RELATIONSHIP OF SUPPLY CHAIN CAPABILITIES AND SUPPLY CHAIN TECHNOLOGY ADOPTION TOWARDS SUPPLY CHAIN OPERATIONAL PERFORMANCE IN TEXTILE AND APPAREL INDUSTRY

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ABSTRACT

In today's dynamic business environment, competition is no longer between firms, but between supply chains. The supply chain dependency leads the business focused on supply chain performance. Considering the importance given to the third industrial master plan by the Malaysia government, current supply chain environment accentuated the need of supply chain technology adoption to facilitate supply chain management. To explain the concerns, this study examined the impact of supply chain capabilities namely, relational capability, information technology capability, and organizational culture capability on supply chain operational performance and supply chain technology adoption. This study also examines the successive impact of supply chain technology adoption on supply chain operational performance and investigates whether supply chain technology adoption mediates supply chain capabilities and performance relationship under study. In order to achieve the research objectives, a two-step approach namely quantitative research method and a triangulation research approach are necessitated. 201 survey questionnaires were distributed to respondents in Malaysian textile and apparel organizations. 121 usable responses representing 60% response rate were empirically tested through structural equation modeling by using SPSS and SmartPLS. Research findings revealed that relational capability, organizational culture capability, and supply chain technology adoption contributed to firm's supply chain operational performance, whereas, information technology capability was insignificant. The findings further revealed that supply chain capabilities have a positive influence to supply chain technology adoption. The findings also revealed a significant mediation effect of supply chain technology adoption in the model under study. A triangulation research approach was employed through face-to-face interviews with four industry practitioners to get their in-depth experiences and perceptions on the model under study. ATLAS.ti results showed that developed model had achieved agreement of industry experts with the suggestion of two emerging terms (human support and work experience) as moderators for future study on the model. Limitations and recommendations for future study are discussed.

Keywords: supply chain capabilities, supply chain technology adoption, supply chain operational performance, textile and apparel industry, Malaysia

ABSTRAK

Dalam persekitaran perniagaan yang dinamik pada hari ini, persaingan tidak lagi melibatkan antara sesebuah firma, tetapi turut melibatkan antara rantaian bekalan. Pergantungan kepada rantaian bekalan ini menyebabkan perniagaan memberikan tumpuan ke atas prestasi rantaian bekalan. Dengan mempertimbangkan kepentingan yang ditekankan dalam pelan induk perindustrian ketiga oleh kerajaan Malaysia, persekitaran semasa rantaian bekalan telah mendedahkan keperluan penggunaan teknologi rantaian bekalan untuk memudahkan pengurusan rantaian bekalan. Sehubungan dengan itu, kajian ini meneliti impak keupayaan rantaian bekalan yang meliputi keupayaan hubungan, keupayaan teknologi maklumat, dan keupayaan budaya organisasi terhadap prestasi operasi rantaian bekalan dan penggunaan teknologi rantaian bekalan. Kajian ini turut mengkaji impak penggunaan teknologi rantaian bekalan terhadap prestasi operasi rantaian bekalan serta menyelidik sama ada penggunaan teknologi rantaian bekalan merupakan pengantara kepada prestasi dan keupayaan rantaian bekalan yang dikaji. Untuk mencapai objektif kajian, dua pendekatan, iaitu kaedah penyelidikan kuantitatif dan pendekatan penyelidikan triangulasi diperlukan. Sebanyak 201 borang soal selidik telah diedarkan kepada responden di organisasi tekstil dan pakaian Malaysia. Sebanyak 121 jawapan soal selidik yang mewakili 60% kadar maklum balas telah diuji secara empirikal melalui pemodelan persamaan struktur dengan menggunakan SPSS dan SmartPLS. Hasil kajian menunjukkan bahawa keupayaan hubungan, keupayaan budaya organisasi, dan penggunaan teknologi rantaian bekalan menyumbang kepada prestasi operasi rantaian bekalan sesebuah firma, manakala, keupayaan teknologi maklumat adalah tidak penting. Hasil kajian juga mendedahkan bahawa keupayaan rantaian bekalan memberikan pengaruh positif terhadap penggunaan teknologi rantaian bekalan. Selain itu, hasil kajian turut menunjukkan kepentingan penggunaan teknologi rantaian bekalan sebagai pengantara bagi model yang dikaji. Pendekatan penyelidikan triangulasi telah diambil melalui temuduga bersemuka dengan empat orang pengamal industri untuk mendapatkan pengalaman yang mendalam dan persepsi mereka terhadap model yang dikaji. Keputusan ATLAS.ti menunjukkan bahawa model yang dibangunkan telah mencapai persetujuan pakar industri dengan cadangan dua terma yang baharu (sokongan manusia dan pengalaman kerja) sebagai moderator untuk kajian masa hadapan bagi model ini. Beberapa cadangan dan batasan untuk kajian masa hadapan turut dibincangkan.

Kata kunci: keupayaan rantaian bekalan, penggunaan teknologi rantaian bekalan, prestasi operasi rantaian bekalan, industri tekstil dan pakaian, Malaysia

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PUBLICATIONS DERIVED FROM THE THESIS

Based on the research presented in this thesis, the following papers have been published with supervisory panel. The remaining parts of the thesis have not yet been published.

Publications in Journals

1. Lee, K. L., Udin, Z. M., & Hassan, M. G. (2014). Global supply chain capabilities in Malaysian textile and apparel industry. *International Journal of Supply Chain Management*, *3*(2), 31–40.

2. Lee, K. L., Udin, Z. M., & Hassan, M. G. (2014). Supply chain technology adoption: Its clarification, evolution, classification, and practicality in textile and apparel industry. *International Journal of Business and Economics Research, Special issue: "Supply Chain Management: Its Theory and Applications"*. 3(6-1), 15-21. doi: 10.11648/j.ijber.s.2014030601.13

3. Lee, K. L., Hassan, M. G., & Udin, Z. M. (2015). The contribution of supply chain technology in Malaysian textile and apparel industry. *Journal of Advanced Management Science*. (In Press)

Publications in Conference Proceedings

1. Lee, K. L., Udin, Z. M., & Hassan, M. G. (2014). Supply chain capabilities: A study in textile and apparel industry. In *Proceedings of 1st International Conference on Innovation Driven Supply Chain*. AIMST University, Kedah.

2. Lee, K. L., Udin, Z. M., & Hassan, M. G. (2014). A review of relational capabilities on supply chain performance in textile and apparel industry. In *International Conference on Management & Business Sustainability 2014: 4th International Conference on Technology and Operations Management*. PWTC, Kuala Lumpur.

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4. Lee, K. L., Hassan, M. G., & Udin, Z. M. (2015). The Effect of Supply Chain Technology Adoption: An Empirical Study of Textile and Apparel Industry in Malaysia. In *2015 International Symposium on Sciences and Mathematics (ISySM 2015).* Bandung, Indonesia. (In Review)

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LIST OF ABBREVIATIONS

Abbreviation	Description of Abbreviation
ACLM	Asian Council of Logistics Management
AMOS	Analysis of Moment Structure
AMOS-SEM	Analysis of Moment Structure Structural Equation Modeling
APICS	Association for Operations Management
APO	Advanced Planning and Optimization
APS	Advanced Planning and Scheduling Systems
AQC	Automated Quality Control System
ARS	Automate Replenishment Systems
ASN	Automatic Shipment Notices
ASRS	Automated Storage and Retrieval Systems
AVE	Average Variance Extracted
B2B	Business to Business
B2C	Business to Customer
C2B	Customer to Business
CA	Cronbach's Alpha
CAD	Computer-Aided Design Systems
CAM	Computer Aided Manufacturing
CAT	Computer Aided Testing
CB-SEM	Covariance Based Structural Equation Modeling
C-Commerce	Collaborative Commerce
CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
CIM	Computer Integrated Manufacturing
CLM	Council of Logistics Management
CMV	Common Method Variance
CNC	Computer Numerical Control
CoT	Cloud of Things

CPFR	Collaborative Planning, Forecasting, and Replenishment
CR	Composite Reliability
CRM	Customer Relationship Management Systems
CRP	Continuous Replenishment Programs
CSCMP	Council of Supply Chain Management Professionals
DFM	Demand Forecasting Management
DOI	Diffusion of Innovation Theory
DRP	Distribution Resource Planning
DSS	Decision Support System
DW	Data Warehouse Systems
E&E	Electrical and Electronic
E-business	Electronic business
E-commerce	Electronic commerce
EDI	Electronic Data Interchange
EFA	Exploratory Factor Analysis
EFT	Electronic Funds Transfer
E-mail	Electronic mail
EOS	Electronic Ordering System
E-procurement	Electronic Procurement
ERP	Enterprise Resource Planning Systems
E-SCM	Electronic Supply Chain Management
F^2	Effect Sizes
FA	Factor Analysis
FMCG	Fast Moving Consumer Goods
FMM	Federation of Malaysian Manufacturers
FMS	Flexible Manufacturing Systems
GCTS	Geo-Coded Tracking Systems
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GoF	Goodness of Fit
GPS	Global Positioning Systems
GT	Group Technology
H	Hypothesis
ICT	Information and Communication Technology

IMP3	Third Industrial Master Plan
IOS	Inter-organizational System
IoT	Internet of Things
IS	Information System
IT	Information Technology
ITC	IT Capability
JIT	Just-In-Time
KPI	Key Performance Index
LIS	Logistics Information System
LV	Latent Variable
MATRADE	Malaysia External Trade Development Corporation
MES	Manufacturing Execution Systems
MGMA	Malaysian Garment Manufacturers Association
MIDA	Malaysian Investment Development Authority
MIDC	Maharashtra Industrial Development Corporation
MKMA	Malaysian Knitting Manufacturers Association
ML	Maximum Likelihood
MRP	Material Requirements Planning Systems
MTMA	Malaysia Textile Manufacturers Association
MV	Manifest Variable
NCPDM	National Council of Physical Distribution Management
OCC	Organizational Culture Capability
P&G	Procter and Gamble
PCA	Principle Component Analysis
PDM	Product Data Management Systems
PLS	Partial Least Square
PLS-SEM	Partial Least Squares Structural Equation Modeling
PMS	Performance Measurement Systems
POS	Point of Sales Tracking Systems
PwC	PricewaterhouseCoopers
Q^2	Predictive Relevance
R^2	Coefficients of Determination
RBV	Resource Based View Theory
RC	Relational Capability

RFID	Radio Frequency Identification Systems
SCE	Supply Chain Event Management Systems
SCM	Supply Chain Management
SCOP	Supply Chain Operational Performance
SCOR	Supply Chain Operation Reference
SCP	Supply Chain Performance
SCT	Supply Chain Technology
SCTA	Supply Chain Technology Adoption
SEM	Structural Equation Modeling
SmartPLS	Smart Partial Least Square
SME	Small and Medium Enterprise
SMED	Single Minute Exchange of Die
SPSS	Statistical Package for Social Science
SRM	Supplier Relationship Management Systems
TMS	Transportation Management Systems
TOE	Technology-Organization-Environment Theory
TQM	Total Quality Management
UK	United Kingdom
US	United States
VAF	Variance Accounted For
VAN	Value Added Network
VIF	Variance Inflation Factor
VMI	Vendor Managed Inventory
VMR	Vendor Managed Replenishment
VPN	Virtual Private Network
VRM	Vendor Relationship Management
WMS	Warehouse Management Systems

CHAPTER ONE

INTRODUCTION

1.1   Background of Study

The concept of supply chain management (SCM) starts to emerge in the mid of 1960s and first appeared in the literature in 1982, with a dramatic increased attraction to researchers since 1990s (Huan, Sheoran, & Wang, 2004; Cooper, 2006). It has gained an incredible attention since 2000s from both academics and practitioner's community (Chan & Qi, 2003). Over the last 30 years, the significance of SCM on the organization's performance has been indicated in literature (Houlihan, 1985). Nowadays, in a competitive business environment, firms need to emphasize on supply chain performance (SCP) instead of organizational performance(Leng & Zailani, 2012). Several studies supported that firm should focused on supply chain performance since it has a huge direct effect on organization performance (Green Jr, Mcgaughey, & Casey, 2006; Green Jr, Whitten, & Inman, 2008; Constangioara, 2012; Deshpande, 2012).

Nowadays, the SCM studies are becoming a great deal of interest among the organizations. This is because the current business trends are shaping global business and providing the opportunities to firms to becoming multi-nationals (Thomas & Griffin, 1996) and thus, increase the complexity of the supply chain. SCM is based on the complete chain which is necessary to involve all partners in the chain to hold the

key of competitiveness (Beske, 2012). In the current decade, the business competition is no longer between firms, but between their supply chains (Deshpande, 2012). Therefore, nowadays, SCM becomes a popular management tool in helping firms improve their competitiveness. The concept of SCM has been recognized to be vital importance for textiles and apparel industry (Lam & Postle, 2006). The management can utilize the functions of SCM to plan, coordinate, and control logistics knowledge flow, capital flow, and information flow of the business. It enables firms to improved response speed and reduced uncertainty of the supply chain (Jacques, 2012).

Meanwhile, competition has increasingly become stiff in the global business environments (Chan & Qi, 2003). Therefore, it is vital that textile and apparel organizations to cooperate to attain common goals such as minimizing delivery cost, stock holding cost, increase punctuality (Jin, 2006), enhance quality, improved flexibility, and quick respond (Thomas & Griffin, 1996; Jacques, 2012) to ensure profitability (Agami, Saleh, & Rasmy, 2012; Jacques, 2012) and customer satisfaction (Thomas & Griffin, 1996; Jacques, 2012). Otherwise, the company will lose competence in extreme varied and fast change market (Thomas & Griffin, 1996). For instance, Zara, the Spanish apparel organization provides a real illustration of the hybrid supply chain. It is one of Spain's greatest and dynamic apparel oragnizations, producing trendy apparel to a universal target market of 18 to 35 year olds. Since, major difficulty in most supply chains is lacked of visibility in actual demand, so, forecast driven was better than demand driven (Christopher, 2000). Therefore, Zara developed a quick response system for the industry to handle visibility problems.

1.1.1   Textile and Apparel Industry in Malaysia

Based on the report provided by Department of Statistics Malaysia (2013), Malaysia's economy registered growth of 5.6% which Gross Domestic Product (GDP) in current term posted a value of RM941.2 billion in 2012 and spearheaded by the service and manufacturing sectors. According to Malaysian Investment Development Authority (MIDA), textile and apparel industry is one of the contributors in manufacturing industry in Malaysia. The manufacturing sector rose to 4.8% in 2012, an improvement from 4.7% recorded in 2011, particularly textile and apparel products, which accounted for 1.7% to the growth within the manufacturing sector. In the last 40 years, technological development enabled textile and apparel industry to implement new procedures and methods to increase the performance (Colovic, 2012). Therefore, according to Third Industrial Master Plan (2006-2020), textiles and apparel industry possess the highest estimate of annual growth of export, which is 7.80% annually from 2006 to 2020. This means that the industry is potential for further development and research.

Fashion is about technology management which utilized technology as an important element to attract customer and gain mutual benefits (Ünay & Zehir, 2012). The adoption and application of the latest technology are required to develop the full potential of textiles and apparel industry. Likewise, supply chain technology (SCT) is important in contributing to the growth of the economy and their linkages to the manufacturing industry. From aforementioned, we can conclude that, in the short term, textile and apparel industry is a limited impact in the economy, but, in long term competitiveness, it has positively contributed towards the development for the country.

However, based on the Maslow's hierarchy of needs, textile and apparel are one of the important elements of physiological needs for human survival. Hence, this mean, textile and apparel are one of the most basic requirements and it provides necessary protection for people. Moreover, the textile and apparel industry has an exclusive position as a independent industry, start from the supplier of the production raw materials to the delivery of completed products to end customer, with considerable value added at each processes (Khurana, Pahwa, Bansal, Dhingra, & Sharma, 2008). With this evidence, indirectly, the researchers were suggested to look for complete chain while studying textile and apparel context. Thus, this industry has potential to be researched, since it has a strong position in the Maslow's hierarchy of needs and limited studies have been done as at to date.

1.1.2 Issues Related to Supply Chain Operational Performance

In Asia, technology is a real concern to develop an efficient supply chain. There is a feeble accessibility of technology application in numerous developing Asia countries. Bringing down the operation cost has been common in Asia. However, this is also the weakness of Asia to develop an efficient logistics and distribution to diminish the cost. Li (2007) states that the used of technological functions can aid extraordinarily in this respect. Besides, joint effort is a range of opportunity in Asia. Presently, a huge number of the collaborative efforts are informal (Li, 2007). As a more formal form of collaboration creates, particularly at the industry level, extraordinarily efficiency and cost savings can be realized. Li (2007) and Ramayah et al. (2013) further stated that the used of technological functions into their daily operations can aid extraordinarily in this respect too.

From the above discussion, the effective SCM should be able to apply technology functions. It is the keys competitive factors (Motwani, Madan, & Gunasekaran, 2000), if adopted the right technology in the right firm and on the right time (Ramos, 2004). However, it is complex and required great investment of time and financial (Ma & Zhang, 2009; Trkman, McCormack, Oliveira, & Ladeira, 2010), A lot of large organizations are conglomerations their business units and acquisitions across global (Axeelsson, Lerpold, Nordnrand, & Sjostrom, 2010) have taken an inordinate length of time to incorporate the supply chain system (Kocoglu et al., 2011; Du, 2007; Power, 2005). The huge initial investment and risk largely restricted vendors to be competitive (Tseng, Wu, & Nguyen, 2011; Shacklett, 2012). The large organizations might have enough resources and budgets to adopt, but it would be a burden or challenged for small and medium enterprises (SMEs) since they have resource's limitation and limited power to negotiation (Lam & Postle, 2006; Ma & Zhang, 2009; Leng & Zailani, 2012).

As Ma and Zhang (2009) noted, most of the enterprises in Malaysia's textile and apparel industry are SMEs. Based on the FMM directory (2013), approximately 75% of Malaysia testile and aparel companies are small and medium sizes. It is the similar situation faced in Hong Kong textile and apparel supply chain (Hunter & Valention, 1995; Lam & Postle, 2006). The development of SMEs is an important growth engines and backbone of economic (Thoo, Hamid, Rasli, & Baharun, 2012; Mizar, 2013). Specifically, Malaysia textile and apparel SMEs offered utilization of resources, employment opportunities, foreign-currency accumulation, and ultimately enhance national economic development (Cooper, 2010). Thoo et al. (2012) reveals that the large companies in Malaysia are appreciated the benefits of SCM, but SMEs have insuficient knowledge and lagging behind in realizing the potential benefits of SCM.

Textile and apparel market demand is uncertain and unpredictable. The nature of this industry leads to high market mediation costs such as loss sales opportunities (e.g., stock outs) during peak season or outstrips inventories during low season and gradually obsolete inventories were generated. SCM is a key to provide cost reduction to textile and apparel organizations through increases speed and flexibility (Fisher, 1997). However, true agility requires a high degree of visibility throughout the supply chain (Storey, Emberson, & Reade, 2005). The industry practitioners should recognize the power of supply chain technology adoption in facilitating the issue in this industry.

The main objective of supply chain technology adoption is to seamlessly connect the point of production to the point of procurement and delivery. For instance, the Internet and web technologies improved connection and communication between supply chain members (Agus, 2011) and provide supply chain operation efficiency (Cooper, 2006). Besides, it also enables supply chain members to review combination of data, performance history, monitor current performance (He & Chen, 2008), forecast demand, and reduce human involvement minutely in the supply chain (McLaughlin, Motwani, Madan, & Gunasekaran, 2003; Zhu, 2010). This is the aims of supply chain managers to view the integrated data of complete chain at one key (Motwani et al., 2000). Based on The Sun Online article that reported by Musa (2010), government always advise industries to automate the operation procedures for process efficiency.

Nowadays, although operational innovations were common, but there is low adoption in supply chain technology, approximately only 10% of the companies such as Wal Mart, Liz Claibone, Toyota, and Dell (Zolait, Ibrahim, Chandran, & Sundram, 2010) succeeded to accomplish (Sehgal, 2009; Jacques, 2012). Even though, firms are noticed that technological innovation able to reduced supply chain costs (Thomas &

Griffin, 1996). However, Ramayah et al. (2008) found several obstacles that hinder the success of supply chain technology adoption which include scarce of information systems, excessive involvement, and emphasis on short term performance. This is supported by Sehgal (2009), high cost where manufacturer need to bear most of the costs, data inaccuracies that require manual overrides, lack of technology standardizations, and security concerns are possible reasons for the low adoption rates.

According to Cooper (2006), the adoption of modern supply chain technology is essential to determine the structure of process flows in the supply chains. As the objective of supply chain during year 1975 until 1985 stated, it is aims to educate all related employees to used supply chain systems (Cooper, 2006). In business globalization, an appropriate supply chain technology able to strengthen cooperation relationships between internal and external supply chain members to enhance supply chain performance (Pan, Yeung, Moon, & Leung, 2006). However, the interdependence between each supply chain members has been greater than before and thus, failure of any supply chain members affects the entire supply chain performance (Ainapur, Singh, & Vittal, 2012). For instance, technology is the main tool used to increase revenues and reduce costs of US textile industry (Cooper, 2006). Besides, Lin (2008) noted that organizational culture also had the ability to influence the technological innovation and thus, it is crucial to avoid failure in the supply chains.

In recent decades, technologies are extensively known as being critical factors in the SCM due to the ability to improved individual organization and supply chain performance (Jin, 2006). Therefore, firms exploiting innovative technologies to direct access to international markets as a boundless business (Jacques, 2012) to sustain competitive advantage (Chan & Qi, 2003). Besides, information technology (IT)

capability has been strong moderating effect upon the relationship between service innovation and supply chain performance (Tsai, 2010). Furthermore, prominent role of IT personnel for the reengineering project is crucial to avoid the efforts being failure (Motwani et al., 2000). For instance, IT personnel provide new technology application training for employees at the right time to avoid shortage of trained personnel that can affect supply chain performance.

In modern business climates, firms have survived by endlessly increasing competition and economy globalization (Agami et al., 2012). Generally, IT has made dramatic different in productivity and service level. In today market, IT application has created a very powerful distribution network in achieve customer's satisfaction which able to find everything under the same roof such as fresh products, consumer products, apparel, and electronic products (Jesus & Rocio, 2011). The good relationship with customer is crucial to achieve their requirements and expectations. Besides, IT applications are popular and it has been proven that able to cut cost, improved services, enhanced supply chain partnership (Jonsson & Gunnarsson, 2005), allow direct link to suppliers or customers (Lockamy & McCormack, 2004a), reduced production cost, shorter lead time, and minimized inventory level (Agami et al., 2012).

In the boundless business environment, businesses are faced an increasing customers pressure in product customization, quality enhancement, and demand responsiveness more than ever (Agami et al., 2012; Leng & Zailani, 2012). In the past, businesses looked only internal improvement and reduced waste, but nowadays, businesses look external of the firm to get ways to become more efficient. Therefore, continue improvements on internal and external operations are necessarily for continuous improvement. Socio Economic and Environment Research Institute (2007) noted that

the low labor costs were crucial for textile and apparel organization, but the other factors are likewise significant such as availability of human capital, employee skills and productivity, infrastructure capability, dependability of suppliers, costs and capital, business environment, and proximity to markets.

The smooth and accurate information flows from upstream and downstream in the textile and apparel supply chain be essential to enhance the overall supply chain performance (Li, Lin, Wang, & Yan, 2006). Besides, information sharing with trading partners is likewise significant (Chan & Chan, 2009; Fawcett, Osterhaus, Magnan, Brau, & McCarter, 2007; Hsu, Chiu, Chen, & Liu, 2009; Kharazi, 2011; Kocoglu, Imamoglu, Ince, & Keskin, 2011; Watanarawee, 2010; Yee, 2005; Yu, Yan, & Cheng, 2001; Zhang & Cheung, 2011). In twenty-first century, supply chain technology is necessary to support information sharing (Beske, 2012). Beske (2012) noted that supply chain was not the one-way street. Thus, the emphasis on upstream and downstream flows of information and material is notable. As Tseng et al. (2011) and Wu, and Nguyen (2011) suggested that the data should get from various fields to become competitive. Furthermore, one of the ways to achieve an agile response to market uncertainty was depended on the supplier partnership to provide quality material and flexible in supply (Christopher, 2000).

Christopher, Lowson, and Peck, (2004) pointed out that commercial success or failures in apparel markets are largely determined by the organizational culture capability such as flexible and responsive to rapid change in demand. The study of Christopher et al. (2004) revealed that organizational structures and forecast were not sufficient to meet the challenges of demand uncertainty. Instead, an agile organization and agile supply chain are required to drive the supply chain. This is because today's textile and

apparel's fashion marketplace is greatly competitive and has been characteristics as short life cycles, tremendous product variety (Sen, 2008), high volatility (Ma & Zhang, 2009), low predictability (Lam & Postle, 2006), high impulse purchasing (Christopher et al., 2004), unclear market boundaries, non-linear direction (Beske, 2012), and enormous number of finished product codes (Ma & Zhang, 2009). Therefore, textile and apparel supply chain must focus on three importance lead times, which is time to market, time to response, and time to serve to be competitive (Christopher et al., 2004).

1.1.3 Gaps and Thesis of the Study

This study investigates gaps from a multidimensional perspective that explains the impacts of several factors on supply chain performance. Basically, the gaps and the thesis of the study could be viewed in the following statements.

Notwithstanding the development of SCM practices, there are only a few empirical studies of SCM in Malaysian textile and apparel industry (Cooper, 2006; Ma & Zhang, 2009; Wang & Zhang, 2009; Ramayah et al., 2013). Moreover, the adoption of SCM in Malaysia's textile and apparel industry has not been broadly explored. Over the most recent couple of years, the area has attracted growing attention from researchers, few studies were found in Malaysia (Ramayah et al., 2013), United States (Jin, 2006; Sen, 2008; Cooper, 2010; Dickson, Waters, & López-Gydosh, 2012), New York (Doyran, 2013), United Kingdom (Purvis, Naim, & Towill, 2013), Hong Kong (Lam & Postle, 2006; Ning, 2006; Pan et al., 2006; Chen & Fung, 2013), Taiwan (Tseng et al., 2011), European (Germany & Partners, 2007), Korea (Kim, 2013), China (Ngai et al., 2012; Cooper, 2013; Li, Zhao, Shi, & Li, 2014), South African (Moodley, 2003),

and Vietnam (Tseng et al., 2011). Besides, most of the SCM researchers were focused on manufacturing industry (Ramayah et al., 2008; Chong, Lin, Ooi, & Raman, 2009; Sukati, Hamid, Baharun, & Yusoff, 2012), since it is more competitive. As a matter of fact, studies analyzing the supply chain capabilities on Malaysian textile and apparel supply chain performance are lacking. Thus, this is an important area for research.

The new business competition is no longer between firms, but between supply chains (Deshpande, 2012; Prajogo & Sohal, 2013). This increases the complexity of the supply chain. A complete supply chain necessitates the involvement of all partners in the chains to hold the key of competitiveness (Beske, 2012). Following the trend, the organizations are likely to see the result in supply chain performance instead of organizational performance, since it has positive effects on organization performance (Green Jr et al., 2006, 2008; Deshpande, 2012; Qrunfleh & Tarafdar, 2013). Besides, nowadays, the organizations switched their focus from finalcial performance to operation performance (Gligor & Holcomb, 2012a). As the organization believed that the operational performance is a positive link to financial performance (Qrunfleh, 2010). Thus, the organizations are more interested to know the factors that can improve the supply chain operational performance. As the supply chain capabilities have been widely used for the assessment of organization performance (Quah, 2010) and hence, it should be applied and tested on supply chain operational performance which is the gap that attempting to fill by present study.

In addition, the development of supply chain technology in relation to SCM has significant improvements in the recent years and it has been considered as a mainstream for performance improvement (Ma & Zhang, 2009). Therefore, more and more organizations adopt supply chain technology in their supply chain operations

(Porter, 2001; Ramayah et al., 2013). However, in terms of supply chain technology adoption, the textile and apparel industry is behinds other industries and yet to reach a much desired level (Jolly-Desodt, Rabenasolo, & Lo, 2006; Ramayah et al., 2013). Moreover, the deployment was slower than expected (Harland, Caldwell, Powell, & Zheng, 2007; Ngai, 2010) and not equilibrated in textile and apparel industry (Ma & Zhang, 2009). Nevertheless, the useful, potential, and great impact of supply chain technology should not underestimate (Ngai, 2010). To the best of the authors' knowledge, to date, there has not much evident research has been conducted to pursue successful adoption of supply chain technology pertaining to the performance of textile and apparel supply chain (Ma & Zhang, 2009). Therefore, the role of supply chain technology adoption has been controversial and remain disputable. Some studies have been observed the dependent, independent, and moderating position of supply chain technology in their research framework (Iyer, 2011; Jin, 2006; Kamaruddin & Udin, 2009; Motwani et al., 2000; Ramayah et al., 2008; Tsai, 2010; Vijayasarathy, 2010; Zhang & Wang, 2011), but lack of mediating empirical test was conducted (Lin, 2008; Lin, Huang, & Lin, 2002). Thus, the mediating results are unclear.

Additionally, Lorenzoni and Lipparini (1999) claim that there is insufficient empirical evidence of the link between relational capability and supply chain performance. One of the most significant current discussions in SCM is information sharing. Not all firms are willing and ready to share information with their suppliers or buyers or even internal organizational members in different departments (Li, Yan, Wang, & Xia, 2005). The concerns of the organizations were that confidential information provided might lead to be a threat to them if the data achieved by their competitor (Agus, 2011; Li et al., 2005; Russell & Hoag, 2004; Zhenxin Yu et al., 2001). Thus, most of the

firms do not have the confidence level (Motwani et al., 2000; Thoo et al., 2011) and trust (Neeley, 2006) to share quality information with their supply chain partners. According to Campo, Rubio, and Yague (2010), greater extents of information sharing lead to higher potential performance in SCM, while greater extents of information quality lead to higher performance in SCM. For instance, SCM between United Kingdom retailer and Chinese apparel manufacturers happened translation issues (Lam & Postle, 2006). For that reason, additional research is needed in order to shed further insights on relational capability and supply chain operational performance.

Furthermore, Georgise *et al.* (2012) noted that the lack of well-developed or poor supporting infrastructure is an obstacle for successful supply chain operation and improvement, especially in developing country such as Malaysia (Andel, 1996). Besides, it is a leading cause of failure for supply chain technology adoption and supply chain operation (Andel, 1996; Ghobakhloo & Tang, 2013). Therefore, the network infrastructure must be capable of providing total network available to support supply chain technology application. Magder (2005) has demonstrated this issue by investigated the Egyptian apparel industry accentuated the need to enhance the supporting infrastructure of the country to expand its export rate of industries. However, a study found that some companies in chemical industry are unwilling to apply IT in their operations (Aspengren, 2000). SCM is looking for the complete chain, so there has no success if one of the supply chain partners failure in adoption. From this context, IT personnel, IT knowledge, and IT reconfigurability of the employee was crucial importance in improving supply chain performance and avoid unnecessary disturb in operation (Jain, 2007). Hence, additional research is necessary in order to shed further insights on firm's IT capability and supply chain operational performance.

Likewise, adopting supply chain technology without an organizational cultural preparation or mind set will fail to yield a standard performance (Xiao, 2008). Thus, the equilibrating of power between the parties concerned and the level of human involvement become the limitations of the supply chain technology adoption (Brereton, 2004). However, involvement, consistency, adaptability (Xiao, 2008), and innovativeness (Ozkaya, 2011) are crucial for improving operation performance. For instance, Maharashtra Industrial Development Corporation (MIDC) is SME in India which produces food, beverage, textile, leather products, etc. Limited resources, lack of connectivity and skilled labor challenge MIDC to adopt supply chain technology (Georgise et al., 2012). Hence, additional research is required to shed further insights on organizational culture capability and supply chain operational performance.

Last but not least, to date, there has been relatively limited single general accepted model of supply chain technology adoption on supply chain performance in the literature exists (Narayanan, Marucheck, & Handfield, 2009). Kamaruddin and Udin (2009) provided empirical evidence of the relationship between supply chain member capability and supply chain technology adoption. Charkaoui et al. (2012) and Thoo et al. (2011) provided empirical evidence of the relationship between supply chain capabilities and supply chain performance. Besides, Vijayasarathy (2010) provided the empirical evidence of the relationship between technology used in supply chain and supply chain performance. Those studies provided a good framework to understudy supply chain capabilities and supply chain technology adoption, but it lacked a comprehensive operational and management framework that could evolve into supply chain technology adoption in SCM and ultimately contribute to supply chain operational performance. Therefore, this research is targeted to fill the linkage between

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supply chain capabilities and supply chain technology adoption on supply chain operational performance in order to better understand the complex phenomenon of Malaysian textile and apparel SCM.

1.2 Problem Statement

Euromonitor International (2013) reported that textile and apparel industries in Malaysia did not face significant impact during the global economic slowdown in 2012, with witnessed the growth in Malaysia's economy. In 2012, textile and apparel industries remained highly competitive with rising domestic demand and purchasing power toward the branded apparel such as Zara, H&M, Gap, Uniqlo, Levi's, Adidas, Mango, G2000, Vincci, and Padini in Malaysia, but consumers were very cautious in their spending. Therefore, apparel specialist retailers remained highly competitive and be the largest distribution channel for apparel in Malaysia in 2012. This is the reason why increasing number of shopping centers being built. For instance, the newly-opened Setia City Mall contains approximately 230 specialist stores (Euromonitor International, 2013). This explains the culture of Malaysian consumers likes to shop in specialist stores instead of other channels. Therefore, in nationwide, what kinds of supply chain capabilities are important to be competitive, and its effects on performance and the adoption of supply chain technology remained much disputable. These arguments indicate that the supply chain operational performance and supply chain technology adoption in Malaysian textile and apparel industries needs enhancement. Hence, this study will investigate the factors that contribute to supply chain operation performance and the adoption of supply chain technology in Malaysian textile and apparel industries.

Textile and apparel supply chain are facing typical problems which including forecasting errors for fashion items, short product cycle for fashion articles, long production lead time (Lam & Postle, 2006) and high production cost (Islam, Khan, & Islam, 2013). Hence, supply chain capabilities and supply chain technology adoption has been claimed to be potent resources to enhance supply chain performance, which has been well known in many different countries and industries (Lin, 2008; Ma & Zhang, 2009). Although the link is indisputable, but supply chain capabilities and supply chain technology adoption were not beyond reproach and its effect on performance remain debatable. Based on the literatures, the effect of supply chain capabilities on supply chain operational performance is not consistent for every firm, it may effective in one firm and nominal in another (Lin et al., 2002; Lin, 2008; Arumugam & Mojtahedzadeh, 2011). Therefore, there are two main issues relating to the improvement of supply chain operational performance.

First, for the improvement of the supply chain operational performance, supply chain capabilities in terms of relational capability, IT capability, and organizational culture capability would play a major role (Lin, 2008; Braunscheidel, Suresh, & Boisnier, 2010; Ramayah & Omar, 2010; Arumugam & Mojtahedzadeh, 2011; Sukati et al., 2012). Textile and apparel are quick change market due to the fashion trends. In supply chain, relational capability is referred to the ability to concerning the way in which two or more people or organizations or things are connected (Power & Simon, 2004). The prior study conducted by Sukati et al. (2012) stated that supplier partnership, customer relationship, and information sharing were important determinant of supply chain performance, while Li et al. (2006) claim that information quality leads to enhanced competitive advantage. Besides, the empirical evidence stated by the researchers

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supported that the combination of IT infrastructure, IT personnal, IT knowledge (Bharadwaj, 2000), and IT reconfigurability (Xiao, 2008) serve as firm's specific IT capability and thus improving supply chain performance. Moreover, the previous study conducted by Fey and Denison (2003) and Tsai (2010) highlighted that an effective organization should possess high level of organizational culture capability, which consists of involvement, consistency, adaptability, and innovativeness. Hence, improvement in the supply chain operational performance is expected to be explained by supply chain capabilities. However, the nature of the relationships between these elements has not been absolutely understood.

Second, the improvement of the supply chain operational performance also closely related to the supply chain technology adoption (Lin et al., 2002; Naing & Fei, 2015). Supply chain technology adoption is a major concern to developing efficient supply chain (Li, 2007). The role of supply chain technology adoption in SCM has not been fully agreed and thus, remain controversial. There is a relatively insufficient study that examines the mediating role of supply chain technology adoption on supply chain operation performance. It extends the area of investigation, especially for the textile and apparel industries in the developing country (Cooper, 2006; Ma & Zhang, 2009; Wang & Zhang, 2009). The supply chain technology adoption is referred to the used and the usefulness of interconnected electronic applications to generate effective and efficient supply chain operation. In textile and apparel industry, the supply chain technology adoption is an important determinant of supply chain performance (Cooper, 2006; Wang & Zhang, 2009; Naing & Fei, 2015). Therefore, supply chain technology adoption is expected to mediate the relationship between supply chain capabilities and supply chain operational performance. To the best knowledge of the researcher, there

is limited studies have investigated the mediation effect of supply chain technology adoption.

Supply Chain Council (2010) claimed that SCOR model is employed by thousands of companies worldwide which including manufacturers, distributors, retailers, and service provider. However, there has been limited academic study that applied SCOR model in measuring the performance of the supply chain (Fynes, Burca, & Voss, 2005; Kocoglu et al., 2011; Vanichchinchai & Igel, 2011). Jolly-Desodt, Rabenasolo, and Lo, (2006) further suggested that the elements in SCOR model, which consists of reliability, responsiveness, agility, cost, and asset management efficiency are suitable to use to measure supply chain performance that involves the complete supply chain members. Millet, Schmitt, and Botta-Genoulaz (2009) stated that SCOR model could provide multi view in business operational environment. However, the present study is focused on supply chain operational performance instead of financial performance, thus, asset management efficiency is excluded. The empirical studies have shown that the elements in SCOR model were effective in measuring the supply chain performance (Fynes et al., 2005; Kocoglu et al., 2011; Vanichchinchai & Igel, 2011). Hence, the effect of supply chain capabilities and supply chain technology adoption to supply chain operation performance is expected to be explained by reliability, responsiveness, agility, and cost.

As of today, there is still lacked of theoretical support for understanding and explaining the reality or the boundaries of SCM (Halldorsson, Kotzab, Mikkola, & Skjott-Larsen, 2007). Therefore, in summary, the poor performance of the supply chain in textile and apparel industries is expected could be improved through supply chain capabilities and supply chain technology adoption. Research that investigates the link among supply

chain capabilities, supply chain technology adoption, and supply chain performance in textile and apparel industries is still in its early development (Cooper, 2006; Lin, 2008; Wang & Zhang, 2009). Owing to strong competition, high complexity, and uncertainty in the textile and apparel market environment, the present study suggests supply chain technology adoption as the mediating effect, which is expected to influence textile and apparel supply chain operational performance. Therefore, this study is an attempt to examine the link between supply chain capabilities, supply chain technology adoption, and supply chain performance in textile and apparel industries. Subsequently, the supply chain capabilities related to supply chain technology adoption and supply chain operational performance would be identified in order to reached enhancement in textile and apparel supply chain operational performance.

