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Determinant Factors of Supply Chain Technology Adoption Among Sabah Small and Medium Enterprises (SMEs)

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ABSTRACT

Small and Medium Enterprises (SMEs) are the key industry in Malaysia which they play an important economic and social role and often contributed to innovation to the country. However, the SMEs in Malaysia still face great challenges within their supply chain such as limited technology access, low productivity, and poor managerial capabilities. Sabah SMEs has low production levels and had to slow down the development of products and services. It will continue affecting the overall operation of Sabah SMEs. As Sabah SMEs have the biggest contribution to Sabah's development and provide many job opportunities, thus, it is needed for this study to identify determinant factors that influence the adoption of supply chain technology within Sabah SMEs such as perceived usefulness, complexity, compatibility and top management support. This study use diffusion of innovation (DoI) theory as underpinning theory to explain the adoption of supply chain technology according to the aspects of innovation attributes and organizational factor. This study employs a quantitative approach through a survey questionnaire distributed purposefully to Sabah SMEs in all sectors (manufacturing, services, and agriculture). The respondents' data obtained will be analysed through Statistical Package for Social Sciences (SPSS) for descriptive analysis while statistical data will be analysed through Structural Equation Modelling (SEM) via Partial Least Squares (PLS). The outcome is to examine the relationship between the variables and

the extent to which the relationship between the variables was related to each other. Hence, this finding may help the SMEs entrepreneur, researchers, and policy-makers to realize and make a refinement on supply chain technology adoption among Sabah SMEs.

INTRODUCTION

Small and Medium Enterprises

SMEs are the key industry in Malaysia which they play an important economic and social role and often contributed to innovation to the country (Decker, Schiefe, & Bulander, 2006). They are firms or business that run entrepreneurial activities (Lucky & Olusegun, 2012) and they have the biggest contribution to the country's economic growth (Lim & Kimura, 2010; Taylor & Murphy, 2004). There is 98.5 per cent of the entire business entities participated by SMEs in Malaysia whereby this percentage represented 907,065 of the total SMEs and the latest contribution of SMEs increased up to 5.2 per cent of the Malaysia GDP growth in 2017 compared to 2016 (Laporan MITI 2017, 2018).

Sabah reported around 6.14 per cent of total SMEs represented by local SMEs (Laporan MITI 2017, 2018). Sabah SMEs have ranked at the seventh-highest number of SMEs where it shows a potential significant for Sabah SMEs to contribute to the country's economic growth. It has been highlighted by Idris and Idris (2017) where Sabah has recorded big changes in the growth of Malaysia such as many infrastructures development and GDP per capita of Sabah rapidly increased. Additionally, Sabah SMEs has contributed about 98 per cent of business development in Sabah and provides many job opportunities to the state (Yusa, 2017).

SMEs Face Challenges within the Supply Chain

Firms realize that they must rely on an effective and efficient supply chain (Njoku & Alexanda, 2015). Unfortunately, Malaysian SMEs still face great challenges within their supply chain such as limited technology access, low productivity as well as poor managerial capabilities (Muhammad, Char, Yasoa', & Hassan, 2010; Saleh, Caputi, & Harvie, 2008; Davis & Vladica, 2006; Saleh & Ndubisi, 2006). Collins, Worthington, Reyes and Romero (2010) highlighted that effective and efficient supply chain can be achieved if the firms use supply chain technology (SCT).

SCT adoption is crucial to survive in supply chain management and remain competitive (Gunasekaranand Ngai, 2004). However, there still has limited adoption of SCT among the SMEs (Alam, 2009; Migiro, 2006; Premkumar, Ramamurthy, & Crum, 1997; Ahsan, 1970). Rahman, Radzi and Yaacob, 2016 and Narayanasamy, Santhapparaj and Eze (2008) highlighted that lack of education and skill leads to the low rate of technology diffusion by the SMEs. Besides, lack of technology model that causes a high risk within the supply chain (Chang, Hung, Yen, & Chen, 2008). Chong, Darmawan, Ooi and Lin (2008) also stressed that Malaysian SMEs perceived the complexity of using the technology.

Bolongkikit, Obit, Asing and Tanakinjal (2006) asserted that the usage level of e-commerce technology among Sabah SMEs in a west coast division still in its infancy level. Besides, Joseph (2017) asserted that Sabah SMEs were facing low production levels and had to slow down the development of products and services due to insufficient technology, limited markets, and limited financing. Thus, it might stunt the growth of Sabah SMEs.

