Supplier Selection Problem of Small-Medium Enterprises in Apparel Sector in Indonesia using Multi-criteria Decision Making Techniques

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Abstract

Indonesia's economic growth as reflected in the country's Gross Domestic Product (GDP) contributed by various aspects of Industry, the Apparel and Textile Industry is no exception. The role of Small and Medium Enterprises (SME) in Indonesia also gives a huge impact on Indonesia's Gross Domestic Product with a contribution of 57.8% in 2018. Since the Small and Medium Enterprises in the Apparel sector are predicted to have a significant role in the future of Indonesia's economic growth, its business strategy needs to be improved. Small and Medium Enterprises supplier selection is one of the supply chain stages that crucial to its business but only a few Apparel Small and Medium Enterprises have a formal supplier criteria reference to be followed. To address this, the paper conducted a survey among experts in Apparel Small and Medium Enterprises in Indonesia through Delphi questionnaires to get the criteria that used in supplier selection decision making. Then the Analytical Hierarchy Process will be used to get the importance rank of the proposed criteria. This study could help decision-makers in Fashion Small and Medium Enterprises to choose the supplier wisely to get better performance for their business strategy.

Keywords
Supplier Selection, Small and Medium Enterprise, Apparel SME, Delphi Method, Analytical Hierarchy Process

1. Introduction

The economic condition of Indonesia has been growing rapidly in the last ten years and leads Indonesia to become the 4th highest growth rate in South East Asia. Indonesia's Gross Domestic Product (GDP) growth had increased from 4.63% in 2009 to 5.03% in 2019 (Asian Development Bank, 2020). This significant growth is affected by various aspects and one of them is Apparel and Textile Industry. The apparel industry is one of the popular industries that promising for developing countries, especially in Asia (Diana, 2018). According to Kementerian Perindustrian Indonesia (2019), apparel and textile industry development have been more competitive due to integrated system from end to end that has been applied in apparel and textile business in Indonesia.

Apparel sector development in Indonesia is not only contributed by local and global big companies but also contributed by Small-Medium Enterprises (SMEs). The report from Kementrian Koperasi dan UMKM Indonesia (2018) stated that the highest contribution in 2018 GDP was coming from Small-Medium Enterprises with 57.8% contribution in that year. The high contribution is the result of their ability to do innovation and their flexibility in economic conditions (Su & Gargeya, 2016). Thus, as a high contributor to the Indonesian economy, SMEs should be well developed and have a good strategy to compete globally (Z.Z.Z & Nurcahyo, 2017). SMEs get more opportunities in having flexible production if compared to large companies; also they quickly adapt to sudden changes of demand and still could reach the full competition conditions (Erdin & Ozkaya, 2020).

Various factors could affect the SMEs business practical, they are the capital factor (Ibrahim, 2016), the organization and management factor (E. R. G. Pedersen et. al., 2016), supply chain management factor (Sulistyarini, 2015), et cetera. The supply chain management was one of the crucial factors in business strategy since the condition in one element of the supply chain could affect other elements and impacted the whole business practical (Sulistyarini, 2015). A strategy itself is several continuously improved steps that are done based on what expectation

of company's future condition (Nurcahyo, et. al., 2018). Thus, good supply chain management is one of the keys to get a successful business strategy and company's future. Based on Levi, et. al (2000), supply chain management is an efficient approach of study that could be applied in integrating achievement between supplier, manufacture, retailer, distributor, and the end customer. An effective supply chain could be assessed by whether the management could cover the whole products & assets supply chain, the stream of information, and funds between elements where the objective is to maximize the profit of the overall supply chain (Chopra, 2007). One of the most crucial objectives in Supply Chain strategy is the network of competent suppliers (Handfield and Nichols, 2004; Su and Gargeya, 2012).

1.1 Objectives

Supplier selection has a significant role in the success measurement of supply chain management in any business, the apparel SMEs included. By having a reference in supplier selection criteria that need to be considered, new insights and better business practices are expected. However, based on a random survey in several apparel small and medium enterprises in Java, found that there is only 9% of apparel SMEs have a reference or formal guidelines in selecting their supplier.