1.3 Research Questions

Based on the research problems, the research questions are addressed. The research questions of this study relate to the relationships of supply chain capabilities and supply chain technology adoption on supply chain operational performance in Malaysian textile and apparel industry. The specific research questions of this study are as follows:

1) What is the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain operational performance?

2) What is the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain technology adoption?

3) What is the relationship of supply chain technology adoption on supply chain operational performance?

4) Does supply chain technology adoption mediating the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance?

1.4   Research Objectives

Based on the research questions, the research objectives are addressed. The general purpose of this study is to investigate the relationships of supply chain capabilities and supply chain technology adoption on supply chain operational performance in Malaysian textile and apparel industry. The specific research objectives of this study are as follows:

1) To investigate the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain operational performance.

2) To investigate the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain technology adoption.

3) To examine the relationship of supply chain technology adoption on supply chain operational performance.

4) To analyze the mediating effect of supply chain technology adoption on the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance.

5) To propose a model by examining the mediating effect of supply chain technology adoption on the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance.

In order to clearly state the linkages between problem statement, research questions, and research objectives, a recapitulation is presented in Table 1.1 as follow.

Table 1.1
Recapitulation of Problem Statement, Research Questions, and Research Objectives

No.	Problem Statement	Research Questions	Research Objectives
1.	Supply chain capabilities are important to be competitive, and its effects on performance remain much disputable.	What is the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain operational performance?	To investigate the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain operational performance.
2.	Supply chain capabilities are important to be competitive, and its effects on the adoption of SCT remain much disputable.	What is the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on SCT adoption?	To investigate the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on SCT adoption.
3.	SCT adoption was not beyond reproach and its effect on performance is remain debatable.	What is the relationship of SCT adoption on supply chain operational performance?	To examine the relationship of SCT adoption on supply chain operational performance.
4.	The role of SCT adoption in SCM has not been fully agreed and remain controversial.	Does SCT adoption mediating the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance?	To analyze the mediating effect of SCT adoption on the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance.
5.	There is still lacked of theoretical support for understanding and explaining the reality or the boundaries of SCM.		To propose a model by examining the mediating effect of SCT adoption on the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance.

1.5   Scope of the Study

This is an empirical study on SCM that concerned on textile and apparel industry in Malaysia. There is a strong possibility that understanding the textiles and apparel industries provide supply chain insights to Malaysia's textile and apparel complete supply chain, including supplier, manufacturer, distributor, retailer, service provider, and customer in Malaysia. Therefore, the total population of 423 organizations in this study is covers all over the country of Malaysia textile and apparel suppliers, manufacturers, distributors, retailers, service providers, and customers listed on the Federation of Malaysian Manufacturers (FMM Directory, 2013) and Malaysia External Trade Development Corporation (MATRADE Directory, 2013), where the targeted respondents are supply chain, planning, and procurement manager (some organizations called them as buyer, purchasing or customer service manager whose are direct deal with customer, supplier, and inventory control) to provide information for this research. Thus, the unit of measure of this study is organization, which range from small to large organization. In this study, there are differences between IT and supply chain technology. The clarification is provided on the following chapter. This scope provides insight for the SCM with the supplement of theories and research framework that would discuss on the following chapters.

1.6   Significance of the Study

This study provides an exclusive theoretical framework intended to assist researchers and practitioners develop a comprehensive understanding of the linkages between supply chain capabilities, supply chain technology adoption, and supply chain operational performance. Therefore, the implication of this study can be divided into two categories, which are theoretical contributions and practical contributions.

1.6.1   Theoretical Contributions

Theoretical contribution can be divided into three sections, namely, empirical contribution, conceptual contribution, and methodological contribution.

1.6.1.1   Empirical Contribution

In terms of empirical contribution, this study would make an original contribution to extent the existing body of knowledge in the area of SCM literature. It offers an empirical analysis of supply chain performance in Malaysian textile and apparel industry through supply chain capabilities, where supply chain technology adoption acts as the mediating factor. After the thorough review of the literature, Malaysian textile and apparel industry has relatively a handful studies in SCM. There are insufficient studies that bridged the gap of supply chain capabilities, supply chain technology adoption, and supply chain operational performance, especially in Malaysian textile and apparel industry. Therefore, this study will contribute to supply chain capabilities, supply chain technology adoption, and supply chain operational

performance literature by investigating a new theoretical approach of supply chain operational performance in a single framework.

1.6.1.2   Conceptual Contribution

In terms of conceptual contribution, this study will be useful for academics. From the theoretical perspective, this study aims to fill the gap of imperfect causal chains of SCM. Therefore, this study will provide a succinct and holistic review of the existing literatures. Several studies have been observed the dependent, independent and moderating position of supply chain technology in their research framework, but there is still insufficient data for mediating position of supply chain technology adoption in SCM. To the best of the author's knowledge, this will be the first research that extents the current body of research in the SCM area by examining supply chain technology adoption as a mediation effect in the relationship between supply chain capabilities and supply chain performance. Besides, the culmination of "Resource Based View", "Diffusion of Innovation", and "Technology-Organization-Environment" theory provides a new concept in viewing phenomenon of SCM in Malaysia textile and apparel industry. In addition, this study proposes a revise framework to explore avenues for further research that could better distinguish the interrelationships among supply chain capabilities, supply chain technology adoption, and supply chain operational performance.

1.6.1.3   Methodological Contribution

In terms of methodological contribution, this study would useful for researchers. From the methodological perspective, this study was mainly employed quantitative research methods with triangulation of research findings through case study to bridge the gap of previous studies on supply chain performance that applied purely a quantitative method. The findings of case study of is used to in-depth explains, interpret, understand, and triangulate the main research findings. This means that all the findings from quantitative survey were validated through semi-structured interview to practitioner or expert in the industry. Besides, based on the rational judgements, the Partial Least Squares Structural Equation Modeling (PLS-SEM) is employed as main analytical tool for this study. A match in time, this study methodologically contributed to the body of knowledge, since most of the SCM study applied Covariance Based Structural Equation Modeling (CB-SEM).

1.6.2   Practical Contributions

In terms of practical contributions, this study will be useful for practitioners. From the practitioner's point of view, this study will be valuable to organization's SCM which includes supply chain managers, supply chain executives, business managers, and owner of an organization as a whole. The result of this study will consequently provide useful and practical guidelines for practitioners while make investment decisions. Besides, this study also helps practitioners understand the resources and conditions required to realize the potential value of their supply chain technology adoption in terms of supply chain operational performance. However, understanding the

relationship between supply chain technology adoption and supply chain performance has long been of interest to researchers and practitioners (Kohli, Devaraj, & Ow, 2012).

The components of the construct that influence supply chain performance found in this study could enhance the ability to understand the complexity of dealing with the textile and apparel supply chain. Furthermore, this study provides a managerial focus to understand current baseline, identify gaps, and provide a managerial framework to improve Malaysia's supply chain competitiveness. This is in conjunction with the needs of Third Industrial Master Plan (2006-2020), textiles and apparel industry have been identified for further development, potential to expand further, and contribute at the highest estimate of annual growth of export, which is 7.80% annually.

1.7   Definition of Key Terms

In social science research, operational definition knows as functional definition that defines something such as variables, terms or objects that used to determine its presence to enable someone to know the specific aspects of construct in a specific study. This study has consisted of five constructs to build up the research framework which including supply chain operational performance as dependent variable, supply chain technology adoption as mediating variable, relational capabilities (which consists of supplier partnership, customer relationship, information sharing, and information quality) as first independent variable, IT capability (which consists of IT infrastructure, IT personnel, IT knowledge, and IT reconfigurability) as second independent variable, organizational culture capability (which consists of involvement, consistency, adaptability, and innovativeness) as third independent variable. However,

in this study, supply chain capabilities noted that consist of relational capability, IT capability, and organizational culture capability. To clarify the language of the present study, several operational definition of key terms are defined as follows:

a)   **Supply Chain Operational Performance**

Supply chain operational performance is defined as the result of systematic, strategic, and efficient coordination of the conventional business functions within and across organization which involve actions and processes associated with transforming material inputs into finished goods (Bharati & Chaudhury, 2006; Christopher, 2011). In the context of this research, four elements which includes, supply chain reliability, supply chain responsiveness, supply chain agility, and supply chain costs are consolidated in measuring supply chain operational performance in order to provide a complete performance measurement throughout the study. Asset management is excluded in the measurement list of supply chain operational performance variable. This is because operational performance does not emphasize financial performance since asset management in the definitions of SCOR model is more to return on investment. In this study, supply chain reliability is defined as the quality of the supply chain in performing and maintains perfect order fulfillment, which deliver needs as per stated requirements. Besides, supply chain responsiveness is defined as the speed of a supply chain provides products, services, or information to members of the supply chain. Furthermore, supply chain agility is defined as the ability to quickly adjust tactics and operations of the supply chain in responses to market changes. Moreover, supply chain costs is defined as the costs associated with operating the supply chain.

b) **Supply Chain Technology Adoption**

Supply chain technology adoption is defined as an interconnected electronic application of hardware or software components used to turn raw data into information or knowledge by which more users adopt the technology as more resources invested increase the usefulness of the technology throughout the supply chain to generate effective and efficient supply chain operations (Mentzer, Keebler, Nix, Smith, & Zacharia, 2001; Singh, 2003; Kamaruddin & Udin, 2009; Henfridsson & Bygstad, 2013). In the context of this research, the adoption refers to the both elements, which includes use and usefulness are consolidated in measuring supply chain technology adoption in order to provide a comprehensive measurement throughout the study. The adoption is not just implementing, but fully utilized the functions of the invested technology. In this study, supply chain technology use is defined as the applications of hardware and software components that used specifically in SCM to generate effective and efficient supply chain operations. While, supply chain technology usefulness is defined as the quality or fact of being useful associated with the applications of hardware and software components that used specifically in SCM.

c) **Supply Chain Capabilities**

Supply chain capabilities is defined as the ability to integrate all activities in the supply chain associated with the information flows and transformation of goods from raw materials to the end user (Handfield & Nichols, 2002). In this study, supply chain capabilities are referring to the relational capability, IT capability, and organizational culture capability.

d)   Relational Capability

Relational capability is defined as the ability to concerning the way in which two or more people or organizations or things are connected (Power & Simon, 2004). In the context of this research, relational capability is operationalized as a set of ability that include supplier partnership, customer relationship, information sharing, and information quality. Supplier partnership is defined as the long term relationship between the organization and suppliers that providing goods or services to the business to achieve significant ongoing benefits. While, customer relationship is defined as the long term relationship between the organization and customers that acquire goods or services from the business to achieve significant ongoing benefits. Besides, information sharing is defined as the extent to which critical and proprietary information of an organization is communicated to a number of people or organizations. In addition, information quality is defined as the degree of excellence of information fits the people or organization's needs.

e)   Information Technology Capability

Information technology capability is defined as the extent of organization's ability to used systems for storing, retrieving, and sending information (Bharadwaj, 2000). In the context of this research, IT capability is operationalized as the extent of organization's ability that include IT infrastructures, IT personnel, IT knowledge, and IT reconfigurability. The core supply chain technology is excluded in IT infrastructure in this study. IT infrastructures is defined as the hardware or software that used directly or indirectly to provide information for users. While, IT personnel is defined as the

people employed in an organization's IT department. Besides, IT knowledge is defined as the IT facts, information, descriptions, or skills acquired by people through experience or education. Moreover, IT reconfigurability is defined as the ability to recombine existing IT resources into new configurations to match with the changed environment.

f)   Organizational Culture Capability

Organizational culture capability is defined as the extent of behavior or pattern of people works in an organization to affect the way of people and groups interacts with each other as well as members in the supply chain (Schein, 2004). In the context of this research, organizational culture capability is operationalized as the extent of behavior or pattern of people works in the organization that include involvement, consistency, adaptability, and innovativeness. Involvement is defined as the act of employees takes part or participates in something. While, consistency is defined as the ability of employees to remain the same behavior, attitude, or quality of work. Besides, adaptability is defined as the ability of employees to copes with unexpected disturbances in the environment. In addition, innovativeness is defined as the ability of employees to apply new approach or new ways of doing things to meet new requirements, inarticulate needs, or problem solving.

1.8 Organization of Thesis

In research, often referred to two broad methods of reasoning, which is a deductive and inductive approach. This research is applied deductive approach to organize the study, which is associated with the positivism paradigm, start from development of theory, hypothesis, observation through data and information, and end with confirmation. This study consists of seven chapters, each chapter can be summarized as follows.

Chapter One is the description of the research overview. This chapter outlines the research background, research problem statement, research questions, research objectives, significance of study, scope of the study, definition of key terms, and organization of the thesis.

Chapter Two is the description of the literature review. This chapter is to shape a theoretical foundation for the research by reviewing pertinent articles and journals to identify research issues, which are value to be research. Besides, this chapter is to provide explanations and justifications for selection of variables in the framework. Moreover, this chapter also provides justification of underpinning theories that supports the theoretical framework.

Chapter Three is the description of the research framework. A theoretical framework and hypotheses are presented in this chapter to proceed with further investigation.

Chapter Four focuses on a better understanding of the research methodology. This chapter covers a discussion of the research design which including survey instrument development, data collection method, techniques of data analysis, and the population and sample use in this study.

Chapter Five is the description of data analysis. This chapter presents the results of this research based on the obtained data. The overall findings from this study will be reported thoroughly and the hypotheses will be completely tested.

Chapter Six focuses on the triangulation of research findings in order to better understanding the research model. The case study has been chosen to best represents the model is illustrated and explained for the purpose of triangulation. It provides validation for empirical findings of this research through the respondents who volunteered to contribute their opinions on the final results.

Chapter Seven attempts to provide a conclusion for this research. In the beginning, it provides a summary of statistical analyses as an overview of this study. It is followed by the discussion of findings, discusses the implications and limitations of the study. Recommendations for further research is provided before the overall conclusion of the entire research objective sets.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive overview of literature pertaining to this study. To build a theoretical foundation on this research, the thorough review of relevant journals and articles is needed. This is to develop a base to identify research issues, which are worth of current research and proceed with further investigation. The first portion discussed the general definition and overview of SCM, and SCM in Malaysian textile and apparel industries. The next portion discussed the overview of supply chain performance with potential variables and the dimensions. Besides, overview of supply chain technology adoption with potential variables and dimensions was discussed in the third portion. The discussions continue with an overview the selected variables of supply chain capabilities and the dimension for each variable. Further, the relationship and interrelationships among supply chain capabilities, supply chain operational performance, and supply chain technology adoption are discussed. Moreover, The underpinning theory of this study is presented as a guide to this study. Lastly, a chapter summary is provided at the end of this chapter as an overview of the chapter.

2.2   Supply Chain Management

The supply chain is an important component of world trade. However, a supply chains itself is not enough; it is more critical to understand its features and the role played by each function in the overall supply chain to work efficiently and effectively (Janvier-James, 2012). Since SCM has been considered as the strategic and systematic coordination of traditional business activities, firms are starting to pay attention to their supply chain to increase competitive advantages (Flynn, Hou, & Zhao, 2010). As the twenty-first century begins, SCM has turned into a significant strategic instrument for firms to reduce costs, but also enable firms struggling to enhance quality, improve customer service, and increase competitiveness (Tan, Lyman, & Wisner, 2002). Supply chain and SCM have played an important role in firm efficiency and have attracted scholars' attention in recent years (Janvier-James, 2012). The real contribution of SCM not only attracted scholars' attention, but also received attention from practitioners.

The concept of SCM is originally derived from the logistical concept since 1950 and matured in 1970 (Habib & Jungthirapanich, 2008). The logistical concept is slowly evolving into the SCM concept and initiated the SCM concept since 1980, and the first publication took place in 1982 (Habib & Jungthirapanich, 2008). The concept of SCM started to emerge in the manufacturing industry since 1985 (Habib & Jungthirapanich, 2008). In the early 1990s, scholars and industry practitioners start to place attention on agile manufacturing (Huan et al., 2004; Cooper, 2006). This is followed by the service industry initiated the SCM in their business operations in 1995 (Habib & Jungthirapanich, 2008). The development and continuing evolution of the SCM role are obvious in the last decade, which gained an incredible attention from both

academics and practitioner's community since 2000 (Chan & Qi, 2003). This has led the SCM to enter the education industry since 2007 (Habib & Jungthirapanich, 2008).

In the twenty first century, SCM has been considered as the most effective operations tools to improved organizational competitiveness. Both agile manufacturing and SCM seem to vary in philosophical emphasis, but the goals of each complements are the same which is to improved competitiveness. Agile manufacturing is emphasized more on partnerships to achieve speed and flexibility in producing goods. While, SCM is emphasis on all aspects which includes quality, speed, flexibility, cost, and asset management. In SCM, the integration of suppliers and customers are crucial to achieve great values (Gunasekaran, Lai, & Cheng, 2008). In short, SCM becomes a popular management tool in helping organizations to improve their performance through the ultimate goal of SCM which is waste elimination and increased efficiency. The evolution of SCM is illustrated in Figure 2.1.
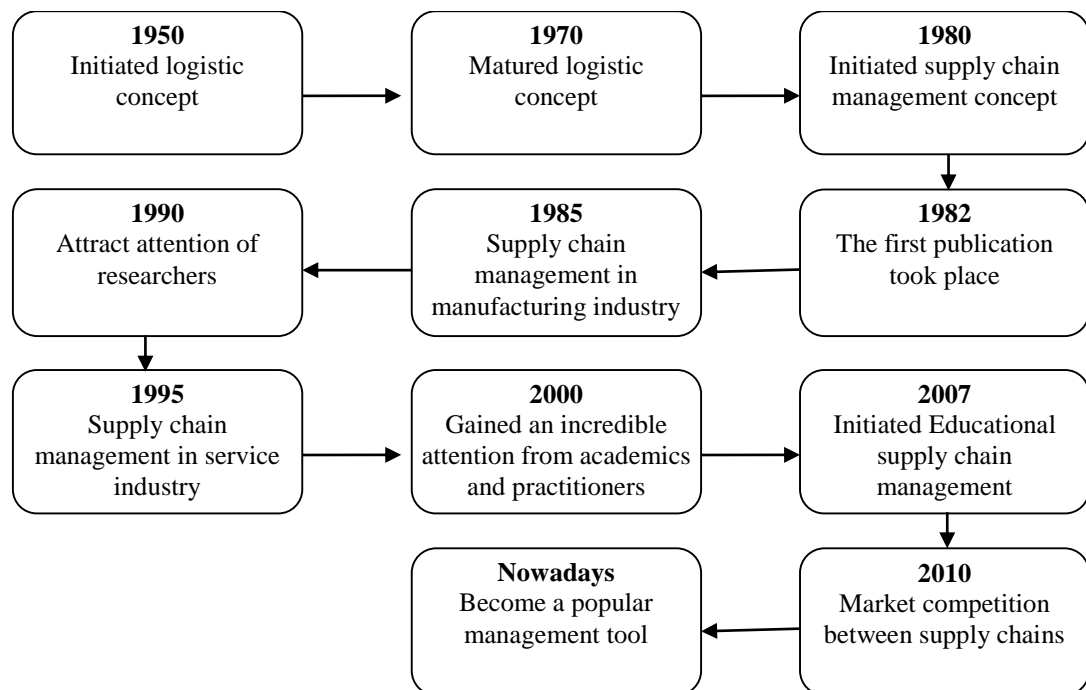
Figure 2.1
The Evolution of Supply Chain Management
Source. Adapted from Habib and Jungthirapanich (2008)

As an introduction for SCM's professional organization, in 1963, Council of Supply Chain Management Professionals (CSCMP) was originally known as the National Council of Physical Distribution Management (NCPDM). It focuses on the physical distribution which integrated transportation, warehousing, and inventory. It is non-profit association that offers guidance in the development, design and improvement in professions of physical distribution. To broaden the focused of physical distribution to logistic management, NCPDM has been recognized as Council of Logistics Management (CLM) in 1985. CLM stayed that way until 2004 and become CSCMP in 2005 that focusing on the broad emphasis on the entire supply chain which includes procurement, manufacturing operation, sales, and marketing functions rather than just logistic management (Council of Logistics Management, 2010).

Supply chain is an organizations network that associated corporate activities and coordination within and between organization to create value for customer (Kumar, 2001). An effective SCM enables firms to make informed decisions in supply chain function, which start from procurement of materials for manufacture to become products and then distribute the products to final customer (Boubekri, 2001). SCM grows within and across organizations by the information flow to truly support the real time communication (Boubekri, 2001). IT applications such as internet, intranet, and extranet based tools are becoming essential for firms to optimize the materials flow and information flow in the entire supply chain (Boubekri, 2001). The extended supply chain network moves beyond the individual firm to inter-organization functions, including suppliers, customers, trading partners, service providers, retailers, manufacturers, and transporters.

SCM is a critically significant strategy for today's highly competitive, turbulent, unpredictability, and dynamic business environments (Rabelo, Helal, & Lertpattarapong, 2004). Organizations are now extremely exploring the potential of SCM concept to get their products to market in minimum time and lower total cost, meanwhile enhanced total quality, increased customer service, and greater profit (Boubekri, 2001). It enables coordinating and controlling of material flow and information flows throughout the business process from sources to customers wherein gets the correct product to the right place at the minimum cost with minimum inventory while offers greater customer service and shortens lead times (Boubekri, 2001). Thus, in twenty-first century, SCM is a crucial and significant strategy to success in the global markets (Gunasekaran et al., 2008).

In the recent years, implementations of SCM paradigm and technology are one of the effective operation strategies to improving flexibility and responsiveness (Fasanghari, Mohammadi, Khodaei, Abdollahi, & Roudsari, 2007). Select the right supply chain technology to support business operations is the key for gaining competitive advantages. Thus, the supply chain technology is opening new doors for supply chain members, including suppliers, customers, trading partners, service providers, retailers, manufacturers, and transporters to optimize the value of the supply chain by create and develop a virtual enterprise more efficiently and effectively as well as lower cost than ever before (Boubekri, 2001). By having the supply chain technology, organization seeking to efficiently improve their operation by emphasis on the SCM instead of traditional cost cutting approach (Boubekri, 2001).

Mentzer et al. (2001) noted that supply chain complexity can be categorized into three, namely (1) direct supply chain, (2) extended supply chain, and (3) ultimate supply chain. Direct supply chain is the most simple types with a supplier, an organization, and a customer in business operations as shown in Figure 2.2. While, extended supply chain involves supplier's supplier and customer's customer in the business operations as shown in Figure 2.3. Ultimate supply chain is complex in nature and it involves the ultimate supplier and the ultimate customer in business operations as shown in Figure 2.4.

| Supplier | ↔ | Organization | ↔ | Customer |
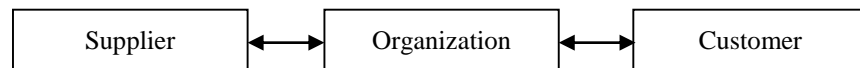
Figure 2.2
Direct Supply Chain
Source.   Adopted from Mentzer et al.(2001)

| Supplier's Supplier | ↔ | ... | ↔ | Supplier | ↔ | Organization | ↔ | Customer | ↔ | ... | ↔ | Customer's Customer |
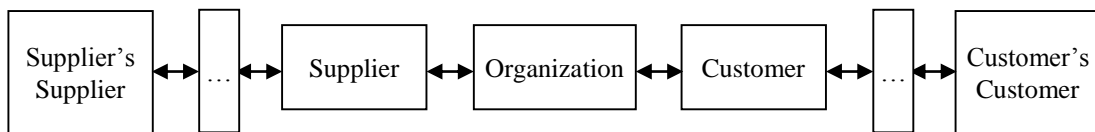
Figure 2.3
Extended Supply Chain
Source.   Adopted from Mentzer et al.(2001)
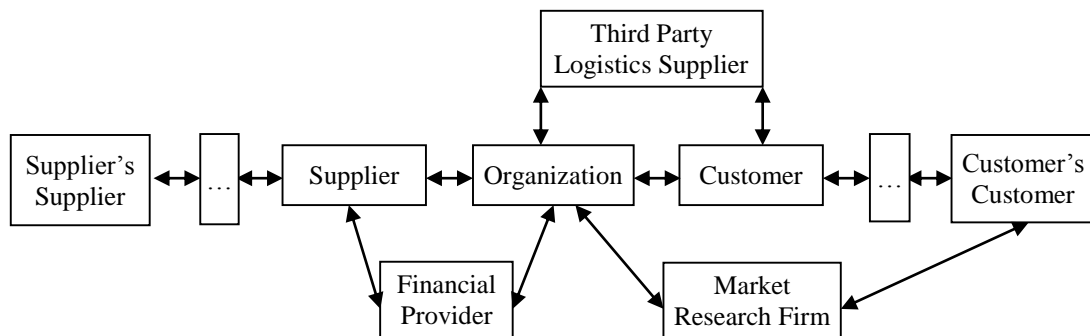
Figure 2.4
Ultimate Supply Chain
Source.   Adopted from Mentzer et al.(2001)

Rather than complexity of the supply chain, the supply chain also can be viewed from it internal or external operations. As illustrated in Figure 2.5, an internal supply chain is a part of an external supply chain. Hence, SCM manages business activities and relationship internally within an organization with purchasing and supply management, production, and distribution and logistics management; and externally within the supply chain with suppliers and customers along the supply chain (Tan, Kannan, & Hanfield, 1998; Tan, 2001; Bratić, 2011).
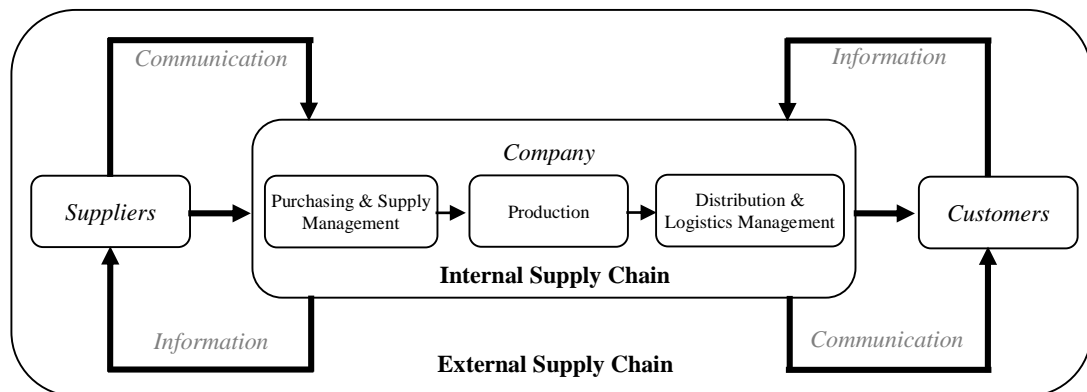
Figure 2.5
Internal and External Supply Chain
Source.   Adapted from Bratić (2011) and Tan et al. (1998)

In current business environment, the utilization of supply chain technologies functions in business operation is becoming general and widely held. It benefits has contributed to organization's supply chain performance with the efficiency and effectiveness in business operation. To visualize the overall process flow and basic concept of current SCM, Figure 2.6 is presented. As the figure shown, recent SCM involved all the complexity, external, and internal supply chain concept and supply chain technology functions as well in efficiently and effectively manage the business activities
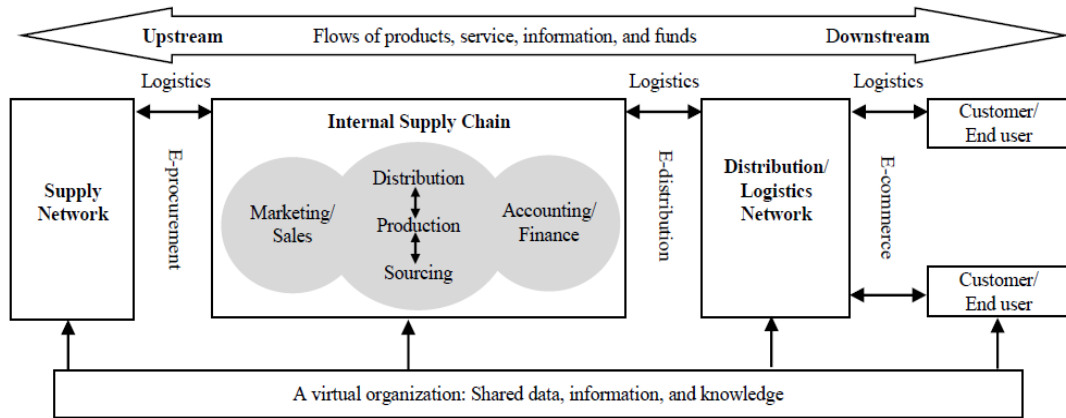
Figure 2.6
Conceptual Framework of Supply Chain Management
Source.   Adopted from Li (2007)

Commonly, SCM must involve several terms, which included raw material extractor, supplier, manufacturer, distributor, transportation, logistics, wholesaler, merchant, retailer, customer, and end user. For easier understanding, Tan (2001) lists three simple description for SCM. Tan (2001) stated that public can understand SCM as (1) the purchasing or supply activities of a manufacturer, (2) the logistics and transportation function of the retailers and merchants, and (3) all the value added activities from the raw materials' supplier to the end users. In simple words, the goal of SCM is to be process efficient and cost effective through collaborative efforts over the whole system. The extent of SCM comprises firm's activities from the strategic level through the tactical and operational levels since the efficient integration of suppliers, manufacturers, wholesalers, retailers, and end users are take into account (Li, 2007). There are various descriptions or definitions of SCM from the professional organizations and scholars are discussed in the following portions.

2.2.1 Definition of Supply Chain Management

Several definitions of SCM have been offered by numbers of researchers or associations in recent years. The CSCMP defines SCM as,

> *"SCM encompassing the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities which includes coordination and collaboration with channel partners such as suppliers, intermediaries, third-party service providers, and customers. In essence, SCM integrates supply and demand management within and across companies."*

Based on the understanding, the primary responsibility of SCM is integrating major business functions and business processes such as manufacturing operations, marketing, sales, product design, finance, and IT within and across companies.

Asian Council of Logistics Management (ACLM, 2011) defines Logistics Management as,

> *"the process of planning, implementing and controlling efficient, effective flow and storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."*

According to CSCMP, logistics management is part of SCM and it is used to integrates, coordinates, and optimizes all logistics functions such as sourcing and procurement, production operation, customer service, fleet management, inbound and outbound transportation management, material management, warehousing, inventory

management, order fulfillment, logistics network design, demand planning, and supply planning. In addition, it is also involved all levels of planning and execution, which are strategic, tactical, and operational (CSCMP, 2013).

The Association for Operations Management (APICS, 2013) defines the SCM as,

> "*the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally.*"

Within the logistics discipline, SCM can be defined as the integration of intra-organization and inter-organization major business activities that add value to customers and end users (Bechtel & Jayaram, 1997; Cooper, Lambert, & Pagh, 1997).

Other than the definition provided by SCM associations, several researchers also contributed their knowledge in this area. Cooper and Ellram (1993) define SCM as "*an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user*". Subsequently, Mentzer et al. (2001) reach another conclusion for the definition of SCM. They defined SCM as an interconnected business network involved in the delivery of products and services ordered by the customer instead of managing the flows of information. Thus, they argued that the term should be supply network management rather than SCM, since the system usually comprises of numerous suppliers and customers. Meanwhile, Heikkila (2002) suggested that SCM had to term as demand chain management in order to reflect the reality which the chain is driven by the demand from end users. However, there are a variety of terms

suggested by different researchers, but the most suitable and official term has remained the same which is SCM.

Ayers (2002) and Handfield and Nichols (2002) describe a supply chain as flows of goods and information within and across organizations from raw materials to end users. Besides, Wieland and Wallenburg (2011) explained SCM as a system of organization, people, technology, activities transformed, information, and resource involved in moving goods from suppliers to customers. Likewise, supply chain activities transform the natural resources, raw materials, and components into completed products. The finished goods or used products might return to the chain at any point where the remaining residual value is recyclable. Lummus and Vokurka (1999) conclude that the definition of SCM can be defined as all the activities involved in delivering a product from raw material to the end customer and the processes are monitored by information systems across all channels. The activities include sourcing and procurement, manufacturing processes, warehousing and inventory management, order management, and distribution.

Cooper and Ellram (1993) point out that supply chain can be characterized as a system wide inventory reduction, cost efficiencies, time horizon, information sharing and monitoring, coordination, and joint planning. While, Huan, Sheoran, and Wang (2004) suggested that SCM can be categorized into three levels, which are operational, design, and strategic. Operational SCM is concerned to daily operation with ensures that customer satisfied by the most profitable way. In the meantime, design SCM is concerned about the location of decision spots and the objective of the chain. While, strategic SCM is to enable business managers to make strategic decisions with goal development in the supply chain.

From the above discussion, the definition provided by Udin (2004) can be considered as a simple and comprehensive understanding on the concept of SCM and best-described it as,

> *"all activities, processes, entities, material, financial and information flows in the integrated network which consists of providers (suppliers), transformers (original equipment manufacturers) and receivers (customers) with the objectives to improve customer satisfaction, delivery and quality of products, and to reduce costs in the cooperative and collaborative environment."*

Based on the aforementioned discussions, a comprehensive definition of the SCM is proposed. SCM can be defined as "all the activities including processes, entities, material, financial, and information flows in delivering product from raw material to the final customer through the integrated functions of supply chain technology adoption that span from internal organization to external trading partners of suppliers, manufacturers, wholesalers, retailers, and service providers with the objectives to improve supply chain reliability, responsiveness, agility, costs, and asset management in the cooperative and collaborative environment."

2.2.2   Supply Chain Management in Malaysia

Today's supply chains are likely to respond promptly, rapidly, efficiently, and effectively to the changes, volatile, and turbulence in the marketplace to achieve, succeed, and sustain competitive advantage in the new edge of business environment that is more global, customer driven, and technological oriented by focusing on

reliability, responsiveness, agility, and costs of the supply chain. There are many SCM studies have been conducted in Malaysia. The trends showed that SCM has provided many benefits to the supply chain or organization. Especially in recent years, firms have utilized supply chain to move their business over the world to become globalize in order to achieve customers' satisfactions with high quality products and cost effective delivery (Lam & Postle, 2006; Crinis, 2012).

2.2.3 Supply Chain Management in Malaysia Textile and Apparel Industry

As a brief introduction for textile and apparel industry, textile and apparel are basic consumption items in both developed and developing countries. According to International Monetary Fund's World Economic Outlook Report (2012) and Naing and Fei (2015), the developing countries such as China, India, Bangladesh, Vietnam, Indonesia, Cambodia, and Myanmar have gain cost advantage than developed countries due to low wage rates labours. However, Malaysia no longer provides low wage rates labour with the emergence of China and Indochina. In Malaysia, the sector has extensive experience as a producer of world known brands such as Brooks Brothers, Ralph, Kohl's, Calvin Klein, Alain Delon, Gucci, Polo, Lauren, Adidas, Nike, Yves St Laurent, Walt Disney, Reebok, Puma, GAP, Oshkosh, Burberry, Ashworth, etc. Those brands are manufactured by Malaysia's contract manufacturers, while Somerset Bay, East India, Seed, Anakku, etc. are warm up to venture oversea (Seong, 2007). Some of the brands such as H&M, Zara, Gap, Uniqlo, Topshop, Forever 21, Mango, Wet Seal, Benetton, New Look, Esprit, C&A, etc. are known as high responsive fast fashion retailers that offer fashionable apparel at affordable price (Caro & Martinez-de-Albeniz, 2014; Mo, 2015).

MATRADE (2013) noted that there are three textile and apparel industries' associations in Malaysia which is Malaysia Textile Manufacturers Association (MTMA), Malaysian Garment Manufacturers Association (MGMA), and Malaysian Knitting Manufacturers Association (MKMA). The textile and apparel industries in Malaysia are recognized as international standard for their quality, reliability, and prompt delivery. Moreover, with the unique benefits of multiconfessional country whose Islam as the official religion, Malaysia is currently known as a producer of fashionable Islamic apparels (MKMA, 2013). These are the reasons why textile and apparel companies managed to sustained operation even the economic slowdown in 2009 with impact (Musa, 2010).

According to MATRADE (2013), the structure of Malaysian textile and apparel industries can be classified into two main sectors, which are upstream and downstream. In the initial stage, upstream consists of fiber, yarn, fabric, and wet processing activities, while downstream consists of apparel, textile products, home textiles, and clothing accessories. However, in the recent year, the industry has covered a board range of activities, including spin, knit, weave, dye, print, silk screen, and embroidery. The textile and apparel that made in Malaysia were illustrated in Table 2.1 as following.

