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Delphi Technique: An Investigation Process of Standard Operating Procedure towards Apparel Small & Medium Enterprise Sector in Malaysia

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Abstract

This study aims to comprehend the process of Delphi study development using experts' consensus validation on the Standard Operating Procedure (SOP) framework of the SME apparel sector in Malaysia. The main objective of this research is to understand how the Delphi study can be used to ascertain the appropriate framework for SOP on the SME apparel sector. Due to the absence of any generic model as guidance, this research study is observed to be relevant to the needs of the industry. To obtain a coherent picture, an expert panel appointed in the Delphi study can assist in determining the suitable framework. All the data were acquired using the median, quartile, IQR, and QD analyses. Even though the findings obtained are only based on Delphi first round, the entire study findings are continued based on the analysis that will be obtained in subsequent Delphi rounds.

Keywords: Delphi Study, Standard Operating Procedure (SOP), Apparel SME in Malaysia.

Introduction

Standard Operating Procedure (SOP) is a specific term used to describe an operational system process, wherein, it explains every industry rule that involves a task, which gives the necessary result that is aligned with the required standard (Environmental Information Washington, 2007). SOP is substantially used in many industries that comprise manufacturing and service. The objective is to ensure that every process is performed consistently, every worker understands the routine task performed, and the production as well as product quality can be controlled and executed in the given time (Enterprise, 2015). SOP is not a new concept in the world of the apparel industry and is used extensively by most enterprises pertaining to the manufacturing industry (Shih et al., 2014). For the apparel industry, every party that works either in management or in operation will perform their duty as determined by the manufacturer through the SOP provided. There are various benefits pertaining to the usage of SOP in the apparel industry like:

- a) Production of products that are of better quality and are more consistent.
- b) Assists in avoiding delay problems in the production of a product.

- c) Helps in reducing communication problems among employees.
- d) Increases employees' concentration in performing a given task.
- e) It assists in training new employees regarding new procedures in line with industry standards.
- f) Additionally, it can increase and maintain employees' safety in handling manufacturing machines.

Apart from these benefits, it must be noted that the language used in SOP should be comprehensible and must be stated in writing. It should have a title, code, logo and company name, areas involved, the responsibility of employees involved, approval and authorization date, procedure explanation, reference, and illustrated attachment if available (Barbosa et al., 2011). SOP in the apparel manufacturing industry must be displayed in close proximity to the workplace and must be stated in the worker's guidebook (Prasanta, 2013).

Problem Statement

The Small and Medium Enterprise (SME) apparel sector in Malaysia is a huge contributor to national economic development and is also acknowledged as the backbone of the industrial development program in the long run (Ping et al., 2010). Malaysian SME in the apparel sector under the category of textile, leather, and shoe has played an active role in establishing entrepreneurship and enhancing job opportunities for local residents (Subhan et al., 2013). The main activities of apparel SME in Malaysia include targeting the domestic market and fulfilling orders from big industry (Kufour, 2008; Wei, 2007). Nevertheless, apparel SME must act consciously to increase productivity and innovation and also work to maximize the export potential to the international market.

In order to ensure that the strategy is implemented effectively, SME in the apparel industry must produce more complex products, increase productivity, and encourage the development of more innovative products (*Unit Perancang Ekonomi Malaysia*, 2016). SME's factory organization needs to be more innovative in developing new products in the markets to compete with the existing competitors, to attract new customers, and to secure relationships with suppliers (Hidayah et al., 2015). According to the Economic Planning Unit (2016), in order to ensure the quality and production of innovative SME products and services, the government must encourage the SMEs to comply with the product-manufacturing standard. The 'Good Manufacturing Practice' will assist in developing new products in accordance with international standards.

Based on interviews with entrepreneurs belonging to apparel SMEs around Kuala Lumpur, Selangor, Johor, and Perak, it was found that the amount of apparel SMEs entrepreneurs that applied SOP in manufacturing activity was small. This was due to the lack of awareness regarding the importance of SOP application and the perception that SOP is a complex procedure. In addition, it was observed that there are certain SMEs that prefer to utilize the manual method, such as writing on paper and giving instructions, which have several weaknesses, such as human error, language problem, communication problem, and lack of understanding regarding the tasks and the instructions provided (Nizam et al., 2010; Noreen et al., 2012).

Consequently, the product development process requires a long time, increases the financial allocation, delays product delivery to the customer, and subsequently coerces the workers to work overtime in order to assure completion of urgent tasks (Ascloy et al., 2004). Such obstacles occur frequently and impact apparel SMEs entrepreneurs in inculcating brand

reputation among customers and industrial practitioners. For this reason, the current study aims to provide efficient solutions in order to deal with the challenges in this field.