Based on the background and problems above, below are the objectives of this study:

1. Identify the crucial criteria in supplier selection decision-making in Apparel SMEs based on experts' point of view.
2. Identify the importance rank of each criterion in Apparel SMEs supplier selection decision making so managers could consider the most crucial criteria.
3. Propose a reference of supplier selection criteria and their importance in Indonesia Apparel SMEs based on expert views.

2. Literature Review

2.1 Small and Medium Enterprises

In general, companies could be differentiated into two types based on their size: Large Enterprises (LEs) and Small and Medium Enterprises (SMEs) (A. Alkhoraif, et al., 2019). According to Indonesia Acts 20 of 2008, SMEs are small firms that are owned and managed by a person or a small party with annual total revenue between Rp. 300.000.000 and Rp. 50.000.000.000 (with assumption total operational days is 300 days per year). Indonesia's Ministry of Koperasi and Small and Medium Enterprises (2017) reported that SMEs gain a share of around 99.99% (62.9 million units) of the total overall entrepreneur sector in Indonesia, while the huge firms only contributed 0.01% or around 5.400 units. The development of SMEs is one of the objectives to decreasing poverty in Indonesia as stated by President Yudhoyono in 2005 (2017). Based on Darwanto (2013), known that SMEs are part of Indonesia's economy that could be more competitive through innovation and creativity since they have competitiveness with a longer lifespan.

2.2 Supply Chain Management in Small-Medium Enterprises

Supply Chain is a set of various approaches that is used to integrate every element such as suppliers, manufacturers, and stores to produce and distribute the product in the right amount of demands, to the appropriate locations and at the scheduled time with a main objective to minimize overall system costs while meeting the service level requirement (Levy, et. al, 2007). On the other hand, the focuses of SCM is on how the firm utilizes and designs the strategy in managing their suppliers', operations, technology, and capability to enhance their competitive advantage (Su & Gargeya, 2016).

Managing a supply chain strategically could be a great way for SMEs to grow in the new technologies rapidly, to develop their business in the new markets, to deal with any government restrictions and policy, and also an easy way to learn from the leading companies (Su & Gargeya, 2016). By the development of itself, the SMEs are expecting to get the maximum benefits from the SCM Practices. The number of studies that investigate the SCM practices in the SMEs context is limited (Park and Krishnan, 2001; Gélinas and Bigras, 2004; Prater and Ghosh, 2005; Vaaland and Heide, 2007; Bordonaba-Juste and Cambra-Fierro, 2009). Furthermore, most of them are not discuss and investigate the SCM practical in the textile and apparel industry (Su & Gargeya, 2016).

2.3 Supplier Selection

The supplier selection criteria enable a firm to identify what kind of vendors could provide great product quality, performance, product availability, and the consistent delivery that is needed by a firm (Petersen et al., 2005; Giunipero et al., 2006). Materials price and quality that is supplied by suppliers have a big effect on the final quality and prices of the products (Su and Zhan, 2019). Supplier selection is the main concern for many firms to design their strategic supply chain partnerships (Spekman, 1988; Giunipero et al., 2006). Based on Tracey and Vonderembse's study (2000), found the important role of supplier selection criteria and also the use of supplier involvement has given direct and significant impacts on their supplier performance which give the direct impact on their performance in manufacturing the products.

On Average, a company uses 60% of their total turnover cost for raw material and its supplier, thus supplier selection decisions in the supply chain aspect will have a significant impact on cost reduction and also increasing the company profit (Bayrak et. al., 2007). However, the supplier selection process is not simple since there are many selection criteria and various characteristics of the supplier (Nurdaiman, 2013). Therefore, the right supplier selection is needed with consideration of the appropriate criteria.

A previous study by Su & Gargeya (2016) on supplier selection of the Textile Industry and SMEs in the United States was conducted through surveys and interviews. This has generated some criteria on Textile SMEs supplier selection and gives many new insights based on SMEs' perspectives. Having a study in the textile industry regarding supplier selection could enable to help Managers to use and making referring to the proposed structure to improve their supplier selection (Guarnieri and Trojan, 2019; Jia, et. al., 2015). The criteria result also helps either the upstream suppliers or the manufacturer to enhance their level of sustainability by focusing on the highlighted important criteria (Jia. Et. al., 2015). Based on the previous study, shows the importance of supplier selection decision-making on Apparel SMEs and how they necessary needed so they could perform better. However, in Indonesia, as a developing country, the study of supplier selection in Apparel and Textile SMEs has not been conducted (Syafrianita, 2016). Therefore, there is no reference yet on Indonesia Apparel SMEs supplier selection to be considered.