Table 2.1
Made in Malaysia's Textile and Apparel Goods

Textiles	Apparels
- Fibers - Yarns (cotton yarn, CVC yarn, polyester/ cotton yarn, polyester/ rayon yarn, spun polyester yarn, texturized nylon yarn, polyester filament yarn, acrylic yarn, acrylic/ wool blended yarn, worsted and woolen yarn, cotton coarse yarn) - Special yarns, textile fabrics and related products - Woven cotton fabrics - Fabrics woven of man-made textile materials - Knitted or crocheted fabrics - Tulles, lace, embroidery, ribbons, trimmings and other small wares - Floor coverings (carpets and rugs) - Home textiles (bed linen, table linen, towels) - Industrial textiles (ropes, cords, car seat fabrics, geo-textiles, dryer fabrics and press belt)	- Jackets - Overcoats - Skirts - T-shirts - Blouses - Pants - Undergarments - Scarves - Handkerchiefs - Headgear (caps and hats) - Textile accessories (zippers, buttons, sewing thread, industrial thread, embroidery thread, drawstrings, labels, laces, embroidered articles, collars, cuffs, hooks and eyes, tape, polyester padding, interlining, Velcro tape, cotton tape and narrow fabric)

Source. Adopted from MATRADE (2013)

According to Malaysian Investment Development Authority (MIDA) (2012), textile and apparel sector are classified as manufacturing industry in Malaysia. Like other countries, the manufacturing industry significantly contributes to the economy, society, and technology of Malaysia. Based on the figure provided by Department of Statistics Malaysia (2013), Malaysia's economy registered growth of 5.6% which Gross Domestic Product (GDP) in current term posted a value of RM941.2 billion in 2012 as shown in Figure 2.7 spearheaded by the service and manufacturing sectors as shown in Figure 2.8.
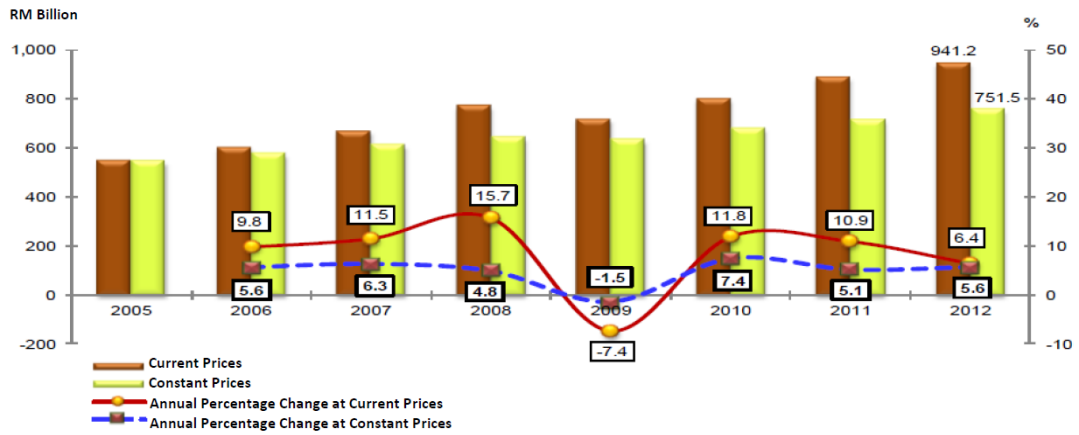
Figure 2.7
GDP and Annual Percentage Change
Source.   Adopted from Department of Statistics Malaysia (2013)
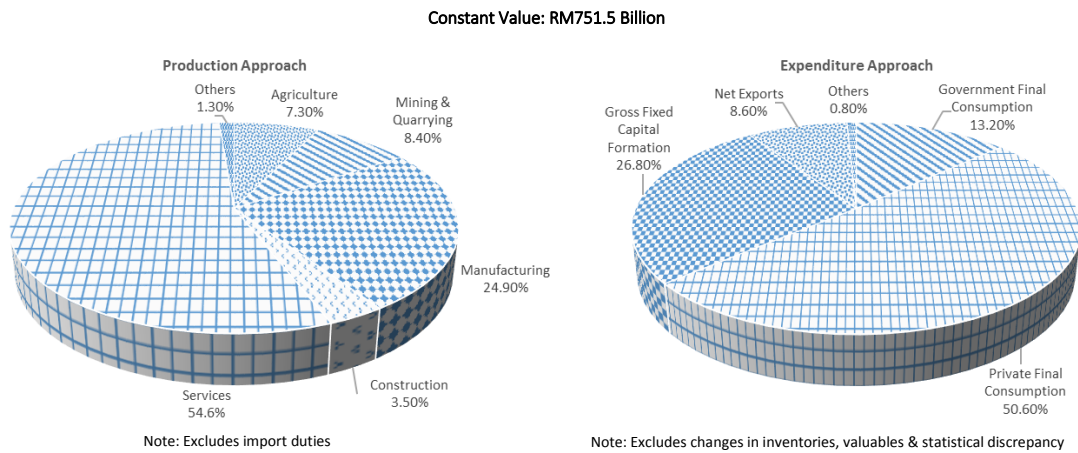
Figure 2.8
Percentage Share at Constant 2005 Prices, in 2012
Source.   Adopted from Department of Statistics Malaysia (2013)

Manufacturing sector rose to 4.8% in 2012, an improvement from 4.7% recorded in

2011. As depicted in Figure 2.9, all the sub-sectors posted positive growth, specifically,

textile and apparel products accounted for 1.7% to the growth of the manufacturing
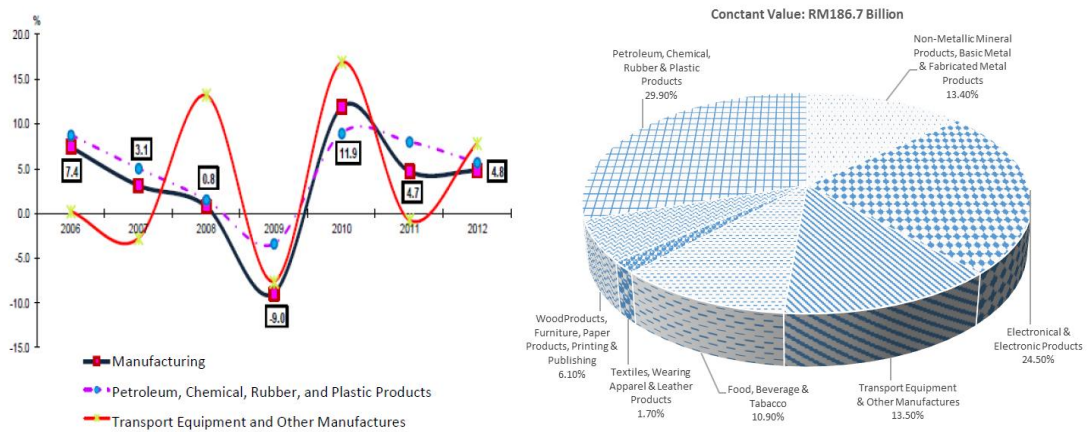
sector.

Figure 2.9
Annual Percentage Change and Percentage Share at Constant 2005 Prices in Manufacturing Sector
Source.   Adopted from Department of Statistics Malaysia (2013)

According to MATRADE (2013), textile and apparel sectors change in strategy from import substitution to export oriented industrialization. The strategy is changed during the Second Malaysia Plan (1971-1975) and led to the positive evolution of the textiles and apparel industry in Malaysia. As reported from MATRADE (2013) and MKMA (2013), the textile and apparel manufacturers had contributed to the growth of the industry in Malaysia which are ranked 11th to export earner and accounted for 1.4% share of Malaysia's total exports of manufactured goods in year 2011. In Malaysia, almost 90% of the apparel exports are from contract manufacturers (Seong, 2007). This is because they maintained a worthy reputation in terms of quality and timely delivery. Thus, it is definitely shown that the exports of textile and apparel were growth 7.9% in 2013, which is from RM9.5 billions to RM10.25 billions as shown in Table 2.2.

Table 2.2
Exports of Textiles and Apparels

Description	2011 Value (RM million)	Share (%)	2012 Value (RM million)	Share (%)	Change (%)	2013 Value (RM million)	Share (%)	Change (%)
Total	**10,805.6**	**100.0**	**9,502.9**	**100.0**	**-12.1**	**10,255.2**	**100.0**	**7.9**
Appael & Clothing Accessories	4,083.8	37.8	3,525.5	37.1	-13.7	3,910.0	38.1	10.9
Textiles	6,721.8	62.2	5,977.3	62.9	-11.1	6,345.2	61.9	6.2

Source. Adapted from MATRADE and MKMA (2013)

In Third Industrial Master Plan (2006-2020), textiles and apparel industry have been identified for further development. This is based on their potential to expand further and contribute at a higher growth of the manufacturing and export's performance. Basically, most of the Malaysia made textile and apparel are exported to United States, Japan, China, Turkey, and Indonesia. The major import markets for Malaysia mainly from China, Taiwan, and Japan (Seong, 2007). Table 2.3 illustrated the exports and investment targets for the 12 targeted manufacturing industries.

Table 2.3
Exports and Investment Targets for the 12 Targeted Manufacturing Industries

Sub-sector	Exports 2006-2020 (RM billion)	Average Annual Growth (%)	2020 Share (%)	Investment 2006-2020 (RM billion)	2020 Share (%)
Total	**11,403.20**	**7.10**	**100.00**	**362.50**	**100.00**
Non Resource-Based	9,202.50	7.10	80.60	232.80	65.30
Electrical and Electronics Products	7,533,90	6.30	65.90	82.40	23.10
Metal Products	514.60	7.60	4.50	44.20	13.60
Machinery and Equipment	494.40	6.40	4.30	30.80	7.70
Textile and Apparel	248.80	7.80	2.10	13.70	3.10
Transport Equipment	232.50	6.30	2.00	42.30	11.60
Medical Devices	178.30	7.60	1.60	19.40	6.20
Resource-Based	2,200.70	7.10	19.40	129.70	34.70
Palm Oil	781.70	7.60	7.00	26.10	7.60
Wood Based Products	545.20	6.40	4.70	25.40	6.20
Petrochemical Products	377.40	6.30	3.30	34.00	9.40
Food Processing	244.60	7.80	2.20	24.60	6.20
Rubber Products	239.00	7.60	2.10	12.90	3.00
Pharmaceuticals	12.80	6.30	0.10	6.70	2.30

Source. Adopted from Ministry of International Trade and Industry (MITI) (2006)

For clearer illustration, Figure 2.10 displayed the comparison between the estimated percentage of exports averages annual growth and investment share among twelve selected industry. It clearly presents that textiles and apparel industry possessed the highest estimate of annual growth of export, which is 7.80% annually from year 2006 to 2020. This means that the industry is potential for further development.
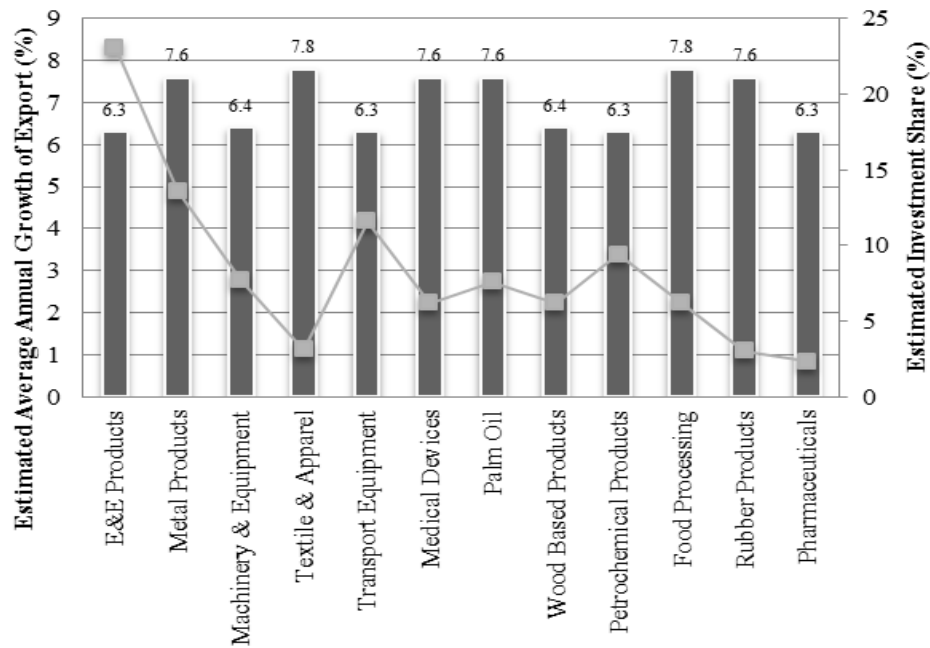
Figure 2.10
Comparison between the Estimated Percentage of Exports Averages Annual Growth and Investment Share among Twelve Selected Industry
Source.   Adapted from Ministry of International Trade and Industry (MITI) (2006)

The Malaysian government still regards textiles and apparel as an industry with potential. According to Third Industrial Master Plan (2006-2020), the local textile and apparel players can seek opportunities from six strategies thrusts which have been drawn up for further development of the textile and apparel industry in Malaysia. In Penang, this industry is one of the top contributors in the economic growth and industrialization process. The industry leaders shared a common view which the key success for this industry is technology (Seong, 2007). Therefore, this study is in line

with the strategy of Third Industrial Master Plan (2006-2020) which focuses on enhancing the adoption of supply chain technologies in manufacturing (i.e., suppliers, manufacturers) and services (i.e., service providers, retailers) sectors to sustain global competitiveness.

The reason of textile and apparel companies in Malaysia relocation, lay offs, and closure is due to the global economic crisis in 2009. The industry expert voiced out that the industry is no longer competitive, which brought new challenges to practitioners to sustain the business (Crinis, 2012). The manufacturers are struggles to survive by increases the level of technology implementation in the industry and offered full package production from factory to retail (Crinis, 2012). Nowadays, textile and apparel industry in Malaysia survives almost totally reliant on contracts from United States and Europe. However, Textile and apparel supply chain is no longer a chain. In information flow perspective, it becomes a net where complicated with an enormous number of small and medium sized companies. In value nets, the business value is generated by all supply chain members who provide different services to a firm (Ma & Zhang, 2009). Successful firms now focused on creating value nets, wherein built a good relationship with supplier and customer with integrated IT systems and real time information (Wang & Zhang, 2009; Shacklett, 2012). Shacklett (2012) has added two aspects successful firms where inventory breakneck speed is one aspect and real time collaboration, knowledge, and information sharing are another aspect that needs to be focused on.

Germany and Partners (2007) pointed out that the challenges of SCM in the European textile industry can be solved through supply chain technology. Time efficiency is one of the key factors for textiles and apparel industry to gain competitive advantage.

Germany and Partners (2007) identified several weaknesses of SCM of this industry. The weaknesses include inaccurate configuration of transport units, and inaccurate inventory that caused by shrinkage, theft, and wrong pickings. Besides, manual verification of deliveries is taken time and may cause errors and inaccurate data, which are differences between data flow and physical process flows. Consequently, lead to wrong, late, inaccurate, and incomplete deliveries to customers. A multitude of additional manual processes have consuming operational processes time. Customer was unable to get real time information about the item's movement and availability from manual work. The potential sales might be lost and the tracking processes might be inefficient and time consuming. Germany and Partners (2007) concluded that supply chain technology adoption can reduce and eliminate a number of the problems encountered in textile and apparel industry. Furthermore, reduce costs, increase sales, and higher quality network of the supply chain. Moreover, data and information accuracy has led to better supply chain transparency and increased supply chain reliability, while reduced manual task and improved operational efficiency.

PricewaterhouseCoopers (PwC) did the survey from 500 participants who are from manufacturing and services industries in 2012, and found six keys of a successful global supply chain (Global Supply Chain Survey, 2013). The findings revealed that the companies that recognized and implemented supply chain strategic have achieved 70% higher performance than ever before. The company focus on delivery, cost, flexibility, outsourcing, visibility, automation and investment in differentiating supply chain capabilities as well as investment in advanced technology to meet the needs of different customer segments has proven to be a winning formula. However, The Sun Online article which reported by Musa (2010) indicates that textile and apparel

companies were not easy to secure loans for technology investments, since local banks had the notion that was a sunset industry.

Nowadays, there are two types of textile and apparel supply chain, which are traditional and modern supply chain (Jolly-Desodt et al., 2006). Traditionally, fabric mills were received information from the apparel manufacturer and subsequently headquarter is interacted with warehouse instead of the distribution center. But, in modern's supply chain which is an example of modern supply chain, the information received from stores were sent by headquarter to fabric mill, apparel manufacturer, and distribution center consistently. Figure 2.7 illustrates the comparison flow of textile and apparel supply chain between traditional and modern's supply chain. As the explanation of Figure 2.11, the structure and information flow of modern's supply chain was centralized, while traditional supply chain was decentralized. It reveals that the adoption of supply chain technology is necessary for current supply chain operation.
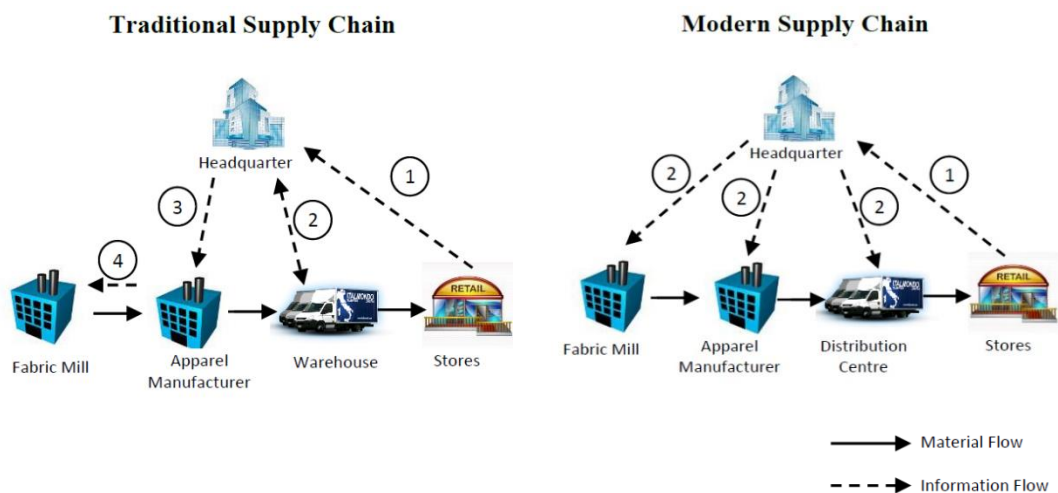
Figure 2.11
The Flow of Textile and Apparel Supply Chain
Source.   Adopted from Jolly-Desodt, Rabenasolo, and Lo (2006).

2.3   Supply Chain Performance

In recent years, the aims of researchers and practitioners towards performance of the supply chain have been increasingly competitive more than ever before which just emphasized on cost minimizations or profit improvements (Chen & Yano, 2010; Watanarawee, 2010). In the new supply chain agenda, there are five steps to achieve supply chain excellent and real value, which included hire the right talent, adopt the appropriate technology, external collaboration, internal collaboration, and managing change in the supply chain (Slone, Dittmann, & Mentzer, 2010). Nowadays, the competition in the market is more on among supply chains, rather than between individual companies. Therefore, effective SCM has become a potent strategy to secure competitive edges in market competitions (Li, Ragu-Nathan, et al., 2006). Subsequently, improving supply chain performance becomes a critical focused for every entity in the market competitions (Agami et al., 2012). The study of Li et al. (2006) indicated that the levels of SCM practices have positive and significant relationship on competitive advantages. Therefore, nowadays, many firms using SCM as their competitive weapons to improving performance (Hult, Ketchen, & Arrfelt, 2007).

Generally, there is different between supply chain performance and organizational performance. Supply chain performance is looking for the intra-organizational and inter-organizational actual output or results, while organizational performance is referred to the intra-organization or individual organizational actual output or results (Huisman & Smits, 2007). The further discussions on supply chain operational performance is as following.

2.3.1 Supply Chain Operational Performance

In nature of resource based view (RBV), performance can be divided into three categories, which are environmental, operational, and financial performance (Shi, Koh, Baldwin, & Cucchiella, 2012). This study focused on supply chain operational performance, since its characterized as having the huge impact for the performance (Li, 2007). Therefore, supply chain environmental and financial performance would not be emphasized on this study, since supply chain operational performance would give positive impact to environmental and financial performance (Simatupang, Wright, & Sridharan, 2002; Shi et al., 2012). Supply chain operations often involve activities and processes associated with transforming raw materials or intermediate components into finished goods (Bharati & Chaudhury, 2006).

Supply chain performance is usually determined in terms of reliability, responsiveness, flexibility, cost, and asset management (Agami et al., 2012). Since this study is focused on supply chain operational performance, thus reliability, responsiveness, flexibility, and cost would become the dimensions in measuring the performance. However, asset management in the definitions of SCOR model is more to return on investment and operational performance is focused on non-financial performance. Therefore, asset management is excluded in the measurement list of supply chain operational performance variables. Basically, the ultimate goal of a supply chain is to efficiently deliver goods and services to customers in minimum time, minimum total cost, and higher quality. It is supported by study of Jacques (2012) and Omar et al. (2006), firms are doomed to failure if they are not aware of the reality of the success factor in the supply chain which is low costs (i.e, supply chain costs), high quality (i.e., supply chain reliability), flexible (i.e, supply chain agility), and quick response (i.e.,

responsiveness). The ultimate goal of SCM also can be summarized as to increase the financial and operational performance of each partner and of the global supply chain (Dominguez, Ageron, Neubert, & Zaoui, 2010).

2.3.1.1   Supply Chain Performance Measurement

The role of performance measurement is essential for both firms and supply chain to improve performance (Bocci & Consulting, 2004). While, performance measurement systems (PMSs) are performance assessment tools that used in stage of monitoring the supply chain performance (Lei, Qiu, & Liu, 2011). Generally, performance measurement can be defined as "*a process of quantify the efficiency and effectiveness of actions*" (Neely, Gregory, & Platts, 1995). Whereas, performance measurement system can be defined as "*a set of metrics used to quantify the efficiency and effectiveness of actions*" (Neely et al., 1995; Lohman, Fortuin, & Wouters, 2004). It is also functions as a key to detecting any potential problems and gaps for improvement in a supply chain. These systems enable users to realize the status of the performance in the supply chain such as strengths, weaknesses, and the levels of current performance in order to allow companies to make informed decisions towards the opportunities and threats. So that organization able to take appropriate actions on the right time (Christopher, 2000) to effectively improve their performance (Nasiri, Davoudpour, & Karimi, 2010; Trkman et al., 2010; Mehrjerdi, 2009; Du, 2007).

Efficiency and effectiveness are used to describe the standard of the performance. Efficiency is used to describe internal standard of performance, while effectiveness is used to describe external standard of performance (Pfeffer & Salancik, 1978).

Efficiency and effectiveness in modern SCM are crucial concerns for firms (Jacques, 2012). According to Ip, Chan, and Lam (2011), effectiveness and efficiency can be measured by six components, which is product reliability, employee fulfillment, customer fulfillment, on-time delivery, profitability, and work efficiency. For example, efficiency is achieved through Just-in-Time production, while effectiveness is achieved through customer or supplier orientation and innovation. However, performance measurement systems are varying substantially from firm to firm (Li, Ragu-Nathan, et al., 2006). Previously, firms' performance measurement concentrated solely on firm's costs and profits. Nowadays, as global demand of goods and services has been languished, firms have been relying on their SCM skills to drive cost out of their supply chains, while improving revenues and quality (Deshpande, 2012).

Firm must be able to establish a performance measurement system that consistent with the goals in their SCM (Thomas & Griffin, 1996), since it is considered as the cornerstones of business excellence (Fisher, Hammond, & Vondra, 2012). The selection of supply chain performance measures became more difficult and challenging to measure effectively, if the complexity of the supply chain kept increasing (Lambert, Cooper, & Pagh, 1998; Beamon, 1999; Sakka, Millet, & Botta-Genoulaz, 2011). This might cause the results of performance measures to become uncompleted and thus, produced inaccurate analyses to firm (Beamon, 1999). The old adage, "*you cannot improve what you are not measuring*" is certainly true for a firm and supply chains as well (Tan *et al.*, 2002). Therefore, the selection of an appropriate performance measurement tool is absolutely vital (Li, 2011), indispensable (Fisher, Hammond, & Vondra, 2012), and a critical step (Beamon, 1999), as it contributes to firm to make the informed decision.

Traditionally, asset management, cost, customer service, productivity, and quality are frequently used performance measures in supply chain functions of purchasing (i.e., sourcing), production (i.e., operations), and logistics (Fawcett, Ellram, & Ogden, 2007). Vinodh, Prakash, and Selvan (2011) noted that the competitiveness in SCM encompasses flexibility, profitability, quality, innovativeness, proactive, responsiveness, cost efficiency, and robustness. Nowadays, many approaches are developed to measure the efficiency and effectiveness of supply chain performance. The often used include game theory, fuzzy theory, balance scorecards, ARIMA model, supply chain operations reference (SCOR) model, and theory of constraints thinking (Agami et al., 2012). Generally, some of the organizations view their supply chain performance in the aspect of environmental, operational, and financial perspective (Jin, 2006; Agan, 2011; Storer & Hyland, 2011). In addition, the performance also can be viewed from two categories which are financial and non-financial performance measures (Mart ńez-Olvera, 2008; Agami et al., 2012). However, the SCOR model is employed in this study (Khare, Saxsena, & Teewari, 2012).

SCOR model encompasses all the activities of all market interactions, customers, suppliers, and material flows (Georgise et al., 2012). It has five keys performance attribute, including (1) reliability refers to delivery and order fulfillment, (2) responsiveness refers to speed, cycle time, and order fulfillment, (3) agility refers to flexibility responding to market, (4) costs containment refers to processing costs, warranty costs, and return processing costs, and (5) asset management refers to inventory, return on fixed asset, and working capital. Scott Stephenes, chief technology officer of the Supply Chain Council mentioned that the main goal of the SCOR model is to enhance competitiveness in three characteristics, which minimize

costs, maximize revenue, and enhance efficiency of asset management (Dibenedetto, 2007). Besides, it can be explained with supply chain relationship level, human, culture, infrastructure, and ICT capability issues (Georgise et al., 2012). Therefore, the component of SCOR model has been chosen to measures supply chain performance in this study with an exception for asset management. This is because of this study is focused on operational performance, while financial performance is not included.

Basically, SCOR model contains three levels throughout the process. Top level is deals with process types. Level two is configuration level and deals with process categories. Whereas, level three is process element level and deals with decompose processes. Besides, it is based on five distinct management processes in textile and apparel supply chain, including (1) plan, (2) source, (3) make, (4) deliver, and (5) return as illustrated in the Figure 2.12.
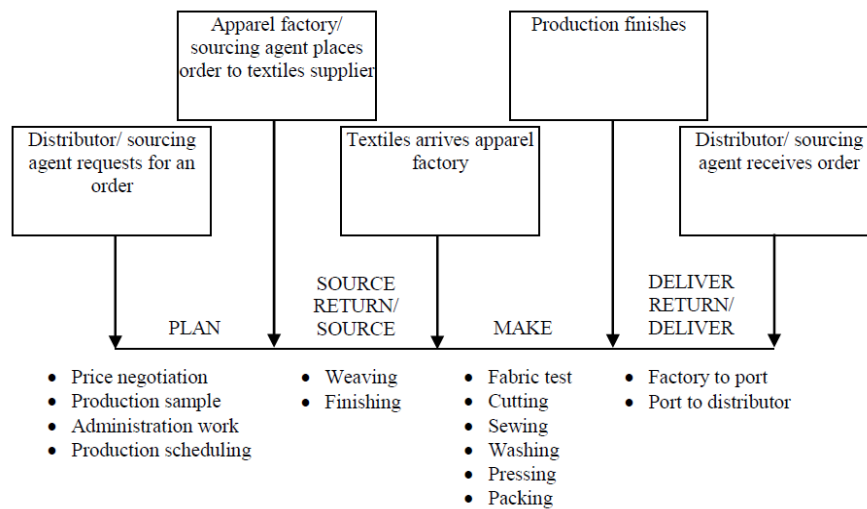
Figure 2.12
Five Distinct Management Processes in Textile and Apparel Supply Chain
Source.   Adopted from Jolly-Desodt, Rabenasolo, and Lo (2006)

Table 2.4 illustrated the definition of dimensions of supply chain operational performance, enclosed with evidence of the literatures that used the same dimension in their studied.

Table 2.4

Definition of Dimensions of Supply Chain Operational Performance

Supply Chain Performance Dimension	Definition	Literature
Supply Chain Reliability	The quality of the supply chain in performs and maintains perfect order fulfillments which deliver needs as per stated requirements.	Fynes et al. (2005), Lin et al. (2005), Tarokh and Soroor (2006), Daley (2008), Betts and Tadisina (2009), Quah (2010), Kocoglu et al. (2011), and Gligor and Holcomb (2012)
Supply Chain Responsiveness	The speed of a supply chain provides products, services, or information to members in the supply chain.	Lin et al. (2005); Tarokh and Soroor (2006), Gunasekaran et al. (2008), Kim (2010), Qrunfleh (2010), Lee (2011), Liu (2011), and Vanichchinchai (2012)
Supply Chain Agility	The ability to quickly adjust tactics and operations of the supply chain in responses to market changes.	Fynes et al. (2005), Wang and Wei (2007), Gunasekaran et al. (2008), Sezen (2008), Betts and Tadisina (2009), Qrunfleh (2010), Ho et al. (2011), Kocoglu et al. (2011), Liu (2011), Gligor and Holcomb (2012), Vanichchinchai (2012), and Gligor et al. (2013)
Supply Chain Costs	The costs associated with operating the supply chain.	Fynes et al. (2005), Lin et al. (2005), Tarokh and Soroor (2006), Quah (2010), Kocoglu et al. (2011), Lee (2011), Liu (2011), and Vanichchinchai (2012)

2.3.1.2 Supply Chain Reliability

There are various understandings of reliability. In general, supply chain reliability can be referred to perfect order fulfillment of the organizations. This can be determined through delivery item accuracy, the time of delivery, documents accuracy, and the perfect condition of the delivered item (Supply Chain Council, 2010). Besides, Vidal and Goetschalckx (2000) provide further explanation on reliability, where the reliable supply chain should delivered products or services within the required timeframe and the conditions as per order stated, and ultimately fulfill the trouble-free function of probability. Therefore, lack of commitment to timely delivery, lack of delivery consistency, customers complain, overall customer dissatisfaction, and overall unreliability are critical failure factors pertaining to supply chain performance (Tarokh & Soroor, 2006).

In quick change, volatile, and turbulence business environment, reliability has become an important key for performance measure in the supply chain operation (Cao & Li, 2008). This is close related to the textile and apparel industry, since the quick changes of fashion trend in textile and apparel needs to be consider during the supply chain operation. Therefore, ensuring supply reliability should be given highest priorities in the modern supply chain (Zaitsev, 2012). This is to enable continuous quality improvement in the supply chain. (Zhang et al., 2011). In this point of view, the reliability is an important dimension for supply chain operational performance, since it can impact on the entire achievement in the supply chain. Thus, the used of the technology is necessary to ensure a functional and reliable system (Kulp, 2002; Eugenio-Gonzalez, Padilla-Zarate, Oca, & Paniagua-Chavez, 2009).

2.3.1.3 Supply Chain Responsiveness

In 1984, textile industry research program in US has started the quick response movement (Christopher et al., 2004). In a rapidly changing market environment such as textile and apparel market, responsiveness is one of the critical determinants to significantly improve supply chains performance (Sen, 2008; Sinkovics, Jean, Roath, & Cavusgil, 2011). Therefore, firms need to faster respond to customer requirements in order to be competitive in today's quick change markets. In the meantime, technological support is required to achieve higher levels of customer responsiveness with stringent time and quality targets (Christopher et al., 2004). Generally, supply chain responsiveness is led to minimized costs, increased speed and improved flexibility (Gunasekaran et al., 2008). To achieve supply chain responsiveness, a suitable and effective adoption of supply chain technology is crucial and desirable to assure the effective communication and efficient material flow along the value chain (Gunasekaran et al., 2008).

From an operation's standpoint, understand customer needs and high responsiveness is needed to benefited firms in achieving higher performance (Jin et al., 2005). However, several studies showed that manufacturer in fashion apparel industry was not fully efficient in quick response such as dissatisfied response time and lack of response accuracy (Iyer & Bergen, 1997; Tarokh & Soroor, 2006; Ramesh & Bahinipati, 2011). Nevertheless, the latest study of Caro and Martinez-de-Albeniz (2014) showed that high responsive supply chain has led the increasing number of fast fashion organizations emerging in the fashion market.

To achieved higher responsiveness in the supply chain require practices from various aspects such as sharing information, established good relationships with supplier and customer, partner involvement, and adoption of supply chain technology (e.g., RFID, EDI, CAM, CAD), electronic point of sale, and automatic replenishment systems (Ma & Zhang, 2009). The study of Ma and Zhang (2009) noted that traditional approach for apparel business is totally depended on market demand forecasts, in fact, the forecasts never accurate enough because customer demand is kept changing at all the time. Therefore, in order to be responsive to customer demands, the strategy should change from demand forecast to demand driven. The speed or time to market was a fundamental way and competitive weapon in fashion markets.

2.3.1.4 Supply Chain Agility

In recent years, the attention and focused of researchers and practitioners have been growing to supply chain agility, since the products and services are driven and defined by customers (Ping & Debin, 2010; Gligor et al., 2013). Agility can be defined as the flexibility and adaptability to react quickly and rapid shifts in supply and demand changing (Jin et al., 2005; Hult et al., 2007). There are differences between agile and lean. Agile is characterized as flexibility, low in prediction, market sensitive, and able to works in rapidly varying demand with high product variety, while lean experts in huge production, but low product variety and needed predictable environments (Christopher, 2000). In the early 1990s, agile manufacturing was proposed and implemented to meet customers' rapidly varying demand through flexibility and reconfigurability (Gligor & Holcomb, 2012a). Flexibility is "*a manufacturing systems'*

ability to adjust to suit customers' preferences", while reconfigurability is "*the ability to adjust to meet changing demands*" (Luo, Zhou, IEEE, & Caudill, 2001).

The study of Jin et al. (2005) revealed that agility can be achieved through the integration of all available resources in the supply chain, including technology, people, and organization (Jin et al., 2005). Meanwhile, supplier partnership is crucial importance to achieve the agile response in rapidly varying market demand (Jin et al., 2005). The study of Tallon and Pinsonneault (2011) which includes 241 firms from Top Computer Executives Directory 2002 justified that agility as part to improve their performance. Therefore, agility is becoming one of the main characteristics in contemporary and modern SCM (Jiang, Ma, Zhou, & Hu, 2008). Aligned with the market demand, several technologies have emerged for firms to manage their supply chain more agile, but most of them are in development stages (Vinodh et al., 2011). However, universal users in the supply system expected that all the information be readily available whenever and wherever it is needed (Jiang et al., 2008).

In SCM, there are several studies defined the different number of characteristics of agility. Christophe (2000) characterizes supply chain agility in terms of two factors, which is flexibility and adaptability, whereas Li et al. (2009) characterized supply chain agility in terms of six factors, which including operational alertness, operational response capability, strategic alertness, strategic response capability, episodic alertness, and episodic response capability. Braunscheidel and Suresh (2009) characterized supply chain agility in terms of four characteristics which including demand response, customer responsiveness, joint planning, and visibility, whereas Gligor et al. (2013) and foundational social and life science theory characterizes supply chain agility in terms of five factors which including alertness, decisiveness, accessibility, flexibility,

and swiftness. In this study, the total of six characteristics are used to define supply chain agility, which including which including alertness, decisiveness, accessibility, flexibility, swiftness, and demand response.

2.3.1.5 Supply Chain Costs

Supply chain costs can be defined as the costs related with operating the business functions in the supply chain, including procurement, manufacturing, and distribution (Ascloy, Haan, & Dent, 2004). However, costs related with overhead functions, sales and promotion, and marketing are not reflected in supply chain costs. Nevertheless, the lead times for manufacturing goods are widely affected the operating costs such as overtime and delivery costs (Ascloy et al., 2004). For the practical example reported by Ascloy et al. (2004), the firm required to operate overtime and sends the goods to customer by fly instead of boat at their own cost if the firm missed a deadline given by the customer. However, shared planning and forecasting information to well matched demand and supply quantity able to reduce overall supply chain costs (Wang & Zhang, 2009).

In Malaysia, apparel manufacturer mostly produced for export and the competitive success was mainly based on the combination of quality, cultural, cost advantage (Ascloy et al., 2004), and value advantage (Kumar, 2001). Inventory carrying costs and damage costs are not less important in the supply chain (Tarokh & Soroor, 2006), while the transportation or logistic costs usually the highest among the operating cost in the supply chain (Fasanghari et al., 2007). In today's business environments, as transportation and petrol costs are kept increasing, thus the optimal management of

operations and resources are vital important (Miertschin, Sumrall, Wahlstrom, Seaker, & Willis, 2006). For instance, Wang and Zhang (2009) suggested that the adoption of e-commerce on textile and apparel supply chain can lead to inventory cost saving, facility cost saving, and transportation cost saving.

2.4   Technology

Originally, the term "*technology*" is known as "*useful arts*" since the last 200 years (Crabb, 1823). In 1937, the American sociologist defines technology as "*all tools, machines, utensils, weapons, instruments, housing, clothing, communicating and transporting devices and the skills by which we produce and use them*" (Bain, 1937). Through the day to day innovation and revolution, dictionaries and scholars have offered a variety understanding towards technology. Technology can be generally defined as the branch of knowledge that deal with the creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects industrial arts, engineering, applied science, and pure science. However, some authors suggested that technology can be most broadly defined as "*the entities, both material and immaterial, created by the application of mental and physical effort in order to achieve some value*" (National Science Foundation, 2002). From the above definitions, in simple words, technology can be defined as a collection of techniques, which include tools and machines that may be used to solve real world problems.

Technology is a challenge of traditional norms. In the present day, technologies significantly affect human, society, the global economy as well as other animal species' ability to control and adapt to their natural environments. The term "technology" can

be applied generally or to specifically such as construction technology, medical technology, IT, etc. Basically, most technology enables process simplification, standardization, automation, and hence improving communications, process efficiency, organizational productivity, and effectiveness. However, not all technology has been used for peaceful purposes. For instance, the development of weapons can be a tool to provide safety for human, but also increasing destructive power to the world.

Likewise, there is no difference for technology in the supply chain. with all other aspects of a firm, the role of technology is crucially important in managing the supply chains. It is not only provides automation and process efficiency, but also provides better qualitative solutions, hence extending the benefits to active cost reductions through better planning, execution, and tracking (Sehgal, 2009). Moreover, Leenders et al. (2006) stated that technology can provide seven important benefits to SCM, which includes (1) cost reduction and efficiency gains, (2) quick and easy access to critical data in real time, (3) speedier communication, (4) less time is required for administrative and tactical supply activities, (5) improved information accuracy, (6) integration of systems with other departments, suppliers, and customers, and (7) provides better cost control. The further discussion on technology is as follows.

2.4.1   Information Technology

The global business competition has revealed the needs of information technology in securing business competitiveness. Nowadays, the word "*IT*" or "information technology" is frequently applied by most of the companies and even individual in the world. Therefore, the information technology is playing an important role at the

moment and future as well. Information technology consists of wide range of technologies, including multimedia, telecommunications, computer hardware and software that involved in information handling and processing (Huff & Munro, 1985). The main function of information technology is to store, retrieve, manipulate, and send information and transmit information, especially the development, installation, implementation, and management of the information for conducting business through the integration of telecommunications equipment and computer application (Daintith, 2009; Chandler & Munday, 2011). In general, IT can be understand as a set of tools, processes, methods, and related equipment such as office automation and multimedia used to collect, store, transmit, manipulate, process, and present information. Basically, the term is generally used as a substitute to computers and computer network.

Basically, IT also encompasses information system (IS) and information and communication technology (ICT). IS are the study of hardware and software that usually people and organizations applied to gather, filter, process, create, monitor, control, and distribute data (Archibald, 1975; Denning, 1999). The final contribution is to support management and operation teams to make the informed decisions (Huber, 1990). Similarly, ICT is frequently used as a stretched synonym for IT, but it is more focused upon the function of communications and the integration of telecommunications by electronic equipment (Murray, 2011). The further discussions on ICT and IS are as follows.

2.4.1.1 Information and Communication Technology

ICT has become indispensable as a factor which creates a competitive advantage for business (Castro, Ramos, & Molinaro, 2009). It is frequently used as a stretched synonym for information technology, but it is more focused upon the function of communications and the integration of telecommunications by electronic equipment (Murray, 2011). There are a few indicators of ICT, which can be referred to two widely used media of mass communication such as newspapers and televisions; telecommunication facilities such as telephones and mobile telephone density (Jaafar, 2002). Based on the study of Bhatnagar and Schware (2000), ICT applications can be generally classified into three, namely decision support to public administrators (i.e. geographical information system), improving service to citizens, and empowering citizens to access information and knowledge. It could make such knowledge and information visible to a vast group of communities. Notwithstanding, the administrators must be open minded and willing to change their working style to utilize the ICT to accomplish higher performance.