Standard Operating Procedure (SOP) of Development Design for SME in Apparel Sector

The SOP framework is developed based on two essential indicators: order activities involved and operational processes conducted. According to Collins and Glendinning (2005), order activities involved will ultimately affect operational processes conducted. Based on interviews obtained from the research population consisting of 343 apparel SMEs that agreed to cooperate, there are five order activities performed:

- a) Made-to-measure (MTM) order,
- b) Self-brand order,
- c) Bulk local order,
- d) Bulk order by local and international brands for local production,
- e) Bulk order by the local brand for international production.

Production processes for order type number one to four (1-4), are usually done locally, while production type number five (5) is done abroad. Order type numbers one and two are mostly made by SMEs because the order is received in small quantities. Such orders frequently receive high demand from customers especially on festive seasons, social or formal functions, or on gatherings. However, bulk orders from number three to five (3-5) are found to be preferred by customers from local and international labels. Low sewing cost, fast sewing time, and ability to receive any order capacity have always made these services more popular and demanding among young customers who want creative and fresh designs (Hidayah et al., 2015).

Figure 1 shows a flow chart of an operational system that is designed at the preliminary stage based on five types of order activities. This flow chart has been classified into five parts, which follow the manufacturing standard based on the suitability of apparel SMEs' activity in Malaysia. Nonetheless, this study only focuses on framework findings from the Delphi technique. This study does not touch on the details of SOP development, though.

