International Journal of Social and Local Economic Governance (IJLEG) **E-ISSN: 2477-1929**
Vol. 3, No. 2, October 2017, pages 75-81 http://ijleg.ub.ac.id

RISK MINIMIZATION STRATEGY FOR APPLE *DODOL* SUPPLY CHAIN WITH ANALYTICAL HIERARCHY PROCESS APPROACH (CASE STUDY IN SMEsBROSEM, BATU CITY, EAST JAVA)

Siti Asmaul Mustaniroh[1*], Mey Wulandari[2], Imam Santoso[1]

[1]Department of Agroindustrial Technology, Faculty of Agricultural Technology, Brawijaya University, Malang, East Java
[2]Alumnae Department of Agroindustrial Technology, Faculty of Agricultural Technology, Brawijaya University, Malang, East Java
Email: [1]asmaul_m@yahoo.com / asmaul_m@ub.ac.id

Abstract

One of the producers of apple dodol in Batu is SMESBrosem, which applies a supply chain system consisting of the supplier, producer, and retailer. This application carries potential risks, such as apple supply delay, production delay, and competitors. Therefore, there is a need for alternative strategies in order to reduce these risks. This study aims to organize a strategy that can be applied in SMESBrosem using Analytical Hierarchy Approach (AHP). The proposed strategies that potentially reduce the risks include making a production plan, conducting a workshop for employees, improving information access and collaboration.

Keywords*: Apple dodol, Strategy, Supply Chain*

1. INTRODUCTION

Malang, Indonesia, has been known for its abundant apple production, thus it is called Apple City, where the centers of production are located in Batu City and Poncokusumo. According to BPS-Statistics Indonesiain Batu (2015), 2.1 million trees were in Batu in 2014 producing about 708.3 tons of fruit. These abundant apple yields were then processed into various products using advanced machine technology, such as a chip, *dodol*,*pia*, and apple-based drinks. *Dodol* is an Indonesian traditional food as sweet confection which commonly made from coconut milk, jaggery, and rice flour, and is sticky, thick and sweet. In Malang, there is a lot of *dodol* products made from apples and it produced in Batu City in several flavors, such as original (apple), jackfruit, and strawberry.

According to Bateman and Scot (2008), supply chain management is the overall management of a network of facilities and some people who get the raw materials from outside the organization, turning them into products, and distributing it to consumers. In the supply chain activities will arise that impact risk management strategies need to be done just right (Geraldin et al., 2007). Risk is an uncertainty which would have a negative effect on the achievement of organizational goals (Nasution et al, 2014). Therefore, it is necessary for the handling of proper risk management. Risk management is an approach taken towards risk by knowing, to identify and evaluate risks in an activity (Labombang, 2011). The objective of risk management is to know the risks involved in a project and develop strategies to eliminate or even avoid, on the other hand also to look for ways to maximize the opportunities that exist (Wideman, 1992)

The supply chain is a system consisting of the supplier (farmer), apple *dodol*, distributor, and retailer in order to meet product demand (Chopra et al, 2004). The core supplier as farmers have the highest risk at the level collecting the dominant risk is the existence of a supplier loyalty. The risks of that happening in the supply chain management of agro-industry shrimp can be addressed and anticipated manner of all stakeholders involved such as farmers, traders, processors, and exporters must apply the model of performance-based contracts, so that each actor knowing the product specifications required, time delivery, and favorable price based on size of business(Nasution et al, 2014).

Institutional risks that arise in the supply chain at SMeS Brosem include apple quality varies, production schedule delays and uncertainty of production capacity has not been measured every month. The risk thoroughly so

the possibility of considerable risk. This can lead to disruption in the supply of raw materials, production processes and products. Therefore, it is necessary to develop strategies to minimize any risks in the supply chain so as to avoid things that will harm the company.

One of the apple *dodol* industries in Batu that apply this system is Small Medium Enterprizes (SMEs) Brosem. It obtains its apple supply from Pujon and produces around 80 packs of apple *dodol* per month. SMESBrosem has a standard for apples that are supplied by its supplier. The apple should be the *manalagi* variant in fresh condition and consist of around 8 apples in one kilogram. However, the risk factors for this system have not been detected, so it can lead to failure in one of the chain components. In a previous study by Wulandari (2016), 12 risk factors in the apple *dodol* supply chain were divided into 3 variables, namely apple supply delay, production delay and competitors. Tang (2016) added that supply chain risk factors include operational risk and disturbance. Supply risk is the major problem for production planning and management (Finch, 2004). Due to this, risk management is needed in order to minimize the risks. Risk management is an approach that is applied to minimize the negative risks (Cabalero et al, 2008). Managing the problems that are faced by the manufacturer is one of the strategies that can be applied (Godfrey et al, 2009).