2.4.1.2 Information System

Generally, information systems have been defined to represent any of an extensive combination of computer software, computer hardware, communication technology designed to handle information related to commercial processes (Flowers, 1996). The term also known as the way of people interacts with the technologies to support business processes (O'Brien, 2003; Beynon-Davies, 2009; Rainer, Kelly, & Casey, 2012). In more detail, information systems are the study of hardware and software that

usually people and organizations applied to gather, filter, process, create, monitor, control, and distribute data (Archibald, 1975; Denning, 1999) with the intentions to support management and operation teams to make informed decisions (Huber, 1990). McLaren, Head, and Yuan (2004) further defined that the information system is an "*enterprise or internal organizational systems used to coordinate information between the manufacturers, suppliers, distributors, and other partners in the supply chain*" to minimize costs and improve the responsiveness of the supply chain. However, Tarokh and Saroor (Tarokh & Soroor, 2006) noted that information system provided relevant, timely and high quality information flow to effectively supports decision making and for synchronizing material flows at all levels within the supply chain. Thus, in overall, this is to assist the management and operation teams to make the informed decisions with information technology (Earl, 1989; Huber, 1990). Sabherwal and Chan (2001) and Qrunfleh and Tarafdar (2013) noted that information system was used for efficiency and flexibility.

In information systems, the efficiency is referring to the use of operational support systems or intra-organizational and inter-organizational systems such as EDI, ERP, e-procurement systems for a supply chain process. Basically, the purposes of information systems are used to monitor, control, and facilitate day to day operations in the supply chain. However, the term flexibility in information systems is referring to the use of the market information systems such as production scheduling, demand forecasting, market analysis and CRM applications for market quick strategic decisions. The information systems are mostly used to monitor product and market trends and quickly respond to fluctuations by propose a plan for delivery lead times and production schedules.

2.4.1.3 Supply Chain Technology

Through no common definition of supply chain technology is universally accepted (Kamaruddin & Udin, 2009), thus, researchers have been broadly defined their understanding towards supply chain technology in their study (Blankley, 2008; Kamaruddin & Udin, 2009; Chandrasekaran, 2010). Singh (2003) defined supply chain technology as an application to turn raw data into information and knowledge that efficient the business operations. Blankley (2008) generally defined supply chain technology as any IT developed and implemented specifically for managing elements or components of the supply chain, or an application of IT used to support SCM efforts. Kamaruddin and Udin (2009) defined supply chain technology as,

> *"a technology or a system that use to coordinating and integrating information flow electronically throughout the supply chain to generate effectiveness and efficiency of business processes"*.

In the meantime, Chandrasekaran (2010) describes the extension of supply chain technology as an infrastructure that serve the purpose of printing, reading product data, and data collection of products' position and movement. Besides, He and Chen (2008) defined SCM information systems as the systems that used to coordinate information between intra-organization and inter-organization members. SCM information systems also known as supply chain technology, which is more specific IT used in managing the supply chain. In simple terms, supply chain technology can be defined as a technology that used to improve the operation processes, productivity, and logistical activities within and between the supply chain channel. Productivity is referred to the optimization, while routine operations are referred to the inventory and capacity management (Collins, Worthington, Reyes, & Romero, 2010). Thus, supply

chain technology has become a critical element for firms to minimized cost, reduced waste, and enhanced efficiency, strengthen the relationship between customer and supplier, and improve competitiveness on both internally and externally along their supply chain (Udomleartprasert & Jungthirapanich, 2004; Campo et al., 2010).

Based on the aforementioned discussions, Figure 2.13 is developed to simplify the understanding on supply chain technology. It is conceptualizing the relationship between information technology and supply chain technology.
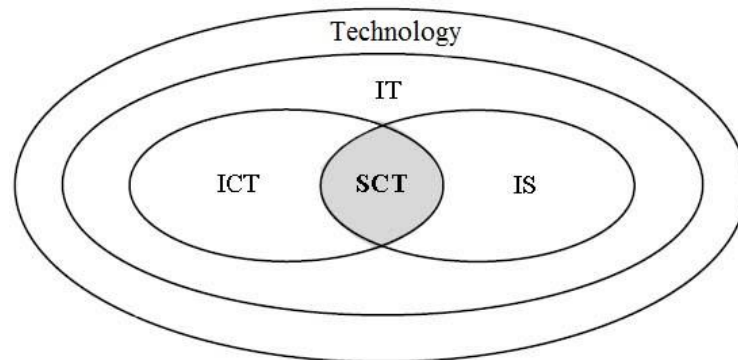
Figure 2.13
Conceptualizing the Relationship between technology, IT, and SCT.
Note.   IT = Information Technology; ICT = Information and Communications Technology; SCT = Supply Chain
        Technology; IS = Information Systems

2.4.2   Supply Chain Technology Adoption

The broad used of supply chain technology enable organizations to improve or remodel their SCM and overall business performance (Motwani et al., 2000; Wang, Chang, & Heng, 2004). The impacts of supply chain technology on SCM can be divided into three, which are (1) transaction processing, (2) supply chain planning and collaboration, and (3) order tracking and delivery coordination (He & Chen, 2008). Furthermore, the used of supply chain technology enable firms in reducing manual

work and costs, speed up information transfer, and improve information quality (He & Chen, 2008), and make full use of and integrate the resources on the supply chain (Kordha & Elmazi, 2009). Moreover, Alam (1996) states that the adoption of supply chain system able to provide tangible and intangible benefits. The tangible benefits include, (1) enhance timely delivery, (2) minimize costs and inventory, (3) better inventory management and product quality, and (4) shorter cycle time. The intangible benefits include, (1) better service quality, (2) shorter response time, (3) real time information, (4) accurate data, and (5) consistent information. Generally, the adoption of supply chain technology has positive and significant impacts on adequacy, accuracy, and accessibility of information (Javanmardi, Khabushani, & Abdi, 2012).

In addition, Chandrasekaran (2010) states that there are ten benefits that firms can derive after the adoption of supply chain technology, which include (1) reduced bullwhip effect in inventory because of information sharing; (2) profits growth across supply chain partners because of reduced inventory costs and faster cycle times; (3) enhanced customer satisfaction because of service responsiveness and consistent quality; (4) improve customer service with real time information because of product track and trace functions; (5) ease of documentation because of customs, paper less, and automated transactions; (6) improve supplier relationships because of advanced information sharing; (7) improved planning capabilities because of information availability; (8) improved forecast accuracy because of collaboration among supply chain partners; (9) enhanced coordination with third-party service providers because of process integration and information sharing; (10) improved supply chain profits through precise inventory replenishment.

Tseng et al. (2011) concluded that the supply chain technology enables firms to determined material requirement, better response to customer, more rapidly react to market changes, enhanced utilization of facilities and labor, and optimal inventory level. Besides, it provides an effective support to SCM which improved customer relationship, broaden marketing channels, expand market occupancy, improve integration (Xuhua, 2008), enhanced information sharing, improve internal collaboration, quick response to customer demand (Jing & Hua, 2008), and complementary of each other's among organizations (Hong & Zhang, 2009; Kordha & Elmazi, 2009). The customers' demand is a significant component of the supply chain, thus, better hold the demands of customers is the basis and crucial in SCM (Jing & Hua, 2008). However, Edmondson et al. (2001) observed that a successful adoption can be achieved through enrollment, preparation and trials to create psychological safety and encourage new behaviors as well as process improvement through reflective practices.

In today's global competitive environment, organizations faced multiple challenges and difficulties in business operations. The use of supply chain technology is considered as an effective tools in managing today's complex supply chains to stay competitive (He & Chen, 2008; Jin et al., 2005). The existing literature revealed that most of the organizations are adopted EDI and RFID technologies as part of their information supply chains (Cazier, Jensen, & Dave, 2008; Chong et al., 2009). The RFID application is approximately a three billion companies in 2006, and expected to grow up to 800% which excess 25 billion by 2015 (Wyld, 2006). Most of the organizations such as Albertson's, Wal-Mart, and Target Corporation in the United States, Carrefour in France, Metro Group in Germany are currently applying RFID

tags in their supply chains (Cazier et al., 2008). However, Bharati and Chaudhury (2006) concluded that SMEs are inexperienced with most of the technologies and less awareness toward the technologies that potential to contribute great value to the supply chain activities. The reason is that companies paid too much attention to the short term performance and lacked of communication, trust, and reluctant to initiatively exchange the information (Hong & Zhang, 2009).

The mobile phone or smart phone technology has been the real wireless technology as a part of our life. Advances in wireless networking are created opportunities for supply chain innovation at the organizational, regional, or national level. It holds the potential to improve the overall business activities (Dawson, 2002; Hill, 2013). The study of Fasanghari et al. (2007) indicated that the Internet improved connectivity and interaction between firms and customers tightly and virtually (Harper, 2010). By having the Internet service, product information and information spreading become rapid and effective. For instance, by utilizing the appropriate technology applications, Benaton, Nike, and Levi's often introduce new products earlier than its competitors. Moreover, Apparelbuy.com provides sufficient product information for customer to view and make comparisons on the product from global retailers (Wang & Zhang, 2009).

In addition, in diffusion of innovation theory, the adopter can be categorized into five accords to the bell shaped curve as illustrated in Figure 2.14. The category is categorized based on the adoption speed from the initial adopter to the non-adopter. Rogers (1995) defined the initial adopters as (1) innovators, and followed by (2) early adopters, (3) early majority adopters, (4) late majority adopters, and the non-adopters known as (5) laggards. By definition, innovators are venture to the new technology

and thus, delight in being on the cutting edge. The decision of early adopters is made upon the data shared by the innovators. The adopters known as early majority when the rate of adoption rapidly increases to the fabled tipping point and the adoption becomes a necessity to social. Lastly, the late majority adopters and laggards are referred to those are more traditional, isolates, and lack of social interaction. Usually, they have less awareness towards the benefit of the adoption.
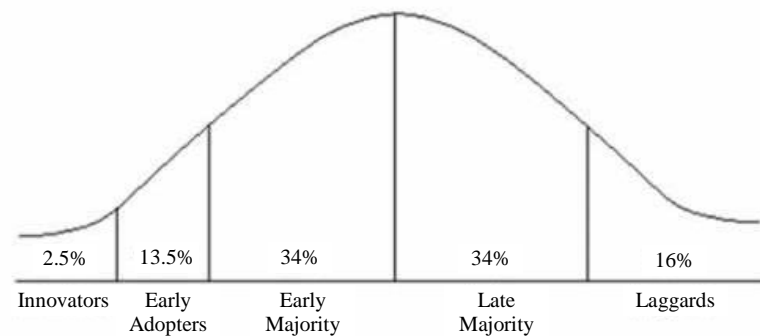
Figure 2.14
Adopter Categorization
Source. Adopted from Rogers (1995)

The supply chain technology has been started since 1970s with information processing. In 1980s, the evolution of supply chain technology has been established for sale data collection. In 1990s, higher levels of integration are achieved through collaboration between supply chain members. In 2000s, supply chain members become more expert in implementing the supply chain technology. In twenty-first century, the adoption of supply chain technology is evolved completely, which fully utilize the functions of the adopted technologies at anywhere and anytime. Table 2.5 illustrated the evolution of the supply chain technology implemented and adopted from the period of 1970s to 2010s.

Table 2.5
Evolution of Supply Chain Technologies Adoption

1970s	1980s	1990s	2000s	2010s
Information Processing	Scanner Systems	Electronic Data Interchange (EDI)	Supply Chain Reinvention	Cloud Computing
	Bar Codes	E-commerce	Warehouse Management Systems (WMS)	Mobile Supply Chain Management System
	Electronic Cash Register	Vendor Managed Inventory (VMI)	Transportation Management Systems (TMS)	
	Just-In-Time (JIT)	Continuous Replenishment Systems	Customer Relationship Management (CRM)	
		Direct Store Delivery	Vendor Relationship Management (VRM)	
		Computer Assisted Ordering	Supply Chain Communication Systems	
		Cross Docking	Radio Frequency Identification (RFID)	
			Global Positioning Systems (GPS)	

Source. Adapted from Collins et al. (2010), Cegielski et al. (2012), Shacklett (2012), Chan and Chong (2013), and BNP Media (2013)

SCM tools or activities can be categorized into three layers or areas, namely supply chain planning tools, supply chain collaboration tools, and supply chain execution tools. Supply chain planning tools take care of sales and planning, demand planning, sourcing, transportation planning, production planning, inventory and warehousing planning, and aggregate planning (Chandrasekaran, 2010). Meanwhile, Slone et al. (2010) state that supply chain technology can be systematically divided into four categories, including software, e-business technologies, visibility and productivity, and process advances. Additionally, Prajogo and Sohal (2013) found that most of the supply chain technology are primarily internally focused technologies, while some of the supply chain technology s are externally focused technologies. However, there are

a number of supply chain technology tools used in each supply chain operation with different justification from literatures. **Appendix A** provides a list of supply chain technology.

 Although, supply chain technology adoption has been conceptualized as a complex procedure, but it has high potential applications in various value chain processes (Kauffman & Walden, 2001). Many research on supply chain technology adoption have been restricted to measure of adoption and non-adoption (Jolly-Desodt et al., 2006; Ramayah et al., 2013). Even though this helps in understanding the adoption decision and the usage of the adoption, but it does not completely measure the reach and the richness of the adoption of supply chain technology (Tornatzky & Klein, 1982). Therefore, this study intent to bridge the gap by move forward to study the extent of the use and the usefulness of supply chain technology adoption.

Table 2.6 illustrated the definition of dimensions of supply chain technology adoption, enclosed with evidence of the literatures that used the same dimension for their studied.

Table 2.6
Dimensions of Supply Chain Technology Adoption

Supply Chain Technology Dimension	Definition	Literature
SCT Use	The applications of hardware and software components that used specifically in SCM to generate effective and efficient supply chain operations.	Lin et al., (2002), Ramayah et al. (2008), Kamaruddin and Udin (2009), and Charkaoui et al. (2012)
SCT Usefulness	The quality or fact of being useful associated with the applications of hardware and software components that used specifically in SCM.	Neeley (2006), Slone (2006), Niu (2010), and Ho et al. (2011)

2.4.2.1 Supply Chain Technology Use

The hardware and software components that used to support SCM applications can be collectively referred as supply chain technology (Singh, 2003). IT in SCM has had very important effects on the development of modern organizations to gain competitive advantage. The findings of Tavassoli et al. (2009) showed that there are so many benefits gained from the use of supply chain technology. The successful adoption of supply chain technology is recognized as one of the significant factors in managing supply chain on today's competitive markets (Xu, Yen, Lin, & Chou, 2002; Wu & Wu, 2005). The study of Charkaoui et al. (2012) used ICT used to measures technological practices, and the result showed that ICT use is positive significantly influences the supply chain performance. Besides, Wei et al. (2009) conclude that the e-business applications are crucial to speed up the supply chain technology adoption. Consistent with the literatures, this study measure supply chain technology adoption by the extent of use of the supply chain technology.

This portion provides brief description for some of the supply chain technology that popular applied in the industry. Internet is a global system of interconnected public network accessed by general users worldwide. Intranet is a private network that shares proprietary information with members within the organization, while extranet is a semiprivate network that allows controlled access to share large volumes of secure data to specific companies (Lin et al., 2002). Conventional telecommunications technologies, characterized by wires, fixed locations, and inflexibility, are rapidly giving way to mobile technologies, which refer to wireless communication technologies (Lee et al., 2009) or specifically known as mobile SCM system (Chan & Chong, 2013). E-commerce allows firms to direct sales to public through Internet

network connection (Wang & Zhang, 2009). Meanwhile, the Internet tool that used to support collaborative SCM is known as c-commerce, which allow to share and exchange information within and across companies electronically (Chong et al., 2009).

Besides, barcode system and RFID are categorized as data acquisition technologies that are applied for logistics data exchange, information tracking, and data collection purposes (Lin, 2008; Patterson et al., 2003; Xuhua, 2008). It also allows firms to management their inventory and raw material tightly and accurately (Patterson et al., 2003) with visibility to help users detect inefficiencies such as shipment delays, burglary, and inventory issues (Kozloff & Gordon, 2003; Llic, Andersen, & Michahelles, 2009). The examples for bar cording are Intermec, Norand, Zebra technologies, and Symbol, while the examples for RFID are Norand, Intermec, Symbol (Cazier et al., 2008; Lin, 2008).

Electronic Inter-organizational System (IOS) is an application for information sharing, process redesigns, and better coordination among supply chain partners (Narayanan et al., 2009). Practitioners and academics agreed that EDI is an important and most widely accepted supply chain technology for development and expansion of inter-organizational communication to create and share information data structure (Jackson & Sloane, 2009; Narayanan et al., 2009; Patterson et al., 2003; Xuhua, 2008). WMS system is an application that intentions to monitor the transaction process within the warehouse, including shipping, receiving, put away, and picking (Harper, 2010). For examples, Catalyst, EXE, Manhattan, and Optum. VMI system is an application that allows supplier to maintain an agreed inventory of material in buyer's warehouse by inventory report provided by buyer (Kulp, 2002).

CRM system is an application to manage customer related activities such as sales, customer service, and marketing in an organized way (Patterson et al., 2003). SRM system is a strategic approach to manage supplier related activities. TMS is intended to achieve company wide load control to procurement and shipping activities between channel partners such as i2, Manugistics, Descartes, nPassage, and Capstan. However, CRM systems, SRM systems, and TMS are considered as a part of the ERP systems (Kumar, 2001). ERP system is an application that enabled firms to share information across departments such as the sales team suggested information regarding new fashion trends to the operation team to developed plan for next season such as SAP, Oracle, JD Edwards, and PeopleSoft. Likewise, MRP system is an application to identified planning for time management and an inventory controls method, which determined the quantity and time to place the order (Patterson et al., 2003; Sagbansua & Alabay, 2010; Radu, Horațiu, Bogdan, & Mihai, 2013).

PDM is the business function tools that are used to support collaborative engineering and responsible for the control of product data (Patterson et al., 2003) such as Windchill, Documentum, and SDRC. AQC systems help monitor the processes and procedures of quality assurance such as Power Way and Pilgrim Software. CAD system is the use of computer systems to assist design tools in form of electronic such as Auto-CAD and PTC. Supply chain planning systems are referring to the application such as forecasting planning, demand planning, supply planning, and APS. APS is applications that coordinate with manufacturing management process which capacity and material resources in accordance with demand changes such as i2, Manugistics, and Logility. MES is a computerized system used in manufacturing to provide real time information for user to monitor manufacturing operations such as materials,

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equipment, and labor in manufacturing processes, for examples, Camstar, Cincom, Intellution, and Kronos. Geo-coded Tracking systems are satellite or cellular tracking devices that commonly used in trucks or trailers to identify the status of shipment such as Qwest.

Cloud computing is a very new area of supply chain technology. In the era of real time supply chain, the roles of cloud computing and wireless and mobile devices are crucially important (Shacklett, 2012; Cheng, Li, Ou, & Kung, 2014; Son, Lee, Lee, & Bong, 2014). Cloud computing technology allowed small firms to establish competitive IT infrastructure with affordable budget or no upfront investment (Plummer, 2008; Staten, 2008). Moreover, cloud technology enabled digital object identifier to close hundreds of data centers in a means time (BNP Media, 2013). In advancing, the study of Yan et al. (2014) suggested cloud of things (CoT) technology to integrate the concepts of the Internet of things (IoT) and cloud computing. CoT provides all supply chain members to interact with each other by collecting data and using the big data strategies in managing their supply chain. It is great if combined with remote desktops function to avoid leaked of confidential data, since all the information is not stored in the device but stays on the premise (Khoo, 2013). In general, these are used to support entire supply chain operations with timeliness and quality of data.

2.4.2.2   Supply Chain Technology Usefulness

Supply chain technology usefulness can be defined as the quality or fact of being useful associated with the applications of hardware and software components that used specifically in SCM. The study of Ho et al. (2011) which include 180 responses from employees who use SCM systems indicates that employee's perceived usefulness, significant and positive impact on attitudes towards use of the SCM systems. Their study showed that the usefulness is potential to apply to measure the adoption of supply chain technology, wherein the positive attitude towards use of the supply chain technology is assumed to have a positive impact on supply chain performance. This is supported by the study of Plewa et al. (2012), the usefulness of technology by individuals is led to higher work productivity, effectiveness, and performance. Additionally, the study of Ghobakhloo and Tang (2013) provided a comprehensive conclusion to the usefulness of the e-commerce. The researchers found that the term "*usefulness*" is a significant discriminator between adopters and non-adopters of different applications. Consistent with the literatures, the extent of usefulness is employed to measure supply chain technology adoption.

2.5   Supply Chain Capabilities

The concept of capabilities is not new. The concept can be found in Selznick (1957) and Penrose (1959) studies, which focused on building distinctive capabilities and is featured in the early business policy frameworks (Learned, Chris, Ken, & William, 1969). Although the previous study give advantageous discernments, but there is still absence of a thorough theoretical framework to understand the phenomena of

capabilities. As noted, capabilities are complex groups of skills and accumulated knowledge. It practiced through organizational processes that allow firms to manage activities and asset utilization (Day, 1994). Capabilities are shown in business activities such as new product development, order fulfillment, and service delivery (Stalk, Philip, & Sgulman, 1992). The variables and components of supply chain capabilities are further discussed as follows.

2.5.1 Relational Capability

The focus in SCM is on the efficient, effective, and timely delivery of goods from raw materials and supplies through manufacturing to the ultimate customer or user. It is required the flow of information in both forward and rearward directions in the supply chain. Without effective information flow, the goals of supply chains cannot be achieved. In addition, the successful implementation of an effective SCM and effective inter-organizational system requires the cooperation of a large number of external partners (Pegels, 2005). In short, relational capability can be defined as the property of two or more data files that can be shared or exchange for view, edit, or transform to become useful information within or between two or more supply chain members (Power & Simon, 2004).

Several researchers found that information sharing, information quality, customer relationship, and supplier partnership are important elements of SCM practices (Li, Ragu-Nathan, et al., 2006; Lee, Lee, & Lin, 2007; Campo et al., 2010; Thoo et al., 2011). The significance of the relationship between customer relationship and supplier partnership on SCM has been recognized many centuries. The management of

customer relationship and supplier partnerships involves all the activities associated to the flow of goods and services from suppliers to final customers (Brereton, 2004). Essentially, partnership is the core of the connection between suppliers and customers. Thus, in order to succeed in long term partnership, the mutual respect, a willingness to share information (Brereton, 2004; Narayanan et al., 2009), share quality's information (Charkaoui et al., 2012), fairness, and trust are required (Sukwadi, Wee, & Yang, 2013). In this point of view, supplier partnership, customer relationship, information sharing, and information quality is essential dimensions in determining relational capability.

Table 2.7 illustrated the definition of dimensions of relational capability, enclosed with evidence of the literatures that used the same dimension in their studied.

Table 2.7
Dimension of Relational Capability

Relational Capability Dimension	Definition	Literature
Supplier Partnership	The long term relationship between the organization and suppliers that providing goods or services to the business to achieve significant ongoing benefits.	Li et al. (2006), Lee et al. (2007), Narasimhan et al. (2008), Qrunfleh (2010), Quah (2010), and Thoo et al. (2011)
Customer Relationship	The long term relationship between the organization and customers that acquire goods or services from the business to achieve significant ongoing benefits.	Li et al. (2006), Lee et al.,(2007), Narasimhan et al. (2008), Qrunfleh (2010), Quah (2010), and Thoo et al. (2011)
Information Sharing	The extent to which critical and proprietary information of an organization is communicated to a number of people or organizations.	Thoo et al. (2011), Gilaninia et al. (2011), Kocoglu et al. (2011), Li et al. (2006), Lin et al. (2002), Narasimhan et al. (2008), and Sezen (2008)
Information Quality	The degree of excellence of information fits the people or organization's needs.	Li et al. (2006), Lee et al., (2009), Campo et al. (2010), and Ramayah and Omar (2010)

2.5.1.1 Supplier Partnership

Technology advancement has become a driver for the organization to form a partnership with suppliers (Agus, 2011). Partnership with suppliers able to strengthen the trust based relationships, establishes the long term relationship, provides interconnected communication network, leverages higher synergy and collaborative business environment (Kocoglu et al., 2011). Moreover, supplier partnerships enable organizations to be cooperative with potential suppliers who are keen to share accountability in achievement (Li, Ragu-Nathan, et al., 2006). Suppliers who establish collaborative relationships with their customers tend to be technologically sophisticated, otherwise, normal market mechanisms have to become intermediate for the relationship between supplier and customer (Kaufman, Wood, & Theyel, 2000). Therefore, the organizations that possess strong technological skills tend to be more potential to success in building partnerships.

In global supply chain, supplier involvement is crucial to achieve higher supply chain performance (Dietrich & Cudney, 2011). In textile and apparel industry, suppliers can be categorized as few types, which include farmers, chemical manufacturers, dye houses, ginning facilities, fabric mills, finishing plants, sewing factories, trim vendors, trucking companies and shipping brokers (Dickson et al., 2012). Building a good partnership with those suppliers of textile and apparel enables the organization to receive more quality materials, optimal inventory levels, and timely delivery (Omar et al., 2006). Hence, only well manage the suppliers linkage can well sustain in the supply chain (Dickson et al., 2012).

Generally, partnerships can be defined through seven characteristics, which are (1) information sharing, (2) planning and coordination, (3) openness and trust, (4) recognition of mutual interdependence, (5) mutual benefits and sharing of risks, (6) compatibility of corporate philosophies, and (7) shared goals (Harrison & Hoek, 2011). There are many advantages to have a good partnership with suppliers, which including (1) reduced negotiations and drawing up of separate contracts, (2) shortened product cycles and lead times, (3) reduced monitoring of supplier soundness, including increased productivity and supply quality, (4) conditions amenable to longer term investment (Harrison & Hoek, 2011). Meanwhile, there are few potential disadvantages of partnership with suppliers, which include (1) the need for organizations to gather substantial information about potential partners on which to base decisions, (2) the inability to price accurately qualitative matters such as design work, (3) potential opportunism by suppliers, and (4) the risk of divulging sensitive information to competitors (Harrison & Hoek, 2011).

2.5.1.2   Customer Relationship

The complementary resources that positive associates with the development of long term customer relationships are including technology resources, business resources, and human resources. These resources have a positive interactive effect on customer connectivity. In business and technology disciplines, CRM system is an application that helps firms obtain and retain gainful customers (Wu & Wu, 2005). The challenges are to communicate with customer by using the right way and at the right time discussed the right topic. Therefore, establish a long term relationship with customers not only enable the firms to keep track of the customer requirements, but also one of

the strategies to remain competitive in an increasingly dynamic market (Omar et al., 2006). The study of Cooper et al. (1997) pointed out that the person who can build and sustain relationships with final customer has gained the competitive advantage in the supply chain. The interaction between supply chain members would enhance firm's ability to achieve desired goals (Deshpande, 2012). For instance, the purpose of Intel asked commitment from computer manufacturers to place Intel sticker on their computers is to grasp the manufacturer's ability to change chip suppliers. Meanwhile, Intel is building a relationship with the end user through the sticker.

By information shared with customer, firms developed real time feedback flow mechanisms from customer who provides accurate demand forecast data and efficiently manages inventory planning and distribution (Kocoglu et al., 2011). Stevenson and Spring (2007) have noted that the precise and real time information flow in the supply chain is essentially imperative to build customer's confident level toward firm (Leng & Zailani, 2012). It ensures supply chain partners to fulfill demand within shorter order cycle times (Simatupang & Sridharan, 2005). Therefore, close relationship with customer enables the organization to distinguish its product from competitors, retain customer's loyalty, and enhance customer value (Li, Ragu-Nathan, et al., 2006).

Nowadays, the marketing model is shifted from the product oriented to the customer oriented. In such situation, it is clear that the power of customer is strong and should put on priority. The good relationship with customer tends to improve the success levels of the firm (Jeffers, Muhanna, & Nault, 2008). Customers are increasingly demanding a different relationship with providers than ever before. Therefore, the creation of the database technologies enabled firms to identify the identity and

purchase behavior of customers through historical information. By having the database technology, firms able to make demands forecast more precisely (Xu et al., 2002).

2.5.1.3 Information Sharing

Information sharing is one of the critical success factors for SCM. It is an involvement to view partner's property data through network connected systems and monitor the progress of supply chain processes (Simatupang & Sridharan, 2005). There are many types of private data such as data capturing, processing status, customer data, inventory data, order status, costing data, and performance status. Information sharing can be defined as the way of communication between organizations or supply chain members (Lee, Kwon, & Severance, 2007). Therefore, it can reflect cooperation between supply chain members (Li et al., 2006, 2005). However, the willingness to share information requires higher level of trust and extent of consistency (Walton & Miller, 1995; Hall & Saygin, 2011).

In the supply chain point of view, the information can be shared within organization or between the organizations (Kocoglu et al., 2011). Intra-organizational information sharing taken place at two levels includes data level and business processes level (Ball, Ma, Raschid, & Zhao, 2002; Yang & Maxwell, 2011). While, inter-organizational information sharing can be divided into four levels which are order information exchange, operation information share, strategic information share, and competition information share (Lin et al., 2002). The gathered and shared real time information is crucial to improved supply chain performance (Campo et al., 2010; Hall & Saygin, 2011; Huisman & Smits, 2007; Kocoglu et al., 2011; Li et al., 2005; Tseng et al., 2011;

Zhao, Xie, & Zhang, 2002). Particularly, information shared result in greatest inventory cost savings (Lin et al., 2002; Yu, Yan, & Cheng, 2002), provide accurate demand forecast, real time information, increasing communication (Kocoglu et al., 2011), reduce total cost, enhance services level, reduce demand uncertainty, higher order fulfillment rate, shorter order cycle time (Li & Lin, 2006; Lin et al., 2002), inventory reduction, expected cost reduction (Cheng & Wu, 2005; Lee, So, & Tang, 2000), reduce logistic and shortage costs (Lee et al., 2000), on time delivery (Hall & Saygin, 2011), and achieve customer satisfaction (Hall & Saygin, 2011) in the supply chain. However, the result is definitely depended on what, when, who, and how the information is shared (Li & Lin, 2006).

In addition, the information share also can be categorized to two categories, which is vertical and horizontal information. Vertical information is shared through upstream firms such as manufacturers, and downstream firms such as retailers, while horizontal information is referred to the information shared within the organization (Li, 2002a; Jing & Hua, 2008). Vertical information sharing can have two effects, which are direct effect and indirect or leakage effect. Direct effect is referred to the changes in strategy by the parties involved in information sharing, while indirect or leakage effect is referred to the changes in strategy by competitor firms (Li, 2002). Li (2002) points out that the leakage effect discourages the retailers to shared demand information with the manufacturer, while encourages manufacturers to share cost related information with retailers.

Furthermore, Yu et al. (2002) categorized information sharing to three levels, which is decentralized control (level one), coordinated control (level two), and centralized control (level three). At level one, the level of inventory is monitored by supply chain

members independently. At level two, the inventories are integrated with the customer order information shared wherein informed decision made after the analysis of retailer's ordering and customer demand. At level three, optimal performance achieved through centralized control to the decentralized supply chain through EDI application which enables retailer and manufacturer retrieve customer's demand information in a synchronized manner (Yu et al., 2002). Besides, Hui and Lingrong (2012) categorized information sharing to four levels, which are no information sharing, partial information sharing, near complete information sharing, and complete information sharing. No information sharing can refer to traditional business operation which forecasts are totally based on the orders from its customers. Partial information sharing shares certain types of information between immediate partners. Near complete information sharing shares almost all the information in visible. Lastly, complete information sharing is ideal but not really practical due to the privacy and security issues.

Naturally, the information can be shared by two aspects in terms of quantity or quality. The quantity and the quality of the information shared are essential for the practices of SCM (Li, Ragu-Nathan, Ragu-Nathan, & Subba Rao, 2004). Large volumes of precise information sharing can be a source of competitive within the supply chain (Li, Ragu-Nathan, et al., 2006). Effective SCM required consistent exchanged and shared of precise information (Sakka et al., 2011) in order to maintain lasting relationships and partnerships with members in the supply chain (Cook, Heiser, & Sengupta, 2011). Information sharing is a key enable for textile and apparel SCM to improve performance (Ma & Zhang, 2009). The lack of information sharing from the supplier's perspective led suboptimal supply chain performance (Kim, Lee, & Park, 1997). While,

the lack of information availability was one of the critical failure factors pertaining to SCM (Tarokh & Soroor, 2006).

2.5.1.4   Information Quality

Information quality represents the quality of information content (Bharati & Chaudhury, 2006; Davis-Sramek, Germain, & Iyer, 2010). The term is often used synonymously with data quality which information is transformed from two or more data. Information quality can be defined as the degree to which the information fits the firm's needs. The quality of information is determined by the criteria of relevance, timeliness, completeness, accuracy, credibility (Campo et al., 2010), and adequacy (Li, Ragu-Nathan, et al., 2006). Besides, based on Cao et al. (2013) suggestion, four dimensions which including data quality, timeliness, portability, and usability are high reliability and validity in measuring information quality. Information quality itself is a multi-dimensional concept, for which extant studies have introduced a number of indicator variables. Among them are accuracy, precision, relevance, currency, completeness, sufficiency, comparability, timeliness, reliability, understand ability, and scope (Bharati & Chaudhury, 2006; Thomson, Perry, & Miller, 2007). Subsequently, Lee et al. (2009) characterized the quality of information in terms of reliability (i.e., consistency and accuracy), timeliness, relevance (i.e., significance, preciseness, and adequacy), and scope (i.e., exhaustiveness and completeness) in their study.

Lack of information accuracy was one of the critical failure factors pertaining to SCM (Chan, 2003; Tarokh & Soroor, 2006) and it can cause certain negative consequences such as bullwhip effect to the supply chains (Kim, Lee, & Park, 1997). The role of information quality in SCM is crucial, since it serves as the foundation for informed decision (Javanmardi et al., 2012). An illustration, the delivery is fully relied on the quality of information shared. Thus, the commitment of shared high quality information significantly improved the overall performance of the supply chain (Bartlett, Julien, & Baines, 2007; Gunasekaran, Patel, & Tirtiroglu, 2001; Tseng et al., 2011). Particularly, improved channel coordination, overall responsiveness, partnership, and ultimately market performance (Kim, 2006). As one leading supply chain expert describes the importance of quality data to logistics is depended to timeliness, comprehensiveness, and appropriateness (Miertschin et al., 2006). However, the significant of its impact on SCM is subject to what, when, how, and who the information is obtained (Gunasekaran et al., 2001; Li, Ragu-Nathan, et al., 2006; Hendarty & Nusantara, 2014).

2.5.2 Information Technology Capability

The revolution of IT began in the United States in 1970s. Meanwhile, researchers started to pay attention on the importance of information systems in management and thus, the first academic papers published (Galbraith, 1984; Huff & Munro, 1985). In 1980s, scholars started to developed theory and case studies on IT (Porter & Millar, 1985). In 1990s, technological advancements have been widely accepted and adopted in society and SCM (Zhang, Donk, & Vaart, 2007). IT utilization is widely recognized as a foundation of success in SCM and an essential approach to improved supply chain

performance (Craighead & Laforge, 2003; Zhang et al., 2007; Zhang & Wang, 2011). Aral and Weill (2007) found that IT capabilities drive differences in firm performance by strengthens IT assets and broadens their impact. The used of IT able to improved flexibility and optimized overall performance (Dozier & Chang, 2007; Fantazy, Kumar, & Kumar, 2009). However, a higher level of IT capability does not promise a higher level of information sharing and information quality (Li & Lin, 2006).

IT is an important and significant resource to accomplish the business vision (Feeny & Willcocks, 1998). Moshiri and Simpson (2011) point out that advances in IT can dramatically change on individual and organizational performance such as transform business organization, increase competition, and foster innovation. Technological advancement played an important role in most sectors of the economy (Ali & Younes, 2013) and it has significantly affected the way of doing business. In automotive industry, IT was found crucial to making their operations responsive to customer requirements (Talavera, 2008). The study of Moshiri and Simpson (2011) revealed that the use of computer by employees has a positive influenced on firm's productivity.

Nowadays, IT is extensively employed in the SCM to strengthen the weaknesses of the supply chain, enhanced operating efficiency, reduced operating costs, increased responsiveness (Xuhua, 2008), increased agility (Javanmardi et al., 2012), reduced cycle times, developed collaborative work, expand market borders, developed seamless partnerships, improved teamwork, enhance customer relationship, proactive on respond (Fasanghari et al., 2007), increase information and product flow (Craighead & Laforge, 2003), improve timeliness and accuracy of information flow (Handfield & Nichols, 2002; Kim et al., 1997). It also offers the potential to shift supply chain networks and processes of working (Dawson, 2002). Therefore, firm prompt in utilize

IT to maintain and sustained the ability to satisfy customer (Omar et al., 2006). The appropriately used of IT offers opportunities for the organization to improve performance of supply chain, productivity, and profitability (Dawson, 2002). However, numerous companies' personnel are lack of IT knowledge and IT skills (Fasanghari et al., 2007). Hence, it requires investments in human and social capital to build up a strong capability of IT (Bensaou, 1999).

The RBV of IT recommends that the IT resources in the firm can be the competitive capability of the firm. Bharadwaj (2000) points out that firm's human IT skills, IT infrastructure, and IT reconfigurability are firm's inimitable resources. Every single IT resource is unique and complex to acquire. The combination of the single IT resource created a firm's potent organizational capability (Bharadwaj, 2000). The relationship between IT capability and organization performance is becoming more complex than ever before (Jeffers et al., 2008). Bharadwaj (2000) points out that various IT capabilities could be sources of competitive advantage. However, a limited number of studies have explored the RBV of IT capability, and most of the analyses to data were conceptual nature.

Table 2.8 illustrated the definition of dimensions of IT capability, enclosed with evidence of the literatures that used the same dimension in their studied.