Even though Malaysia has been blessed with abundant of innovation and resources (MIDA, 2016) as well as government initiatives, these challenges can continue impact to the overall operation and competitiveness of SMEs, especially for Sabah SMEs. Therefore, this paper aims to identify the SCT adoption among Sabah SMEs and to identify a relationship between determinant factors such as perceived usefulness, complexity, compatibility and top management support with the SCT adoption among Sabah SMEs.

LITERATURE REVIEW

Supply Chain

What is the difference between effective supply chain and simply supply chain? The supply chain is a connection from one business to another business that has a common interest (Rajgopal, 2016). In details, the supply chain is an organization's network that represents various processes and activities to produce products and services and deliver this value to the end customer (Christopher, 2016; Rajgopal, 2016). According to Nagurney (2013), a supply chain consists of the flow of products and services from raw materials suppliers to intermediate manufacturers or producers. Next, the flow continued to the final product manufacturers as well as to the wholesalers and retailers. Lastly, the flow of products and services move to the customers that have been connected by logistic service providers.

The supply chain is needed in each firm. However, many firms believe they must rely on effective supply chain (Njoku & Alexanda, 2015). Successful supply chain requires effective management as well as effective technology. As the supply chain is a critical area for the firm's success (Patterson et al., 2004), the supply chain executive, for instance, must able to manage and gather that information from upstream to downstream to achieve effective supply chain (Dittmann, 2010). It is because this information allows the firm to have better access to the host country and exploit global opportunities through various sources (Zizah, Rosmah, Scot-Lad, & Entrekin, 2010).

The supply chain represents massive activities in a borderless economy. It is a network that consists of suppliers, manufacturers, distributors, wholesalers, retailers, and customers (Cutting-Decelle et al., 2007). This network, in turn, must be supported by three pillars which are business processes, structures in the organization and technologies. In order to reach an actual efficacy of product being marketed to the marketplace, supply chain technologies were built to improve traceability and transparency. Waller, Johnson and Devis (1999) also emphasized that technology is needed to make the arrangement work. Hence, the supply chain technology usage leads to better supply chain management.

Supply Chain Technology Adoption

Supply chain technology (SCT) is meant to increase supply chain performance gradually (shah, 2009). SCT adoption is considered to be an important component of firms' supply chain operational strategy (Thun, 2010). It has been highlighted by Dahnil, Marzuki, Langgat and Fabeil (2014) that the adoption of SCT within the SMEs provides many opportunities for the firm internally. SMEs know that relying on SCT within their supply chain can help them achieve a strategic opportunity (Collins et al., 2010). It is because of SCT is a tool to improve the effectiveness and efficiency of supply chain management (SCM) and it necessary for organizational strategy (Kamarudin & Udin, 2009). The SCT is an innovation that can influence organizational productivity, competitiveness, flexibility and has been recognized in the SCM area (Deitz, Hansen, & Richey-Jr, 2009).

Jadhav (2015) emphasized that SCT is a substantial need in fully integrated supply chain management (SCM) solutions

whereby the technology connecting all network strategy functionality. According to Umney (2014), SCT was being shaped by new business areas, changes of workflow, production process, environmental effects, outsourcing plan, and globalization. Power (2005) stressed out that technology plays as "connectivity" with supply chain participants. If firms plan to globalize their products and services worldwide, the firms should adopt SCT for being connected with outside supply chain members. For instance, most of the firms prefer to use EDI as a platform to communicate the firms' information to the trading partners (Narayanan, Marucheck, & Handfield, 2009). Therefore, SCT adoption helps the firm in SCM effectively and efficiency.

Diffusion of Innovation

Diffusion of Innovation (DoI) theory will be the underpinning theory for this study. DoI theory is one of the oldest theories in social sciences, developed by Rogers (1962). The DoI theory has been generated to study the innovations' adoption and use in a wide perspective (Brown, Venkatesh, & Hoehle, 2015). Basically, the DoI theory explained how the new ideas, products or systems can be spread through a specific population (Chen, Gillenson, & Sherrell, 2002). In other words, DoI views innovation diffusion as a communication process whereby new ideas are passed from one party to another party in a particular social group (Yi, Jackson, Park, & Probst, 2006).