In the development of strategies to minimize the risk of one of them using Analytical Hierarchy Process (AHP). AHP is a continuation of the fuzzy FMEA method that will produce a strategy that will be minimizing any risks that arise so as not to cause potential impact on Brosem SMeS.

In the conventional use of conventional FMEA methods in risk management will yield different results when compared with the Fuzzy FMEA-AHP method (Basuki, 2015). Research conducted by Jong et al. (2013) on the application of the fuzzy failure mode and effect analysis methodology to edible bird nest, using FMEA fuzzy to analyze the EBN production process in Sarawak, Malaysia. This study aims to determine the problems of control and management of quality EBN processing and risk assessment of formal and effective tools. Solutions offered include moisturizing, insulating the wall cavity, installing sponges and polystyrene boards on the roof, performing inspections, using sponges or bubbles to package. Sarinah and Djatna (2015) on the analysis of risk reduction handling strategies in the seaweed processing industry: the case in South Sulawesi, aims to identify the structure of the seaweed supply chain, potential supplier criteria, risks and supplier risk assessments, dried seaweed for seaweeds industry at PT XYZ. Supply of seaweed consists of 6 criteria and service, cost, quality, delivery process, technology, and productivity. Suharjito et al. (2010) on the identification and evaluation of risk of corn supply chain management with a fuzzy logic approach, aiming to support appropriate decision-making in effective, efficient, and responsive supply chain management at every level of the corn supply chain. The results of this study are that farmers have the highest risk compared to the risk at the collecting trader level, agroindustry risk, distributor risk and consumer risk. Risks that occur in corn supply chain management can be overcome and anticipated by contracts of cooperation between parties concerned with a balanced distribution of risks and benefits between supply chain actors

2. METHOD OF RESEARCH

There are three main risk factors in the SMESBrosem supply chain. The Analytical Hierarchy Process (AHP), which determines the hierarchy structure of the manufacturer from the literature and empirical data, can be used for comparison and decision-making to address these risks (Chen, 2006). The decision-making process in AHP is transparent, so every component in the system can be elaborated. All information and priority elements can be obtained subjectively based on stakeholder instruction (Kumar et al, 2009). The measurement process was based on the criteria with multiple comparisons. Every point was scored on a range from 1 to 9 according to Saaty (2004) (Table 1).

Table 1. Sample Pairwise Comparison Matrix.

	A1	**A2**	**A3**
A1	1		
A2		1	
A3			1

Source: Nasibu (2009)

The steps in AHP method can be described as follows (Suryadi, 2002).

1. We defined the problem and determine the desired solution.
2. We developed a hierarchical structure of the problems.
3. We established a pairwise comparison matrix that depicts the relative contribution or influence of each element on each objective and criteria.
   To determine the relative importance between elements, we used the scale of numbers from 1 to 9. If one element compared to themselves value, it will be worth 1 (Table 1).
4. Eigen values calculation
   The calculation of the maximum eigen value (1).
   $\lambda_{max} = \frac{1}{n}\sum_{i=k}^{n} Vbi$ (1)
   $V_b = \frac{Va}{Vp}$ (2)
   V_a = (aij) x Vp (3)
   where :
   λ_{max} = maximum eigen value
   Vb, Va = Vector Between
   Vp = Vector Priority
5. Consistency test
   Value level of consistency or consistency index (CI) was calculated using following formula (2).
   CI = (λ_{max}-n) / (n-1) (4)
   where :
   CI = consistency index
   λ_{max} = Theeigen value
   n = number of elements
   The more the CI value approaching 0, the more consistent the observations were.
   Calculation of consistency ratio (CR) determined using following formula (3).
   $CR = \frac{CI}{RI}$ (5)
   Information:
   CR = Ratio Consistency (Consistency Ratio)
   CI = Consistency Index (Consistency Index)
   RI = random index (indexrandom)
   Random index value varies according to the order of the matrix (Table 2). The value of consistency ratio (CR) of less than or equal to 0.1 were considered as consistent and accountable result.
6. We repeated the steps 3, 4, 5, and 6 for the whole level of the hierarchy.
7. We checked the consistency of the hierarchy.

3. RESULTS

The minimization strategy is one of the solutions that can reduce risk factors faced by manufacturers (Sommerville, 2006). Several strategies that can be applied in the apple *dodol* supply chain are presented in Table 2. Furthermore, the values were determined (Figure 1). As seen in Table 2, the priority strategy for apple supply variable is a workshop for employees (0.323). For production variable, production planning is the main priority (0.425). Furthermore, for product availability, the improvement in information and communication access is the top priority (0.425).

