2} + C_{1,3} X_{1,3} + C_{1,4} X_{1,4} + C_{2,1} X_{2,1} + C_{2,2} X_{2,2} + C_{3,1} X_{3,1}$

Constrains : $X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} = a_1$ (supply market)

$X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} = a_2$ (supply market)

$X_{3,1} + X_{3,2} + X_{3,3} + X_{3,4} = a_3$ (supply market)

RESULTS AND DISCUSSION

Supply Chain Network

The agents of melinjo chip's supply chain in Bantul District are all the people who are involved in melinjo chip distribution process from the producer to the consumer including farmers, Melinjo traders, producers of melinjo chip, collectors traders, large traders, retailers, consumers, packaging equipment providers, slot workers, production workers, and firewood providers.

The role of melinjo farmers and traders is to provide the raw materials of melinjo chip for the producers. The producers of melinjo chip will offer their products to the middlemen, large traders, and retailers. Merchant traders will sell melinjo chip directly to the retailers and some sell-through merchants. Generally, producers sell their products to retailers who will directly sell it to the consumers.

Model analysis

1. Decision Variables Identification

The supply chain of melinjo chip in Bantul District is started from the producers that acquired melinjo seeds as raw material which obtained from traders and farmers melinjo, then processed the melinjo seeds into melinjo chip. The producers sold the melinjo chip through merchant traders, wholesalers, or directly to retailers. Next, retailers sell it to consumers. Retailers in this study were located in Piyungan, Demangan, Kotagede, Sentul, Beringharjo, Bantul, Legi, and Magelang market. This study aims to optimize the costs incurred by
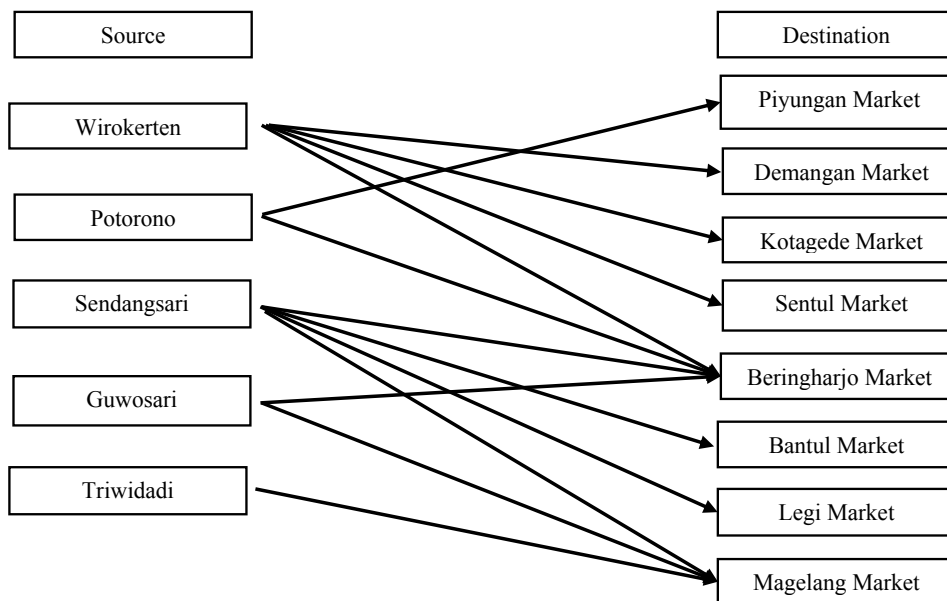

Figure 1. Sources and destinations for the transportation model of melinjo chip in Bantul District.

producers of melinjo chip in Banguntapan Sub District consisting of Wirokerten Village, Potorono Village, and Pajangan Sub District which consist of Sendangsari Village, Guwosari Village, and Triwidadi Village.