In DoI theory, there are five important stages in technology adoption which are knowledge, persuasion, decision, implementation and confirmation stage (Taherdoost, 2018). Every stage has a different process of innovation diffusion. Knowledge is a stage of gaining technology's information, persuasion is a stage of being persuaded in adopting the technology, decision is a stage to decide either to adopt or reject the technology, implementation is a stage of implement the technology and use it, and confirmation is a stage of evaluating the final outcome of using the technology (Kamarudin & Udin, 2009).

As this study focusing on SCT adoption among Sabah SMEs, diffusion theory is relevant for this study. In addition, the term 'adoption' has been used to describe the implementation of new ideas or behaviours (Damanpour, 1991). Kaminski (2011) highlighted that implementation stage known as a trial stage where the organization has made full use of such technology. In this paper, it will more focus on the implementation stage because the SCT adoption by the firm should use the SCT on a regular basis. Therefore, in this paper, due to the interested of organizational perspective on SCT adoption, the study will limit on focusing on key innovation and organizational factors. Figure 1 shows a proposed conceptual framework of determinant factors affecting SCT adoption.

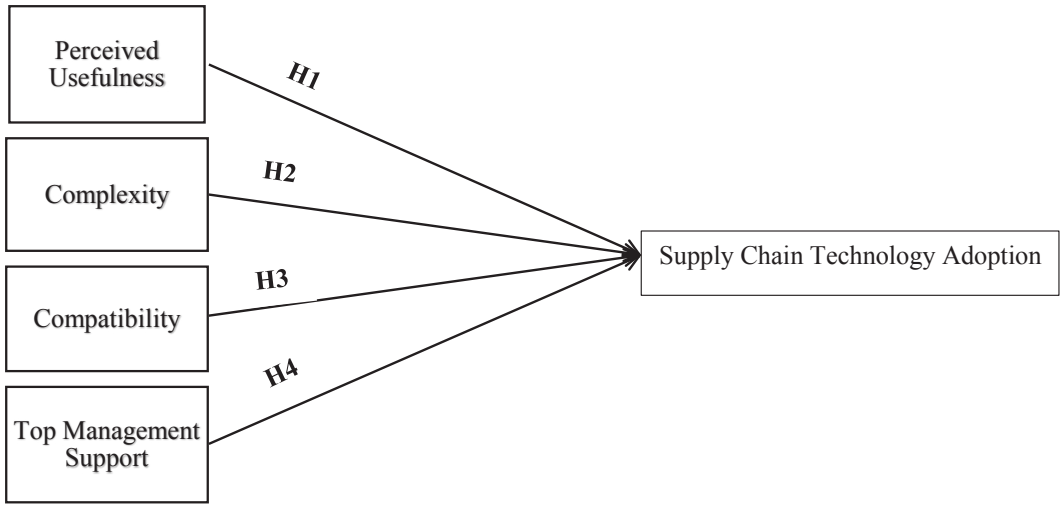

Figure 1 Proposed conceptual framework

Perceived Usefulness

Perceived usefulness has been widely used in technology adoption studies. Based on Davis (1989), the perceived usefulness is a highly significant predictor in the implementation of new technology. He also emphasized that perceived usefulness represented as the effectiveness of particular technology because the users can improve their performance and productivity with low effort level. It has been supported by Daud, Mohammad, Azmi, and Mohamed (2013) that perceived usefulness is an important reason for using technology. For example, customers tend to visit a well-designed web site that provides effective and efficient experience while they were shopping online. When firm capable to serve its customers successfully and fulfil their shopping needs, the firm will more likely perceive the usefulness when using this technology (Koufaris & Hampton-Sosa, 2004).

The perceived usefulness is considered as an important factor compared to relative advantage. Perceived usefulness and relative advantage are considered as an interchangeable factor in technology diffusion (Tarofder, Marthandan, Mohan, & Tarofder, 2013). Perceived usefulness stated as the most relevant factor in a work setting and there was a solid statement of the direct relationship between perceived usefulness and IT adoption (Jeyaraj et al., 2006). It has been agreed by Tornatzky and Klein (1982) that perceived usefulness considered as a consistent characteristic of innovation and has been the most correlated factor towards the IT diffusion.