3. Methods

This research aims to identify the crucial criteria of supplier selection and its importance rank Indonesia apparel SMEs. The method that is used in this research is by survey and questionnaire to the experts by using Delphi method to get the list of crucial criteria that needs to be noticed in selecting the suitable supplier. The initial data of experts' opinions that verify and validate supplier selection criteria on the apparel sector in the previous study are collected through the first questionnaire which will be given to experts in seven apparel SMEs spread across Indonesia and will be compiled into one result.

The experts in this research are those are who responsible for selecting the supplier of the Apparel Small-Medium Enterprises and have deep knowledge and experience on suppliers' characteristics and the criteria of them that are being needed by their business. They are also being chosen based on their experience in their field for more than 1.5 years. The compilation of experts' opinions from the first questionnaire will be resent to them to being reviewed through the second-round questionnaire. In this round, the experts have to state whether they agree with the results or not and give feedback regarding their reasons to agree or disagree The third-round questionnaire was given to the experts to obtain their assessment on the importance scale from each sub-criteria. The results from the third round questionnaire next will be the list of supplier selection criteria that needs to be noticed.

After the criteria and sub-criteria have done gathered and approved by all the experts, the questionnaire to assess the sub-criteria's importance based on the experts' opinion is distributed. The result will be used for the calculation and arrange the pairwise comparison matrix. The calculation of eigenvector, the consistency check will be conducted and the weight of each sub-criterion will be gotten. Based on this AHP calculation, then the rank of the supplier selection criteria & sub-criteria can be concluded.

In the end, this study will provide a proposed supplier selection criteria and the importance rank so the apparel SMEs in Indonesia and suggest it as a reference for managers in selecting the most suitable supplier with their business strategy.

4. Results and Discussion

The surveys and interviews were conducted to the experts of supplier selection in several Apparel SMEs through questionnaires which designed based on several criteria that being considered in previous researches (Su & Gargeya, 2015; Guarnieri & Trojan, 2019; Jia, et. al, 2015; Su & Zhan, 2019; Ishak & Wijaya, 2020) as could be seen in Table 1. The result from the first round survey of the Delphi method is the crucial criteria based on the experts' opinions. These opinions will be divided into criteria and sub-criteria for supplier selection and will be given to the experts in the second round to get deeper opinions and perspectives from the experts.

Table 1. Supplier selection criteria on previous researches

Criteria and Sub Criteria	Reference
Accordance to the law	Guarnieri & Trojan (2019)
Continuous Improvement on Process and Product	Su & Gargeya (2015), Guarnieri & Trojan (2019)
Communication System	Su & Gargeya (2015), Guarnieri & Trojan (2019), Su & Zhan (2019)
Customer Service & Support	Su & Gargeya (2015), Guarnieri & Trojan (2019), Ishak & Wijaya (2020)
Cost	Guarnieri & Trojan (2019), Jia, et. al (2015)
Delivery Accuracy	Su & Zhan (2019)
Documentation and Self Audit	Ishak & Wijaya (2020)
Environmental impact	Guarnieri & Trojan (2019)
Flexibility	Su & Gargeya (2015), Guarnieri & Trojan (2019)
Fulfill customer requirement	Su & Gargeya (2015), Guarnieri & Trojan (2019)
Geographical Location	Su & Gargeya (2015), Guarnieri & Trojan (2019)
On-time Delivery	Su & Gargeya (2015), Guarnieri & Trojan (2019), Jia, et. al (2015), Ishak & Wijaya (2020)
Open and Honest Communication	Su & Gargeya (2015)
Product Price	Su & Gargeya (2015), Guarnieri & Trojan (2019), Su & Zhan (2019), Ishak & Wijaya (2020)
Product Design	Su & Zhan (2019), Ishak & Wijaya (2020)
Quality of Product	Su & Gargeya (2015), Guarnieri & Trojan (2019), Jia, et. al (2015), Ishak & Wijaya (2020)
Quality Control Management	Jia, et. al (2015), Su & Zhan (2019), Ishak & Wijaya (2020)
Relationship with the supplier	Su & Gargeya (2015)
Responsiveness	Su & Gargeya (2015)
Supplier Capacity	Guarnieri & Trojan (2019), Ishak & Wijaya (2020)
Supplier Certification	Su & Gargeya (2015)
Supplier Reputation	Su & Gargeya (2015)
Trust	Su & Gargeya (2015), Guarnieri & Trojan (2019)
Waste Management	Guarnieri & Trojan (2019), Jia, et. al (2015)

