

THE IMPLEMENTATION OF ANALYTIC HIERARCHY PROCESS ON THE SELECTION OF SUPPLIER IN START-UP BUSINESS: A CASE STUDY

Ahmad Setyo Irawan¹, Liliani².

^{1,2} International Business Management, Universitas Ciputra.
asetyo@student.ciputra.ac.id, liliani@ciputra.ac.id

ABSTRACT

The purpose of this research is to determine the prioritized suppliers according to the criteria made by Batik Canting, a Start-up Business selling Batik Shoes in Surabaya. The process of selection considers multi-criteria of quality, delivery and price. The data collection methods in this study include interview and questionnaire. Judgmental sampling is used to determine informants who have knowledge and experience in selection of suppliers. These informants are people from the internal management as well as other external informants. Furthermore, data are analyzed using Analytic Hierarchy Process (AHP). The result indicates the hierarchy of criteria and sub-criteria. The most important criteria is the product quality, followed by delivery, and price. The rank of suppliers is determined, and it is shown that one supplier outperformed three others. Thus, the company is advised to choose suppliers that prioritize product quality in order to improve the perception and satisfaction level of the customers.

Key words: Supplier Selection, AHP, Start-ups, Product Quality, Delivery, Price.

1. INTRODUCTION

Fashion business is highly potential to be developed in Indonesia, because clothing is one of human primary needs. The needs of fashion are not limited to clothing items, but also its complimentary products, such as fashion accessories, handbags, wallets, shoes, sandals, etc. In addition, demand of fashion products increases as the population grows and the ever-changing trends of fashion drive people to shop for new fashions (CiputraEntrepreneurship.com). These conditions require fashion business start-ups to create an efficient supply chain, allowing them to cope with consumer demands.

In order to improve the effectiveness and efficiency of the supply chain, good management is mandatory to administer the distribution of products. The process of supply chain management includes series of integrated activities in planning and managing products and services, starting from the purchase of raw materials, production planning, transformation process of materials, and storage of both raw materials and finished products until the delivery of finished products to customers (Budiman, 2013). Therefore, a good supply

chain is very important for start-ups, since it results in saving cost, time and other resources, improve performance and competitiveness (Merry, Ginting, and Marpaung, 2014).

Selection of suppliers is very important in creating a good supply chain of a start-up business. Any errors in the selection of suppliers, may lead to a decrease in productivity. For example, if a supplier is less responsive to the company's request and delay in delivery of the product will potentially result in the cessation of the production process (Jannah, Fakhry and Rakhmawati, 2011). The same problems also experienced by Batik Canting, a start-up business in fashion industry, which was established in 2012. Batik Canting produced fashion shoes for men and women, which featured with Indonesian batik, combined with various fabrics such as suede, denim, canvas and leather. In order to achieve its vision of becoming a company that excels in creating high quality of fashion products and be able to compete in international markets, Batik Canting must have reliable suppliers to support the company's vision.

Until the period of research, Batik Canting had 4 suppliers who could produce 80 to 100 pairs of shoes each month. In this

case, management of Batik Canting considered that the number of suppliers was fairly enough. Moreover, Batik Canting had contract agreement with each supplier, detailed with price, standard quality specification and delivery to ensure the continuity of supply. However, there were still problems with supply due to untimely delivery and product defects in each shipping. Even worst, these problems once affected Batik Canting's sales, as there were only few variants of shoes available thus leaving customers with less options.

Consequently, Batik Canting must resolve the above problems by selecting priority of reliable suppliers. Therefore, management of Batik Canting had mapped the advantages and disadvantages of each suppliers, namely: (1) Mr. Hari, located in Mojokerto (around 60 km from Surabaya), thicker insole quality, shoes are more comfortable, neat stitching, a bit messy on gluing, price was Rp 45,000 for a pair of shoes, easiness in communication and production capacity of 50-60 pairs each month. (2) Mr. Oyik, located in Mojokerto, less thick insole quality, neat stitching, neat gluing, price was Rp 50,000 for a pair of shoes and production capacity of 50-60 pairs each month. (3) Mr. Mukti, located in Sidoarjo (around 25 km from Surabaya), customizable insole quality, neat stitching, a bit messy on gluing, price ranged from Rp 45,000 to Rp 55,000 for a pair of shoes and production capacity of 50 pairs each month. (4) Mr. Ila Iskandar, located in Bandung (around 700 km from Surabaya), customizable insole quality, neat stitching and gluing, quick processing time, production capacity of 15-20 pairs per-week, price was Rp 75,000 for a pair of shoes with additional shipping charge. To sum up, the comparison among suppliers indicated that Mr. Ila Iskandar had the advantages of better product quality, faster processing time, but it had more expensive costs and limited frequency of inspections. Meanwhile, suppliers from Mojokerto and Sidoarjo had the advantages of cheaper price and easy for inspection visits, but they had average product quality and longer the process processing time.