Previous researchers found that perceived usefulness generally become the main determinant in explaining technology usage (Horst, Kuttschreuter, & Gutteling, 2007; Legris, Ingham, & Collerette, 2003). Ramayah, Jantan and Aafaqi (2003) claimed the perceived usefulness has a significant impact toward student's acceptance in the usage of course online. It is because the usage of course online helps the students to accomplish their task that resulting in the enhancement of task achievement such as quick response. Thus, perceived usefulness is a relevant factor that can influence SCT adoption. Based on the discussion above, this study proposed the first hypothesis as:

H1 There is a positive relationship between perceived usefulness and supply chain technology adoption.

Complexity

Complexity refers to the unpredictability in the behaviour of the system (Deshmukh, Talavage, & Barash, 1998). It has been stressed by Bozarth, Warsing, Flynn and Flynn (2009) that complexity is an unpredictable response of the system to give a set of inputs. In other words, complexity focusing on the challenges to understand, handle and use a complex technology (Briscoe, Keranen, & Parry, 2012). Hsieh and Wang (2007) highlighted that to overcome the complexity of particular technology, the users must have extra effort and need to use more features to support their job performance. It has been agreed by Mattis (2015) that the more complexity, the more effort needed. Hence, complexity reflects a negative relationship to the SCT adoption in the supply chain. This leads to the following hypothesis:

H2 There is a negative relationship between complexity and supply chain technology adoption.

Compatibility

Compatibility is the degree to which the technology perceived to be consistent with the user's needs, existing value and past experiences (Sonnenwald, Maglaughlin, & Whitton, 2001; Premkumar et al., 1997; Rogers, 1983). Technology compatibility considered important factor because the conformance of user's behaviour can enhance the rate of technology adoption (Rogers, 2003). Premkumar et al. (1997) agreed that

any technology brings in to the firm, the technology will make changes to the current work practices.

Tornatzky and Klein (1982) highlighted that technology compatibility within the organization is one of the consistent factors in technology diffusion studies. Compatibility was found to be a significant effect on RFID adoption (Wang, Wang & Yang, 2010). Additionally, Al-Jabri and Sohail (2012) also agreed that compatibility has a positive significant effect on mobile banking adoption. Cooper and Zmud (1990) highlighted that high compatibility between technology and task leads to a positive perception of adopting the technology. Therefore, the discussion above lead to developing the third hypothesis for this study as follows:

H3 There is a positive relationship between compatibility supply chain technology adoption.

Top Management Support

Top management support has been identified as the most significant variable in the implementation of technology (Sanders & Courtney, 1985; Tarofder et al., 2013). Several empirical studies also affirm the significance of top management support in technology diffusion (Ifinedo, 2008; Somers & Nelson, 2004). Dong, Neufeld and Higgins (2009) highlighted that Top management support is crucial to provide sufficient funding for training and technical assistance.

Top management support is when senior-level executive sponsors the project, contribute their time for review plan, go through the process and result, as well as facilitate management problem (Young & Jordan, 2008). Top management level is very important in providing vision, guidance, and support (Li & Lin, 2006). In addition, the top management level can immediately investigate a problem, make a decision and execute the plan in a predictable manner (Ferrier, 2001). Top management must acknowledge and understand all areas of business in order to build up a consistent strategy that parallels with an organizational goal (Njoku & Alexanda, 2015). Albaladejo (2001) stated that the managerial and technical skills of entrepreneurs and workforces are integral efforts which leads to in-firm technological learning. Active involvement of the top management level can help the firm to make a strategic decision in SCT adoption. Thus, a top manager can develop a better plan and make an accurate decision for future production. Above discussions lead to developing the fourth hypothesis for this study as stated below:

H4 There is a positive relationship between top management support and supply chain technology adoption.

METHODOLOGY

Research Design

Research design is a strategy, plan, and structure of conducting a research project (Drake, 2012). According to hair, Hult, Ringle and Sarstedt (2014), when applied to a research problem, confirmatory research can be used either confirm prior established theories or identify data patterns and relationship. So, confirmatory research method applied whereby the outcome is predicted using the hypotheses which are derived from the theory and the result of previous studies. This study also will design a descriptive analysis by using SPSS to seek information like standard deviation and meanwhile a statistical analysis will be obtained from PLS-SEM to examine the relationship between variables. This study applies a quantitative method to get result and findings as the study aims to find out the answer through numerical evidence (Choy, 2014). In this study, the population consists of all SMEs in Sabah either they are from services, manufacturing or agriculture sector. The sampling frame for this study is obtaining from SMEs database provided by SME

Corporation Sabah. All SMEs are the perfect sample as this study is identifying the supply chain technology adoption among Sabah SMEs. Based on databased provided by SME Corporation Sabah, there were 824 of SMEs has been listed. This study considered a number of 824 of SMEs in Sabah as a population and the minimum sample size is 138 as calculated using G-power calculation. The questionnaires will be distributed at all five Sabah division such as Interior, Kudat, Sandakan, Tawau and West Coast division in order to engage with SMEs from different background of businesses.