The result of the first questionnaire which contained 46 sub-criteria is shown in Figure 1. The 46 sub-criteria later split into 10 criteria based on their characteristics. However, only 2 sets of sub-criteria under order system & cycle time criteria and capacity criteria that are fully accepted by the experts. While, only one sub-criteria from the product & process technology criteria that is accepted by the experts; Supplier's Continuous Improvement. The final agreement of the criteria and sub-criteria list was concluded after the third questionnaire. Based on the results from this survey, it can be concluded that the experts agree on 10 criteria and 30 sub-criteria that crucial and need to be considered in supplier selection decision. Furthermore, this result will be calculated to figure the convergence of the experts' assessment in the third-round questionnaire. The final result of the Delphi Method can be seen in Table 2. Then, the importance rank of crucial criteria and sub-criteria will be identified so it could enable the decision-maker of supplier selection to have a better and efficient business practice.

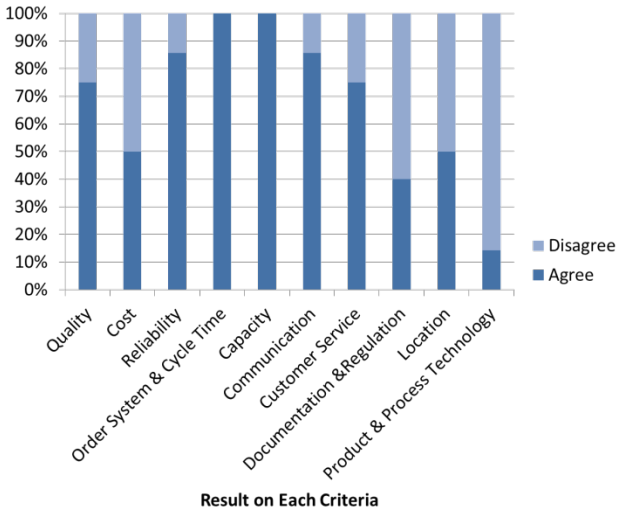
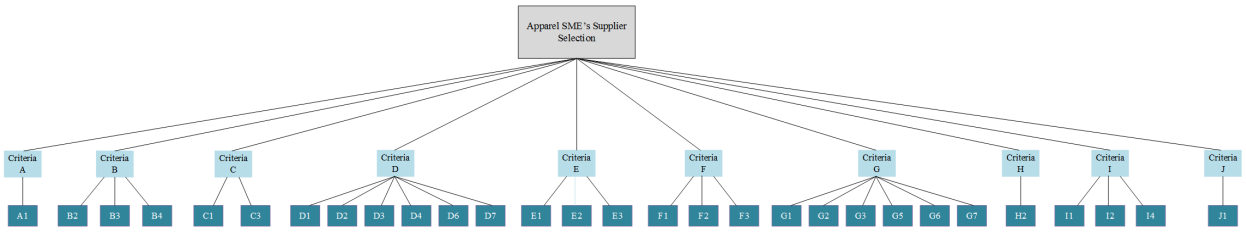


Figure 1. First-round questionnaire result

Table 2. provides information regarding the result of convergence calculation based on the standard deviation and Interquartile range of each sub-criteria that is confirmed to be the supplier selection crucial criteria by the experts. A sub-criterion is convergent if the value of its standard deviation less than 1.5 and its Interquartile Range should be less than 2.5. Hence, based on the result and the range of the convergence, there's one divergent sub-criterion that is not included later in the final list of supplier selection criteria.