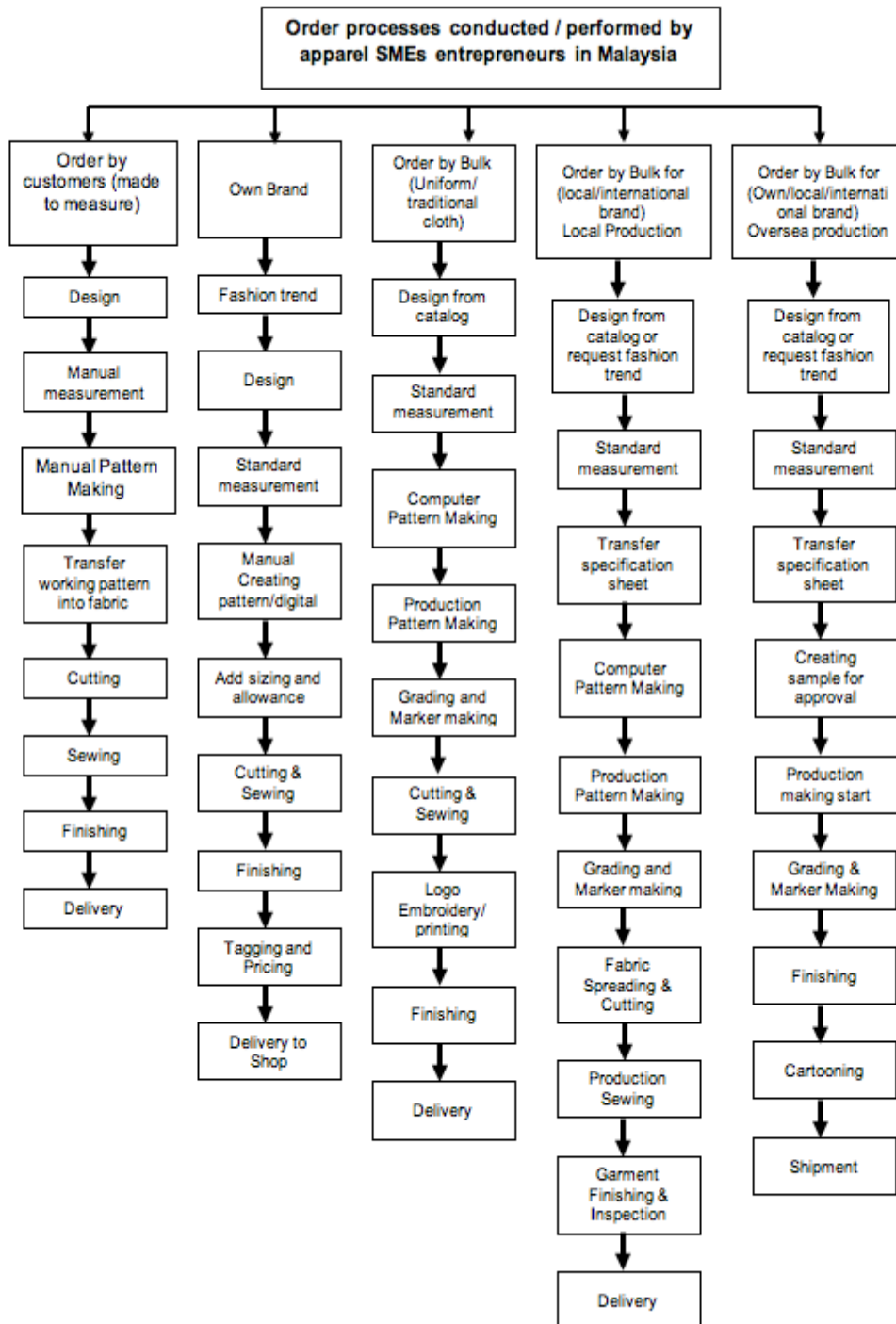


Figure 1. Flow chart an operational process based from the interviews 343 SMEs apparel in Malaysia.

Research Methodology

The analysis was performed using the Delphi technique to acquire experts’ consensus viewpoints regarding the SOP design that is developed according to the suitability of SMEs’ activities in Malaysia. Delphi technique includes both quantitative and qualitative methods that combine the views systematically in accomplishing an agreement or consensus (Yaakub & Ismail, 2010). Delphi technique is suitable for this research because it can provide a clear

decision in explaining the suitability of a method that could assist in the early development of this research framework. Although the usage of this technique is famous in pedagogy and health fields (Skulmoski & Hartman, 2007), it has also been utilized broadly and extensively in apparel and textile industries, see Table 1:

Table 1
Previous Studies on Delphi Technique in Apparel & Textile Industries.

<i>Authors</i>	<i>Title</i>	<i>Methodology</i>	<i>Panel</i>	<i>Rounds</i>
Huang & Tan, 2007	Product quality for apparel industry in Taiwan	Mean, median, mode, standard deviation	22	1
Bigliardi et al., 2011	Innovative cafeteria in Small & Medium Enterprises (SMEs)	Descriptive analysis, Discriminant analysis	15	2
Oxborrow, 2015	Apparel Supply Chain in Uk	Mean & standard deviation (standard deviation was taken as a proxy for the level of consensus)	24	2
Ning, 2006	Apparel & textile supply Chain in Hong Kong	Coefficient of variation was employed to judge whether they have consensus to certain extent), Cronbach's, Fuzzy measure	10	3
Venkatesh & Paluri, 2016	India's SME apparel manufacturing	Interpretive structural modelling analysis	8	1
Lee et al., 2002	Apparel & Textile manufacturing industry: characterisation and needs assessment	Descriptive Statistics (mean)	22	2
Gupta & Dasgupta, 2015	Apparel transportation lead time	Principle component multiple regression analysis	16	2

To ensure the implementation of the Delphi technique, several things must be emphasized like experts as panels, panel size, methodology selection, preliminary research questions, number of rounds, and consensus achievement setting (Yaakub & Ismail, 2010).

Preliminary Research Questions

Questions built in the Delphi technique could be set in an open form and broad scope. However, the questions that focus on a limited scope could also be applied in this Delphi research method (Adler & Ziglio, 1996). Such questions only require a short, thorough, and simple answer to limit the discussion. Thus, the selection of using a limited scope, to measure Standard Operating Procedure (SOP) design for apparel SMEs in Malaysia, is appropriate for this study. Likert scale was used to rate 1 (strongly disagree), 2 (disagree), 3 (not sure), 4 (agree), and 5 (strongly agree). For each question, an item was displayed on one side, a Likert scale as well as a space to state view, comment or retrieve suggestions from experts.

Selection of Expert Panel

The selection of expert's panel in the Delphi study is a major issue to ensure the smoothness of the research process and determine the decisions pertaining to a research finding (Sani, 2016; Yousuf, 2007). The qualified experts selected met all the below mentioned criteria (Woudenberg, 1991):

- a) They have broad experiences and knowledge in the domain of research conducted.
- b) They are fully committed to every Delphi round conducted.
- c) They are able to provide views and suggestions that are related to the research field.

Generally, the size of the members involved as experts' groups is different, depending on the research sample factor required. There are two sample sizes, which represent the panel group for the Delphi technique: homogeneous group (a group of experts that represent similar expertise) and heterogeneous group (a group of experts that have expertise in the topic but are from a different social or professional group) (Somerville, 2008).