DISCUSSION AND CONCLUSIONS

Perceived usefulness generally become the main determinant in explaining technology usage (Horst et al., 2007; Legris et al., 2003). Complexity has been highlighted as an unpredictable response of the system to give a set of inputs (Bozarth et al., 2009). Meanwhile, compatibility refers to the degree to which the technology perceived to be consistent with the user's needs, existing value and past experiences (Sonnenwald et al., 2001; Premkumar et al., 1997; Rogers, 1983) and top management support is one of the organizational factors that significance with the adoption of supply chain technology (Ifinedo, 2008; Somers & Nelson, 2004). These factors can be considered as important factors in technology diffusion as discussed in the literature review.

As the supply chain is one of the important functions in business operation (Slack, Chambers, & Johnston, 2010), it is imperative to identify the determinant factors affecting supply chain technology adoption, which has received very little attention by another study, especially in Sabah. By using a diffusion of innovation (DoI) theory, this study, therefore, addressed what it intended to examine. Based on the previous study of technology diffusion, this study enriches our insight on the determinant factors that influences the SCT adoption among Sabah SMEs.

From the theoretical view, this study contributes to the important factors towards the SCT adoption among Sabah SMEs by providing the benefits of SCT from previous empirical studies. It also contributes to the importance of individual and organizational perspective in technology diffusion by using a diffusion of innovation (DoI) theory. From the practical view, this study contributes to the practitioners, researchers, and policymaker. For practitioners which is Sabah SMEs, they can gain deeper knowledge in term of supply chain technology adoption due to huge demand from the customer that may encourage the firm to be more efficient and effective in managing their supply chain. For the researcher, this study will be a platform for further research in this field, especially those who are concerned in identifying the factors on the SCT adoption and supply chain management. Last but not least, for the policy-maker, this study can be a benchmark to make any refinement in helping the Malaysian SMEs especially in Sabah to realize the importance of SCT in their firm.

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Appendix A: Survey Questionnaire

i. Section A (Supply Chain Technology Adoption)

INSTRUCTION: Based on the statement, please TICK (✓) the most suitable answer to indicate either you adopt or not adopt the technology by placing a tick.

1-None	2-Very little	3-Somewhat	4-Significant amount	5-To a great extent

No	Items	1	2	3	4	5
1	Product Data Management (PDM)	1	2	3	4	5
2	Customer Relationship Management (CRM)	1	2	3	4	5
3	Automated Quality Control systems (AQCs)	1	2	3	4	5
4	Bar-coding technology	1	2	3	4	5
5	Computer-aided Design (CAD)/ Manufacturing systems	1	2	3	4	5
6	Warehouse Manufacturing Systems (WMS)	1	2	3	4	5
7	Transportation Management Systems (TMSs)	1	2	3	4	5
8	Transportation Management Systems (TMSs)	1	2	3	4	5
9	Radio Frequency Systems (RFID)	1	2	3	4	5
10	Geo-Coded Tracking System (GCTS)	1	2	3	4	5
11	E-Commerce Technologies	1	2	3	4	5
12	Supply Chain Planning (SCP) systems	1	2	3	4	5
13	Supply Chain Event Management (SCE)	1	2	3	4	5
14	Demand Forecasting Management (DFRM)	1	2	3	4	5
15	Enterprise Resource Planning (ERP)	1	2	3	4	5

ii. Section B (Perceived Usefulness)

INSTRUCTION: Based on the statement, please CIRCLE (✓) the most suitable answer to indicate the extent to which you strongly disagree or strongly agree with the statement by placing a circle on a scale of 1 or 5.