Table 2.8
Dimensions of IT Capability

Information Technology Capability Dimension	Definition	Literature
IT Infrastructures	The hardware or software that used directly or indirectly to provides information for users.	Broadbent and Weill (1997), Broadbent et al. (1999), Byrd and Turner (2000), Ravichandran and Lertwongsatien (2005), Jain (2007), Agan (2011) Lu and Ramamurthy (2011), and Ismail and Mamat (2012)
IT Personnel	The people employed in an organization's IT department.	Broadbent and Weill (1997), Bryd and Davidson (2003), Ravichandran and Lertwongsatien (2005), and Jain (2007)
IT Knowledge	The IT facts, information, descriptions, or skills acquired by people through experience or education.	Jain (2007), Lu (2006), and Tsai (2010)
IT Reconfigurability	The ability to recombine existing IT resources into new configurations to match with changed environment.	Masselos et al. (2002), Shannon and Chow (2004), Lu (2006), Jain (2007)

2.5.2.1 IT Infrastructures

Broadbent et al. (1999) defined IT infrastructure as the combinations of technological and human components. Technological infrastructure is refers to the hardware, software, communications technologies, and data application, while human component is refers to the commitments, expertise, skills, norms, competencies, values, and knowledge of the employee. Hence, it is complex and difficult to imitate (Barney, 1991). Byrd and Turner (2000) furher defined the IT infrastructure as all the technology components, applications, software, and all physical components that are used to improve operations, process, and create various capabilities within the organization. While, Bharadwaj (2000) defined IT infrastructure as firm's communication technologies, computer, and the shareable technical platforms and

databases. It provides a foundation for communications interchange across and within organization to develop and implement present and future business applications (Broadbent et al., 1999). However, the used of inappropriate technology was one of the obstacle in the development of e-SCM (Tarokh & Soroor, 2006).

Firm's IT infrastructure has been defined as a key of business resource and competitive weapon for survived in competitive marketplace (Bharadwaj, 2000). The successful firms exploit their infrastructure capabilities to redesign their products and services (Bharadwaj, 2000). Therefore, the selection of firm's IT infrastructure is increasingly accepted as one of the critical steps for firm to become competitive. It is particularly important for firms to made dynamic change on business processes and extensive international business operations (Broadbent et al., 1999). The well manage of IT infrastructure enables firms to reduced production time, improved communication among employees (Moshiri & Simpson, 2011), improve production cost, improve interconnectivity (Boon-itt, 2009), and best support demand-side initiatives (Broadbent et al., 1999; Aral & Weill, 2007).

Researchers and practitioners alike noted that the potential value of an organization's IT infrastructure has significantly impact on integration and supply chain performance directly (Niu, 2010; Agan, 2011; Tallon & Pinsonneault, 2011). From the statistical perspective, this is because IT infrastructure expenditures accounted more than 58% of an organization's IT budget and the percentage is growing at 11% annually (Byrd & Turner, 2000). The statistic result illustrates that the characteristics of IT infrastructure determined the value of the infrastructure for the organization (Byrd & Turner, 2000) and it having a critical impact on the firm's ability to use IT competitively (Duncan, 1995).

2.5.2.2   IT Personnel

IT personnel believed to have a myriad of knowledge, skill, and competencies. Lee et al. (1995) identified that IT personnel should possess four types of knowledge and skills in general, namely (1) technology management knowledge and skills, (2) interpersonal and management skills, (3) business functional knowledge and skills, and (4) technical knowledge and skills (Lee et al., 1995). These skills typically take time to evolve through the accumulation of experience and often tacit and dependent, which might take years to develop. Firm's strong IT personnel allow firm to integrated the IT functions and business processes more effectively and communication more efficiently than competitors (Bharadwaj, 2000). The role of IT personnel is important to contribute to the routine processes of business activities.

Furthermore, IT personnel are played an important role in organization functions. Thus, IT personnel have significant impacts on strategic business goals. It is because they possess the professional's specialized skills and tacit knowledge toward specific business operations and information systems in the organization (Moore & Burke, 2002). Feeny and Willcocks (1998) noted that companies must be able to build and sustain strong IT personnel. It is like Broadbent et al. (1999) state that the roles of IT expert in the development and management of infrastructure services are crucial importance for firms to operation smoothly. Lack of experience personnel, inadequate training, and inappropriate people in key positions was critical failure factors in the development of e-SCM (Tarokh & Soroor, 2006). For instance, Zara, a Spanish clothing retailer, has a super-responsive supply chain in the highly volatile fashion apparel industry in which customers' tastes change unpredictably and rapidly. To solve the deficient supply issues, firm's IT personnel work closely with line managers to

understand the business requirements and operation processes. The close teamwork between IT personnel and business operations enabled the business functions to be more responsive and flexible (Ferdows, Lewis, & Machuca, 2004).

2.5.2.3 IT Knowledge

IT knowledge is one of the firm's intangible resources. The firm's IT knowledge embedded the skills and experience of its employees and widely recognized as a unique, inimitable, and valuable resource (Bharadwaj, 2000; Tsai, 2010). Awareness of the technology resulted in knowledge accumulation and ultimately leads to technology adoption (Walton & Miller, 1995). Jeffers et al. (2008) highlighted the importance of knowledge sharing between knowledgeable employees are critically important to improved knowledge. If the members of the team are share common goal, IT knowledge has the ability to improved organizational learning and further enhanced supply chain performance (Deshpande, 2012). IT knowledge seems to be one of the benefits to our life, but it is considered as one of the prerequisites for employment. It is believed that every employee has their special and unique IT knowledge and skills in their expert area.

2.5.2.4 IT Reconfigurability

IT reconfigurability is firm's ability to recombine two or more existing resources into new configurations for matching the changed environment (Wei & Wang, 2010). It is not only made desire changes and added value but also to reinvent the value to firm

(Wei & Wang, 2010). In the recent year, the effective IT reconfiguration has attracted the attention of market competition, especially those companies that under the circumstances of globalized economy and internationalized market (Xuhua, 2008). Besides, IT reconfigurability enable firms to introduced new products and processes with considerably less expenses and ramp up times. It is vital for firms to accommodate unexpected changes of customer requirements and supply chain operational environments (Overby, Bharadwaj, & Sambamurthy, 2006). For instance, Procter & Gamble's shared services platform that delivers reusable business support services to enable brand managers to quickly and efficiently launch new products (Dodgson, Gann, & Salter, 2006). In long term, it is believed that not only save time and costs, but also smoothen the business activities.

2.5.3   Organization Cultural Capability

In general, culture can be defined as the combination of the language, behaviors, beliefs, rituals, rules, institutions, and practices that characterize a society (Schniederjans, Schniederjans, & Schniederjans, 2010). Organizational culture has been broadly studied by anthropologists and other organizational researchers since the early 1980s (Hofstede, Hofstede, & Minkov, 2010). Thus, resulted in plentiful definitions (Chatman & Jehn, 1994; Hofstede et al., 2010; Martin, 2004; O'Reilly, 1989; Quinn, 1988; Schein, 1990; Trice & Beyer, 1993). Deshpande and Webster (1989) defined organizational culture as a set of shared assumptions and understandings about organizational functioning. It also can be generally defined as a set of behavior and actions of employees who work in an organization in which affects the way people and groups interact with each other (Moore & Burke, 2002; Colovic,

2012). While, the characteristics of culture can be described as staffing, training, compensation, evaluation (McAfee, Glassman, & Honeycutt, 2002), common values, attitudes, assumptions and beliefs of employees in the organization (Colovic, 2012). In short, organizational culture capability can be understood as the way of employees think they should do.

Denison and Mishra (1995) and Gordon and DiTomaso (1992) found that organizational cultures valued can be flexibility, adaptability, consistency, and direction. While, O'Reilly et al. (1991) found that organizational culture profile item set can be 54 items totally which include the selected dimensions of organizational culture, namely, involvement, adaptability, consistency, and innovativeness. Organizational innovativeness is vital to be sustained within the uncertainty market. However, existing studies tend to focus only on a few dimensions of organizational culture and innovativeness rare to be consider (Lai & Yusof, 2011). People are the key to success for an organization. Therefore, organizations have to employ the right people to the right position to performing the right job (Fawcett, Magnan, & McCarter, 2008).

Table 2.9 illustrated the definition of dimensions of organizational culture capability, enclosed with evidence of the literatures that used the same dimension in their studied.

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Table 2.9

Dimensions of Organizational Culture Capability

Organizational Culture Capability Dimension	Definition	Literature
Involvement	The act of employees takes part or participates in something.	Etzioni (1975), Glaser and Zamanou (1987), O'Reilly et al. (1991), Denison and Mishra (1995), Fey and Denison (2003), Udomleartprasert and Jungthirapanich (2004), and Li et al. (2011)
Consistency	The ability of employees to remains the same in behavior, attitude, or quality of work.	O'Reilly et al.(1991), Denison and Mishra (1995), Fey and Denison (2003), Xiao (2008)
Adaptability	The ability of employees to copes with unexpected disturbances in the environment.	O'Reilly et al. (1991), Denison and Mishra (1995), Fey and Denison (2003) Fynes et al. (2005), and Xiao (2008)
Innovativeness	The ability of employees to apply new approach or new idea to meet new requirements, inarticulate needs, or problem solving.	O'Reilly et al. (1991), Robeson (2009), Ozkaya (2011), and Ismail and Mamat (2012)

2.5.3.1 Organizational Involvement

Organizational involvement can be defined as the act of employees takes part or participates in something. It is supported by Mishra and Shah (2009) and Love and Roper (2009) where organizational involvement also represents the degree of strategic integration of internal resources and communication across different departments into a particular project to ensure achieved time efficient and cost effective. The frequent connections with other departments enable effective communications and resulted in process simplification (Henke, Krachenburg, & Lyons, 1993). Referring to the argument of Echtelt et al. (2008), organizational involvement in their opinion means the resources such as capabilities, investment, information, knowledge, and ideas that employees provide to the tasks and the responsibilities they assume for the benefit of an organization.

2.5.3.2 Organizational Consistency

There is important to clearly understand the concept of consistency because it is the backbone of numerous influential theories such as social psychology and personality theories (Triandis, 1999). Westerners viewed themselves consistent among the different aspects of identity, while East Asian viewed themselves as multiple selves. However, there is believed that consistent persons received positive social evaluations from others (Suh, 2002). Previous culture research has focused on examined the consistency of self-descriptions across contexts and multiple self-dimensions (English & Chen, 2007). The result of English and Chen (2007) showed that East Asians' relatively lack of consistency in the self-concept at the global level. However, Malaysian organization is believed to have consistency in a certain level.

2.5.3.3 Organizational Adaptability

Adaptability refers to the ability of the organization to reshape supply chains to cope with changed environment. The adaptabilities of supply chains are mostly depended on the ability of information systems to detect market changes and guide user to take appropriate actions (Lee, 2011). For the executives' perception, adaptive expertise is focused on the aspects of resourceful and constructive when solving problems (Castro, Ramos, & Molinaro, 2010). It is believed that, textile and apparel companies in Malaysia have strong adaptability in dealing with the quick change market.

2.5.3.4 Organizational Innovativeness

Innovativeness is a key to success. In textile and apparel industry, product innovation and process innovation are continuous and almost infinite practice (Ünay & Zehir, 2012). It is the concept of openness to new ideas as a feature of organization's culture (Hurley & Hult, 1998; Kibbeling, Bij, & Weele, 2013). The act of innovation able to help organizations to gain competitive advantage (Porter, 1990) through overcome the difficulties and challenges of such intense competition (Colovic, 2012). Innovation can be described in a broadest sense such as involved new methods and new technologies in performing business activities (Kimberly & Evanisko, 1981; Damanpour, 1991). Particularly, innovation can be viewed as any practices that are new to organizations such as new equipment, new products, new services, new processes, new policies, projects, and new knowledge (Knight, 1967; Damanpour & Evan, 1984) that are directly or indirectly associated to the routine work of an organization (Knight, 1967; Kimberly & Evanisko, 1981; Damanpour & Evan, 1984).

Innovativeness involves the willingness to use and recombined the existing information and resources into valuable opportunities (Hurley & Hult, 1998; Kibbeling et al., 2013). In the present era, firms innovative utilize supply chain technology to deal with the uncertainty to reduce costs, increase quality, achieve customer satisfaction, and gain competitive advantage and core competencies from competitors (Thomas & Griffin, 1996; Jacques, 2012). The innovativeness is critical for firms to enhance performance and sustain the competitive advantage in the supply chain (Storer & Hyland, 2011). In twenty-first century, a critical need for many organizations is the ability to quickly develop innovative business processes in order to take advantage from quick changing technologies and markets (Bernstein, Klein, & Malone, 1999).

Most management observers today agree that the successful organizations of the twenty-first century must be able to keep developing new business processes and new ways of doing things more rapidly than ever (Bernstein et al., 1999).

2.6 The Relationship between Supply Chain Capabilities and Supply Chain Operational Performance

RBV researchers assume that every firms hold diverse resources and capabilities that competitors find costly and difficult to duplicate and implement (Lim, Stratopoulos, & Wirjanto, 2012). In today's global marketplace, to achieve competitive advantage, an organization's ability to be responsive to competition by focus on four competitive characteristics which is cost, quality, speed, and flexibility (Javanmardi et al., 2012). Besides, supply chain relational capability is critical important factors on supply chain operational performance (Lee et al., 2007; Ramayah & Omar, 2010; Sukati et al., 2012). Meanwhile, IT capability (Arumugam & Mojtahedzadeh, 2011; Angappa Gunasekaran et al., 2008; Udomleartprasert & Jungthirapanich, 2004; Zhang & Wang, 2011) and organizational culture capability (Braunscheidel, Suresh, & Boisnier, 2010; Tsai, 2010; Tukamuhabwa, 2011; Wang, 2008) are equally important.

From the aforementioned, definitely the supply chain capabilities which relational capability, IT capability, and organizational culture capability have the ability to influence and give impact to supply chain performance. The further discussions on the relationship between each supply chain capabilities and supply chain performance are as following sections.

2.6.1 The Relationship between Relational Capability and Supply Chain Operational Performance

In SCM study, several researchers found that supplier partnership (Lee, Kwon, et al., 2007; Narasimhan et al., 2008; Prajogo & Olhager, 2012; Sukati et al., 2012; Seyda, 2013; Sukwadi et al., 2013), customer relationship (Lee, Kwon, et al., 2007; Narasimhan et al., 2008; Sukati et al., 2012; Seyda, 2013), information sharing (Narasimhan et al., 2008; Charkaoui et al., 2012; Sukati et al., 2012; Seyda, 2013), and information quality (Qrunfleh, 2010; Charkaoui et al., 2012) improved supply chain operational performance. The higher level of supplier partnership, customer relationshsip, and information sharing can lead to optimize supply chain costs (Dominguez et al., 2010; Thatte, Rao, & Ragu-Nathan, 2013), improved supply chain reliability (Ramayah et al., 2008; Sukati, Hamid, Baharun, Tat, & Said, 2011; Thatte et al., 2013), enhanced supply chain responsiveness (Sukati et al., 2011; Thatte et al., 2013), and flexibility in managing uncertainties in supply and demand (Ramayah et al., 2008; Dominguez et al., 2010).

Supplier partnership is critical for textile and apparel companies since it can provide quickly respond to a rapid changing market (Sukwadi et al., 2013). This finding is supported by the study of Fynes et al. (2005) and Srinivasan et al. (2011). The most basic benefit of partnering with suppliers is the buyer can assure quality materials consistently and timely deliveries from suppliers (Omar et al., 2006; Amad, Hamid, Salleh, & Choy, 2008). For instance, the partnership of Procter and Gamble (P&G) and Wal-Mart, P&G as an information and capital rich manufacturer, while Wal-Mart as an information and capital rich retailers get a win-win cooperation of information sharing across their mutual supply chain and achieved mutual benefits and enhanced

both supply chain performance (Cooper, 2010). In short, Rashed et al. (2010) conclude that a good partnership with suppliers positively impact on operational performance of the organziations. Inversely, the low dependency on supplier partnership is led to the worst in the supply chain performance (Chen & Fung, 2013).

In addition, the popularity of customer relationship management is growing in the international context. Good relationship with customers enabled providers to clearly understand customer wants and needs (Omar et al., 2006). It is commonly agreed that the higher customer focus enabled organizations to achieved higher performance in the supply chain (Omar et al., 2006; Vachon & Klassen, 2007; Rapp, Trainor, & Agnihotri, 2010). In short, Rashed et al. (2010) conclude that a great relationship with customer positively impact on operational performance of the organziations. Contrariwise, the low dependency on customer relationship is led to the worst in the supply chain performance (Chen & Fung, 2013).

The mixed method study of Fawcett et al. (2007) from 588 questionnaires survey and 144 interviews results indicated that information sharing capability found to impact on supply chain operational performance. Information sharing is a well-known manner to increase at least 50% (Ramayah & Omar, 2010) supply chain performance (Lin et al., 2002; Sezen, 2008; Kocoglu et al., 2011; Marinagi, Trivellas, & Reklitis, 2015). Specifically, the high levels of information sharing improved responsiveness (Jin et al., 2005; Gilaninia et al., 2011) and efficiency (Gilaninia et al., 2011) of all activities in the supply chain. Furthermore, the information sharing between the distribution center and retailer can result in enhanced order fulfillment rate and avoid lost sales, especially during promotion and peak season (Walton & Miller, 1995; Watanarawee &

Baramichai, 2010). Therefore, many firms have encouraged retailer and their upstream suppliers to shared demand information (Lee et al., 2000).

Furthermore, the quality of the information is also absolutely critical to influence the supply chain performance. Several researchers found that information sharing positively influences the supply chain performance (Miertschin et al., 2006; Qrunfleh, 2010; Charkaoui et al., 2012; Marinagi et al., 2015). The study of Ramayah and Omar (2010) further revealed that information quality was more to predictor for supply chain performance. However, several researchers argued that information sharing with key suppliers does not affect the supply operational performance (Rashed et al., 2010; Gyaneshwar & Kushwaha, 2012; Leng & Zailani, 2012).

2.6.2 The Relationship between IT Capability and Supply Chain Operational Performance

IT capability is considered as one of the major factors in SCM and which is a critical factor to improve supply chain performance. IT capability significant direct relationship with supply chain performance (Zhang & Wang, 2011). Specifically, several researchers observed that IT infrastructure was the most significant factor to minimize costs (Hassan, Hussain, & Rahman, 2013), enhanced operational agility (Lu & Ramamurthy, 2011). Besides, IT infrastructure not only positively affected transparency, but also reducing corruption at the same time (Khoo, 2013). In organizational perspective, IT personnel acts as important enabler of key IT products and services for smoothen the business operation flow (Henderson & Venkatraman, 1994). An appropriate technical solution is proposed by the IT personnel to solve business problems that related to IT applications (Lee et al., 1995). Basically, IT

personnel is utilized the flexibility of IT infrastructure in suggesting the solution to the management (Byrd & Turner, 2000). Therefore, IT personnel exhibit direct and positive effect on organization's agility performance (Fink & Neumann, 2007).

Furthermore, the use of IT knowledge in managing the supply chain is one of the top three critical success factors (Teo & Ang, 1999). IT knowledge of users is important for fully utilize the adopted technologies in improving business operation (Ang, Davies, & Finlay, 2000). Ang et al. (2000) noted that IT knowledge can be acquired through training and courses. In addition, IT reconfigurability positive and significant influenced on supply chain performance (Wei & Wang, 2010). Particularly, it has the advantages of robustness, flexibility, and agility to business activities (Zhang & Tao, 2008). For instance, bundle modular production system (BMPS), the result of reconfiguration of the bundling system and modular production system provide cost-effective and time efficient production for manufacturer to the quick response to volatile and quick-change market (Moin, Sarwar, & Doulah, 2013). Surprisingly, the contradict finding of Liu et al., (2013) found that IT capability did not direct influence to supply chain agility, but IT capability influence supply chains agility through mediating effect.

2.6.3 The Relationship between Organizational Culture Capability and Supply Chain Operational Performance

Organizational culture have been proof to be critical factors of organization's performance since many years ago (Baker & Sinkula, 1999; Cohen & Levinthal, 1990; Slater & Narver, 1995). Generally, culture has direct effect on organization's success or failure. Several researchers demonstrated that organizational culture must align with

organizational goals (Nadler & Tushman, 1980; Deal & Kennedy, 1982; Denison, 1990; Goll & Sambharya, 1995; Christensen & Gordon, 1999; Braunscheidel et al., 2010). This is because organizational culture has a significant and positive effect on supply chain performance (Braunscheidel et al., 2010; Thoo et al., 2011; Qrunfleh & Tarafdar, 2013; Sukwadi et al., 2013), specifically improved flexibility (Zhang & Tansuhaj, 2007) and enhanced responsiveness of global SCM (Zhang & Tansuhaj, 2007; Razalli, 2008). The study of Thoo et al. (2011) and Abdullah et al. (2013) found that organizational culture had a significant effect on supply chain performance of Malaysia SMEs. Furthermore, the study of Braunscheidel et al. (2010) which include 218 responses from supply chain professionals that listed in New York's Institute of Supply Management (ISM) indicated that organizational culture has positive direct relationship with supply chain performance.

In 21st century, textile and apparel organization must be efficient in providing products at low prices while having the ability to rapid adapts to quick-change market (Cooper, 2010). Besides, the organization must be also having the ability to consistenly provide high quality and innovative products to market at a rapid pace (Cooper, 2010). Technological and administrative innovations are pertaining to supply chain operational management. Several studies found that innovativeness in the supply chain bring benefits to supply chain performance (Tukamuhabwa, Eyaa, & Derek, 2011; Camisón & Villar-López, 2014) such as improved flexibility (Omar et al., 2006), save labor cost and inventory cost (Collins et al., 2010). Furthermore, the involvement of employees to participate in related job functions significantly affected the supply chain performance (Udomleartprasert & Jungthirapanich, 2004; Vanichchinchai, 2012). The study of Feng and Wang (2013) revealed that organizational involvement was

important in improving supply chain responsiveness, since it can identify gaps in organizational capabilities. Therefore, it is difficult for organizations to achieved desired performance without full involvement of employees (Katila & Ahuja, 2002). This is one of the reasons why Toyota's UK supply chain had emphasized on employee involvement and innovativeness in meeting just-in-time supply (Vanichchinchai, 2012).

2.7 The Relationship between Supply Chain Capabilities and Supply Chain Technology Adoption

Basically, the adoption of technology innovation is influenced by three broad factors, which are organizational, technological, and external environmental contexts (Kwon & Zmud, 1987; Power & Simon, 2004; Russell & Hoag, 2004; Wen, Zailani, & Fernando, 2009; Salim & Sulaiman, 2011; Scupola, 2013). These factors are significantly contributed to RFID adoption in China's manufacturing industry (Wen et al., 2009) and the adoption of c-commerce in Malaysia's E&E industry (Chong et al., 2009). Besides, the study of Melville et al. (2004) argues that the internal and external factors such as competitive environment, trading partners, infrastructure, broader educational, and cultural environment can influence on the effectiveness of supply chain technology adoption. In the industry, supply chain capabilities play an important role in the implementation of supply chain technology (Collins et al., 2010). According to Lin and Ho (2009), supply chain technology adoption able to help manufacturers, supplier, and retailers to improved communication and collaboration with efficiently and effectively.

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From the aforementioned, definitely the supply chain capabilities which relational capability, IT capability, and organizational culture capability have the ability to influence and give impact to supply chain technology adoption. The further discussions on the relationship between each supply chain capabilities and supply chain technology adoption are as following sections.

2.7.1 The Relationship between Relational Capability and Supply Chain Technology Adoption

Technology is a main binding force that often holds trading partner relationships together (Walton & Miller, 1995). Therefore, the readiness of the supplier to adopt new technology acts as a critical element (Dietrich & Cudney, 2011). Scupola (2013) added that the direct communication through the adopted technology closer the relationship between supply chain members. Today businesses are making use of supply chain technology such as extranets, intranets, and the Internet to leverage the available information from its trading partners and the marketplace (Faisal, Banwet, & Shankar, 2006).

Supplier partnership is associated with the usage of e-purchasing tools in SCM (Feeny & Willcocks, 1998; Giunipero, Ramirez, & Swilley, 2012). The findings of Nguyen et al. (2015) highlighted the importance of supplier partnership in the adoption process. This is because the effective and efficient communication between supplier and organization is achieved through adoption of adequate technologies. Several researchers have demonstrated that excellent supplier partnerships are important factors to improving the adoption of e-business (Lai, Wang, Hsieh, & Chen, 2007; Lin & Lin, 2008), mobile SCM system (Chan & Chong, 2013), RFID technology (Ngai et

al., 2012), EDI system (Maltz & Srivastava, 1997), and ERP system (Abu-Shanab, Abu-Shehab, & Khairallah, 2015; Hwang & Min, 2015).

Customers are the core driving force of technology adoption. The study of Nguyen et al. (2015) found that customer relationship is one of the main factors in making a positive contribution to the success of the supply chain technology adoption. Furthermore, the findings of Bharati and Chaudhury (2006) revealed that customer was significantly impacted on adoption decisions. For instance, the study of Gertler (1995) on Ontario's advance manufacturing technologies adoption revealed that the closeness or a great relationship between supplier and customer is a key for the successful implementation.

Nowadays, information sharing among trading partners has been growing become an important aspect to influence organization's decision to adopt supply chain technology (Chong et al., 2009) especially in textile and apparel industry (Caridi, Perego, & Tumino, 2013). This condition has subsequently boosted the use of the supply chain technology to share information electronically (Maltz & Srivastava, 1997; Icasati-Johanson & Fleck, 2003; Chan & Chong, 2013; Hendarty & Nusantara, 2014) to overcome the globalization concerns, enhanced accurate and timely information (Caridi et al., 2013; Doyran, 2013), increased flexibility, and minimized supply chain costs (Maltz & Srivastava, 1997). The organization can achieve a higher successful level of implementation of such supply chain technologies, if the organization incorporated shared training regimes and workplace practices between supplier and customer. Therefore, Kumar et al. (2013) noted that information sharing had to examine prudently before supply chain technology is adopted. However, Fawcett et al.

(2007) revealed that many companies were found to have placed emphasis more on connectivity, but often overlook the willingness to share information.

The study of Cao et al. (2013) and Hendarty and Nusantara (2014) demonstrate strong relationship between information quality and supply chain technology adoption especially SCM system and ERP system. Improper training prior to the adoption is one of the main causes of data entry errors that unable to allow users to use the adopted system confidently (Hendarty & Nusantara, 2014). Hence, in today's complex supply chains, the use of technology is considered as a prerequisite for the effective control of information quality.

2.7.2 The Relationship between IT Capability and Supply Chain Technology Adoption

Technological capability is a standout among the most influential factors in supply chain technology adoption. The number of studies show that the characteristics of the technology itself possess the power to influence the adoption process (Tornatzky & Fleischer, 1990; Rogers, 2005; Scupola, 2013; Hsu, Ray, & Li-Hsieh, 2014) such as cloud computing adoption (Hsu et al., 2014). It is intriguing to note that IT infrastructure is one of the factors that strongly affected the adoption of supply chain technology (Chau & Tam, 1997; Tan & Teo, 2000; Mustonen-Ollila & Lyytinen, 2003; Khoumbati, Themistocleous, & Irani, 2006; Nguyen et al., 2015). The adoption of supply chain technology is not without costs, but also requires a sophisticated IT infrastructure to adopt effectively (Kozloff & Gordon, 2003). Therefore, the Malaysian government offer financial incentives and technological infrastructure to speed up technology adoption (Saleh & Ndubisi, 2006). Several researchers observed that IT

infrastructure was needed prior to the technology adoption (Tornatzky & Fleischer, 1990; Fichman, 2000; Nguyen et al., 2015) such as computer to use positively influence the adoption process (Agarwal, Ahuja, Carter, & Gans, 1998).

Chandrasekaran (2010) points out that availability of infrastructure and needs competence of implementation personnel are the factors that affect the choosing a supply chain technology solution. Therefore, human factor is one of the most importance factors during technology adoption and introducing processes (Tsai, Lai, & Hsu, 2013). The improvement of IT personnel's managerial and technical knowledge and skills is a must before the new technology is adopted in the organization (Harkness, Kettinger, & Segars, 1996). IT personnel is crucial in determining the right adoption and smooth use of all staff in the respective department (Melville et al., 2004; Wade & Hulland, 2004; Ferratt, Agarwal, Brown, & Moore, 2005; Khoumbati et al., 2006; Yeh, Lee, & Pai, 2014). IT personnel is a dimension that is strongly underpinned by diffusion of innovation theory as it represented the complexity dimension in the theory (Rogers, 1995). As Harper (2010) points out that an effective ERP system requires continuous support and maintenance by IT personnel.

Several researchers observed that IT knowledge was one of the important factors that influence the organizations to adopt something new to their organization (Orlikowski, 1993; Zhu, Kraemer, & Xu, 2003; Brown & Fai, 2006; Kozan, Öksoy, & Özsoy, 2006; Evangelista, McKinnon, & Sweeney, 2013; Hendarty & Nusantara, 2014; Nguyen et al., 2015). The study of Kyobe (2004) strengthened the relationship of IT knowledge and CRM adoption. However, the analysis of Hadjimanolis and Dickson (2000) and Speier and Venkatesh (2002) revealed that the relatively limited or incomplete technological knowledge towards the adoption of technology is common in practice.

This may due to the users do not received adequate training prior to the implementation and do not understand the potential of the adopted technologies (Evangelista et al., 2013; Hendarty & Nusantara, 2014; Nordin & Othman, 2014). A surveyed of the relationship from small business in Iran was not significant, however, they found that the adopters of EDI possess employees with high IT knowledge (Ghobakhloo & Tang, 2013). Therefore, Peltier et al. (2009) and Nguyen et al. (2015) concluded that the organizations are slow in adoption of new technology when managers do not possess sufficient relevant IT knowledge toward their business practices.

As of today, there is still limited literature that is examined the relationship between IT reconfigurability and supply chain technology adoption. However, this study found a real example from the study of Lim and Istook (2012), the textile and apparel organization reconfigure the function of CAD system that is normally performed in producing mass production garments to automated pattern generation custom fit garment, also known as made-to-measure (MTM) garment significantly increase the adoption of CAD system in the organization.

2.7.3 The Relationship between Organizational Culture Capability and Supply Chain Technology Adoption

There is relatively a dearth of study on the impacts of organization culture in the SCM literatures (Orlikowski, 1993; McDermott & Stock, 1999; Nahm, Vonderembse, & Koufteros, 2004; Braunscheidel et al., 2010; Thoo et al., 2011). However, previous studies demonstrated that the organizational culture has been considered as an important factor to supply chain technology adoption (Zhang & Tansuhaj, 2007; Lin, 2008; Braunscheidel et al., 2010; Hwang, 2011; Lai & Yusof, 2011; Livermore &

Rippa, 2011; Scupola, 2013; Hwang & Min, 2015). Generally, Livermore and Rippa (2011) found that culture affects usefulness, while Hwang (2011) showed that culture impact on the use of supply chain technology. Specifically, several studies in organizational culture indicated that organizational culture has significant effect on ERP adoption (Hwang & Min, 2015), advanced manufacturing technology adoptions (Zammuto & O'Connor, 1992; Gertler, 1995; McDermott & Stock, 1999), common technology adoption (Abdullah et al., 2013), cellular manufacturing practices (Yauch & Steudel, 2002), real time manufacturing practices (Nahm et al., 2004).

Employee involvement has not been thoroughly studied as enabler of technology adoption (Abdullah et al., 2013; Nordin & Othman, 2014). Accordingly, organizations ought to be given special attention to enhance employee involvement in adopting supply chain technology as a strategic tool. This is because in today's globalizing society, the used of technology is crucial for firm to obtained greater synchronization among the various linkages in the supply chain (Ghisi & Silva, 2001). Several researchers highlighted the contribution of employee involvement in the success of supply chain technology adoption (Haines III & Lafleur, 2008; Scupola, 2013; Nguyen et al., 2015) such as the adoption of RFID (Wen et al., 2009). Lee et al. (2007) further noted that top management involvement also has significant relationship with supply chain technology success level. These showed that the intra-organizational involvements are crucially important, nevertheless, the inter-organizational involvements are equally important for an organization to successfully implementation of the technology (Gertler, 1995). However, lack of employee involvement is one of the supply chain technology adoption critical failure factors (Tarokh & Soroor, 2006; Ngai et al., 2012; Nordin & Othman, 2014).

In diffusion of innovation theory, formalization is referred to the working culture of employees in an organization, whether they follow the organization rules and working procedures (Rogers, 1995). In currently study, one of the dimension which is known as "consistency" possesses the similar meaning of formalization and they are measuring the similar items. This reveals that consistency significant and positively influenced to supply chain technology adoption. In addition, cultural adaptabilities between two parties or adaptability to the new work practices are required to achieve successful adoption of a supply chain technology (Tsai et al., 2013; Suriyapperuma, Yajid, Khatibi, & Premarathne, 2015). However, commonly, the cultural adaptation through supplier or manufacturer investments to retailers (Tsai et al., 2013).

The study of Detert et al. (2000) discovered that organizational culture towards organization-wide acceptance of change is a critical precursor of innovation. Scupola (2013) added that employee resistance to change at the operational level able to affect the adoption process. The innovativeness of personnel in the domain of technology has a positive and significant relationship with the use of new technology. It's means that innovativeness has the ability to give impact to supply chain technology adoption (Agarwal & Prasad, 1998; Mahler & Rogers, 1999) such as the adoption of e-commerce (Webb, 2008). This is supported by Agarwal et al. (1998) and Ghobakhloo and Tang (2013), employee's innovativeness in the domain of IT positively influence the adoption process. The operational benefit is an important factor for organization to make consideration on the adoption of c-commerce in business operation. However, the study of Chong et al. (2009) is inconsistent with the findings of Webb (2008) in which innovation attributes have no impact on c-commerce adoption.

2.8   The Relationship between Supply Chain Technology Adoption and Supply Chain Operational Performance

Nowadays, supply chain technology is universally regarded as an essential tool in improving SCM and gained competitive advantages from competitors. Despite the number of research during the past two decades, the results on supply chain technology adoption towards supply chain performance are rather mixed and thus, there is still an ongoing debate about the impact of supply chain technology adoption towards the supply operational performance (Humphreys, Fynes, & Wiengarten, 2014). Operational benefits associated with supply chain technology adoption in SCM have proven to be an area of keen interesting by researchers and practitioners for recent decades (Blankley, 2008). Huisman and Smits (2007) found that investments in network ability can lead to higher supply chain performance, but that organization success seems to depend on the type of technology investments. However, a technology alone did not provide significant relationship to supply chain performance, but observable effects can be realized if the supply chain technology widely spread and adopt (Powell & Anne, 1997; Vijayasarathy, 2010; Henfridsson & Bygstad, 2013).

In the era of advanced technology, the utilization of supply chain technology would allow long term survival for textile and apparel organizations (Cooper, 2010). The adoption of new technology is often linked with the demolition of existing or obsolete technology. The new technology not only directly showed results in optimal production costs, but also indirectly add value for human and organizational capital (Moshiri & Simpson, 2011). By having the power of supply chain technology, supply chain must be rapid, innovative, and flexible in response to gain profitability, competitive advantage, and core competencies (Jacques, 2012). The literature

illustrates that technological innovation is the most strategy effort for firms to be competitive (Tsai, 2010), especially logistics firms that wish to improve organizational and supply chain performance (Helms, Ettkin, & Chapman, 2000).

The adoption of supply chain technology offer organizations abundant benefits. Several researchers found that supply chain technology adoption is led to operational benefits (Hamid, Krishnapillai, & Anuar, 1999), reduce costs, improved reliability (Burn & Ash, 2005), reduce inventory cost, improved flexibility (Porter, 2001; Bingham, Hoefle, Phan, Sizemore, & Keller, 2003; Hwang & Min, 2015), enhanced agility (Vickery, Droge, Setia, & Sambamurthy, 2010; Bagheri, Hamid, AR, Mardani, & Soltan, 2013; Bagheri, Hamid, Shekarchizadeh, Mardani, & Asgari, 2014; Bagheri, Hamid, Soltani, Mardani, & Soltan, 2014; Hwang & Min, 2015), increase responsiveness (Bingham et al., 2003), providing management support, improve customer service, reducing operational costs, gaining competitive advantages (Premkumar, Ramamurthy, & Crum, 1997; Sawy, Malhotra, Gosain, & Young, 1999; Chan, Choi, & Hui, 2012; Dolci & Maçada, 2014), minimizing bullwhip effect, reducing inventories, maximizing efficiency of activities, higher quality (Burn & Ash, 2005; Cao et al., 2013), lowering cycle times (Hamid et al., 1999; Vickery et al., 2010; Cao et al., 2013), better transaction efficiency (Hamid et al., 1999; Efendi, Kinney, Smith, & Smith, 2013), and greater market transparency (Efendi et al., 2013). The adoption of B2B is led to performance improvement through lower administrative and purchasing costs (Efendi et al., 2013), while the adoption of the Internet and mobile technology is led to enhance agility in the supply chain (Samdantsoodol, Yu, Cang, & Angarag, 2013), responsiveness and flexibility (Sukwadi et al., 2013). It is clear that supply chain technology investments revolutionize supply chain performance

(Ranganathan, Dhaliwal, & Teo, 2004; Collins et al., 2010). However, these advantages and benefits can be elusive (Edmondson et al., 2001). Different applications can lead to the different outcomes, even the use of similar technologies (DeSanctis & Poole, 1994).

In SCM, the information plays a key role in the supply chains coordination and performance enhancement. Therefore, the true supply chain technology adoption is the way to enhancing a firm's supply chain performance (Kwon & Suh, 2005; Dominguez et al., 2010) and support some of their operations (Shacklett, 2012; Bhaskaran, 2013). The study of Tseng et al. (2011) points out that advance technology is led to modern manufacturing facilities and efficiently improved production processes with maximize the inherent advantages. In Vietnam apparel industry, the growth of the performance is mostly depended on the supply chain technology (Tseng et al., 2011). For those firms that unable to invest technology correctly would lose competitiveness in quick response to market changing and reduce production costs (Thomas & Griffin, 1996). Thus, a successful business operation is not only equipped with computers and the Internet, but also supply chain technology adoption. The organization gained the competitive advantage through technology adoption that is exclusive and competitors find costly and hard to be imitated (Piccoli & Ives, 2005; Fasanghari et al., 2007).

Manufacturing industries are behind the service industries in terms of the adaptation of new technology, the partly reason is because of the flexibility and cost of the adaptation (Moshiri & Simpson, 2011). Supply chain technologies championed by network leaders in their supplier networks are now ubiquitous (Subramani, 2004). Firms like Wal-Mart, Dell, Seven-Eleven, Saturn, Toyota, Cisco, Ford, Chrysler, and Charles Schwab have utilized their supply chains to arise as leaders in respective

businesses industry (Subramani, 2004; Faisal et al., 2006). The adoption of e-commerce has achieved visible improvements in value chain activities, which increased revenue generation and operational efficiency (Tan & Ibrahim, 2010; Yahya, 2011). The finding of Tseng et al. (2011) study identified that the supply chain technologies have positive relationship with supply chain performance, especially improving the efficiency in textile manufacturing production processes. These are supported by the study of Ismail and Mamat (2012) which indicates that the supply chain technology adoption able to improve the standard of information and communication.