If it involves international research, a heterogeneous approach of experts' group will be considered and the number of experts within the group must exceed 100 people (Dalkey, 1969). Meanwhile, if the research sample is homogeneous a small number of experts, between 10 and 15, is sufficient for the group (Yaakub & Ismail, 2010; Ziglio, 1996). Nevertheless, several literature studies state that the number of experts between 6 and 12 is optimal for combining systematic views from a homogeneous group of experts (Hogarth, 1978; Mitchell, 1991). Additionally, it is observed that a smaller number of experts have a better performance than a larger number of experts as it ensures an ideal and more secure decision (Yaakub & Ismail, 2010).

For this study, eight experts have been identified as experts' panel from the homogeneous group, based on expert's selection criteria (Hogarth, 1978; Mitchell, 1991). The experts must have enormous experiences and knowledge in the Malaysian fashion and SME industry. For this reason, the selected group of experts required for the current study consists of industrial practitioners and academics, who are involved comprehensively in the apparel industry in Malaysia. The experts agree to participate in a number of rounds in Delphi until the consensus is achieved. Experts panel were selected based on their willingness, ability, experience, and knowledge concerning asserting views regarding the research (French et al., 2002). Apart from that, experts' opinions from SME Corp., which handles apparel SMEs in Malaysia, were also sought in this study. The involvement of expert groups who have different perspectives will provide a better consensus based on their respective views and expertise (Okoli & Pawlowski, 2004).

Data Analysis Setting

According to Yaakub & Ismail, (2010), the consensus level within the research study can be determined using a precise scale. Statistical analysis methods such as median, quartile, IQR, and QD are used to measure agreement or consensus level among expert panels. Median is used to measure a more specific tendency than the mean (Mahmod & Dahalin, 2015).

However, to obtain a variety of results, Inter-Quartile Range (IQR) usage is considered (Mahmod & Dahalin, 2015). Items in this study have been divided into three levels according to the agreement achieved: low, moderate, and high. Median is the center point of a data set and IQR is the difference between the third quartile and the first quartile. Meanwhile, QD is half of IQR. There are three levels of QD: high (QD = 0.0-0.5), moderate (QD = 0.51-1.00) and

low (QD = >1.00). A high QD level signifies a high level of agreement among respondents, while a moderate QD agreement indicates the item is in a moderate agreement level. Whereas a low QD level depicts a low agreement level regarding the item and needs to be reviewed. Thus, only high and moderate consensus levels will be considered in this study, and a low consensus level will be considered in the subsequent round. Consensus levels are explained in table 2 below:

Table 2

Consensus Level Obtained from Kasem (1979) and Narongsakhet (2003) research studies.

<i>Quartile Deviation</i> (QD)	<i>Consensus</i>	<i>Median (M)</i>	<i>Significance Level</i>
QD < 0.5	High	M > 4	High
0.5 < QD < 1.0	Moderate	M < 3.5	Low
QD > 1.0	Low or No Consensus		

Delphi Round

For this study, 42 Delphi questions are prepared that represent apparel SME's order activities and its integration with SOP practices. SOP instrument questions need to be prioritized to give an understanding of the uniformity of SOP with the types of orders performed by Malaysian apparel SME companies. Findings from these questions will assist in ascertaining the main procedure of apparel manufacturing processes in Malaysian SME. The questions for Delphi first round have been provided to all panels involved through e-mail and direct delivery to the panel involved. The panel was given a month to state the agreed scale and suggestion or opinion for enhancement. The researcher had difficulty in collecting all the answers given, especially from the expert panel that was involved with the industrial practitioner; however, the researcher was able to collect all the questions of Delphi first round after the time given. All the questions were analyzed by using the median, interquartile range (IQR), and quartile deviation (QD) to determine the consensus.

Results and Conclusion

The analysis showed that all five types of order indicators achieved high and moderate levels of consensus, between QD (0-0.5) and QD (0.51-1.00). The results demonstrated no process was eliminated from the framework, although there were several suggestions from the panel for enhancement on all the manufacturing processes. Nonetheless, items for question Q12, B9, and B13, which were on a moderate level of consensus, did not change because there was no enhancement suggestion from the panel. Items that achieved a high agreement level will be retained for Delphi first round, while items that achieved the lowest consensus level will be reviewed for Delphi's second round. Enhancements have been made after analyzing according to consensus conducted. Various opinions and suggestions were provided by the expert panel in understanding the real meaning of SOP usage in the SME apparel sector in Malaysia. The results from Delphi's first round are depicted in Figure 2.