The hierarchy of each criterion and sub-criteria need to be defined before the calculation of the AHP method being applied. Based on the hierarchy, the factors that affect the final decision that wants to be achieved will be being breakdown. The hierarchy enables the decision-maker in getting know what sub-criteria underlying each criterion. Hence, they could make a better final decision regarding the supplier selection. The hierarchy of the final list criteria and sub-criteria is shown in Figure 2.

Figure 2. Apparel SME's supplier selection hierarchy



The rank of the importance was acquired by applying the AHP method to the dataset which based on the comparison scale assessment by the experts. The next step of the AHP method is calculating the eigenvector of each criteria and sub-criteria to get the weight of each of them. The eigenvector can be acquired after the pairwise comparison matrix being calculated. This matrix will be based on the scale assessment that being compiled from the experts. In this step of calculation, the eigenvector need to be normalized first before getting the weight. The consistency Ration has to be calculated by compare the CI value (Consistency Index) with Random Consistency Index (RI), or can be followed based on below formula:

$$CR = \frac{CI}{RI} = \frac{\frac{(\lambda_{max} - n)}{n-1}}{RI}$$

The value of CR has to be less than 0.1 or 10% due to the priority to get a high reliable and consistent result of the AHP method. Based on Saaty (1990), the RI of the set of the data could be referred to Table 3. Based on the CR formula above, all of criteria and sub-criteria calculations are already consistent with the highest value of CR in 0.097 in criteria hierarchy level.

Tabel 2. Delphi method result

Criteria	Sub Criteria	Std. Dev	IR	Evaluation	
				Std. Dev	IR
Quality	High Quality Product	0.90	0.0	KON	KON
	Quality Management	0.53	1.0	KON	KON
	Defect Rate Standards	0.75	0.8	KON	KON
Cost	Total Cost	1.13	0.5	KON	KON
	Product's Price	0.49	0.5	KON	KON
Reliability	Fulfill SMEs Demand	0.38	0.0	KON	KON
	Supplier's reputation	0.76	1.0	KON	KON
	Right Quantity	0.49	0.5	KON	KON
	Have similar Culture with SMEs	1.21	1.5	KON	KON
	Worker's Skill and Knowledge	0.69	0.5	KON	KON
	Have a knowledge about current Industry Situation	0.53	1.0	KON	KON
Order System & Cycle Time	On time Delivery	0.38	0.0	KON	KON
	Cycle Time	0.98	1.0	KON	KON
	Easy Order System	0.49	0.5	KON	KON
Capacity	Production Capacity	0.49	0.5	KON	KON
	Shipment Capacity	0.69	0.5	KON	KON
	Capacity of worker	0.79	1.0	KON	KON
Communication	Effective & Efficient Communication	0.95	1.5	KON	KON
	Open & Honest Communication	0.49	0.5	KON	KON
	Good communication system	0.49	0.5	KON	KON
	Have a good relation with SMEs	0.53	1.0	KON	KON
	Responsiveness	0.58	0.0	KON	KON
	Supplier need to proactive to the SMEs	0.76	1.0	KON	KON
Customer Service	Easy to Access of Customer Service	0.53	1.0	KON	KON
	Flexibility	0.53	1.0	KON	KON
	Service that is Effective and Efficient	0.76	1.0	KON	KON
Documentation & Regulation	Restriction on long working hours	1.72	3.0	DIV	DIV
	Accordance to the law	0.82	1.0	KON	KON
Location	Geographical Location is reachable	0.79	0.5	KON	KON
Product & Process Technology	Continuous Improvement	0.76	1.0	KON	KON

Table 3. Random Index (RI) consistency

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Finally, after being calculated, the weight and rank of each criterion of apparel small and medium enterprises could be seen in Table 4. The highest rank is quality criteria with 26.97% weight if being compared with the others. The

product and process technology criteria being the least criteria that is considered among the experts of apparel small and medium enterprises in selecting the supplier with the percentage of 1.48% if compared to the other criteria, even though it has slightly different weight with the documentation and regulation criteria with the percentage of 1.49%. Most of the experts state in the first and second round questionnaire that the technology aspect is exceptional to be applied either in a supplier's process or product. However, this exceptional criterion considered will not give many advantages to the apparel small and medium enterprises business practice based on experts' perspective. Hence, only continuous improvement from the supplier that considered will affect the decision of selecting the supplier by the apparel's small and medium enterprises.