Based on the previous background, further study was needed to propose criteria

and priority of suppliers that met most of the criteria for Batik Canting. The method of selection used was the Analytic Hierarchy Process (AHP), considering that AHP could accommodate multi-criteria and graphically illustrate the decision making process, making it easier to understand (Marimin, et al., 2013). Thus, the results of this study were expected to be a reference for Batik Canting and other similar business in the selection of suppliers.

2. THEORETICAL BACKGROUND

2.1. Supply Chain Management

The supply chain is a network of companies that work together to produce and deliver products to end user (Pujawan and ER, 2010), it consists of various suppliers encompassed raw materials to components of final product to customers (Kotler and Keller, 2012). Supply chain management aims to coordinate suppliers, production, inventory, location, and transportation to create a composition that best in responsiveness and efficiency that enable the company to serve the customers well (Hugos, 2011).

Three phases required in supply chain management, specifically in selection of customers, in order to coordinate the production and inventory are firstly, determine the objectives of selection, secondly, establish criteria of selection, and thirdly, breakdown the criteria into second level sub criteria (Suciadi, 2013).

This study focused on quality, delivery, and price, as the criteria for selection of suppliers. These criteria then divided into sub criteria, based on the dimensions. The following are brief explanation of the main criteria of selection:

1. Product Quality

Product quality is the level of excellence of a product (Wolfe, 2009) with distinctive characteristics that able to meet customer needs (Kotler and Armstrong, 2012).

2. Delivery

Delivery or distribution and transportation is basically aim to deliver products from the production location to end user (Pujawan and ER, 2010).

3. Price

Price is the amount of monetary units and other non-monetary units that contain utility and usefulness (Tjiptono, 2011), thus become one of the key consideration in choosing a supplier (Jannah, et al., 2011).

2.2. Analytic Hierarchy Process

Problems in decision-making can be addressed involving multiple criteria by using Analytic Hierarchy Process (AHP). Saaty and Vargas (2012) explained that AHP is a basic approach to decision-making designed to select the best alternative from a number of alternatives in accordance with some criteria. Afterwards, decision-making process is performed by pairwise comparison, which is then used to develop priorities and rank the alternatives.

Marimin, et al (2013) explained four principles in resolving the problems with the explicit logical analysis, that include the preparation of the hierarchy, assessment of each hierarchical level, priority setting, and logical consistency.

a. The structure of the hierarchy is being organized by identifying the knowledge or information being observed, starting from complex issues, then continuously detailed into substantial elements.

b. Each hierarchical level is being assessed using paired comparisons. According to Saaty and Vargas (2012), to a variety of problems, a scale of 1 to 9 is set as a consideration in comparing pairs of elements in each level of the hierarchy of certain elements that are in the upper level,

c. Determination of priorities. A pair of elements compared based on specific criteria and weigh the intensity of preference between elements. His relationship illustrates the effect on the level of the hierarchy of elements relative to each element on a higher level,

d. Logical consistency. All elements are grouped logically and consistently graded according to a logical criterion. AHP measures the overall consistency of the various considerations through a consistency ratio. Value consistency ratio should be 10% or less. If more than 10%, the assessment is still random and needs to be repaired.