The advent of advance supply chain technology and intense global competition has attracted numerous world class manufacturers and service providers into adoption an integration strategic approach in SCM (Tan, 2002). Nowadays, integration of supply chain activities and adoption of supply chain technology becomes competitive necessities in most of the industries (Patterson, Grimm, & Corsi, 2003) such as manufacturing (Zhu, Kraemer, & Xu, 2006; Chong et al., 2009; Kamaruddin & Udin, 2009; Yeh et al., 2014), service (Zhu et al., 2006; Yeh et al., 2014), finance (Yeh et al., 2014), retail or wholesaler (Zhu et al., 2006; Peltier et al., 2009; Vlachos, 2014) hotel (Hassan et al., 2013), and health care (Cao, Jones, & Sheng, 2014). Vlachos (2014) founds that implementation of RFID practices enable the retailer to improve the performance of supplier, inventory, distribution, forecasting, plan, and sales. Particularly, this is to enable the organization extends its supply chain such as information sharing to upstream suppliers and downstream customers (Sabbaghi & Vaidyanathan, 2008). While, Peltier et al. (2009) studied the adoption of CRM technology in small retails. The analysis revealed that CRM technology offered a

better opportunity to strategically understand customers. In addition, a case study of Tristen Corporation by Cotteleer and Bendoly (2006), the data showed a significant improvement on operational performance immediately after the adoption of ERP. Thus, there is many company such as Cisco, Ford, Dell, General Electric, and China's logistics service providers have started to pay attention on adoption of more efficient supply chain technologies, because they believed that supply chain technologies able to bring them benefits (Bovet & Martha, 2000; Lancioni, Smith, & Oliva, 2000; Anderson & Lee, 2001; Lin, 2008) such as enables accurate, timely, accessible, and adequate information to be shared throughout the supply chain (Javanmardi et al., 2012).

The study of Patterson et al. (2003) which include responses from a manager indicated that the technology advancement is necessitated in every facet of the business. Therefore, the adoption of new technology for synchronization business process is needed to hold market share and improve market penetration (Patterson et al., 2003). Supply chain technology adoption enables firm to transfer more accurate and real time information visibly such as demand and inventory levels (Patterson et al., 2003; Shacklett, 2012). This is aligned with the study of Gunasekaran et al. (2008), supply chain technology applications are direct effects to supply chain responsiveness as well as speed and flexibility. Therefore, in order to achieve a smooth information, material, and financial flow along the supply chain, the suitable supply chain information system such as web-based information system application is critically important to reduce communication barriers and improves supplier or customer profiling (Gunasekaran & Ngai, 2003, 2004a; Gunasekaran et al., 2008).

The study proof that many organizations are adopting new supply chain technology to achieve improvement in operational performance (Blankley, 2008) to automate the internal and external processes of the organization (Peppa & Moschuris, 2013). Specifically, it is supported by the study of Mizar (2013) and Peppa and Moschuris (2013), the utilization of technology in operation can influence on the delivery, quality, flexibility and cost. In fact, the greater business value can be achieved through selected the correct technology at the right time and the well managed of the adoption (Blankley, 2008). An interview of Dell Computer's Michael Dell by Magretta (1998), fast moving the pace of every elements of business is essential to avoid lose competitiveness in the industry. However, operational improvements are time consuming due to learning effects (Blankley, 2008; Collins et al., 2010). Therefore, it is important for organization to make informed decisions while adopting the technology, otherwise, the result can be absolutely negative, especially, the SMEs (Singh, 2003; Fantazy et al., 2009; Dietrich & Cudney, 2011).

However, supply chain technology impact on the performance of SCM are not equally (Fasanghari, 2008). For instance, some firms have reported that there is scarce or insignificant gain from the adoption of supply chain technology (Porter, 2001; Gyaneshwar & Kushwaha, 2012). In the meantime, the study of Ramayah et al. (2008) seemed to be contradictory with the result of Udomleartprasert and Jungthirapanich (2004), Arumugam and Mojtahedzadeh (2011), Tseng et al. (2011), and Vijayasarathy (2010). The study of Ramayah et al. (2008) point out that the use of supply chain technologies had insignificant relationship with supply chain performance. Thus, it is critical to investigate the relationship between supply chain technology adoption and supply chain operational performance.

2.9 The Interrelationship among Supply Chain Capabilities, Supply Chain Technology Adoption, and Supply Chain Operational Performance

The next step after the discussion of all direct relationships in the theoretical framework is focused on the mediating effects of supply chain technology adoption associated relational capability, technological capability, and organizational culture capability towards supply chain operational performance. The mediating role of supply chain technology adoption is becoming increasingly important in current practice and it is a cutting-edge research topic for SCM community. Lin (2008) points out that technological innovations adoption significantly mediated the relationship between technological, organizational, and environmental characteristics, and supply chain performance. Gunasekaran and Ngai (2004) further stated that there is impossible to achieve an effective supply chain without the aid of technological functions. This means that supply chain technology adoption is like a nerve system for SCM or as a mediator to share information on various values adding activities along the supply chain (Omar et al., 2006). Interestingly, the recent textile and apparel supply chain study, Crinis (2012) and Cooper (2013) noted that the industry should focus on the technology advancement in managing the supply chain. However, at present, the researchers and practitioners know very little about these relationships. The comprehensive discussions are as following subsections.

2.9.1 The Mediating effects of Supply Chain Technology Adoption in the Relationship between Relational Capability and Supply Chain Operational Performance

Hall and Saygin (2011) and Jesus and Rocio (2011) noted that timely operation able to provide business opportunities and competitive edge, but it required the support

through technology adoption. Nowadays, fashion supply chains are shared real time information to be responsive to customer requests (Kumar, 2001; Christopher et al., 2004). A lots of firm achieved and remained competitive through the uses of supply chain technology to share data between supply chain members to form a virtual supply chain (Christopher, 2000; Boon-itt, 2009). This is because the organizations realized that information based is better than inventory based (Christopher, 2000). Therefore, the intention of performance improvement can be achieved through adoption of supply chain technology (Collins et al., 2010). For instance, the adoption of e-commerce in business processes becomes more essential to business partners to shared supply chain information (Lin et al., 2002).

Effective SCM is heavily relied on the technological functions to provide the reliable intermediate for high quality information transmission (Jing & Hua, 2008). As information access and quickly respond to market changes is a primary reason for using an supply chain technology, thus, information quality becomes intrinsic in satisfying that goal (Javanmardi et al., 2012; Lee et al., 2009). The developing country such as India and China received a large contribution from supply chain technology in minimize the cost and maximize the value of the supply chain (Kumar, 2001).

Different SCM practices required support from appropriate technological applications (Qrunfleh, 2010). The significant relationship between levels of information sharing and supply chain performance is mediated by supply chain technology adoption, namely extranet technology (Lin et al., 2002), EDI, VMI, and POS (Lin et al., 2002). As a result, information shared through supply chain technology application able to enhanced order fulfillment rate, shorter order cycle time (Lin et al., 2002), minimized total cost (Lin et al., 2002; Jonsson & Gunnarsson, 2005; Javanmardi et al., 2012),

reduced demand uncertainty (Lin et al., 2002), improved quality, enhanced timeliness (Javanmardi et al., 2012), provides better services (Gunasekaran et al., 2001; Jonsson & Gunnarsson, 2005), and improved supply chain partnership (Jonsson & Gunnarsson, 2005). Besides, with use of supply chain technology, remarkable progresses do in all parts of the supply chain and enhanced connectivity (Lockamy & McCormack, 2004a; Tavassoli et al., 2009) and reduced supply chain operation disruption risks (Zhang & Wang, 2011).

Several strategies have been developed based on the information sharing to deal with the supply chain effectiveness and efficiency. VMI is one of the strategies that often used to upgrade the overall supply chain performance, but it seems like more attractive for supplier attention (Rouibi & Burlat, 2010). Kulp (2002) founds that the extent of VMI use increases with precise and reliable flows of information from the retailer to the manufacturer led to enhance supply chain performance. For instance, Toyota using the FMS to providing high level of responsiveness to customer and also make further improvement from the valuable feedback (Gunasekaran, et al., 2001). This is a significant strategy to balance the flow of product and process changes to quickly response to the customer needs (Thomas & Griffin, 1996; Stewart, 1997).

In addition, Dell using online selling their customer configured computers have become famous. Through online ordering, Dell able to provide goods to customers exactly what they want accordingly to the order list and led to reduction in 70% inventories (Xuhua, 2008). Moreover, Dell shares customer information with partners of its supply chain, which are their suppliers and customers through extranet and the Internet to view their confidential information, including warranty claims, planned product changes, latest sales forecasts, and defect rates as well (Mehrjerdi, 2009, 2010).

The information sharing was goes in both upstream and downstream in their supply chain. Which means that Dell's tier one suppliers are required to provide their latest information such as defect rates and production difficulties to Dell to collaboratively come up solutions for the problems (Zolait et al., 2010). The Internet connectivity optimized the information sharing among members in the supply chains (Wei et al., 2009).

2.9.2 The Mediating effects of Supply Chain Technology Adoption in the Relationship between IT Capability and Supply Chain Operational Performance

The study of Lu and Ramamurthy (2011) which includes response from 128 organizations' information systems executive revealed that IT capability and supply chain technology adoption positive and significant impact on operational agility. The results of Udomleartprasert and Jungthirapanich (2004), which includes 371 manufacturers in Thailand's estate industrial indicated that the relationship between supportive infrastructure and supply chain performance is mediated by supply chain technology adoption, namely SRM and CRM systems. Moreover, IT personnel exhibit direct and indirect effect on firm's agility performance through the mediating effect of supply chain technology adoption (Fink & Neumann, 2007). Information sharing is facilitated by supply chain technology adoption to increase the information quality (Kumar & Pugazhendhi, 2012). For example, inventory level is one of the valuable information to share with customer or supplier via the Internet (Chan & Chan, 2009). Thus, the Internet is a platform for coordinating activities among supply chain partners (Melville & Ramirez, 2008).

2.9.3 The Mediating effects of Supply Chain Technology Adoption in the Relationship between Organizational Culture Capability and Supply Chain Operational Performance

Previous studies demonstrated that the organizational culture has been considered as an important factor to supply chain technology adoption (Braunscheidel et al., 2010; Lai & Yusof, 2011; Lin, 2008; Zhang & Tansuhaj, 2007) and associated with supply chain performance (Braunscheidel et al., 2010; Thoo et al., 2011). Organizational culture geared around technology adoption can provide linked with performance improvement (Abdullah et al., 2013). Therefore, employee involvement in all business area is the key to meet the objective of global performance in the supply chain organization. This enables the organization to adopt a new and more collaborative way to managing relationships with their partners in the supply chain (Dominguez et al., 2010).

Supply chain technology adoption enables the organizations to conduct business by electronically with their supply chain partners along the value chain. It is also created opportunities for organizations to developed interrelationships with supply chain members (Lee, Lee, & Lin, 2007). The supply chain technology adoption is critical and important success factors for an organization (Miertschin et al., 2006; Kamaruddin & Udin, 2009). Therefore, for the companies that successfully adopted supply chain technology as the mediating tools for business activities (Thomas & Griffin, 1996; Kamaruddin & Udin, 2009) would gain a competitive advantage from their competitors (Kamaruddin & Udin, 2009) and get opportunities for cost reduction and service improvement (Thomas & Griffin, 1996; Hassan et al., 2013). In this point of view, the adoption of supply chain technology became a real contribution to SCM (Iyer, 2011; Kim, 2006; Tsai, 2010). However, the used of new technologies were added

complexity to the business transaction and processes (Dembla, Palvia, & Krishnan, 2007; Monteiro & Pollock, 2014). Thereby, organizations have to provide relevant technological knowledge to improved users' usability and usefulness (Svensson, 2003).

2.10 Justification for the Selection of Supply Chain Technology Adoption as Mediator

In social science research, the mediator (i.e., mediating variable or intervening variable) explain how external physical events take on internal psychological significance (Baron & Kenny, 1986; Hayes, 2013). In other words, it expresses to "how" or "why" such effects occur, instead of specify "when" certain effects will hold (moderators). Mediator is a third variable in the research framework (Baron & Kenny, 1986; Hayes, 2013). According to Baron and Kenny (1986) and Hayes (2013), the variable functions as a mediator when meets the three conditions which are (1) independent variable significantly impact the presumed mediator (i.e., Path *a*), (2) the presumed mediator significantly impacted the dependent variable (i.e., Path *b*), (3) the relationship between independent variable and dependent variable (i.e., Path *c*) decrease (partial mediation) or eliminates (full mediation). Normally, in social science research, treat phenomena that have multiple causes, it is more likely to decrease the relationship between the independent variable and dependent variables. Figure 2.15 clearly exhibited the nature of the mediator variable.
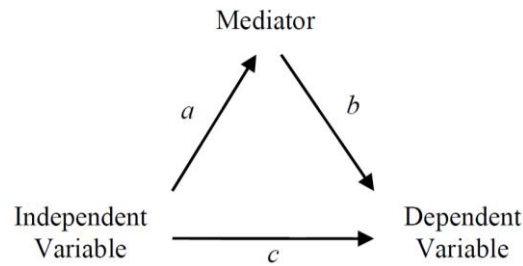
Figure 2.15
The Nature of Mediator Variable
Source. Adopted from Baron and Kenny (1986) and Hayes (2013)

As discussed in the previous section of this chapter, supply chain capabilities link to supply chain operational performance directly and indirectly through supply chain technology adoption. However, supply chain capabilities are developed from the heterogeneous resources (Halldorsson et al., 2007). Hence, this means supply chain capabilities are mediated by heterogeneous resources. Recently, Collins et al. (2010) found the strong evidence of the link between knowledge management capabilities, supply chain technology investment, and supply chain performance. It is supported by Power and Simon (2004), the adoption of technology innovation is influenced by three broad factors, which are organizational, technological, and external environment contexts. These factors are considered as supply chain capabilities. Thus, supply chain capabilities are the important factors for supply chain technology adoption (Harper, 2010). Furthermore, Lin (2008) found that the link between technological, organizational, and environmental context and supply chain performance is mediated by technological innovation adoption. Specifically, Lin et al. (2002) found that the link between information sharing and supply chain performance is mediated by supply chain technology application which is extranet technology. The literatures further illustrate that supply chain technology adoption is linked to better supply chain reliability (Eugenio-Gonzalez et al., 2009), responsiveness (Gunasekaran et al., 2008; Ma & Zhang, 2009), agility (Jin et al., 2005), and costs (Wang & Zhang, 2009).

As discussed above, in general, supply chain technology adoption is potential to be a mediator in the relationship between supply chain capabilities and supply chain operational performance. One of the different between this study and the above researches is that in terms of the dimensions of supply chain technology adoption. This study proposes supply chain technology use and supply chain technology usefulness to measure supply chain technology adoption, while Kamaruddin and Udin (2009) use only supply chain technology use. Meanwhile, other researchers only use single item in measure supply chain technology adoption which is c-commerce (Chong et al., 2009) and extranet technology (Lin et al., 2002). This study expands the meaning of supply chain technology adoption and proposes a new measurement for assessing supply chain technology adoption which is supply chain technology usefulness. Besides, most of the supply chain or operation management studies focus more on the manufacturing operations. Hence, this study attempts to fill the gap in the area of textile and apparel industry, which focus on the complete chain of the single industry. This means that not only manufacturers, but also involved suppliers, retailers, service providers, and customer in the study. Since the supply chain is a chain that involved all trade members in using the same supply chain technology. Last but not least, this study attempts to fill the gap in supply chain capabilities and its relationship with supply chain technology adoption and supply chain operational performance.

2.11 Underpinning Theory

This section discusses the underpinning theory for this study. Although SCM has existed for almost 30 years, but as of today, there is still lacked of theoretical support for understanding and explaining the reality or the boundaries of SCM (Halldorsson et al., 2007). In short words, there is no right theory for SCM study. Therefore, Ketchen and Hult (2007) and Halldorsson et al. (2007) suggested to employ organizational theories in analyzing phenomena in SCM, since, current rival is increasing to compete between supply chains rather than between organizations. As Halldorsson et al. (2007) suggested, researchers should depend on more than one theoretical explanation when analyzing phenomena in SCM. Moreover, Halldorsson et al. (2007) and Ketchen and Hult (2007) argued that SCM has no unified or right theory. This is supported by several researchers, which reveal that it is impossible to have a single theory can be generally applied to all kinds of technology adoption (Kimberly & Evanisko, 1981; Zmud, 1982; Damanpour & Evan, 1984; Robey, 1986; Swanson, 1994; Lai & Guynes, 1997; Thong, 1999; Zhu et al., 2006; Lee & Shim, 2007). Oliveira and Martins (2011) further suggested that the combination of more than one theoretical model is appropriate for the study that examines complex new technology adoption. Therefore, this study would consider three theories in order to provide a comprehensive view of SCM (Halldorsson et al., 2007; Ketchen & Hult, 2007).

Conclusively, Resource Based View (RBV) theory was a dominant explanatory theory, while Diffusion of Innovation Theory (DOI) and Technology-Organization-Environment (TOE) model were complementary theory for this study. Specifically, RBV employed as theoretical background of complete research framework under study, while diffusion of innovation theory and technology-organization-environment

model employed as theoretical background for the links between supply chain capabilities and supply chain technology adoption. The reason of DOI theory and TOE model employed concurrently is to use the strengths of one theory to overcome the weaknesses of the other theory. Indeed, the TOE model has an additional context that is not covered in the DOI theory, which is environment (Oliveira & Martins, 2011). However, the DOI theory emphasized on the human factors which is the one of the most important context for organizational and technology adoption study (Melville et al., 2004; Wade & Hulland, 2004). Aforementioned theoretical perspectives are further discussed as follows:

2.11.1 Resource Based View Theory

RBV becomes an important guide for this study. The RBV deals with the coordination and application of relational assets, internal competences, heterogeneous resources, and capabilities (Wernerfelt, 1984, 1995; Grant, 1991; Peteraf, 1993; Barney, 2001; Halldorsson et al., 2007). The capabilities in RBV are known as the combination of two or more resources (Grant, 1991). The construct of these resources and capabilities helped a particular firm to gained competitive advantages and further transforms the short run competitive advantage into a sustainable competitive advantage (Wernerfelt, 1984, 1995; Grant, 1991; Peteraf, 1993; Barney, 2001; Halldorsson et al., 2007).

Basically, in this study, RBV is acted as a coordination and application of relational assets (i.e., supplier partnership, customer relationship, information sharing, and information quality), internal competence (i.e., IT infrastructure, IT knowledge, IT personnel, IT reconfigurability), heterogeneous resources (i.e., involvement,

consistency, adaptability, and innovativeness) and capabilities (i.e., supply chain capabilities, namely relational capability, IT capability, and organizational culture capability) to help firm to gained competitive advantages and further transform (i.e., supply chain technology adoption) the short run competitive advantage into a sustained competitive advantage (i.e., supply chain operational performance). In a short sentence, relational capability, IT capability, organizational culture capability, and supply chain technology adoption would be the resources and capabilities that used to improve the supply chain operational performance in Malaysian textile and apparel industry. In RBV, the transformation is the key to improved performance. Therefore, this study proposes that only supply chain capabilities that improved the supply chain technology adoption can create the desired supply chain operational performance as shown in Figure 2.16.

Generally, the heterogeneous resources encompass technological, financial, organizational, reputational, human, and physical. Subsequently, the combination of two or more heterogeneous resources would become potent capabilities of a firm and serve as its source of competitive advantage. Besides, Fahy (2000) suggested that resources can be categorized into three categories, which are (1) tangible, (2) intangible, and (3) capabilities. Meanwhile, Mills, Platts, and Bourne (2003) categorized the resources into six categories, which are (1) tangible resources, (2) knowledge resources, skills, and experience, (3) system and procedural resources, (4) cultural resources and values, (5) network resources, and (6) resources with potential dynamic capability. In this study, relational capability, IT capability, organizational culture capability, and supply chain technology adoption are the capabilities and resources that use to improve the supply chain operational performance.
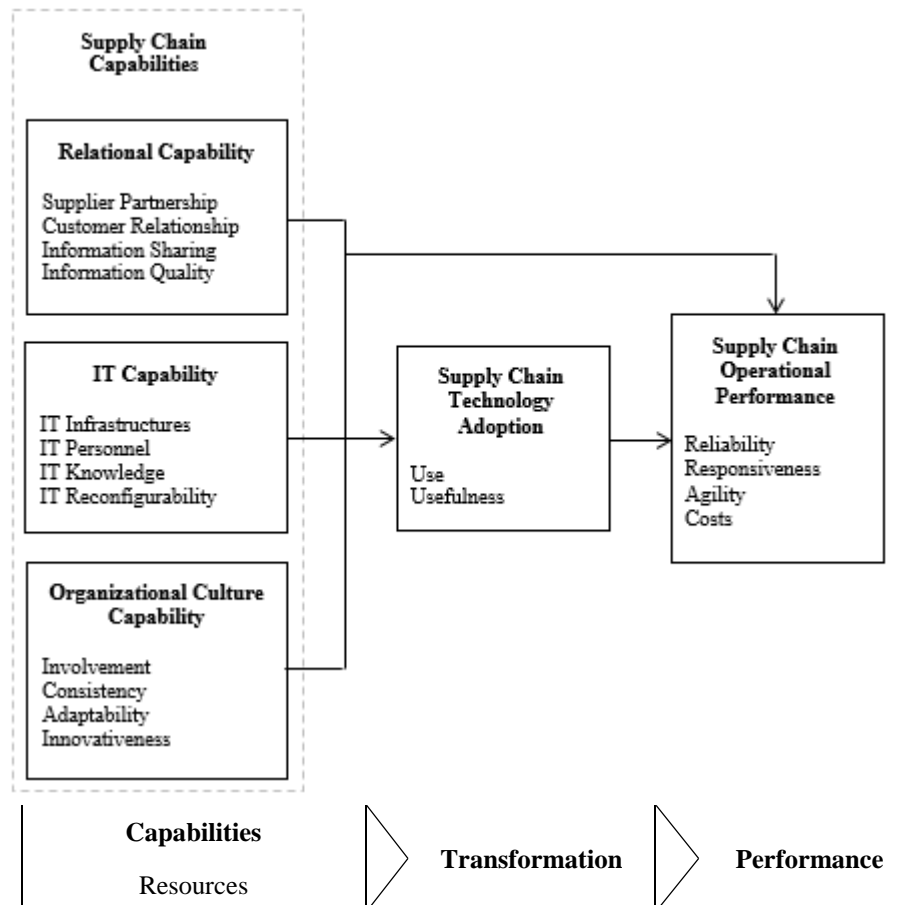
Figure 2.16
RBV Value Creation Approach

The existing literatures in SCM pertaining to supply chain performance showed that RBV is one of the common guides for study (Morash & Lynch, 2002; Zhang & Tansuhaj, 2007; Cao, Vonderembse, Zhang, & Ragu-Nathan, 2010; Srinivasan et al., 2011; Storer & Hyland, 2011; Tukamuhabwa, 2011; Humphreys et al., 2014; Reyes, Worthington, & Collins, 2015). Barney (2001), Peteraf (1993), and Wernerfelt (1984; 1995) articulated the basic assumptions and propositions of RBV theory with reference to the relationship between firm resources and performance. Wernerfelt (1984) pointed out that well manage of critical resources were able to gaining competitive advantages and higher performance. Furthermore, Barney (2001), Peteraf (1993), and Wernerfelt (1984) identified that the unique and critical resources not only enable the firm to growth and survival, but also gain sustainable competitive advantage.

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The business environment is characterized as flexibility, speed, and rapid shifts. The textile and apparel supply chain environmental is kept changing, thus, firms have to build further competencies from their capabilities to react quickly to the changes by innovative reconfigures existing capabilities (Halldorsson et al., 2007). This study suggests that the operational performance of textile and apparel supply chain would depend on the internal and external resources or capabilities of the firms such as relational capability, IT capability, organizational culture capability, and supply chain technology adoption.

2.11.2 Diffusion of Innovation Theory

Diffusion of innovation theory can be defined as a theory that explains the process by which an innovation is interconnected through a range of networks over time among the members in a social system (Rogers, 1983). This process relies heavily on human and organizational resources (Rogers, 2003). In addition, this theory further provides the explanation on what, why, and how new ideas and technology spread through cultures (Rogers, 2003). Rogers (1995) noted that an adoption was a decision to make full use of an innovation, while rejection is a decision not to adopt an available innovation. Rogers (1995) divided the factors into three broad dimensions, which are (1) individual characteristics, (2) internal characteristics of organization, and (3) external characteristics of organization. Besides, Rogers (1995) has introduced individual innovativeness into five categories, which include innovators as the earliest adopters, and follow by early adopters, early majority, late majority, and laggards as latest adopters. To simplify the explanation, a model of diffusion of innovation theory is presented in Figure 2.17 as follows.
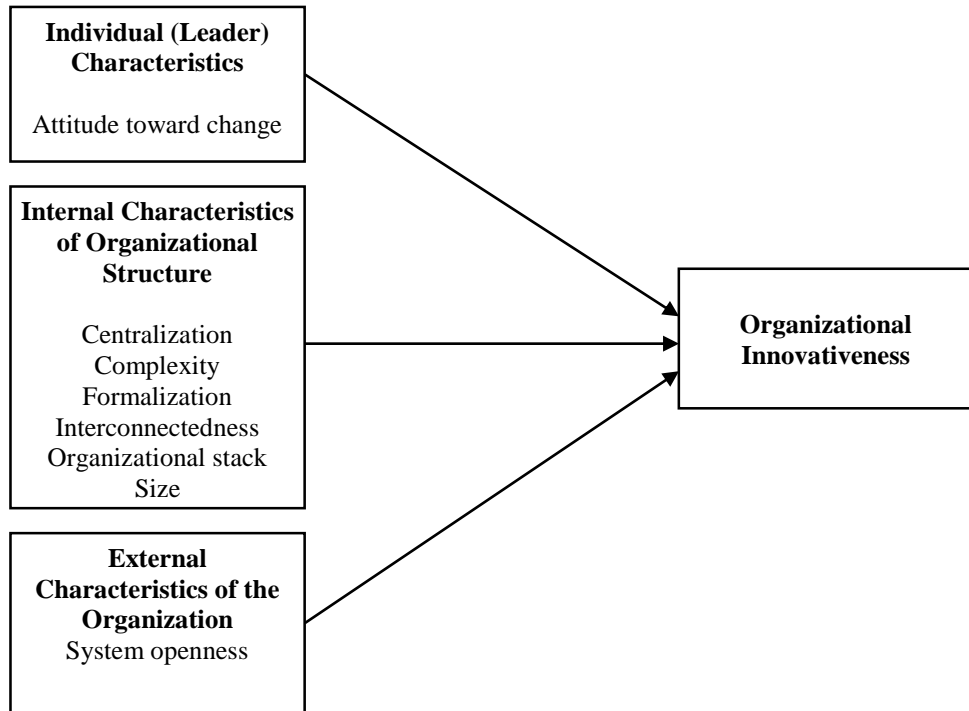
Figure 2.17
Diffusion of Innovation Theory
Source.   Adopted from Rogers (1995)

The diffusion of innovation theory has been extensively applied as a complementary theory in studying supply chain technology adoption (Ranganathan et al., 2004; Scupola, 2013). In this study, the innovation is referred to the supply chain technology adoption. Besides, researchers have used slightly different factors such as individual characteristics dimension is represented by relational capability, which consists of supplier partnership, customer relationship, information sharing, and information quality; internal characteristics of organization dimension is represented by organizational culture capability, which consists of involvement, consistency, adaptability, and innovativeness; external characteristics of organization dimension is represented by IT capability, which consists of IT infrastructure, IT personnel, IT knowledge, and IT reconfigurability. These are used to explain the extent of use and usefulness of supply chain technology adoption in an organization. To proof the

effectiveness of innovation diffusion theory, there is a number of studies applied the theory to investigate the extent of supply chain technology adoption (Premkumar, Ramamurthy, & Nilakanta, 1994; Scupola, 2013) and factors that affecting supply chain technology adoption (Grover, 1993; Grover & Goslar, 1993; Premkumar & Ramamurthy, 1995; Premkumar et al., 1997; Mustonen-Ollila & Lyytinen, 2003; Chan & Chong, 2013; Ramayah et al., 2013).

The adoption is referred to the extent of supply chain technologies use to support supply chain operation, management, and relationships to achieve higher supply chain operational performance. Specifically, the adoption is referred to both levels, which are use and usefulness. At first, organization must be purchased and adopted the supply chain technology. Afterwards, it must be defined as useful by the end users in the organization (Rogers, 1995). This study believed that the combination of use and usefulness of adoptions able provides the guidance in identification of the factors that affecting supply chain technology adoption.

2.11.3 Technology-Organization-Environment Model

Technology-Organization-Environment (TOE) model can be defined as a theory that explains the factors influencing organizations to adopt new technology (Tornatzky & Fleischer, 1990). Tornatzky and Fleischer (1990) divided the factors into three broad dimensions, which are (1) technology, (2) organization, and (3) environment. To simplify the explanation, a model of TOE is presented in Figure 2.18 as follows.
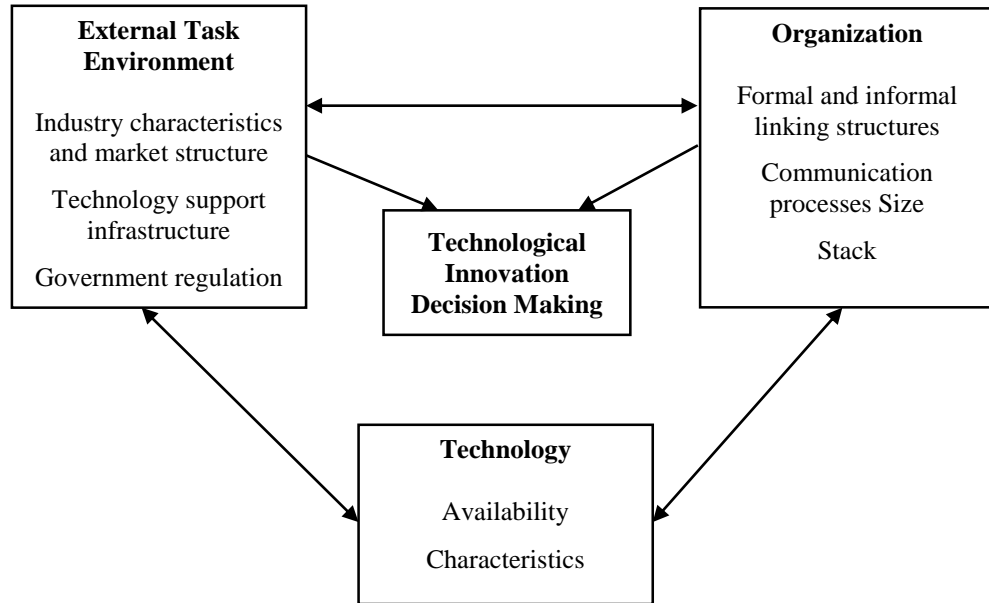
Figure 2.18
Technology, Organization, and Environment (TOE) Framework
Source.   Adopted from Tornatzky and Fleischer (1990)

In this study, researchers have used slightly different factors such as technology

dimensions is represented by IT capability, which consists of IT infrastructure, IT

personnel, IT knowledge, and IT reconfigurability; organization dimensions are

represented by organizational culture capability, which consists of involvement,

consistency, adaptability, and innovativeness; environment dimensions are

represented by relational capability, which consists of supplier partnership, customer

relationship, information sharing, and information quality. These are used to explain

the use and usefulness of supply chain technology adoption. The broad applicability

and explanatory power of TOE model made it become a popular theory used by

researchers. There is a number of studies applied TOE model to explain the adoption

of e-business (Zhu et al., 2003; Zhu, Kraemer, Xu, & Dedrick, 2004; Zhu et al., 2006;

Xu, Zhu, & Gibbs, 2004; Zhu & Kraemer, 2005; Yeh et al., 2014), inter-organizational

systems (Grover, 1993; Mishra, Konana, & Barua, 2007), open systems (Chau & Tam,

1997), RFID (Cao et al., 2014), EDI (Kuan & Chau, 2001), cloud computing (Hsu et al., 2014), information systems (Thong, 1999), CRM (Papastathopoulou, Avlonitis, & Panagopoulos, 2007), mobile SCM system (Chan & Chong, 2013), e-commerce (Awa, Ojiabo, & Emecheta, 2015), and enterprise systems (Ramdani, Kawalek, & Lorenzo, 2009).

2.12 Chapter Summary

From the literature review, there is a broad selection of supply chain capabilities aspects that influence supply chain performance. Given that the building blocks for supply chain capabilities are unique combinations, including relational capability, IT capability, and organizational culture capability. Particularly, each of them is measured by four dimensions, where relational capability measured by supplier partnership, customer relationship, information sharing, and information quality; IT capability measured by IT infrastructure, IT personnel, IT knowledge, and IT reconfigurability; organizational culture capability measured by involvement, consistency, adaptability, and innovativeness. Besides, supply chain technology adoption is measured by supply chain technology use and supply chain technology usefulness. While, supply chain operational performance is measured by reliability, responsiveness, agility, and cost. Theoretical framework and hypotheses are developed based on the theoretical support and the thorough review of the literatures.

CHAPTER THREE

RESEARCH FRAMEWORK AND HYPOTHESES

3.1   Introduction

Given that the discussions on literature review have provided the foundation to understand the framework of this study. Thus, this chapter provides the information regarding the concepts embedded in the study together with their theoretical framework and research hypotheses. The theoretical framework of the study shows that supply chain capabilities are related to supply chain technology adoption and supply chain operational performance. The relationship is based on the resource based view as dominant theory that suggests the performance of a supply chain is influenced by its relational and internal resources. Besides, diffusion of innovation theory, and technology-organization-environment theory are the complementary theory for the study. In general, there are three main direct relationships and one indirect relationship. A chapter summary is provided at the end of this chapter as an overview of this chapter.

3.2   Theoretical Framework

This section has narrowed down the literature review to form a boundary for this study. A figure of the theoretical framework is presented in Figure 3.1 to illustrate the relationships of the variables that undertaken in this study.
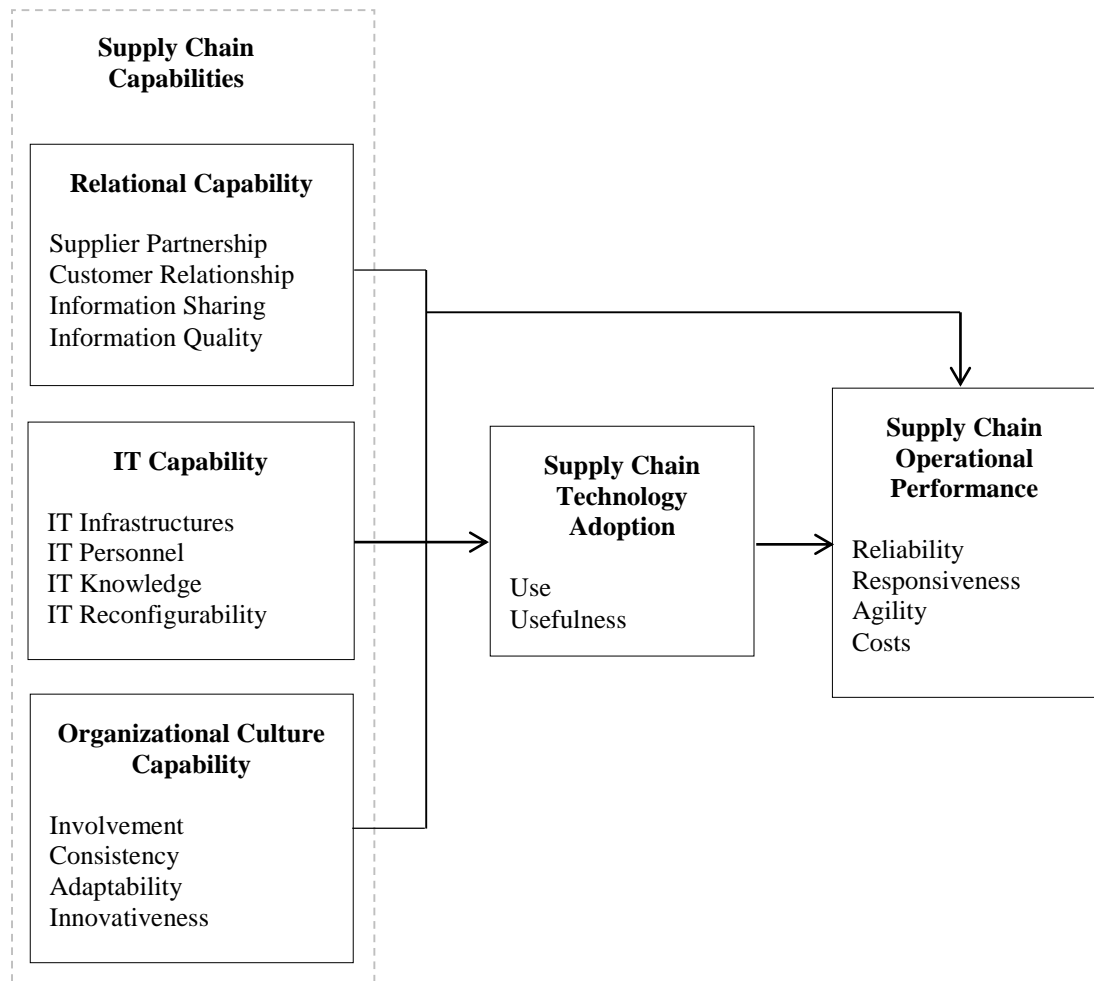
Figure 3.1
Theoretical Framework

Figure 3.1 illustrated five major variables in the framework of study where relational capability, IT capability, and organizational culture capability are independent variables to supply chain technology adoption and mediates the relationship between supply chain capabilities and its outcome, also known as supply chain operational performance. The theoretical framework represents the researcher beliefs on "how" certain phenomena (i.e., concepts or variables) are linked to each other (i.e., a model) and a justification of "why" the researcher believe that these variables are related with each other (i.e., a theory) (Sekaran & Bougie, 2010). The following section provides theoretical support to each variable under study.