Process		SOP 1 Order by customer (made-to-measure)		SOP 2 Order for Own (Brand/design)		SOP 3 Order by bulk (Uniform)		SOP 4 Order by bulk (brand) (Production Local)		SOP 5 Order by bulk (brand) (Production Oversea)			
Pre- Production process	(P1) Ordering and measurement	Personal Customer order	Online retail Pre- Order	Own design order and online retail pre- order (local brand)		Customer order from the catalog		Customer order from local/oversea brand		Customer order from local /oversea brand			
		Customer own design	From the Online Catalog	Fashion Trends: Identify the quantity, material, color, cutting, act		Catalog: Info design matters		Info ordering include design matters		Info ordering include design matters			
		Manual measurement	Standard format Measurement	Standard format Measurement or Custom measurement		Standard format set Measurement		Standard format Measurement		Standard format Measurement			
	(P2) Idea Development (Confirming design, material, shape, accessories, color, act)	Drawing: Manual or Computerize		Manual Sketch or Computerize Drawing/printing (CAD) Manual embroidery		Computerize Drawing/ printing/ embroidery (CAD)		Computerize Drawing/ printing/ embroidery (CAD)		Specification Sheet Preparation			
		Order calculation and confirm by customer		Order calculation and meeting		Standard order calculation and confirm by customer		Standard calculation and group meeting		Expenditure Calculation and group meeting			
		Place Order		Place Order		Place Order Specification Sheet		Place Order Specification Sheet		Place Order (oversea production)			
Production process	(P3) Model Development	Final design with material selection		Creation Sampling		Or Outsourcing production	Sampling Creation and confirm the sampling		Sampling Creation and confirm the sampling		Fit Sample (oversea production)		
		Create the pattern (by manually)		Manual Creating Pattern			Production Standard pattern making (2D CAD)		Production Standard pattern making (2D CAD)				
		Add Seam allowances		Manual Correction and checking size set of pattern			Creating range of size by Grading (2D CAM)		Creating range of size by Grading (2D CAM)		Than confirmation sample (oversea production)		
		Finalist all the pattern before cutting process		Add Seam allowances			Align all size pattern Marker making (2D CAM)		Align all size pattern Marker making (2DCAM)				
	(P4) Production Development	Manual Fabric Spreading		Manual Fabric Spreading		Or Outsourcing production	Fabric Spreading Manual/automatic (3D CAM)		Fabric Spreading Manual/automatic (3D CAM)		Production start (oversea production)		
		Manual cutting		Manual cutting			Computerized cutting (3D CAM)		Computerized cutting (3D CAM)				
		Connection of group sewing		Connection of group sewing			Bundling/Hanger all the cutting fabric		Bundling/Hanger all the cutting fabric				
		Sewing Manual Embroidery		Sewing Manual Embroidery			Connection of group sewing		Connection of group sewing				
		QC garment		QC garment			Sewing Computerize Embroidery/Printing (3D CAM)		Sewing Computerize Embroidery/Printing (3D CAM)				
	Post Production process	(P5) Final Production	Finishing		Tagging		Garment Inspection (visit)		QC/QA Garment Inspection		Garment Inspection		QC/QA Garment Inspection (visit)
Delivery to customer			Finishing		Finishing		Finishing & Packaging		Finishing & Packaging		Finishing & cartooning		
			Delivery to shop		Cartooning		Delivery and Distribution		Delivery and Distribution		Delivery and Distribution		
				Shipment		Delivery		Delivery		Shipment			

Figure 2. The generic model constructed after analyzing Delphi first round

The findings show Standard Operating Procedures (SOPs) still need further scrutiny. According to experts involved in this Delphi method, the SOP items approach needs to be validated so the procedures stated are aligned with the needs of apparel SME in Malaysia. Although the Delphi method requires a long time to obtain agreements or consensus among experts, this method is viewed as one of the best methods in identifying SOP development for SMEs in the

apparel sector. Even though research findings are based only on Delphi first round, it clearly shows that the importance of SOP usage among SMEs entrepreneurs in the apparel sector in Malaysia needs to be standardized. Perhaps, consensus level decisions might change if there is a low agreement level on Delphi's second round and the subsequent rounds. However, if this happens, the researcher suggests the use of the Delphi Fuzzy Method or case study that is capable of acquiring data accurately with only a single round based on experts' consensus. This matter needs to be scrutinized and evaluated based on previous research studies to acquire certainty on its usage in the apparel industry.

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