1-Strongly disagree	2-Disagree	3-Neutral	4-Agree	5-Strongly agree

No	Items	1	2	3	4	5
1	Using supply chain technology enhances my firm's productivity.	1	2	3	4	5
2	Using supply chain technology increases my firm's effectiveness in supply chain management.	1	2	3	4	5
3	Using supply chain technology makes handling of operation easier.	1	2	3	4	5
4	Supply chain technology helps my firm to solve the problem quicker.	1	2	3	4	5
5	Supply chain technology supports critical aspects of supply chain management.	1	2	3	4	5
6	Using supply chain technology allows my firm to accomplishing more work than would otherwise be possible.	1	2	3	4	5
7	Supply chain technology helps my firm to save time in spending on unproductive activity.	1	2	3	4	5

iii. **Section C (Complexity)**

INSTRUCTION: Based on the statement, please CIRCLE (✓) the most suitable answer to indicate the extent to which you strongly disagree or strongly agree with the statement by placing a circle on a scale of 1 or 5.

1-Strongly disagree	2-Disagree	3-Neutral	4-Agree	5-Strongly agree

No.	Items	1	2	3	4	5
1	My firm believes that supply chain technology is complex to be used.	1	2	3	4	5
2	My firm believes that there is a complex process for the development of supply chain technology.	1	2	3	4	5
3	The operation of the supply chain technology in my firm is considered easy.	1	2	3	4	5
4	It takes too long to learn how to use supply chain technology in my firm.	1	2	3	4	5
5	Using supply chain technology requires particular skills for my employees.	1	2	3	4	5
6	It will be very difficult to integrate supply chain technology into my firm's current work practices.	1	2	3	4	5

iv. **Section D (Compatibility)**

INSTRUCTION: Based on the statement, please CIRCLE (✓) the most suitable answer to indicate the extent to which you strongly disagree or strongly agree with the statement by placing a circle on a scale of 1 or 5.

1-Strongly disagree	2-Disagree	3-Neutral	4-Agree	5-Strongly agree

No.	Items	1	2	3	4	5
1	Using supply chain technology is compatible with all aspects of my firm's style.	1	2	3	4	5
2	Using supply chain technology is completely compatible with my firm's current situation.	1	2	3	4	5
3	Using supply chain technology fits well with my organizational strategy.	1	2	3	4	5

v. **Section E (Top Management Support)**

INSTRUCTION: Based on the statement, please CIRCLE (✓) the most suitable answer to indicate the extent to which you strongly disagree or strongly agree with the statement by placing a circle on a scale of 1 or 5.

1-Strongly disagree	2-Disagree	3-Neutral	4-Agree	5-Strongly agree

No.	Items	1	2	3	4	5
1	My firm restructures work process to leverage supply chain technology opportunities.	1	2	3	4	5
2	My firm ensures an adequate fund to research and development (R and D) of supply chain technology in the firm.	1	2	3	4	5
3	My firm facilitates supply chain technology throughout the firm.	1	2	3	4	5
4	My firm is willing to take risks involved in adopting supply chain technology.	1	2	3	4	5
5	My firm is likely to be concerned in adopting supply chain technology to achieve competitive advantage.	1	2	3	4	5
6	My firm is likely to consider the importance of adopting supply chain technology.	1	2	3	4	5
7	My firm really supports the use of supply chain technology in the firm.	1	2	3	4	5
8	My firm really encourages employees to use supply chain technology in their daily tasks.	1	2	3	4	5

vi. **Section F (Demographic Profile)**

INSTRUCTION: Please read EACH question carefully and provide the correct information by placing a TICK (✓) in the space provided.

1. Gender

( ) Male
( ) Female

2. Age (years)

( ) Under 20 years
( ) 20-29 years
( ) 30-39 years
( ) 40-49 years
( ) 50-59 years
( ) Over 60 years

3. Race

( ) Bumiputera Sabah
( ) Bumiputera Sarawak
( ) Malay
( ) Chinese
( ) India
( ) Others Specify: _____

4. Level of Education

( ) PhD
( ) Master
( ) Degree
( ) Diploma
( ) High school
( ) Primary school
( ) Others Specify: _____

5. Level of management

( ) Top management (e.g., Chief Executive Officer, Chief Operation Officer, President, owner)
( ) Middle management (e.g., General manager, Divisional manager, Regional manager)
( ) First-level management (e.g., Office manager, Shift supervisor, Crew leader, Store manager and etc.)

*****Question end*****