2. Constrains Identification

The constraints in the model are the number of melinjo chip stock from the producers in Bantul District and the needs of melinjo chip of each destination market. The number of needs of each destination market is the result of multiplication between the number of retailers in the destination market and the average of melinjo chip sales for one day then multiplied by seven to know the needs of the destination market within a week. It is the number of needs in a week.

The constraints are:

Constraint needs in each market = the number of melinjo chips sold out by traders in a week

3. Constraint Equation

The constraints were divided into two catagories namely the supply and constraints the needs of melinjo chip constrains. Supply constraints is a constraint of the melinjo chip sold by producers within one week 3,827.5 kg, while the needs constraint is the average sales of melinjo chip within a week at the merchant retailers in each market. The needs of melinjo chip retailers in each market can be seen in Table 1. Melinjo chip demand may increase during Eid al Fitri celebrations, Eid al Adha, and New Year's holiday period. However, the demand of melinjo chip will decrease after Eid al Adha celebrations.

1) Constraints 1 (Needs of Piyungan Market) = 280 kg

2) Constraints 2 (Needs of Demangan Market) = 245 kg

3) Constraints 3 (Needs of Kotagede Market) = 630 kg

4) Constraints 4 (Needs of Sentul Market) = 280 kg

Table 1. The needs of melinjo chips in each market

Markets	Total of Retailers	Total of sales (Kg/Day)	Sales of Markets (Kg/Day)	Sales of Markets (Kg/Week)
Piyungan	20	2	40	280
Demangan	35	1	35	245
Kotagede	15	6	90	630
Sentul	20	2	40	280
Beringharjo	35	20	700	4,900
Bantul	20	2	40	280
Legi	12	2	24	168
Magelang	20	15	300	2,100

Source: Primary Data Analysis, 2017

Table 2. Marketing cost of melinjo chip in each purpose

Source	Destination	Production (kg)	Total Cost(Rp.)	Cost per kg (Rp.)
Wirokerten	Beringharjo Market	740.5	155,800	210
	Demangan Market	30	17,800	593
	Kotagede Market	60	13,600	227
	Sentul Market	22.5	16,700	742
	Total	853		
Potorono	Beringharjo Market	43	2,500	58
	Piyungan Market	30	14,800	493
	Total	73		

Source: Primary Data Analysis, 2017

Table 3. The transportation model before minimization in Banguntapan Sub District

To From	Beringharjo Market	Demangan Market	Kotagede Market	Sentul Market	Piyungan Market	Supply Market
Wirokerten	210 740.5	593 30	227 60	742 22,5		853
Potorono	58 43				493 30	73
Demand	4,900	245	630	280	280	926

Source: Primary Data Analysis, 2017

5) Constraints 5 (Needs of Bringharjo Market) = 4,900 kg

6) Constraints 6 (Needs of Bantul Market) = 280 kg

7) Constraints 7 (Needs of Legi Market) = 168 kg

8) Constraints 8 (Needs of Magelang Market) = 2,100 kg

The Analysis of transportation model in Banguntapan Sub District

a. Function purpose:

Distribution of melinjo chip from producer to consumer need of packing cost, transportation, loading and unloading, parking, and retribution. Production of melinjo chip and demand of each market are the results of calculation within a week.

Table 2, is calculation of marketing cost of melinjo chip. Marketing cost is the total cost of production.

Minimizing : $Z = 210X_{1,1} + 593X_{1,2} + 227X_{1,3} + 742X_{1,4} + 58X_{2,1} + 493X_{2,5}$

Constrains : $X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} + X_{1,5} = 853$

$X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} + X_{2,5} = 73$

Based on Table 3, the first source, Wirokerten Village, allocates the chips to Beringharjo, Demangan, Kotagede, and Sentul Market of 740.5 kg costing Rp. 210, 30 kg costing Rp. 593, 60 kg costing Rp. 227, and 22.5 kg costing Rp. 742 respectively.