Table 2. Minimization Strategies for Apple *Dodol* Supply Chain Risks.

		Details
Purpose	Risk Minimization in Apple *Dodol* Supply Chain	Minimization of risks such as apple supply, production, and product availability
Variable	1. Apple supply	1. Preventing supply delay
	2. Production	2. Preventing production delay
	3. Product Availability	3. Reducing competitor risk
Alternative Strategies	1. Collaboration	1. Collaborating with apple supplier and retailer in Batu City 2. Making a deal for standard apple price
	2. Workshop for Employees	1. Encouraging the employees to fulfil the production deadline 2. Stimulating product innovation 3. Providing explanations about correct machine usage and maintenance 4. Providing explanations about apple handling

3.	Production Plan	1. Apple supply order schedule 2. Production time 3. Production capacity 4. Machine maintenance
4.	Improvement of Information Access	1. Providing information for supplier and manufacturer about the delay and recent apple price 2. Getting to know apple *dodol* demand in market

The Scoring Variable and Alternative Strategies shown in Table 3.

As seen in Table 3, the prior strategy for apple supply variable is a workshop for employees (0.323). For production variable, production planning is the main priority (0.425). Furthermore, for product availability, the improvement in information and communication access is the top priority (0.425).

Table 3. Scoring Variable and Alternative Strategies

Score	Apple Supply **(0.482)**	Production (0.390)	Product (0.128)
Collaboration	0.159	0.142	0.275
Workshop for Employees	**0.323**	0.266	0.100
Production Planning	0.194	**0.450**	0.200
Improvement in Information and Communication	0.324	0.142	**0.425**

3.1. Production Planning

Production scored the highest among the other variables (0.294). This is related to the schedule for ordering the apple supply. Orders are regularly made 2 days before production in SMESBrosem, so the apples are in good condition when being processed. According to Djunaidi et al (2005), planning should be made by the manufacturer of production and order raw materials, so they can obtain the best quality. Beside order planning, SMESBrosem should plan the production schedule precisely, due to an inconsistent production schedule each month. Furthermore, production capacity also fluctuates so planning is needed in order to prevent excess product that leads to loss. On the other hand, if the production is low, SMEsBrosem cannot meet the market demand. Machine maintenance should be conducted regularly, so there will be no problems encountered during production. These plans are required to fulfill the schedule in order to keep the supply chain in balance (Gasperz, 2005).

3.2. Workshop for Employees

The second most important strategy is conducting a workshop for the employees (0.272). Improving employees' skills through a workshop will help them to be more competent in jobs such as on-time production, product innovation, machine usage and maintenance, apple supply handling, and demand forecasting. A workshop is one effective way to promote employees' loyalty (Purnawanto, 2010).

3.3. Improvement in Information and Communication Access

The improvement in information and communication access in SMESBrosem was done from supplier until retailer. The necessary information from the supplier concerns the apple supply, apple quality in the garden, and apple market price. This information helps SMESBrosem to minimize the production risks. An information system is required in an organization in order to maintain information processing from the field to the headquarters, in order to be more efficient in fulfilling market demand and be more competitive (Wedhasmara, 2009). Moreover, the communication between consumer and manufacturer should be improved, so they can enhance product quality and invent new products. Market research is a method to observe the consumers' demands for products. This is required if the manufacturers want to innovate their products for which demand has decreased (Griffin et al, 2007). These improvements will help SMESBrosem to make new products that can join the competition in the market.

3.4. Collaboration

Finally, collaboration with the supplier and retailers should be done by SMEsBrosem (0.167). The collaboration will allow SMEsBrosem to promote its product in a severage area in Batu. Furthermore, consumers will have easier access to the product. Supply delay can be overcome with collaboration with

the suppliers. They both can make a deal about standard apple price to minimize the risk due to fluctuating apple prices. Collaborating with the other elements in the community is very important to develop a business. This is important to prevent the problems that may be faced by a manufacturer including technical problems, production problems, and marketing (Nugroho et al, 2013).Eligibility for marketing the product a relatively score. This indicates that market research is very important to assess the suitability of current agricultural activity and potential as a diversification activity for farming (Chavez et al, 2012).