3. RESEARCH METHOD

This study used qualitative descriptive approach that incorporate quotations, excerpt of data to illustrate particular conditions (Moleong, 2013: 11). Sampling technique used was judgmental or purposive sampling in which researchers selected a sample based on the characteristics of the samples adjusted for the purpose of research (Kuncoro, 2013: 139). The subjects of this research were the owners of Batik Canting, who directly related with the suppliers, fully understood the operation of Batik Canting and were able to determine the selection criteria of suppliers. In addition to those subjects, practitioners from similar companies were also considered as they can provide references to the selection criteria of suppliers. Meanwhile, objects of this study were suppliers of Batik Canting, Mr. Hari, Mr. Oyik, Mr Mukti, and Mr Ila Iskandar. The data collection method in this study was interview, questionnaire and documentation. Interview used semi-structured interview to gathered information about the selection criteria of suppliers. Questionnaire used to obtain comparative value of each supplier based on the criteria and sub-criteria. A scale of 1 to 9 used for the questionnaire to express opinion and distinguish relationships intensity among elements. In addition, the documentations were gathered from the production and other operational activities of Batik Canting, such as documentation of the exhibition, finished products and defects. Triangulation of different data source used to confirm the validity and reliability in this study. Additional test using Expert Choice program used to confirm the reliability of the AHP calculation, requiring the value of consistency ≤ 0.1 (Saaty, 2012).

The method of analysis consist of several steps (Marimin, et al., 2010):

1. Determine Goal: selecting the best suppliers for Batik Canting
2. Set several selection criteria.
 - a. Product quality, with sub-criteria of conformance (condition in which the product met certain specifications and function without any defects), reliability (the degree to which the product

- design and operational characteristics met certain standard), aesthetic (how the aesthetics of products were able to attract customers).
- b. Delivery, with the sub-criteria of timeliness, order quantity fulfillment and received in good condition.
 - c. Price, with the sub-criteria of cheaper, ease of payment, and reasonable price compared to quality of services or products.
3. Make a hierarchical structure of decision model
 4. Perform steps in AHP using Expert Choice software, which consist of pairwise comparison, calculations and test of consistency.

$$CI = (\lambda_{max} - n) / (n - 1) \quad 1$$

$$CR = CI / RI \quad 2$$

Description:

- CI = Consistency Index
- CR = Consistency Ratio
- RI = Random Consistency Index
- λ_{max} = Consistency Vector
- n = Size of Comparison Matrix

Values random consistency index (RI) in accordance with the size of the matrix is as follows:

Table 3.1. Values random consistency index (RI) in accordance with the size of the matrix

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,52	0,89	1,11	1,25	1,35	1,40	1,45	1,49

5. Select the best suppliers based on performance rank.

4. RESULT AND DISCUSSION

4.1. Data Analysis

Based on the interviews with the owners of Batik Canting, the analysis aimed to select the best supplier based on priorities of product quality, delivery, and price. The sub-criteria of product quality were conformity, aesthetic of design, and reliability. The sub-criteria of delivery were timeliness, order quantity fulfillment, and received in good condition. While the sub-criteria of the price

were cheaper, ease of payment, and reasonable price compared to quality of services or products. The hierarchy level of alternatives consists of four suppliers: Mr. Hari (Mojokerto), Mr Oyik (Mojokerto), Mr Mukti (Sidoarjo), and Mr Ila Iskandar (Bandung).

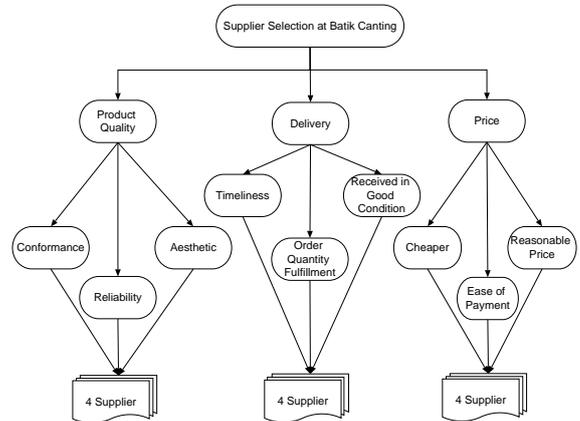


Figure 4.1 Model Analysis using AHP

Based on the combination of the priority of all criteria gathered from the respondents, it showed the consistency ratio of 9.6% ($\leq 10\%$), thus considered as consistent. Next, the priorities for each criteria of selection are shown in Table 4.1. The first priority is the criteria of quality (76.5%), followed by products (13.2%), and price (10.2%).

Table 4.1. Weight of Criteria Priority

Criteria	Percentage	Rank
Quality	76,5%	1
Delivery	13,2%	2
Price	10,2%	3

Afterwards, a matrix of pairwise comparisons were arranged based on the sub-criteria of each main criteria. The result of the calculation showed consistency values of 5.7% for the sub criteria of quality, 1.6% for the sub criteria of delivery, and 9.6% for the sub-criteria of price. All of these values were considered to be consistent as they were less than 10%.