3.3   Research Hypotheses

Based on the research objectives, theoretical framework, and related theories discussed earlier, the research hypotheses are developed to discuss about the quantitative part of this study. However, a series of propositions will be established after the quantitative analysis to guide the qualitative part of this study. According to Bailey (1978), the researcher had to state the suspected relationship between two things as hypotheses and then test it by statistical analysis. Kumar (2010) further defined the hypothesis as "*a proposition that is stated in a testable form and that predicts a particular relationship between two or more variables*". Thus, four main hypotheses were developed for further investigation. Figure 3.2 presented an outlay of the research framework to visualize the relationships and hypotheses undertaken by this research.
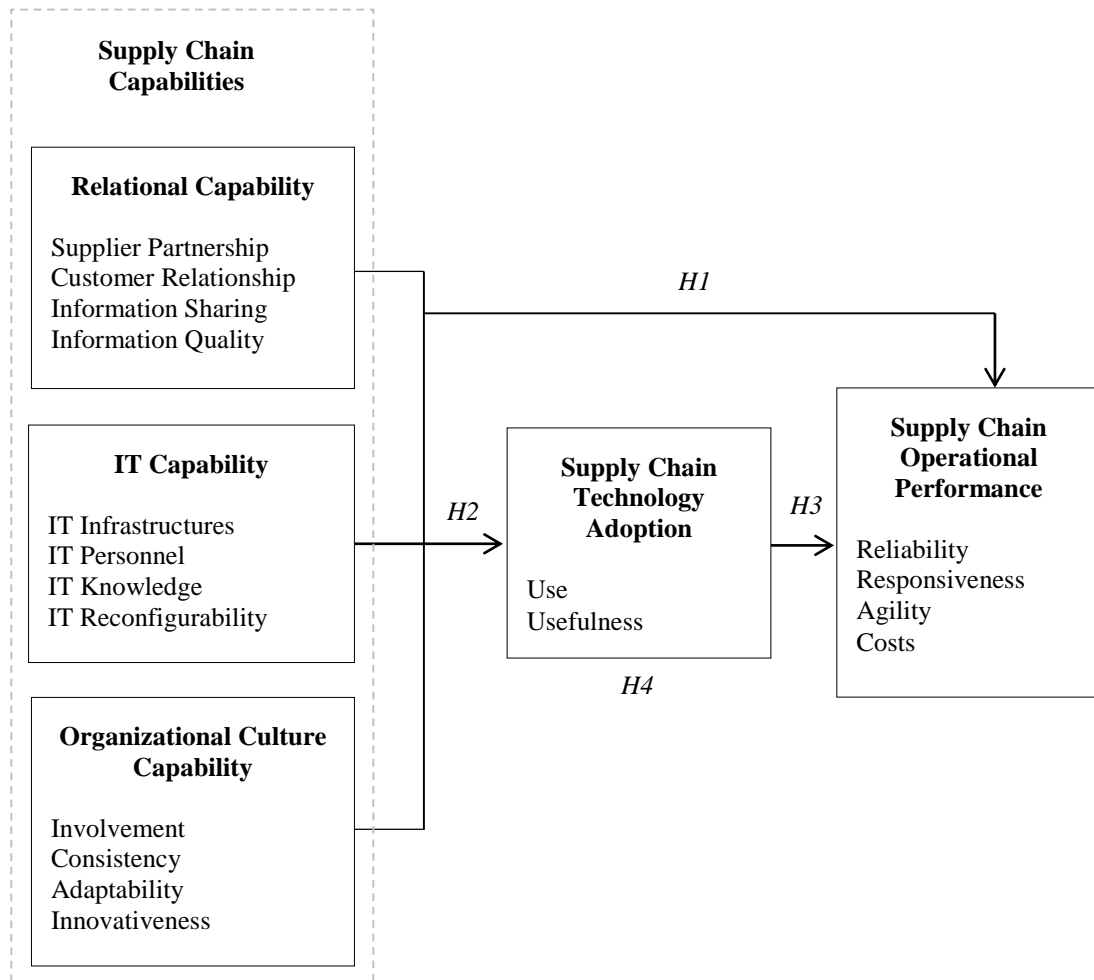
Figure 3.2
Theoretical Framework of Hypotheses

The current model was synthesized from conceptual and empirical studies conducted by Arumugam and Mojtahedzadeh (2011), Braunscheidel et al. (2010), Charkaoui et al. (2012), Thoo et al. (2011), Chong et al. (2009), Lee et al. (2007), Lin (2008), Lin et al. (2002), and Sukati et al. (2012). From the review of the literatures, it is believed that supply chain capabilities and supply chain technology adoption have a positive relationship with supply chain operational performance.

3.3.1 Research Hypothesis 1 - Supply Chain Capabilities and Supply Chain Operational Performance

The increasing complexity in the global supply chain has necessitated the needs for manufacturers to focus more on supply chain performance (Omar et al., 2006). Supply chain capabilities have been identified as the most important factors on performance improvement. However, some of the organizations did not realize the importance of supply chain capabilities and thus, does not focus and fully utilized the capabilities that they have. Based on the results of literature review, relational capability, IT capability, and organizational culture capability is the main components of supply chain capabilities in supply chain performance improvement.

In SCM, relational capability is one of the common practices in business activities. Sezen (2008) points out that information sharing is a common approach to increased supply chain performance. This is further supported by Fawcett et al. (2007), Ma and Zhang (2009), Ramayah and Omar (2010), and Gilaninia et al. (2011). Ma and Zhang (2009) noted that information sharing is one of the key enabler for textile and apparel SCM in improving supply chain performance. While, the study of Charkaoui et al. (2012) identified that information sharing and information quality are influenced more to the improvement of supply chain performance. Ramayah and Omar, (2010) revealed that operational and strategic information exchange was significantly impact to supply chain performance, which improved at least 50% of the performance. The contribution of supplier partnership (Omar et al., 2006; Sukwadi et al., 2013) and customer relationship (Omar et al., 2006) also critical for textile and apparel organizations to be rapid respond in the quick-change market. Several researchers have concluded that relational capability namely, information sharing, information quality, supplier partnership, and customer relationship have significant relationship with supply chain

performance (Lee, Kwon, et al., 2007; Qrunfleh, 2010; Thoo et al., 2011; Sukati et al., 2012; Chen & Fung, 2013). It is totally matched with the current textile and apparel business environment. Based on market conditions, relational capability such as the high quality of information sharing between apparel manufacturers, textile producers, fibres suppliers, and fashion retailer is needed to provide an agile and responsive supply chain, since the industry is no longer lean (Christopher, 2011). Moreover, the relational capability enable Li and Fund, Hong Kong based trading company, successfully managed their supply chain around the world and meet the requirements of almost any customer. Thus, it is believed that higher relational capability is led to higher supply chain operational performance.

Besides, IT capability also not less important in providing performance improvement to organizations. Several researchers have found that IT capability namely, IT infrastructure, IT knowledge, IT personnel, and IT reconfigurability enable the organization to distinguish themselves from the business competitors (Henderson & Venkatraman, 1994; Ang et al., 2000; Bharadwaj, 2000; Wei & Wang, 2010; Hassan et al., 2013). Particularly, the research of Zhang and Wang (2011) indicated that IT has positive and direct relationship with supply chain performance. Hassan et al. (2013) observed that IT infrastucture was the most significant factor to minimize costs, while Henderson and Venkatraman (1994) found that IT personnel acts as important enabler of key IT products and services. Furthermore, IT knowledge (Teo & Ang, 1999; Ang et al., 2000) and IT reconfigurability (Zhang & Tao, 2008; Wei & Wang, 2010) also essential to allow employees fully utilize the adopted technologies in improving supply chain operation. From this point of view, IT capability showed the potential in supply chain operational performance improvement.

In addition, the existing literatures have theorized and demonstrated that organizational culture has been considered as an important factor to improved supply chain performance (Braunscheidel et al., 2010; Thoo et al., 2011). The study of Braunscheidel et al. (2010) which include 218 responses from supply chain professionals that listed in New York's Institute of Supply Management (ISM) indicated that organizational culture has positive direct relationship with supply chain performance. In Malaysia, several researchers found that organizational culture had significant influence on SMEs supply chain performance (Thoo et al., 2011; Abdullah et al., 2013). Particularly, Cooper (2010) noted that textile and apparel organizations must be able to rapid adapt to quick-change market. Besides, Cooper (2010) and Camisón and Ana (2014) further noted that the organization must be also effective by having the ability to consistenly provide high quality and innovative products to market at a rapid pace to hold the competitiveness. For instance, the study of Al-Yamani and Bukhari (2011) noted that the environment created by Arabic cultural elements significantly contributed to the improvement of quality of fashion and design. It is difficult for organizations to achieved desired performance without employees' involvement (Katila & Ahuja, 2002). Based on the empirical evidence, organizational culture capability is positively related to supply chain operational performance.

From the above literatures, the following hypotheses will be tested.

H1. *Supply chain capabilities are positively related to supply chain operational performance.*

Specifically:

H1a. *Relational capability is positively related to supply chain operational performance.*

H1b. *IT capability is positively related to supply chain operational performance.*

H1c.   Organizational culture capability is positively related to supply chain operational performance.

3.3.2   Research Hypothesis 2 - Supply Chain Capabilities and Supply Chain Technology Adoption

In general, the adoption of technology innovation is affected by three broad factors, which are organizational, technological, and external environmental contexts (Melville et al., 2004; Power & Simon, 2004; Wen et al., 2009; Scupola, 2013). Technology is a main binding force that often holds trading partner relationships together (Walton & Miller, 1995). The effective and efficient communication between supplier and organization is achieved through adoption of adequate technologies. There is not only relational capability, but IT capability and organizational culture capability also considered as significant adoption components.

Several researchers have demonstrated that supplier partnership (Maltz & Srivastava, 1997; Ngai et al., 2012; Chan & Chong, 2013), customer relationship (Gertler, 1995), information sharing (Maltz & Srivastava, 1997; Icasati-Johanson & Fleck, 2003; Chan & Chong, 2013; Hendarty & Nusantara, 2014), and information quality (Cao et al., 2013; Hendarty & Nusantara, 2014) are important factors in influencing the adoption of supply chain technology. Therefore, Kumar, Singh, and Shankar (2013) noted that the extent of information sharing has to be examined prudently before the supply chain technology is adopted. Meanwhile, the adoption decision must be based on the types of information shared, since the quality of information is recognized by users needs (Cao et al., 2013). Furthermore, the study of Gertler (1995) on Ontario's advance manufacturing technologies adoption revealed that the closeness of customer relationship and great supplier partnership are keys for successful adoption. This

implies that supply chain technology adoption is related with higher levels of relational capability.

In the technological context, there are two types of technology, which is explicitness and accumulation of technology (Power & Simon, 2004) that significantly an impact to the adoption of supply chain technology (Lin & Ho, 2009). A number of studies showed that IT capability it selves is one of the important factors in growing the extent of supply chain technology adoption (Tornatzky & Fleischer, 1990; Rogers, 2005; Scupola, 2013; Hsu et al., 2014). Human IT resources are one of the keys enabler on the adoption processes. IT personnel acts as the important determinant of the right adoption and smooth use of all staff in the respective department (Melville et al., 2004; Wade & Hulland, 2004; Ferratt et al., 2005; Khoumbati et al., 2006; Yeh et al., 2014). Moreover, sufficient IT infrastructure in the organization maintained in a good condition is essential to have a smooth adoption process (Agarwal et al., 1998; Fichman, 2000; Bhatti, 2005). The study of Kyobe (2004) and Evangelista et al. (2013) revealed that great extent of employees' IT knowledge hints higher level of supply chain technology adoption. While, employees' ability of IT reconfiguration also can provided organization more benefits on the adopted technology (Moin et al., 2013). This revealed that textile and apparel company need skilful employees to operate the adopted technology in the moden business activities (Crinis, 2012). Hence, it is proposed that higher IT capability lead to the greater levels of supply chain technology adoption.

The existing literatures have theorized and demonstrated that organizational culture has been considered as an important factor for supply chain technology adoption (Braunscheidel et al., 2010; Lai & Yusof, 2011; Lin, 2008; Zhang & Tansuhaj, 2007).

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Several studies shown that organizational culture has significant relationship with the adoption of advanced manufacturing technology adoptions (Zammuto & O'Connor, 1992; Gertler, 1995; McDermott & Stock, 1999), common technology adoption (Abdullah et al., 2013), cellular manufacturing practices (Yauch & Steudel, 2002), real time manufacturing practices (Nahm et al., 2004). Haines and Lafleur (2008) indicated that user involvement is led to greater technology adoption. Conversely, lack of user involvement is one of the supply chain technology adoption critical failure factors (Tarokh & Soroor, 2006; Ngai et al., 2012). Therefore, all operations must proceed consistently with the used of supply chain technology to avoid errors in business activities (Rogers, 1995). In addition, cultural adaptabilities between two parties are required to achieve successful adoption of supply chain technology (Tsai et al., 2013). Agarwal et al. (1998) and Ghobakhloo and Tang (2013) highlight the need of personal innovativeness in the technological domain is necessary to contribute to the adoption process. Hence, organizational culture capability not only offers the use of supply chain technology, but also helps in realizing the usefulness of the adopted supply chain technology. From this viewpoint, organizational culture capability has the ability to influence the adoption of supply chain technology.

Based on the aforementioned discussion, the following hypotheses are then proposed.

H2.   Supply chain capabilities are positively related to supply chain technology adoption.

Specifically:

H2a.   Relational capability is positively related to supply chain technology adoption.

H2b.   IT capability is positively related to supply chain technology adoption.

H2c.   Organizational culture capability is positively related to supply chain technology adoption.

3.3.3 Research Hypothesis 3 - Supply Chain Technology Adoption and Supply Chain Operational Performance

In today's business trend, digital solutions and computerization is one of the most important tools contributing to the significant advancement of textile and apparel industry (Hu, 2011). It is become independent and the benefits has extended to the whole areas of textile and apparel industry including design, machinery, manufacturing, integrated production control and management, information management, quality testing and evaluation, and tools for marketing and retailing. Thus, it is believed that the adoption of supply chain technology provides numerous benefits to textile and apparel companies.

Huisman and Smits (2007) found that investments in network ability can lead to better supply chain performance, but the organization's success relies upon the type of technology invested. Kamaruddin and Udin (2009) pointed out that supply chain technology adoption is led to improving effectiveness and efficiency of business transactions such as rapid access to information, improved communication, better customer service, minimize paperwork, enhance productivity and time efficiency. Besides, Tseng et al. (2011) concluded that the supply chain technology enabled firms to determined material requirement, better response to customer, quickly respond to market changes, optimal facilities and labor utilization, and minimize inventory holding costs. Besides, it provides an effective support to SCM which improved customer relationship, broaden marketing channels, expand market occupancy, improve integration (Xuhua, 2008), enhanced information sharing, improve internal collaboration, quick response to customer demand (Jing & Hua, 2008), and complementary of each other's among organizations (Hong & Zhang, 2009; Kordha

& Elmazi, 2009). These benefits is particularly valuable to textile and apparel industry, since it has short product life cycles (Wang & Zhang, 2009).

Furthermore, Motwani et al. (2000) stressed that global SCM and corporations have benefited from using supply chain technology in their global SCM efforts. Thus, some of their respondents were decided to replace their existing system by new supply chain technology. Nowadays, the use of supply chain technology is considered as a prerequisite and effective tools in managing complex supply chains (He & Chen, 2008; Jin et al., 2005). According to Lin and Ho (2009), the adoption of supply chain technology enables members in the supply chains to communicate with each other more effectively and responsively. Besides, Vickery et al. (2010) have demonstrated that adoption of supply chain technology offers supply chain agility improvement and cycle times reduction, while Bingham et al. (2003) argued that supply chain software adoption provided inventory cost reduction and enhanced supply chain responsiveness. Particularly, advanced computer technology is being utilized extensively in USA apparel industry for producing mass customization apparel such as pattern making, grading, and marker making that need fast and accurate process from product planning to manufacturing and marketing (Lim & Istook, 2012). Hu (2011) pointed out that used of CAD, computer aided manufacturing (CAM), CIM, and computer aided testing (CAT) significantly encouraged and simplified textile and apparel practical operations. Hence, it is proposed that supply chain technology adoption is led to better supply chain reliability, higher supply chain responsiveness, greater supply chain agility, and minimise supply chain costs.

Nowadays, the adoption of supply chain technologies becomes competitive necessities in most of the industries (Patterson, Grimm, & Corsi, 2003). It is crucial and important success factors for an organization (Miertschin et al., 2006; Kamaruddin & Udin, 2009). In Vietnam apparel industry, performance improvement is typically depended on the supply chain technology (Tseng et al., 2011). Indeed, ERP systems and the VMI schemes has significantly contributed to the success of Hong Kong largest apparel organization, TAL Group's SCM (Chow, Choi, Cheng, & Liu, 2010), and even allows a small specialty store to reach customers worldwide through e-commerce (Wang & Zhang, 2009). Jin (2006) further found that US large apparel manufacturers such as Limited, Benetton, and Liz Claiborne are benefit from EDI utilization in increasing their operational performance in global supply chains. For those textile and apparel companies that unable to adopt the technology correctly would lose competitiveness in the quick-change market (Thomas & Griffin, 1996). Supply chain technology reasonably inexpensive, greatly flexible, and significantly reduced the switching costs of suppliers and customers (Porter, 2001). However, a technology alone did not provide significant relationship to supply chain performance, but observable effects can be realized if the supply chain technology widely spread and adopt (Powell & Anne, 1997; Vijayasarathy, 2010; Henfridsson & Bygstad, 2013). Under this condition, it can be expected that supply chain technology adoption has positively and directly affects to supply chain operational performance.

Based on above arguments, a hypothesis is thus stated as follows.

H3.   *Supply chain technology adoption is positively related to supply chain operational performance.*

3.3.4 Research Hypothesis 4 - Mediating Role of Supply Chain Technology Adoption

Technology has become a necessity in human life, while supply chain technology has become a requirement in effective business operations. In addition to the business activities, it is heavily relied on the technological functions to provide the reliable intermediate for high quality information transmission (Jing & Hua, 2008). In textile and apparel industry, supply chain technology will be therefore be even more important than ever before (Hu, 2011). The findings of Lin et al., (2002) indicated that the levels of information shared between firms have positive and significant effect on supply chain performance and the relationship is mediated by extranet technology applications, namely, EDI, VMI, and POS respectively. Furthermore, the results of Udomleartprasert and Jungthirapanich (2004), which includes 371 manufacturers in Thailand's estate industrial indicated that the relationship between supportive infrastructure and supply chain performance is mediated by supply chain practices such as SRM and CRM systems. Moreover, IT personnel exhibit direct and indirect effect on firm's agility performance through the mediating effect of supply chain technology (Fink & Neumann, 2007). For instance, the IT knowledge and IT reconfigurability obtained from trainings are to provide more comfortable conditions for users to use the systems (Bhatti, 2005).

The nature of textile and apparel fashion trend challenge the industry to fulfill the unpredictable demand in short time period (Hilletofth & Hilmola, 2008). The technology adoption might become a real contribution to SCM (Iyer, 2011; Kim, 2006; Tsai, 2010), if the organization able to understand the technology functions and complete processes flow (Miertschin et al., 2006; Kamaruddin & Udin, 2009). This can be empirically supported by the study of Lin (2008) with the significant mediating

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effect of supply chain technology adoption. Lin (2008) stressed that the adoption of supply chain technology is significantly influenced by environmental, technological, and organizational characteristics and the adoption have further improved firm's supply chain performance. As a summary for above arguments, supply chain technology adoption is potentials to be a mediator in the relationship between supply chain capabilities and supply chain operational performance.

These lead to the following hypotheses comprised.

H4. **Supply chain capabilities affect supply chain operational performance indirectly through supply chain technology adoption as a mediating variable.**

Specifically:

H4a. *Relational capability affects supply chain operational performance indirectly through supply chain technology adoption as a mediating variable.*

H4b. *IT capability affects supply chain operational performance indirectly through supply chain technology adoption as a mediating variable.*

H4c. *Organizational culture capability affects supply chain operational performance indirectly through supply chain technology adoption as a mediating variable.*

Table 3.1
Recapitulation of Research Hypotheses

No.	Problem Statement	Research Questions	Research Objectives	Research Hypotheses
1.	Supply chain capabilities are important to be competitive, and its effects on performance remain much disputable.	What is the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain operational performance?	To investigate the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on supply chain operational performance.	H1. Supply chain capabilities are positively related to SCOP. H1a. Relational capability is positively related to SCOP. H1b. IT capability is positively related to SCOP. H1c. Organizational culture capability is positively related to SCOP.
2.	Supply chain capabilities are important to be competitive, and its effects on the adoption of SCT remain much disputable.	What is the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on SCT adoption?	To investigate the relationship of supply chain capabilities (relational capability, IT capability, and organizational culture capability) on SCT adoption.	H2. Supply chain capabilities are positively related to SCT adoption. H2a. Relational capability is positively related to SCT adoption. H2b. IT capability is positively related to SCT adoption. H2c. Organizational culture capability is positively related to SCT adoption.
3.	SCT adoption was not beyond reproach and its effect on performance is remain debatable.	What is the relationship of SCT adoption on supply chain operational performance?	To examine the relationship of SCT adoption on supply chain operational performance.	H3. SCT adoption is positively related to SCOP.
4.	The role of SCT adoption in SCM has not been fully agreed and remain controversial.	Does SCT adoption mediating the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance?	To analyze the mediating effect of SCT adoption on the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance.	H4. Supply chain capabilities affect SCOP indirectly through SCT adoption as a mediating variable. H4a. Relational capability affects SCOP indirectly through SCT adoption as a mediating variable. H4b. IT capability affects SCOP indirectly through SCT adoption as a mediating variable. H4c. Organizational culture capability affects SCOP indirectly through SCT adoption as a mediating variable.
5.	There is still lacked of theoretical support for understanding and explaining the reality or the boundaries of SCM.		To propose a model by examining the mediating effect of SCT adoption on the relationship between supply chain capabilities (relational capability, IT capability, and organizational culture capability) and supply chain operational performance.	

3.4   Chapter Summary

The research framework is developed based on the extensive literature review of past study. The research framework is formulated by including four relational capability measures, four IT capability measures, four organizational culture capability measures, two supply chain technology adoption measures, and four supply chain operational performance measures. Furthermore, the theoretical framework of the study is supported by a dominant theory and two complementary theories in explaining the relationship among the variables. Finally, there are four general hypotheses have been developed to test the relationship. The next chapter will provide the detail of research methodology used in the present study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This chapter focused on a better understanding methodology of the research. Thus, the following sections discuss the research design, population and sampling, unit of analysis, data collection methodology, instrument development and validity of the instrument, pilot study, and techniques of data analysis. This research applies quantitative research methods with a specific focus on survey design and it reflects post-positivist philosophical assumptions. A chapter summary is provided at the end of this chapter as an overview of this chapter.

4.2 Philosophical Assumptions and Stances

According to Creswell (2009), philosophical worldviews (assumptions) representing the belief of researchers that guild inquiries. Guba (1990) defined worldview as meaning "*a basic set of beliefs that guide action*". However, other researchers called worldview as paradigms (Mertens, 1998; Lincoln & Guba, 2000), epistemologies and ontologies (Crotty, 1998), or broadly conceived research methodologies (Neuman, 2000). The types of beliefs held by individual researchers will often lead to embracing

an approach in their research. The philosophical ideas will help explain why choose the particular approaches for their research.

The philosophical assumption of the study is post-positivist worldview. It represents the thinking after positivism, challenging the traditional notion of the absolute truth of knowledge (Phillips & Burbules, 2000) and recognizing that we cannot be positive about our claims of knowledge when studying the behavior and actions of humans (Creswell, 2009). Hence, this mean, the absolute truth can never be found in conducting the quantitative research. In quantitative studies, researchers have to find the relationship among variables and from there the hypotheses are formed and tested. Thus, the post-positivism assumption characterized as determination, reductionism, empirical observation and measurement, and theory verification (Creswell, 2009). According to Creswell and Plano-Clack (2011) and Creswell (2009) ontology known as the nature of reality; epistemology known as the relationship between researcher and the things being researched; axiology known as the role of value; rhetoric known as the language of the research; methodology known as the processes of the research. In simple words, this study is conducted through the processes of the research in nature of reality.

4.3   Research Design

Research designs are comprised plans and the procedures for research that span the decision from broad assumptions to detailed methods of data collection and analysis. In social science research, there are three major research paradigms in education, which is quantitative, qualitative and mixed methods (Creswell, 2009). Basically, a

quantitative research method provides detailed assessment of patterns and responses characterized by formal, objective, and systematic process which numerical data used to obtain information from the world. Instead, a qualitative research method provides more depth into the understanding of survey responses which subjectively answer the 'why' and 'how' of human behavior, opinion, and experience that is difficult to obtain through data collection quantitatively. While, mixed method is the combination of quantitative and qualitative methods into a single study. Thus, it is suitable for the research that is aimed to answer the complex questions. The concept is using the strengths of one method to overcome the weaknesses of the other method. Rationally, based on the research questiona and research objective presented, quantitative research method is appropriate and enough for this study to be conducted. However, the triangulation of research findings through case studies is employed to strengthen the main research findings and provide stronger justification to produce a comprehensive conclusion for this study.

4.3.1 Quantitative Research

The study was employed quantitative method in testing objective theories (e.g., theoretical framework of the present study) by examining the relationship among variables (Creswell, 2009). The intent of this study is to examine the relationship of supply chain capabilities and supply chain technology adoption towards supply chain operational performance on Malaysian textile and apparel industries. Since this study employed a quantitative research design in conducting the research, the instrument was survey questionnaires. The survey data also known as numbered data was collected from Malaysian textile and apparel companies to test the theoretical framework by

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statistical procedures. This form of inquiry has assumptions about testing theories deductively, building in protection against bias, controlling for alternative explanations, and being able to generalize and replicate the findings (Creswell, 2009).

Having identified the variables in a problem situation and developed the theoretical framework, the next step is to design the research in such a way that the requisite data can be gathered and analyzed to arrive at a solution. The various concerns involved in the research design in this chapter are shown comprehensively in Figure 4.1. This research design was started by discussion of the details of this study, which comprised the population of this study, unit of analysis, and sampling design. The discussion of research design was followed by the instrument development which involved the design, structure, and measurement scale of the survey questionnaire. The pretesting and pilot study were discussed before the data collection methodology to test the content validity and reliability. The data collection methodology was discussed about the method, procedure, and time period of data collection of this study. Analytical methodology and interpretation were discussed the hypotheses testing of this study.

Details of Study		
Population	Unit of analysis	Sampling design

Instrumentation		
Design of survey questionnaire	Structure of questionnaire	Measurement scale

Pretesting and Pilot Study	
Content validity	Pilot study

Data Collection Methodology		
Data collection method	Data collection procedure	Data collection time period

Analytical Methodology and Interpretation	
SPSS	PLS-SEM

Figure 4.1
Flow Chart for Quantitative Research Design
Source.   Adapted from Creswell (2009) and Sekaran and Bougie (2010)

4.3.1.1 Survey Method

In social sciences, survey is the most commonly used method for empirical research (Grant, Teller, & Teller, 2005), particularly logistics and SCM research (Mentzer & Kahn, 1995; Griffis, Goldsby, & Cooper, 2003). The survey method is employed in this study because it encompasses the broader population study or larger sample size (Bryman & Bell, 2003). Traditionally, self-administered, postal or mail surveys have been often used and offer low-cost and easily administered results from a large number of respondents (Griffis et al., 2003). Nowadays, web-based or online survey becomes more popular in survey method due to it provide short response time. However, both traditional and web-based surveys have their own advantages and disadvantages. Table 4.1 shown the comparison between advantages and disadvantages of traditional and modern surveys.

Table 4.1

Comparison between Advantages and Disadvantages of Traditional and Web-based Survey

	Advantages	**Disadvantages**
Traditional Survey (Self-administered, Postal or Mail Surveys)	• Concentration of process control • No clustering of interview • No interview bias • Low administration costs	• Low return rate • High non-response rate • Leading to lack of external validity for samples • No control over the survey situation
Modern Survey (Web-based or Online Survey)	• Short response time • Low variable costs • Convenience for respondents and researchers • No media gap to overcome • Willingness to answer open-ended extend • High item response rate	• Low questionnaire response rate • High fixed cost at the beginning • Little sample control • Coverage error

Source.   Adopted from Grant, Teller, and Teller (2005)

Based on the advantages and disadvantages of the types of the survey, the mixed between traditional and modern survey method have been better potential to be used in this study as the researcher attempts to understand the textile and apparel industries in Malaysia. The concept is like Creswell and Plano-Clack (2011) discussed in the mixed method research design, using the strengths of one types of survey method to overcome the weaknesses of the other types of survey method in order to get as much as possible responses from the population, since small sample size in Malaysian textile and apparel industries.

4.3.1.2 Triangulation of Research Findings

Triangulation of research findings is to provide validation for main research findings of this study through case studies in Malaysia textile and apparel industry. The sample of this study is determined through survey participants who are volunteered to participate for future study as question in the last section of the survey questionnaire. Based on the total number of the volunteered organizations, cluster sampling technique is applied to determine the right sample to be interview, since this study is looking on the complete supply chain. The face to face interview is conducted through the aid of interview protocol, which is a semi-structured questionnaire. The semi-structured questionnaire is used to guide the semi-structured interview with the aims of providing flexibility in data collection. However, the interview protocol is developed based on the factors found to be significant or contradicting with the hypotheses of this study. Therefore, the emerging terms found that is not covered by this research is possible. As suggested by Yin (2003), all the data obtained from the semi-structured interviews need to fulfill the validity and reliability test before coding and thematic analyses. This

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is to provide a real measure and high consistency on the findings. The Atlas.ti software is applied to aid the processes of coding and thematic analysis.

4.4   Population and Sampling

Population of the study refers to a group of people or things of interest that the researcher desires to study or make inferences based on a derived sample (Sekaran & Bougie, 2010). This study focused on textiles and apparel companies in Malaysia. Specifically, it was covered all states in Malaysia, especially Selangor, Penang, Negeri Sembilan, and Johor (Crinis, 2012). Only those organizations registered in FMM Directory (2013) and MATRADE directory (2013) were selected to the population list. A mixed of Malaysian textile and apparel suppliers, manufacturers, distributors, retailers, service providers, and customers were chosen to help reveal the differing chains affecting the adoption of supply chain technology and the performance of supply chain operation. All respondents were involved with the SCM and the adoption of supply chain technologies in their organization.

The sampling design for this population known as single stage sampling procedure. The population of this study was 423 organizations, which consist of 65 organization registered under FMM directory, 351 organizations registered under MATRADE directory and seven organizations concurrently registered in both directory. The sample size is identified based on the sample tabled by Krejcie and Morgan (1970), sample size formula by Dillman (2000), and G*Power software by Faul, Erdfelder, Lang, and Buchner (2007). This sample size of this study was 201 organizations (Krejcie & Morgan, 1970). Gorsuch (1983) and Kline (1979) recommended that

sample size 100 is acceptable, while Guilford (1954) argued that sample size 200 is better. The sample is determined using simple random sampling also known as a systematic or probabilistic sample (Creswell, 2009). Simple random sampling was chosen because of its accuracy and accessibility (Kervin, 1992; Saunders, Lewis, & Thornhill, 1997), and its least biasness and offers the most generalizability (Sekaran, 2003) to each individual in the population has an equal probability of being selected (Creswell, 2009).

4.4.1 Unit of Analysis

The unit of analysis of this study was organization. The targeted survey subjects were managing directors, supply chain managers, planning managers, and procurement managers (some organizations called them as a buyer, purchasing, order fulfillment, order management or customer service manager whose most responsible for SCM or direct deal with a customer, supplier, and inventory control) to represent their organization to provide information in order to maximize the validity for this research content. Therefore, middle level employees in Malaysian textile and apparel companies were considered appropriate to participate in this study.

4.4.2 Sampling Design

A sample is a group of participants or individuals selected from a bigger group of population for survey purpose (Salant & Dillman, 1994). The appropriate sample size selection is imperative for reducing the sampling error. Roscoe (1975) provides the

rule of thumb for sample size in which the appropriate sample size should be in the range between 30 and 500. Additionally, Hair et al. (2010) suggested that the sample size should be ten or more times in excess of the number of the variables. For this study, there are five variables and thus, the required sample should be 50 or more. Specifically, Salkind (2003) highlighted that a proper sample size is indispensable for any research. Excessively small sample size is not an ideal representative of the population, since it may lead to committing Type I error, which is the probability of rejecting a certain finding that is supposed to be accepted (Salkind, 2003). Nevertheless, extremely large sample size is not applicable too, since it may lead to committing Type II error, which is the probability of accepting a certain finding that is supposed to be rejected (Sekaran, 2003).

4.4.2.1 Sample size

An appropriate sample size is crucial to minimizing the sampling error. The intention is to have an appropriate sample size that able to represent the population under study. Based on the population of 423 organizations, Krejcie and Morgan (1970) scientific guideline determined the sample size of this study was 201 organization. The need of different technique for sample size determination is important to avoid incorrect sample size and ensures accuracy for the study. Based on the concerned, the alternative computation of sample size suggested by Dillman (2000) was shown as Equation 4.1:

$$n = \frac{(N)(p)(1-p)}{(N-1)\left(\frac{B}{C}\right)^2 + (p)(1-p)}$$

Equation 4.1
Sample Size

Whereby n is sample size, N is population size, p is proportioned of population expected to select, B is the acceptable number of sampling error or precision (can be set at 0.05 or 5%), C is Z statistic (critical value of 1.96 = 95% of confidence level), B is true population value (can be set at 0.10, 0.05, or 0.03).

The researcher was not known about the proportion of participants in respond before data collection. Hence, Dillman (2000) suggested that the proportion of 0.05 should be used instead of 0.03 for a more homogenous sample since, 0.05 could provide a greater sample size. However, Biemer and Lyberg (2003) noted that the formula always provided a sufficient sample size for all range of population. For this study, the computation of sample size by Dillman (2000) equation was illustrated as follows, where N=423, p = 0.5, B = 0.05, C = 1.96.

$$ n = \frac{(423)(0.5)(1 - 0.5)}{(423 - 1)\left(\frac{0.05}{1.96}\right)^2 + (0.5)(1 - 0.5)} $$

$$ n = 202 $$

The results shown that this study required 202 organizations to complete the survey. Based on the formula, the sample was within the sampling frame of +5% margin errors. As can be observed, the sample size obtained from Krejcie and Morgan's scientific guideline and method suggested by Dillman (2000) was no major difference. Hence, the sample size of 201 determined from Krejcie and Morgan's scientific guideline was adopted in this study, since it always provide reliable sample size and popularity in practice. The computation of sample size by Dillman (2000) and the priori power analyses are used for verification purpose.

4.4.2.2 A Priori Power Analyses

In order to avoid the above discussed error, Cohen (1988) and Ticehurst and Veal (1999) noted the importance of using a suitable power of statistical test in determining an absolute sample size for the population under study. The power of a statistical test can be defined as the probability of rejecting a null hypothesis or specific effect size of a particular sample size at a particular alpha level (Cohen, 1988). It is suitable and worthy to use power analysis to detecting the effects of different sample sizes that have been determined through other methods.

The sample size can be computed through G*Power by user-specified values for the to-be detected population effect size ($f2$), required significance level (α), the desired statistical power (1-β), and total number of predictors in the research model (Faul et al., 2007). The priori power analysis can be computed through the statistical test of linear multiple regressions with fixed model and R^2 deviation from zero (Faul et al., 2007). Consistence with the standard recommendations by Cohen (1988), the effect size (f^2= 0.15); significance alpha level (α= 0.05); and desired statistical power (1-β = 0.95) should be used to computed the sample size. For this study, a total number of three predictors (RC, ITC, and OCC) were used to determine the sample size. Based on the input provided, the total sample size of 119 is appropriate for this study as shown in Figure 4.2 and Figure 4.3. The figures further revealed that the actual statistical power for detecting effect sizes of this study was determined at a recommended value of 0.95 (Cohen, 1988).
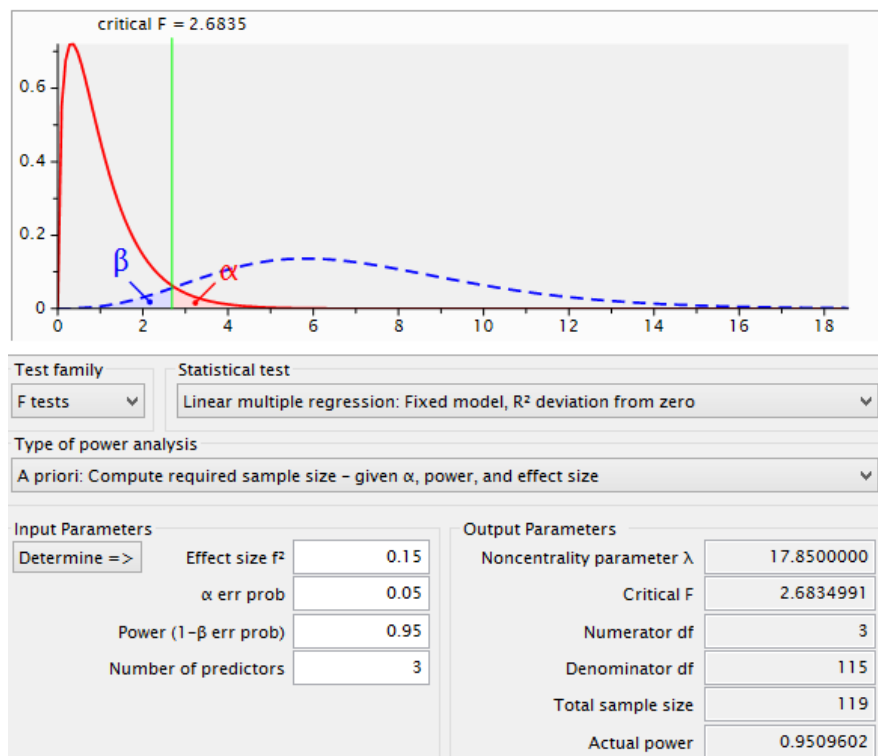
Figure 4.2
Power Analysis of a Priori: Compute Required Sample Size
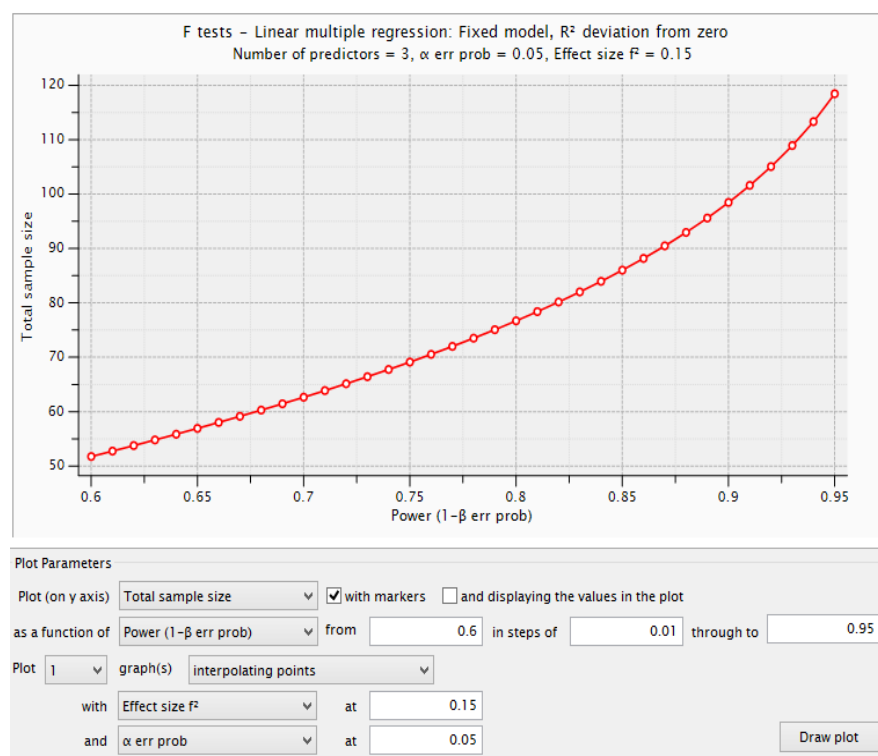
Figure 4.3
X-Y Plot for Medium Effect Power Analysis

4.4.3 Estimating Expected Response Rate

For this study, 201 questionnaires were distributed among the participated organizations. Babbie (1990) noted that 50% response rate was considered as sufficient in social science surveys. Consistent with the recommendation by Babbie (1990), this study is expected to achieve at least 101 responses from the survey.