The managerial implications of these research are follows:

1. Make a plan of production associated with the production schedule, production capacity, and machine maintenance. An Apple processing schedule can often delay due to the supply of apples coming in late, so we need a plan booking to suppliers that the raw materials arrive on time. The production capacity is not fixed can be minimized by doing the correct forecasting of *dodol* apple sales in the last month. It also needs to be done in a scheduled engine maintenance so that production can continue without constraining machines were broken.
2. Conduct training to be a more qualified workforce that is able to produce in accordance with the capacity of *dodol* apples. Workforce training can be done by directing the manpower or do a job rotation so that each employee is able to master all fields of work assigned to him.
3. Improved information and communication with relevant suppliers about the price of apples in the market and the quality of the apples in the garden. Other than that information and communication are also needed between SMESBrosem with consumers to know the tastes of consumers
4. Cooperation with suppliers of apples and a few retailers in Batu. Collaborated can be conducted with the suppliers who have the capacity of a large procurement of raw materials. Moreover, the distribution of dodol apples at several retailers in Batu can expand the marketing network products.

5. CONCLUSION

Strategies that can be applied to minimize the supply chain risk in SMESBrosem include production planning, conducting a workshop for employees, improving information and communication access, and collaborations with suppliers and retailers.

6. REFERENCE

Abdurachman, U. 2004. *Analisis Faktor-faktor yang Menimbulkan Kecenderungan Minat Beli Konsumen Sarung*. Jurnal Manajemen dan Kewirausahaan 6 (1) : 1-21.

Astana, I. 2007. *Perencanaan Persediaan Bahan Baku Berdasarkan Metode MRP* (Material Requirements Planning). Jurnal Ilmiah Teknik Sipil 11 (2) : 1- 11.

Basuki, A. 2015. *Manajemen Resiko Kerusakan di Unit Pengemasan PT. Semen Indonesia, Tbk, Pabrik Tuban*. Prosiding Seminar Nasional Manajemen Teknologi XXII, Institut Teknologi Sepuluh November, Surabaya, pp. 1-6.

Bateman, T., and Scott A. 2008. *Manajemen Kepemimpinan dan Kolaborasi dalam Dunia yang Kompetitif*. Jakarta: Salemba Empat.

Cabalero, R., Arvind K. 2008. *Collective Risk Management in a Flight to Quality Episode*. The Journal of Finance 63: 2195-2230.

Chen, F. 2006. *Applying the Analytical Hierarchy Process (AHP) Approach to Convention Site Selection*. Journal of Travel Research 45 : 167-174.

Chavez , MD. P.B.M. Berentsen and A.G.J.M. Oude Lansink.. . 2012. *Assessment of Criteria and Farming Activities for Tobacco Diversification. using the Analytical Hierarchical Process (AHP) Technique.* Agricultural Systems 111 (2012) 53–62

Chopra, S., Sodhi S. 2004. *Managing Risk to Avoid Suplly Chain Breakdown*. Sloan Management Review 46 (1) : 53-61.

Djunaidi, M., Siti N., Ika O. 2005. *Pengaruh Perencanaan Pembelian Bahan Baku dengan Model EOQ untuk Multiitem dengan All Unit Discount.* Jurnal Ilmiah Teknik Industri 4 (2) : 86 – 94.

Finch, P. 2004. *Supply Chain Risk Management. Supply Chain Management*: An International Journal 9 (2) : 183-196.

Gaspersz, V. 2005. Production Planning and Inventory Control *Berdasarkan Pendekatan Sistem Terintegrasi MRP II dan JIT Menuju Manufakturing 21*. Jakarta: Gramedia Pustaka Utama..

Geraldin, L., I Nyoman P., Dyah S. 2007.Manajemen Risiko dan Aksi Mitigasi untuk Menciptakan Rantai Pasok yang Robust. Jurnal Teknologi dan Rekayasa Teknik Sipil : 53-64.

Godfrey, P., Craig B., Jared M. The Relationship between Corporate Social Responsibility and Shareholder Value: An Empirical Test of The Risk Management Hypothesis. Strategic Management Journal 30 : 425-445.

Griffin, R., Ronald J. 2007. *Business, Eighth Edition.* Jakarta: Erlangga..

Jong, C. H., Tay, M. K., dan Peng, L.C. 2013. *Application of the fuzzy Failure Mode and Effect Analysis methodology to edible bird nest processing.* Computers and Electronics in Agriculture 96: 90–108

Kumar, S., Omkarprassad S. Analytical Hierarchy Process: An Overview of Applications. European Journal of Operational Research 169 : 1-29.

Labombang, M. 2011. *Manajemen Risiko dalam Proyek Konstruksi.* Jurnal Smartek 9 (1) : 39 - 46.

Nasution, S, Y Arkeman, K Soewardi, dan T Djatna. 2014. *Identifikasi Dan Evaluasi Risiko Menggunakan Fuzzy Fmea Pada Rantai Pasok Agroindustri Udang*. Jurnal Riset Industri (Journal of Industrial Research) Vol. 8 No. 2, Agustus 2014, Hal. 135 – 146

Nugroho, A., et al. 2013. M*enumbuhkembangkan Socioecopreneur Melalui Kerjasama Strategis*. Jakarta: Penebar Swadaya.