Potorono Village the secound source allocates the products to two the two destinations namely Beringharjo Market as much as 43 kg at a cost of Rp. 58, and

Piyungan Market as much as 30 kg at a cost of Rp. 493. From both sources, the lowest cost is in Beringharjo Market. Based on the two sources, the sales of melinjo chip are mostly marketed to Beringharjo Market, because the highest number of sales is at Beringharjo and the location is very strategic which close to Malionoro. The Marketing cost of melinjo chip is depend on the amount, the more the less the cost.

Based on Table 3, the total of transportation costs incurred by marketing actors melinjo chip in Pajangan Sub District prior to minimization can be calculated by using using the formula below:

$Z = \sum$ (operational cost of distribution of melinjo chip per kg per supply area x supply quantity)

$$Z = \sum (C_{1,1} X_{1,1} + C_{1,2} X_{1,2} + C_{1,3} X_{1,3} + C_{1,4} X_{1,4} + C_{2,1} X_{2,1} + C_{2,5} X_{2,5})$$

$$= \sum (210X_{1,1} + 593X_{1,2} + 227X_{1,3} + 742X_{1,4} + 58X_{2,1} + 493X_{2,5})$$

$$= \sum ((210 \times 740,5) + (593 \times 30) + (227 \times 60) + (742 \times 22,5) + (58 \times 43) + (493 \times 30))$$

$$= Rp. 220,894$$

Table 4 describes the allocation of melinjo chip from the sources to the destinations in Banguntapan Sub District. There are two sources and five destinations in allocating melinjo chip. The allocation of melinjo chip distribution with the objective of minimizing costs can be seen by using transportation analysis. The operational cost of melinjo chip distribution before being minimized was Rp. 220,894, then the analysis results in table 4 show that the cost of melinjo chip distribution can be reduced to Rp. 120,330, so the operational cost can be minimized to Rp. 100,564.

The lowest marketing costs can be obtained if the producers of melinjo chip in Banguntapan Sub District with the first source of Wirokerten Village allocate the melinjo chip to the first destination which is Beringharjo market with the number of 573 kg and the fifth destination which is Piyungan Market with the number 280 kg and the second source which is Potorono Village allocate melinjo chip to the second destination which is Demangan Market with the number of 73 kg.

Table 4. The operational cost of distributing melinjo chip after analysis

Source	Destination				
	Beringharjo Market	Demangan Market	Kotagede Market	Sentul Market	Piyungan Market
Wirokerten	573	0	0	0	280
Potorono	0	73	0	0	0
Total Transportation Cost		120,330			

Source: Primary Data Analysis, 2017

The Analysis of transportation model in Pajangan Sub District

Minimizing : $Z = 213X_{1,1} + 109X_{1,2} + 493X_{1,3} + 236X_{1,4} + 738X_{2,1} + 228X_{2,2} + 345X_{3,1}$

Constrains :

$X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} = 1,386$
$X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} = 1,165$
$X_{3,1} + X_{3,2} + X_{3,3} + X_{3,4} = 350$

Sendangsari Village as the first source allocated to the four destinations, which are Magelang Market, Beringharjo, Bantul, and Sentul. Beringharjo market is the destination with the larg-est allocation of melinjo chip of 789 kg with the lowest cost of Rp. 109. Guwosari Village as the second source allocated to the two destinations, which are Magelang Market and Beringharjo Market. Same with source one, Beringharjo Market destination is the largest allocation amount of 1000 kg at a cost of Rp. 228. Triwidadi Village as the third source allocated only to one destination, which is Pasar Magelang as much as 350 kg with the cost of Rp. 345. From those three sources, the lowest cost is in Beringharjo market just like in the Banguntapan Sub District transportation model. Based on those three sources, almost all of the melinjo chip are marketed to Beringharjo Market. The location of