Additionally, weights for all sub-criteria are shown in Table 4.2. It indicates that "reasonable price " was ranked as the most important criteria (73.4%) because price was determined according to the requested quality. In second place, aesthetics sub-

criteria had 51.7%, because shoes design became important feature regarding the customer interest. On the contrary, ease of payment method was ranked last due to various easy payment methods using ATM, mobile as well as Internet banking.

Tabel 4.2 Weight of Sub-Criteria Priority

Criteria	Percentage	Rank
Conformance	12,4%	8
Aesthetics	51,7%	2
Reliability	35,9%	5
Timeliness	45,8%	3
Order quantity fulfillment	41,6%	4
Received in good condition	12,6%	7
Cheaper	14,9%	6
Ease of oayment	11,7%	9
Reasonable price	73,4%	1

Based on the alternatives of suppliers, pairwise comparison matrix was arranged. It resulted in the weight of each suppliers based on overall criteria and sub-criteria. As shown in Table 4.3, Mr. Ila Iskandar ranked first (50,1%), followed respectively by Mr. Mukti (26,8%), Mr. Oyik (11,9%), and Mr. Hari (11,1%).

Table 4.3 Weight of Alternatif Pemasok

Alternatif Pemasok	Persentase	Peringkat
Mr. Ila Iskandar	50,1%	1
Mr. Mukti	26,8%	2
Mr. Oyik	11,9%	3
Mr. Hari	11,1%	4

Furthermore, the sensitivity percentage of each supplier based on overall sub-criteria of Product Quality showed that Mr. Ila Iskandar (50.9%) had highest percentage. The next were Mr. Mukti (27.6%), then Mr. Oyik (13.1%) and lastly Mr. Hari (8.9%). Meanwhile, the sensitivity percentage based on overall sub-criteria of Delivery showed the rank of supplier were Mr. Ila Iskandar (46.7%), the second is Mr. Mukti (26.2%), then Mr. Hari (21.5%) and lastly Mr. Oyik (5.6%). And the sensitivity percentage of each supplier based on overall sub-criteria of Price showed suppliers who had the best value is Mr. Ila Iskandar (49.0%), second is Mr. Mukti (21.6%), then Mr. Hari (18.4%) and lastly Mr. Oyik (11.1%).

4.2. Discussion

Selection of suppliers was determined from the highest priority based on the assessment criteria and sub-criteria determined by the company, consisted of quality, delivery and price. Product quality was very important for Batik Canting in order to set differentiation as it offered a model of value, delivered higher quality with lower price (Kotler and Keller, 2012). Therefore, in selecting a supplier, companies must compare alternatives of suppliers in advance, then determined quality specifications. The following interview excerpts expressed the respondents' opinions on the importance of product quality:

"...so I compare for this supplier, it might have same material, but the quality can be different. So I have to see it with the fabric as well..." (E-cw)

Product Quality became important for the Batik Canting as it represented the company's brand. Hence, Batik Canting should be able to maintain the product quality in order to meet and improve customer satisfaction.

"...we also have to maintain product quality, which is the shoes we sell, while this also aims to fulfill... to fulfill the customer's expectation or satisfaction..." (E-mi)

"...quality will determines whether this or that buyer will.. ehm.. repurchase in the future. It's the same with determining our customer loyalty." (I-pk)

Besides quality, delivery was also important because it referred to how well the product or service was delivered to customers. In accordance with indicator of delivery, on time delivery became important because customers waited to receive the product they purchased (Pujawan and ER, 2010). Late delivery often occurs in Batik Canting due to the supplier was unable to provide the materials as requested, then outsourced the order to other suppliers, thus needed more time.

"...The one that often happened in practice is supplier can't provide the material that we ask, sometimes they have to buy from other supplier... that's it.. it will delay our production" (E-cw)

In this case, suggestion given by the respondents, that is to choose carefully for

supplier that can quickly provide the company's requirements within specified time period.

"...then we have delivery process. It is usually done before, in how many days. therefore it won't be in such narrow time frame to our further process." (E-cw)

The third important factor is the price. According to the respondents, price that matched the quality would be important to be considered in choosing a supplier. Afterwards, the company could determine the sales price in accordance with product quality and customers expectation.