Table 4. Apparel SME's supplier selection criteria & sub-criteria rank

Code	Criteria	Weight	%	Criteria Rank	Subcriteria	Weight	Subcriteria Rank
B	Quality	0.270	26.97%	1	High Quality Product	0.735	1
					Quality Management	0.186	2
					Defect Rate Standards	0.079	3
C	Cost	0.209	21%	2	Total Cost	0.875	1
					Product's Price	0.125	2
D	Reliability	0.206	20.57%	3	Fulfill SMEs Demand	0.403	1
					Right Quantity	0.261	2
					Supplier's reputation	0.134	3
					Have a knowledge about current Industry Situation	0.089	4
					Worker's Skill and Knowledge	0.071	5
					Have similar Culture with SMEs	0.041	6
E	Order System & Cycle Time	0.094	9.45%	4	On time Delivery	0.640	1
					Cycle Time	0.257	2
					Easy Order System	0.103	3
G	Communication	0.078	7.77%	5	Open & Honest Communication	0.190	1
					Effective & Efficient Communication	0.449	2
					Good communication system	0.130	3
					Responsiveness	0.080	4
					Have a good relation with SMEs	0.090	5
					Supplier need to proactive to the SMEs	0.062	6
I	Customer Service	0.055	5.52%	6	Flexibility	0.257	1
					Easy to Access of Customer Service	0.640	2
					Service that is Effective and Efficient	0.103	3
F	Capacity	0.035	3.48%	7	Production Capacity	0.653	1
					Shipment Capacity	0.277	2
					Capacity of worker	0.069	3
H	Location	0.024	2.39%	8	Geographical Location is reachable	1.000	1
J	Documentation & Regulation	0.015	1.49%	9	Accordance to the law	1.000	1
A	Product & Process Technology	0.015	1.48%	10	Continuous Improvement	1.000	1

Furthermore on the sub-criteria, based on Table 4., can be concluded that the sub-criteria being considered the most are suppliers' high-quality product and the total cost that to be paid by the apparel's SME. Most of the experts recognize that some of the suppliers did not deliver the expected quality or service even though the total cost that apparel's SME spent is quite high. Hence, the criteria quality and cost are considered as the most crucial criteria that need to be carefully assessed and analyzed when selecting a supplier. Another highlight of the high contribution criteria is the communication criteria. Experts believe that the more open communication between suppliers and apparel SMEs, will give a good impact on both sides' business practices. Hence, almost all communication's sub-criteria being considered by all experts' in selecting the supplier.

In a conclusion, this study revealed that there are 10 criteria that is crucial for selecting a supplier in the Indonesia's apparel Small and Medium Enterprises, which based on its rank are quality, cost, reliability, order system & cycle time, communication, customer service, capacity, location, documentation and regulation, and the product & process technology. In each criterion contained several sub-criteria that have strong impact to the supplier selection. The total of sub-criteria that is important to be considered are 29 sub-criteria under the 10 criteria above. The result of this research could be used by Indonesia's apparel small medium enterprises as their reference in selecting a supplier or even develop their own formal reference of supplier selection criteria. The aim of this rank and the list of criteria and sub-criteria are to gain more effective and profitable business practice for Indonesia's apparel small medium enterprises. Further objective of this research result is to indirectly improve Indonesia's economy development and increasing Indonesia's GDP in the future.

However, this study only focuses on general perspectives of experts without considering the other factors in the supply chain current issue. Hence, for future research could consider other factors from supply chain point of view that could affecting the supplier selection in Indonesia's apparel small and medium enterprises, such as sustainability factor, export and import factor, et cetera. More multi criteria decision making techniques also could being explored in the future research, both quantitative method and qualitative method.

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Biography

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