Purnawanto, B. 2010. *Manajemen SDM Berbasis Proses Pola Pikir Baru Mengelola SDM pada Era Knowledge Economy*. Jakarta: Grasindo..

Saaty, T. 1994. *Decision Making with the Analytical Hierarchy Process*. International Journal Services Sciences 1 (1) : 83-98.

Sarinah dan Djatna, Taufik. 2013. *Analisis Strategi Penanganan Risiko Kekurangan Pasokan Pada Industri Pengolahan Rumput Laut: Kasus Di Sulawesi Selatan*. AGRITECH 35 (2) : 223-233

Sommerville, I. 2006. *Software Engineering*. Jakarta:.Erlangga.

Suharjito, Marimin, Machfud, H. Haryanto, B., Sukardi. 2010. *Identifikasi dan Evaluasi Risiko Manajemen Rantai Pasok Komoditas Jagung dengan Pendekatan Logika Fuzzy.* Jurnal Manajemen dan Organisasi 1(2): 118-134

Tang, C. 2006. *Perspectives in Supply Chain Risk Management*. International Journal of Production Economics 103 (2) : 451-488.

Wedhasmara, A. 2009. *Langkah-langkah Perencanaan Strategis Sistem Informasi dengan Menggunakan Metode Ward and Peppard.Jurnal Sistem Informasi* 1 (1) : 14-22.

Wideman. 1992. *Project and Program Risk Management: A Guide to Managing Project Risk Opportunities.* New York: Project Management Institute.

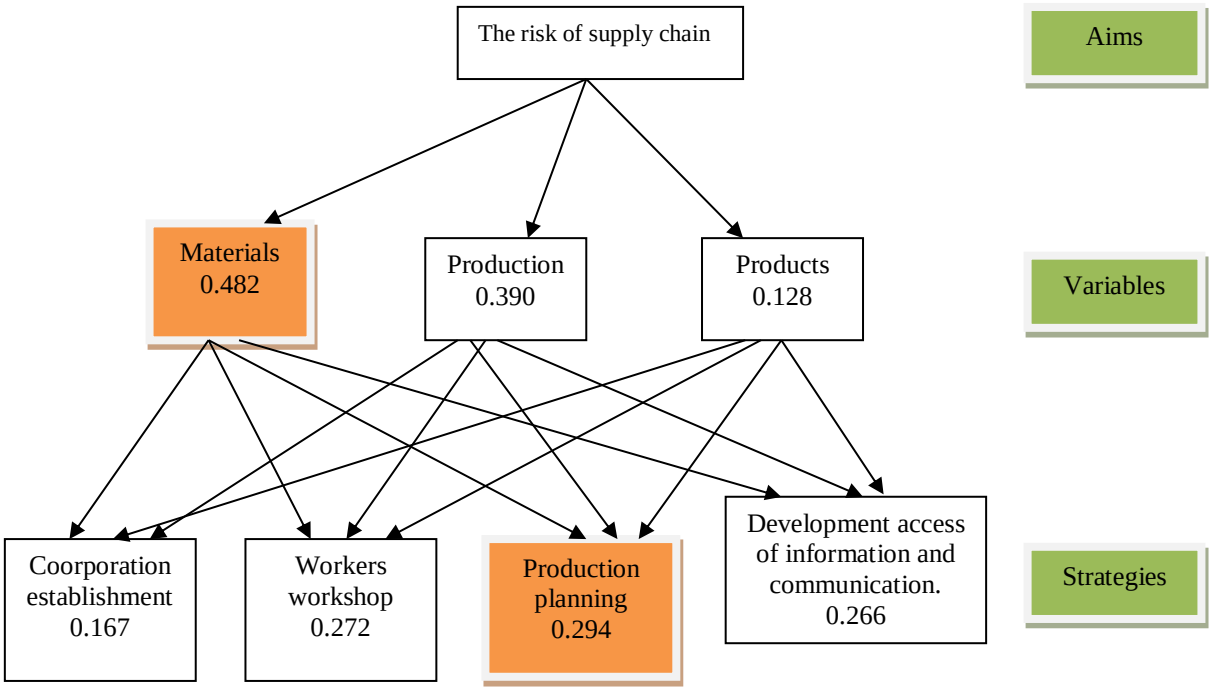

Figure 1. Hierarchy Structure in Minimization of Apple *Dodol* Supply Chain Risks