"...So, first of all, the price must meet the quality, it has to be appropriate..." (E-mj)

Other fact that happened in practice was supplier simply wanted committed in one-time transaction and do not want to commit in long-term contracts. On the other side, long-term contracts offered benefits such as fixed price, quality standards, delivery time, term of payment as mentioned in the contract. It would also reduce cost related to searching for new supplier, prototyping, product adjustment and communication.

"karena ada pemasok-pemasok yang utamanya nggak mau kerjasama yang terlalu panjang. Jadi dia maunya main lepas... yang bagus adalah kalo misalnya kita memperpanjang kontrak, sehingga harga bisa ditekan dari situ..." (E-cw)

"...jangan mentang-mentang harga murah kualitasnya murah, nanti kesannya menjadi barang yang murahan dong" (I-ab)

Based on the result of AHP, the selection of suppliers in hierarchical priority is shown in Figure 4.2. The chart displayed that among all suppliers of Batik Canting, Mr. Ila Iskandar from Bandung got the highest score as he had better quality and timely delivery compared to other suppliers. Additionally, Mr. Ila Iskandar offered more variety of attractive designs in which would increase the variety of products sold by Batik Canting. Meanwhile, Mr. Mukti ranked second, as he was not as good as Mr. Ila Iskandar in timely delivery and product quality but offered cheaper price. Next, Mr. Oyik and Mr. Hary were ranked third and fourth consecutively due to some defects in the product and less reliable products such as loose stitches within one week of usage.

These problems caused some customer complained and returning the shoes to Batik Canting. To show responsibility, Batik Canting repair the shoes with no additional charge. However, it cost Batik Canting additional expense for shipping, rework, and certainly it is greatly affected customer satisfaction.

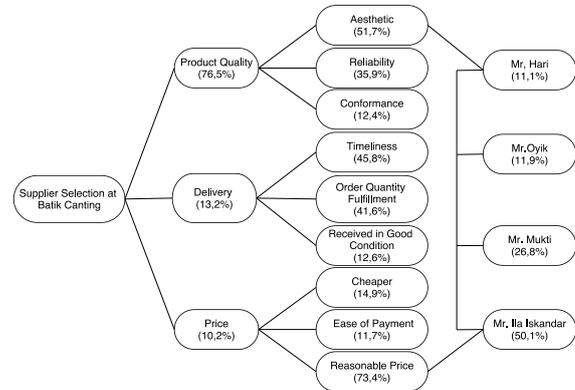


Figure 4.2. Hierarchical Priority of Suppliers

4.3. Implication

Based on the results, several managerial implications can be made for Batik Canting:

1. Arrange a long-term contract and price agreement to maintain standard of quality and avoid unpredicted increase in production cost.
2. Intensively communicating the product and design specifications to avoid mistakes as well as misunderstanding.
3. Apply Standard Operating Procedure for delivery in order to minimize defects during shipping.
4. Give warning when supplier does not meet the quality standard of does not fulfill other subjects in the agreement.
5. Always have several alternative suppliers which are properly selected, thus Batik Canting does not strongly rely on a particular supplier.

5. CONCLUSION

Based on the results of AHP and further discussion regarding the selection of suppliers the following conclusions are presented:

1. The most important criteria in the selection of suppliers of Batik Canting

- was Product Quality (76.5%), followed by Delivery (13.2%), and Price (10.2%).
2. The priority of each sub-criteria were as follows:
 - Sub-criteria of Quality: aesthetic design (51.7%), product reliability (35.9%) and product conformity (12.4%).
 - Sub-criteria of Delivery: punctuality (45.8%), order quantity fulfillment (41.6%), and received in good condition (12.6%).
 - Sub-criteria of Prices: Prices relevant to service quality (73.4%), cheaper (14.9%), ease of payment (11.7%).
 3. Alternative of suppliers are prioritized as follows: Mr Ila Iskandar (50.1%), Mr Mukti (26.8%), Mr. Oyik (11.9%), and Mr. Hari (11.1%).

This study has limitation regarding the subjectivity of the respondents, particularly in the case of Batik Canting. So, the result of this study might not be generalized. Nonetheless, this matter has been addressed using the AHP consistency test. In addition, further research is suggested to consider other factor or criteria into the multi-objectives hierarchy research model, for instance: the after sales service, location or other criteria.

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