Table 5. Marketing cost of melinjo chip in each purpose

Source	Destination	Production (kg)	Total Cost (Rp.)	Cost per kg (Rp.)
Sendangsari	Beringharjo Market	789	86,200	109
	Magelang Market	492	104,840	213
	Bantul Market	30	14,800	493
	Legi Market	75	17,700	236
	Total	1,386		
Guwosari	Beringharjo Market	1,000	228,000	228
	Magelang Market	165	121,720	738
	Total	1,165		
Triwidadi	Magelang Market	350	120,900	345

Source: Primary Data Analysis, 2017

Table 6. The transportation model before being minimized in Pajangan Sub District

From \ To	Magelang Market	Beringharjo Market	Bantul Market	Legi Market	Supply
Sendangsari	213	109	493	236	1,386
	492	789	30	75	
Guwosari	738	228			1,165
	165	1,000			
Triwidadi	345				350
	350				
Demand	2,100	4,900	280	168	2,901

Source: Primary Data Analysis, 2017

Table 7. The operational cost of melinjo chip distribution after analysis

Source	Destination			
	Magelang Market	Beringharjo Market	Bantul Market	Legi Market
Sendangsari	0	1,386	0	0
Guwosari	0	717	280	168
Triwidadi	0	350	0	0
Total Transportation Cost		314,550		

Source: Primary Data Analysis, 2017

Beringharjo is near from the producers, that is why many producers sell the melinjo chip at Beringharjo Market. The Marketing cost of melinjo chip is depend on the amount, the more the less the cost.

From Table 6 total transportation costs incurred by marketing agent of melinjo chip in Pajangan Sub District before being minimized can be calculated using the formula:

$Z = \sum$ (operational cost of distribution of melinjo chip per kg per supply area x supply quantity)

$$Z = \sum (C_{1,1} X_{1,1} + C_{1,2} X_{1,2} + C_{1,3} X_{1,3} + C_{1,4} X_{1,4} + C_{2,1} X_{2,1} + C_{2,2} X_{2,2} + C_{3,1} X_{3,1})$$

$$= \sum (213X_{1,1} + 109X_{1,2} + 493X_{1,3} + 236X_{1,4} + 738X_{2,1} + 228X_{2,2} + 345X_{3,1})$$

$$= \sum ((213 \times 492) + (109 \times 789) + (493 \times 30) + (236 \times 75) + (738 \times 165) + (228 \times 1,000) + (345 \times 350))$$

$$= Rp. 693,807$$

Table 7 is the allocation of the distribution of melinjo chip from the sources to the destinations in Pajangan Sub District. There are three sources and four destinations in allocating melinjo chip. The allocation of melinjo chip distribution

with the objective of minimizing costs can be seen by using transportation analysis. Operational cost of melinjo chip distribution before being minimized was Rp. 693,807. Then, the analysis results show that the cost can be reduced to Rp. 314,550. Furthermore, the operational cost is decreased of Rp. 379,257.

The lowest marketing costs can be obtained if the producers of melinjo chip in Banguntapan Sub District with the first source which is Village Sendangsari allocates melinjo chip to the second destination which is Beringharjo Market with the number of 1,386 kg. The second source is Guwosari Village allocating melinjo chip to the second destination in Beringharjo market of 717 kg , followed by the third destination is Bantul market of 280 kg, and finished is Legi market of 168 kg. The third source is Triwidadi Village allocating melinjo chip to the second destination of Beringharjo market of 350 kg.

CONCLUSION AND SUGGESTION

Based on the analysis of transportation model with minimum cost, the results are Banguntapan Sub District with Wirokerten

Village source allocates melinjo chip to Beringharjo and Piyungan Market while Potorono Village allocated to Demangan Market. Sub District of Pajangan with the sources of Sendangsari Village and Triwidadi Village allocate melinjo chip to Beringharjo Market, while Guwosari Village allocates it to Beringharjo Market, Bantul Market, and Legi Market.

The result of transhipment model illustrate that the cost of melinjo chips marketing can be minimized, so the producers should allocate on to markets that mention in transhipment model.

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