4.4.4 Sampling Techniques

For this study, the probability sampling technique was adopted. In nature, probability sampling can be either simple random sampling (unrestricted) or complex probability sampling (restricted) (Sekaran & Bougie, 2010). The simple random sampling technique was chosen to use in this study. This technique was chosen with the reason of it provides every organization in the population of this study an equal opportunity of being selected as subjects in the sample (Saunders et al., 1997; Sekaran & Bougie, 2010). Thus, there is no bias of the researcher against the selection of the sample (Salkind, 2003) and offers the most generalizability (Cavana, Delahaye, & Sekaran, 2001). Practically, this study generated the random numbers through using the computer system in which a mathematical formula {= rand ( )} in Microsoft Excel 2013 was applied to enable selection of the subjects in the sample.

4.5   Instrumentation

The use of appropriate and correct instruments provides higher accuracy in results and scientific quality of the research (Sekaran, 2003). Survey questionnaire was the instrument of this study. Thus, following sections discussed the design of the questionnaire, structure of the questionnaire, and measurement scale used in the questionnaire. Structure of the questionnaire describes the construct of the questionnaire and dimensions of each variable as well as the corresponding source for the items. In a survey questionnaire, respondents are asked to answer closed-ended questions.

4.5.1   Design of Questionnaire

This section describes how the questionnaire to be designed. The length and format of the questionnaire are strictly important for getting a response in data collection activities. This is the first impression for the respondents towards the survey, whether they are willing to participate. Therefore, the questions were neatly categorized into a section and proper format for easy reading such as proper font size and font style. Besides, the questionnaire was compressed into a booklet style which is double side printing to reduce the number of pages. The design of the survey booklet was designed creatively to attract respondents to participate.

The items used to measure the variables of this study were discussed evidently. There are five sections available in the questionnaire. Company profile in the first section, and follow by supply chain capabilities (relational capability, IT capability, and organizational culture capability), supply chain technology adoption, supply chain operational performance, and respondent's profile was in the last section. In this study,

the exogenous or independent variable is supply chain capabilities and supply chain technology adoption. Besides, the endogenous or dependent variable is supply chain operational performance.

As discussed in the foregoing section, there is a list of supply chain technology that obtained from literatures. In term of the selection of the items in the dimension of "supply chain technology use", researcher select the items based on the number of study has been done in particular supply chain technology. The priority to be select is given to the largest number of study did and verified by the practitioners during the content validity process. The total questions in the questionnaire were 116 items. The question in company profile and respondent profile was six and seven items respectively. Thus, the grand total of questions in the questionnaire was 129 items. As a summary for questionnaire design, Table 4.2 illustrated the section of measurement variables, number of items, number of dimensions, and the corresponding sources of literature.

Table 4.2
Summary of Questionnaire Design

Variable	Number of Questions	Dimension	Source
Section 1:			
Company Profile	(6)		
Section 2: Independent Variables:			
Relational Capabilities	(6)	Supplier Partnership	Halley and Beaulieu (2009); Karim (2010)
	(5)	Customer Relationship	Halley and Beaulieu (2009); Li et al. (2006)
	(6)	Information Sharing	Li et al. (2011); Li et al. (2006); Soon (2010)
	(8)	Information Quality	Lee (2011); Li et al. (2006); Slone (2006)
Information Technology Capabilities	(6)	IT Infrastructure	Byrd and Turner (2000); Jain (2007)
	(6)	IT Personnel	Anthony and Davidson (2003); Jain (2007)
	(5)	IT Knowledge	(Lu, 2006; Jain, 2007)
	(6)	IT Reconfigurability	Jain (2007); Lu (2006)
Organization Cultural Capability	(6)	Involvement	Fey and Denison (2003); Li et al. (2011)
	(5)	Consistency	Fey and Denison (2003); Xiao (2008)
	(6)	Adaptability	Fey and Denison (2003); Xiao (2008)
	(6)	Innovation	Ozkaya (2011); Robeson (2009)
Section 3: Mediating Variables:			
Supply Chain Technology Adoption	(12)	Use	Forger (1998); Gunasekaran et al. (2001); Li (2002); Dawson (2002); Patterson et al. (2003); Helo and Szekely (2005); Bharati and Chaudhury (2006); Fawcett et al. (2007); Xuhua (2008); Jeffers et al. (2008); Lin (2008); Kamaruddin and Udin (2009); Vijayasarathy (2010); Slone et al. (2010); Tseng et al. (2011); Glenn et al. (2009); Kurnia et al. (2015)
	(9)	Usefulness	Kaye and Neeley (2006); Niu (2010); Slone (2006)
Section 4: Dependent Variable:			
Supply Chain Operational Performance	(7)	Reliability	Betts and Tadisina (2009); Daley (2008); Gligor and Holcomb (2012); Soon (2010)
	(6)	Responsiveness	Kim (2010); Lee (2011)
	(6)	Agility	Betts and Tadisina (2009); Gligor and Holcomb (2012); Wang and Wei (2007)
	(5)	Costs	Lee (2011); Soon (2010)
Section 5:			
Respondent Profile	(7)		

4.5.2   Structure of Questionnaire

There are no universal agreements about the optimal length of questionnaires. Basically, six questions are standard used to measure a dimension. As reported, the short simple questionnaire is better and usually gets higher response rates than long complex questionnaires (Krosnick, 1999). Subsequently, the way questions are phased in the questionnaire is important to obtain an accurate response. There are several general guidelines to follow for constructing quality questions in a questionnaire (Krosnick, 1999; Leung, 2001). First, the questions should be short, simple, and easy to understand to avoid confusing. Besides, a question should ask for only one piece of information at a time and avoid double negative question. Furthermore, always ask precise questions to get the exact level of detail that need for the research. Moreover, approach selection is important for sensitive issue's question and bias minimization, only the correct approach can obtain a real response. Lastly, there have to ensure that the respondents have the necessary knowledge towards the research. **Appendix B** provides the justification for the sources of adaption of each item in the questionnaire.

From the literature review, an instrument was developed with the aims to cover the research objectives of this study. Basically, the questionnaire is divided into five sections. First section captured the company profile. Section two covers the independent variables, namely, supply chain capabilities, while supply chain technology adoption captures on section three. The dependent variable, supply chain operational performance captures on section four. The last section is capturing the respondent profile. The full set of survey questionnaire that used for data collection in this study is presented in **Appendix C**.

4.5.3 Measurement Scale

Both Five-point and six-point Likert's scales were applied in the survey questionnaire of this study. Five-point Likert scale is familiar and frequently used in most of the survey questionnaire to obtain participant's preferences, the degree of agreement, and the extent of agreement. It presents a simple and convenient method for respondents to answer the questions (Krosnick, 1999). This is to allow repondents to choose the neutral point while answering the questions in supply chain capabilities and supply chain technology adoption sections, since it is non-comparative in nature (Krosnick, 1999). Nevertheless, six-point Likert scale was applied in performance section of the questionnaire. This is to get higher discrimination and reliability values from the respondents towards their perception on the supply chain operational performance whether is increased or reduced, since it is unidimensional which only able to measure a single trait in nature (Chomeya, 2010). Both five-point and six-point Likert's scales were applied concurrently in the questionnaire to avoid and control common method biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

In this study, respondents were asked to specify the degree of practice for each of the factors contribute to the supply chain operational performance. In measuring the use of supply chain technology adoption, respondents were requested to choose a response on five-point Likert scales anchor at '*1=not adopted, 2=little extent, 3=moderate extent, 4=considerable extent, 5=great extent*'. Meanwhile, in measuring the usefulness of supply chain technology adoption and supply chain capabilities, respondents were requested to choose a response on five-point Likert scales anchor at '*1=not at all, 2=little extent, 3=moderate extent, 4=considerable extent, 5=great extent*'. In supply chain operational performance dimensions, respondents were

requested to specify the degree of agreement by six-point Likert's scales anchor at '*1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree, 6=strongly agree*'.

4.6   Pretesting and Pilot Study

Pretesting is aims to test the validity of the instrument, while pilot study is intents to test the reliability of the instrument. Reliability is defined as a test of how consistently a measuring instrument measures the concept it is measuring (Sekaran & Bougie, 2010). While, validity is defined as a test of how well an instrument that is developed measures the right concept it is intended to measure (Sekaran & Bougie, 2010).

4.6.1   Pre-test: Content Validity

In the research design, validity is used to determine the ability of an instrument in answer the questions scientifically. The validity is critical in research, it helps the researcher to determine the correct methods that truly measures the idea or constructs in the question. Thus, the instrument should be pre-tested and reviewed by a number of academicians and industrial practitioners to ensure and further enhance the content validity, readability, and brevity. As Flynn, Sakakibara, Schroeder, Bates, and Flynn (1990) noted, there is no statistical analysis can be used to ensure the content validity, it can only determine by experts in the area. Since this study comprehensively adapted relevant questions from previous study, content validity test is needed to test how well an instrument or scale to measure the particular concept.

A two steps practice was applied to develop and refine the survey questionnaire. Firstly, content or face validity is warranted by three academicians who have obtained a doctorate in the field of SCM. Subsequently, face validity discussions with seven industrial practitioners were organized to obtain comments, suggestions, and improvement towards the developed instrument. Meanwhile, the researcher is together with the industrial practitioners while they are completing the questionnaire. This is to enable immediately identify and discussion on the difficulties and inappropriate wording and sentence structure using in the questionnaire. As a proof of the pre-test, **Appendix D** exhibited the letter of invitation to validate the content of the survey questionnaire from three academicians and seven practitioners. From the comments, the researcher has made amendments on the existing questionnaire to become the final version that can be distributed to the respondents.

4.6.2   Pilot Test: Reliability and Confirmatory Factor Analysis

Pilot study is a small scale preliminary study that conducts before the distribution of the final survey questionnaire to the full scale of the sample. According to Creswell (2003), pilot test or field test is important to establish the reliability of the instrument and to improve the quality of questions, format, and the scale. Besides, it is to validate the instruments before distribute the final questionnaires to the large scale of respondents in an attempt to avoid time and money wasted on inadequate design. In this regard, as recommended by Robbins (1999) that sample size for pilot test should range from twenty-five to seventy-five, while Hill (1998) suggested that ten to thirty participants were acceptable.

The pilot study was carried out once the questionnaire been finalized by the experts of academicians and industrial practitioners in SCM. A total of 30 questionnaires were distributed to the population, but not to those who form part of the final sample to test the reliability of each item in the questionnaire. The small sample size has been chosen due to the constrained by small population of this study. To assess the reliability of the construct, Cronbach's alpha above the recommended threshold value of 0.70 (Ringle et al., 2006; Henseler et al., 2009; Hair et al., 2011) is indicates high internal consistency in each construct. However, there were no amendments needed to the items in the questionnaire based on the result of the pilot study in reliability. Nevertheless, the pilot study may not be suitable for case studies.

4.6.3   Results of the Pilot Study

Based on the results of pilot study as shown in Table 4.3, all the value of Cronbach's Alpha were range from 0.872 to 0.965 in which assess the reliability threshold value of 0.70 (Ringle et al., 2006; Henseler et al., 2009; Hair et al., 2011) and thus, indicates high internal consistency in each construct.

Table 4.3
Pilot Study (Reliability)

Dimensions	Number of item	Cronbach's Alpha	Cronbach Alpha if Item Deleted
Relational Capability			
Supplier Partnerships			
"Partner with supplier is able to…"	**6**	0.895	
1) help us serve our customer better.			0.917
2) reduce our production processes.			0.861
3) reduce our production down time.			0.842
4) solve our operation problems faster.			0.872
5) provide a better inventory control.			0.866
6) provide a better quality control in supply.			0.885
Customer Relationship			
"We are able to work with customer to…"	**5**	0.911	
1) understand their demand forecast.			0.891
2) request their feedbacks.			0.903
3) understand their product expectations.			0.873
4) understand their delivery expectations.			0.903
5) achieve their satisfaction levels.			0.888
Information Sharing			
"We are able to…"	**6**	0.947	
1) share proprietary information within the organization.			0.938
2) receive proprietary information from our trading partners.			0.924
3) use shared information for decision making.			0.945
4) share proprietary information with trading partner.			0.932
5) use shared information to plan our production.			0.940
6) use IT system to share information.			0.946
Information Quality			
"Information sharing between trading partners and us is …"	8	0.929	
1) sufficient enough for our work.			0.919
2) sufficient timely.			0.915
3) easily accessible.			0.916
4) easy to manipulate to meet our needs.			0.920
5) consistently presented in the same format.			0.918
6) sufficiently up-to-date for our work.			0.917
7) trustworthy.			0.926
8) reliable.			0.928
Information Technology Capability			
IT Infrastructures			
"We are able to…"	6	0.965	
1) enforce standards of new IT platforms.			0.956
2) develop new IT systems.			0.956
3) keeping IT systems scalable.			0.962
4) make evolutionary changes to IT platforms.			0.954
5) keeping the data architecture flexible.			0.966
6) integrate business processes.			0.954

Dimensions	Number of item	Cronbach's Alpha	Cronbach Alpha if Item Deleted
IT Personnel			
"Our IT personnel have…"	6	0.907	
1) strong technical skills.			0.884
2) strong managerial skills.			0.882
3) upgrade their skills.			0.882
4) non-technical communication skills.			0.913
5) innovative ideas for new IT initiatives.			0.894
6) excellent business skills.			0.885
IT Knowledge			
"We are able to…"	5	0.924	
1) fully utilize IT functions to improve work efficiency.			0.913
2) provide training programs for our employees to acquire new IT skills.			0.897
3) use IT to avoid possible mistake in business process.			0.903
4) constantly seek new ways to improve work effectiveness.			0.918
5) use existing IT innovatively.			0.902
IT Reconfigurability			
"We are able to…"	6	0.948	
1) reconfigure our IT resources to match current environment.			0.935
2) utilize potential of IT to breakthrough business performance.			0.932
3) adjust IT resources to better match our current requirement.			0.933
4) innovatively integrate our IT resources.			0.947
5) use IT innovatively to open up new markets.			0.942
6) reconfigure IT resources to support business initiatives.			0.939
Organizational Culture Capability			
Involvement			
"Our employees are able to…"	6	0.954	
1) make decisions with available information.			0.950
2) work as a team.			0.947
3) access easily to the information that they needed.			0.941
4) contribute to company continuously.			0.944
5) have a positive impact to company.			0.948
6) make company to be competitive.			0.942
Consistency			
"Our employees are able to…"	5	0.949	
1) steadily follow the guidelines while working.			0.937
2) propose win-win solutions in disagreement.			0.939
3) follow the ethical code that set by company to guides their behavior.			0.928
4) reach consensus with partners.			0.949
5) steadily follow the way of doing business.			0.931

Dimensions	Number of item	Cronbach's Alpha	Cronbach Alpha if Item Deleted
Adaptability			
"Our employees are able to…"	6	0.924	
1) accept customer recommendations.			0.906
2) get customer's input as part of their decision making.			0.887
3) response quickly to trading partners.			0.906
4) adopt new methods in working.			0.926
5) make decisions based on the interests of final customers.			0.909
6) take challenges in working.			0.905
Innovativeness			
"Our employees are able to…"	6	0.937	
1) incorporates a large body of new technological knowledge.			0.926
2) fully utilize the function of new technologies.			0.928
3) design new products for customer.			0.922
4) develop new methods to accomplish better the business goals.			0.92
5) produce high innovative product.			0.931
6) apply new administrative techniques.			0.926
Supply Chain Technology Adoption			
Use			
"Our company has adopted…"	12	0.898	
1) Bar-Coding Technology			0.907
2) Computer-Aided Design Systems (CAD)			0.889
3) Customer Relationship Management Systems (CRM)			0.878
4) Electronic Data Interchange (EDI)			0.880
5) Enterprise Resource Planning Systems (ERP)			0.880
6) Extranet			0.882
7) Internet			0.893
8) Intranet			0.909
9) Material Requirements Planning Systems (MRP)			0.889
10) Radio Frequency Identification Systems (RFID)			0.894
11) Supplier Relationship Management Systems (SRM)			0.884
12) Wireless or Mobile Devices			0.879
Usefulness			
"Adoption of supply chain technology enables our company to..."	9	0.922	
1) quick respond to change.			0.954
2) provide better support to new functions.			0.908
3) enhance linkages with trading partners.			0.911
4) reduce inventory level.			0.904
5) enhance business efficiency.			0.904
6) enhance asset tracking speed.			0.905
7) provide real time communication.			0.910
8) speed up business transactions.			0.909
9) improve data accuracy.			0.910

Dimensions	Number of item	Cronbach's Alpha	Cronbach Alpha if Item Deleted
Supply Chain Operational Performance			
Reliability			
"During the last three years, our company achieved significant improvement in…"	7	0.892	
1) customer service level.			0.913
2) speeding of new products introduction.			0.867
3) delivering quality products to customers.			0.873
4) responding to urgent customer request.			0.866
5) providing accurate information to members in the supply chain.			0.877
6) meeting deadlines as promised to members in the supply chain.			0.860
7) providing adequate information to members in the supply chain.			0.875
Responsiveness			
"During the last three years, our company achieved significant improvement in…"	6	0.892	
1) responding to supplier or customer.			0.879
2) timely delivery.			0.866
3) delay responds.			0.858
4) speed of informs each other whenever problems occur.			0.901
5) deliver emergency orders.			0.865
6) delivery lead time.			0.869
Agility			
"During the last three years, our company achieved significant improvement in…"	6	0.929	
1) adaption to product volume changes.			0.916
2) solve unexpected problems.			0.911
3) resources reallocation to support demand changes.			0.903
4) customization level.			0.919
5) speed of respond to demand changes.			0.922
6) expedite shipments.			0.920
Costs			
"During the last three years, our company achieved significant reduction in…"	5	0.872	
1) inventory costs.			0.847
2) transportation costs.			0.862
3) operation process to save costs.			0.817
4) waste in processes to save cost.			0.878
5) communication costs.			0.821

Note: Cronbach's Alpha ≥ 0.70 indicates high internal consistency

4.7 Ethics in Data Collection

Basically, ethics in research were addressed while collecting data. As formerly noted, the respondents should be willing to share information in the survey if they have decided to participate (Cooper & Schindler, 2007). Nobody should be forced to participate to the survey (Sekaran, 2003). This is to reflect the true objective during the process of answering the survey questions. Moreover, if the respondents agreed to participate, they have an obligation to be honest and truthful in the responses based on the best estimate without any misrepresentation or untrue information (Sekaran & Bougie, 2010). Meanwhile, to protect respondent identity, the name of the respondent cannot be used and should only refer to the way of pseudonyms. Besides, the researcher should never conveniently ignore certain aspects of the data obtained (Bryman & Bell, 2003). In addition, all information provided by the respondent should be treated as strictly confidential and used for professional purposes and educational publication(s) only. Thus, individuals should respect the confidentiality of the data obtained by the researcher. The request to disclose the response data or survey questionnaires are prohibited in research. The individuals should have an open mind in accepting the results and recommendations reported by the researchers in their study (Sekaran & Bougie, 2010).

4.8 Data Collection Methodology

Data can be collected in a variety of ways. For this study, data obtained from primary sources, which is individual represent an organization to participate and response through survey questionnaires (Sekaran & Bougie, 2010).

4.8.1 Data Collection Method

In this study, postal and online surveys were the main data collection methods in this study. Therefore, firstly, there must have a cover letter (**Refer to Appendix E**) to explain the importance and objective of the research in the context of SCM in Malaysian textile and apparel industry. The letter head of the academic institution, the supervisor's real signature, certification of study from respective school (**Refer to Appendix F**), and approval letter of data collection from graduate school (**Refer to Appendix G**) are sign of originality to build respondents confident level to participate. Besides, the cover letter is reported that able to enhance the response rate for postal survey (Whitley, 1985). Mail surveys are most widely used in SCM research and the response rate is sufficient and enough for obtain good results in data analysis (Mentzer & Kahn, 1995). Therefore, at the beginning, the data was collected through distributed the questionnaire by both conventional and e-mail out to 201 managing directors or supply chain managers in Malaysia textile and apparel organization listed in FMM Directory (2013) and MATRATE directory 2013. Besides, e-mail survey questionnaire was attached with the link of web-based questionnaires from docs.google.com to convenience the respondents in response (**Refer to Appendix H**). E-mail or web-based surveys are known as the response efficient and cost-effective way to collect data, which should provide more rapidly response and greater response rate (Grant et al., 2005).

4.8.2 Data Collection Procedure

There are several activities were taken during the data collection period in order to encourage and increase the willingness of the respondents to participate in this research. The best procedure in data collection is essential to get a response. Thus, the response rate should be increased by following activities:

1) Pre-survey e-mail and phone call notifications for participation are significance and imperative to respondents (Grant et al., 2005).

2) A set of conventional survey packet which consists of cover letter, certification of study, approval letter of data collection, stamped reply envelops, and survey booklets were mailed to respondents. Cover letter clearly explains the purpose of the study as well as ensuring anonymity and emphasizing confidentiality by the permission letter. A stamped and enclosed self-address reply envelope were attached together for respondent's convenience to return the completed questionnaire.

3) To improve the response rate, a survey package was sent through e-mail and the link of a web-based survey questionnaire was also provided to the respondents to make them more convenient to respond, since the Internet and mobile data services have been available everywhere recently.

4) Follow up is important to get a response. Thus, the consistent follow up with email and phone calls are strategies to increase the response rate. Besides, the second follows up mail with a replacement questionnaire were sent to those who have not responded to the survey to increase the response rate.

4.8.3 Data Collection Time Period

The data collection time period was approximately two months. However, the consistent follow up upon initial mail out is important to achieve the time setting. The respondents gave approximately one month to responses upon the initial mail out. Then, the respondents who have not responded within the one-month period were followed up by a mail with a replacement questionnaire.

4.9 Analytical Methodology

In recent decades, structural equation modeling (SEM) is one of the most useful advanced statistical analysis techniques that have emerged in social sciences (Hair, Hult, Ringle, & Sarstedt, 2014). These methods are suitable for the study that needs to indirectly estimate unobserved latent variables (Burt, 1973; Carmines & McIver, 1981; Chin & Todd, 1995). Basically, there are several techniques in SEM analytical methods. Thus, the selections of suitable analytical techniques were presented after the discussion of strengths and weaknesses of respective technique.

SEM has a prerequisite for the estimation of a measurement model. The reliability and validity of the model can be tested through the relations between reflective variables and construct. Basically, this model is commonly represented as a block (Kmenta & Ramsey, 1980; Fornell & Cha, 1994) that comprises of a set of indicators for an individual latent construct (Falk & Miller, 1992). Several individual latent construct with its own indicators comprise the outer model or measurement models (Fornell & Cha, 1994). The inner model or structural model is highlights the relations among the endogenous and exogenous constructs by tests the hypothesized relationships among

constructs (Falk & Miller, 1992). Table 4.4 show the organization of multivariate methods.

Table 4.4
Organization of Multivariate Methods

	Primarily Exploratory	**Primarily Confirmatory**
First generation techniques	• Cluster analysis • Exploratory factor analysis • Multidimensional scaling	• Analysis of variance • Logistic regression • Multiple regression
Second generation techniques	• PLS-SEM	• CB-SEM • Confirmatory factor analysis

Source.   Adopted from Hair, Hult, Ringle, and Sarstedt (2014)

Two analytical techniques in SEM which includes covariance based structural equation modeling (CB-SEM) (Joreskog, 1971; Joreskog & Sorbom, 1996) and partial least squares structural equation modeling (PLS-SEM) (Wold, 1973, 1974, 1975) is discussed in the following section. Briefly, the objective of CB-SEM is to reproduce the theoretical covariance matrix, without focusing on explained variance (Falk & Miller, 1992). Conversely, PLS-SEM aims to maximize the explained variance of the endogenous latent constructs (Falk & Miller, 1992). Falk and Miller (1992) stated that:

> "*The maximum likelihood (ML) and PLS approaches to path models with latent variables are complementary rather than competitive. ML is theory-oriented, and emphasizes the transition from exploratory to confirmatory analysis. PLS is primarily intended for causal-predictive analysis in situations of high complexity but low theoretical information* (Joreskog & Wold, 1982)."

4.9.1 Covariance-Based Structural Equation Modeling (CB-SEM)

CB-SEM intends to analyze the difference between observed sample covariance matrix and algorithm estimated matrixes. It is to see whether the implied model fits the data (Bollen, 1989). In CB-SEM, the loadings are assigned to a particular construct before the estimation (Joreskog, 1967, 1971; Long, 1983; Steenkamp & Trijip, 1991). CB-SEM assumes theoretical development of the model is strong (Falk & Miller, 1992). Thus, it aims to "*reproduce the observed data covariance matrix against an estimated covariance matrix*" (Bollen, 1989; Joreskog & Sorbom, 1996). In fact, it requires "*relatively high quality data and relatively strong developmental ideas*" (McArdle & Alber, 1990). Hence, several underlying assumptions are needed to performing this method. Firstly, the observed variables must be normally distributed and data observations have to be independent (Wold, 1981). The distributional problems often faced by complex models (Chin, 1998). However, there are estimators available to deal with non-normality (Browne, 1984; Bollen, 1989). Chin and Newsted (1999) noted that this technique often needs large sample sizes with the minimal range from 200 to 800 to be appropriate. These concerns are important in this study, since there is constrained in sample size.

4.9.2 Partial Least Square Structural Equation Modeling (PLS-SEM)

Components based SEM such as PLS-SEM is rapidly becoming popular and a commonly used alternative to CB-SEM such as analysis of moment structure structural equation modeling (AMOS-SEM). PLS-SEM is alike to ordinary least squares or linear least squares regression, but being a components-based SEM technique

(Lohmoller, 1989; Chin, Marcolin, & Newsted, 1996). It comprises of two elements, which included measurement models (i.e. outer model) and structural model (i.e. inner model). PLS-SEM is seen as a precursor to future CB-SEM analyses (Chin & Newsted, 1993). This is one of the reasons why the researcher select PLS-SEM. However, there are many other reasons that PLS-SEM been selected (Lee, 2000). First, CB-SEM has a limitation in assessing complex models with sample size constraints (Chin & Newsted, 1999). However, PLS-SEM is considered has the capability in explaining complex models without sample size constraints (Fornell & Bookstein, 1982; Chin, 1998; Wittingslow & Markham, 1999) and nearly always converges (Wold, 1981). Moreover, PLS-SEM does not need normal distribution and it emphasized predictor specification or also known as nonparametric (Cassel, Hackl, & Westlund, 1999). Besides, PLS-SEM able to cope with both reflective and formative measures (Anderson & Gerbing, 1988). Several researchers have been employed PLS-SEM in their recent study in examine factors of supply chain technology adoption and assessing its impacts on supply chain performance (Lee, Kim, & Kim, 2014; Hwang & Min, 2015).

In order to crystal clear the aforementioned discussion between CB-SEM and PLS-SEM, a comparison of CB-SEM and PLS-SEM is illustrated in Table 4.5 as follows. The comparison helped the researcher in deciding the approach to be chosen (Hair, Sarstedt, Ringle, & Mena, 2012). The next section provides justification for the selection of PLS path modeling.

Table 4.5
Comparison of CB-SEM and PLS-SEM

Criteria	Covariance Based SEM (CB-SEM)	Components Based SEM (PLS-SEM)
Objective	Parameter-oriented	Prediction-oriented
	The goal is theory testing, theory confirmation, or the comparison of alternative theories.	The goal is predicting key target constructs or identifying key "driver" construct.
Approach	Covariance-based	Variance-based
Assumption	Typically multivariate normal distribution and independent observations (parametric)	Predictor specification (nonparametric)
Parameter estimates	Consistent	Consistent as indicators and sample size increase (i.e., consistency at large)
Latent variable scores	Indeterminate	Explicitly estimated
Epistemic relationship between an LV and its measures	Typically only with reflective indicators. However, the formative mode is also supported.	Can be modeled in either formative or reflective mode.
Implications	Optimal for parameter accuracy	Optimal for predictive accuracy
Model complexity	Small to moderate complexity (e.g., less than 100 indicators)	Large complexity (e.g., 100 constructs and 1,000 indicators)
Sample size	Ideally based on power analysis of specific model. Minimal recommendations range from 200 to 800.	Power analysis based on the portion of the model with the largest number of predictors. Minimal recommendations range from 30 to 100 cases
Type of optimization	Globally iterative	Locally iterative
Significance tests	Available	Only by means of simulations; restricted validity
Availability of global Goodness of Fit (GoF) metrics	Established GoF metrics available	Are currently being developed and discussed

Source.   Adapted from Chin and Newsted (1999) and Hair et al. (2014)

4.9.3   Justification for the Selection of PLS Path Modeling

Several data features such as model complexity, small sample size, data are non-normally distributed, and uses of different scale types are among the most common listed reasons for using PLS-SEM (Henseler, Ringle, & Sinkovics, 2009; Hair et al., 2012). A simulation study by Reinarts, Haenlein, and Henseler (2009) and Afthanorhan (2013) noted that PLS-SEM was the suitable technique of analysis for the study concerned with complex model, prediction and theory development, since these issues hindered the study dealing with small sample. As this study examines complex models with mediating effects, it was considered judicious to choice the analysis technique that is best ready to handle these issues. The data features of this study encompassed:

1) The structural model complexity is intensified with numerous indicators.

2) The model complexity is extraordinary for examines the mediation hypotheses.

3) The overall model complexity of this study reveals the sample size obtained is relatively small.

4) The data obtained by this study is non-normally distributed.

5) The use of different scale types in measuring the construct of this study.

6) The goal of this study is predicting key target constructs, instead of theory testing or theory confirmation. This is because the theoretical development and replication for most construct of this study are limited within Malaysia.

4.10 Statistical Package for Social Science (SPSS)

The data obtain from survey questionnaires were entry and analyzed by using applications of Statistical Package for Social Science (SPSS) Version 20 for window (Coakes & Steed, 2007) and Partial Least Squares (SmartPLS) Version 2.0 M3. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are powerful statistical techniques (Hair et al., 2010). Therefore, the data will subject to EFA and CFA to examine. The most commonly used technique is to consider factors loading that are greater than 0.5 (Hair et al., 2010). Then CFA techniques will be used to gauge the dimensions that converge into the defined variable through PLS-SEM (Byrne, 2010).

Basically, SPSS was mainly used for descriptive analysis, which showed the statistic of sample characteristics and all the constructs used in this study. Descriptive Statistics developed based on the basic of probability theory and aim to summarize a sample rather than population. It was conducted to compute the value of central tendency and variability with each dimension of the variables. Measures of central tendency include means, median, and mode, while measures of variability include standard deviation (variance), minimum and maximum values of the variables, kurtosis, and skewness (Pallant, 2011). Besides, data screening is play an important role to obtained a précised statistical results. An analysis of non-response bias, missing value, common method variance, outlier, and fundamental statistical assumptions (i.e. test of linearity, normality, homoscedasticity, multicollinearity) was conducted through SPSS at the initial stage.

4.11 The Two-Step Modeling Approach

In this study, the PLS-SEM approach was adopted and which involves two steps approach. Estimating the measurement model (i.e. outer model) is performed before the assessment of the structural model (i.e. inner model) (Barclay, Higgins, & Thompson, 1995). In estimating the measurement models, each constructs is tested separately in the beginning to establish the validity and unidimensionality (Hattie, 1985; Fornell & Cha, 1994; Chin, 1998). There is the same for handle the higher-order construct domain (Wilson, 2010). The specified indicators that do not relate to the construct should do appropriate modification to suit the overall theory or construct of the study before assessment of the structural model proceeds. These steps are following the EFA or principle component analysis (PCA) accepted procedure (O'Cass, 2002a, 2002b; Grace & O'Cass, 2003; O'Cass & Grace, 2003).

Assessment of the structural modeling for the inner model relationship can proceed once the assessments of the measurement models completed. This assessment provides a nomological validity to the model (Fornell & Cha, 1994; Chin, 1998; Tenenhaus, Vinzi, Chatelin, & Lauro, 2005). This two-step approach is useful when measures the models that are not well developed and involved higher order constructs. This is match to the condition of this study, which involved second order construct. A summary of PLS-SEM assessment procedure is exhibited in Figure 4.4. Some relevant PLS statistics and interpretation are further discussed on the following sections.

| Measurement Model Evaluation Procedure |
| Internal consistency (Composite reliability) |
| Indicator reliability |
| Convergent validity (Average Variance Extracted) |
| Discriminant validity |
| Structural Model Evaluation Procedure |
| Coefficients of determination (R^2) |
| Predictive relevance (Q^2) |
| Size and significance of path coefficients |
| f^2 effect sizes |
| q^2 effect sizes |

Figure 4.4
Summary of PLS-SEM Assessment Procedure
Source. Adopted from Hair et al. (2014)

4.11.1 Measurement (Outer) Model Evaluation

Some relevant PLS statistics are discussed to aid the interpretation of PLS results that

presented in Chapter Five of this study.

4.11.1.1 Loadings – Reflective Indicants

A loading also known as the relationship where the indicants (i.e. items or manifest variables) reflect the construct. Falk and Miller (1992) recommended that loadings of 0.50 and above to be appropriate. The square of the loading is equal to the variance contributed or shared by the variable and construct (Fornell & Larcker, 1981). This means that the measures share at least 50% of the variance with construct and thus, less than 50% measurement error variance (Barclay et al., 1995). Besides, Chin (1998) suggests that loadings 0.70 and above is applicable. However, Barclay et al. (1995) and Chin and Newsted (1999) further recommended that loadings between 0.50 and 0.60 to be appropriate for the first time studies. Consequently, the threshold value of 0.50 and above that suggested by Falk and Miller (1992) was adopted in this study.

4.11.1.2 Internal Consistency – Composite or Maximized Reliability

Internal consistency statistics are only appropriate for reflective constructs (Chin, 1998). The internal consistency of a model is measured by Cronbach's Alpha (Cronbach, 1951). The Cronbach's Alpha with threshold value 0.70 and above considered as reliable measures (Nunnally, 1978; Chin, 1998). However, for current research study, the credence should be given more to the composite reliability estimate (Raykov & Shrout, 2002). The higher the reliability indicates the lower the error variance (Raykov, 2001). Sometime, composite reliability also referred to construct validity (Fornell & Larcker, 1981; Holmes-Smith & Rowe, 1994). Werts et al. (1974) formulate the composite reliability by proportionate the weights of indicators as Equation 4.2:

$$P_c = \frac{(\sum_i l_i)^2}{(\sum_i l_i)^2 + \sum_i var(e_i)}$$

<div align="right">

Equation 4.2
Composite Reliability
</div>

Whereby l_i symbolizes the standardized outer loading of the indicator variable i of a specific construct, e_i is the measurement error of indicator variable i, and $var(e_i)$ denotes the variance of the measurement error, which is defined as $1 - l_i^2$.

4.11.1.3 Discriminant Validity

Besides, discriminant validity indicates the extent to which indicators of a given latent variable differ from indicators of the other latent variables (Campbell & Fiske, 1959). Therefore, the correlation between constructs (i.e. off-diagonal elements) needs to be lower than the reliability estimates (i.e. diagonal elements) (Gaski & Nevin, 1985; O'Cass, 2002a, 2002b; Patterson & Smith, 2003; O'Cass & Pecotich, 2005).

4.11.1.4 Cross-loading in PLS Analyses

In PLS analysis, cross-loading value should be examined to assess the discriminant validity. Usually, the lack of correlations between measures of unrelated constructs is demonstrated the discriminant validity (DeVellis, 2003). Generally, the interpretation of cross loading in PLS analyses is similar to interpretation of cross-loadings in SPSS factor analysis. This can be generally understood that the measure of intended construct should load better or higher than other constructs (Chin, 1998; Agarwal & Karahanna, 2000).

4.11.1.5 Average Variance Extracted Statistic

Fornell and Larcker (1981) have created a formula for Average Variance Extracted (AVE) as shown in the Equation 4.3. This formula is used to assess convergent validity. The threshold value for AVE should be 0.50 and above to be appropriate (Fornell & Larcker, 1981). The value demonstrated that the number of variance captured by the construct through its items is higher than the variance due to measurement error (Fornell & Larcker, 1981).

$$AVE = \frac{(\sum_i l_i)^2}{n}$$

<div align="right">

Equation 4.3
Average Variance Extracted (AVE)

</div>

4.11.1.6 Assessing Parameter and Loading Significance

The significance of parameter estimates can be assessed by bootstrapping or jackknife option (Chin, 1998). Both are resampling techniques by derive t-statistics. However, bootstrapping is a more common and acceptable method in resampling techniques. Thus, bootstrapping was applied to decide parameter significances for this study (Efron & Tibshirani, 1993). Chin (1998) suggests 200 bootstrap samples to be appropriate. However, this study followed the advice by Hair et al. (2014) with 5000 bootstrap sample. Popular critical t-value or z-value for a two-tail test are ±1.65 ($\alpha = 0.10$), ±1.96 ($\alpha = 0.05$), or ±2.58 ($\alpha = 0.01$). For directional hypotheses, one-tail test are appropriate in which ±1.28 ($\alpha = 0.10$), ±1.65 ($\alpha = 0.05$), or ±2.33 ($\alpha = 0.01$). As a summary for the section, Table 4.6 exhibited the rules of thumb for evaluating reflective measurement models.

Table 4.6
Rules of Thumb for Evaluating Reflective Measurement Models

Assessment	Threshold value
Indicator reliability	Loadings>0.50
Convergent validity	AVE>0.50
Internal consistency reliability	CR>0.708
Discriminant validity	• All indicator's outer loadings on a construct should be higher than its cross loadings with other construct. • The square root of the AVE of each construct should be higher than its highest correlation with any other construct.
Critical value for a two-tail test	$\pm$1.65 (α = 0.10), $\pm$1.96 (α = 0.05), or $\pm$2.58 (α = 0.01)
Critical value for a one-tail test	$\pm$1.28 (α = 0.10), $\pm$1.65 (α = 0.05), or $\pm$2.33 (α = 0.01)

Source. Adapted from Hair et al. (2014) and Fornell and Larcker (1981)
Note. AVE=average variance extracted; CR=composite reliability or Cronbach's alpha

4.11.2 Statistics to Assess the PLS Structural (Inner) Model

Assessment of structural model provides the determination of how well empirical data support the theory or concept. Therefore, the theory or concept of the study can be empirically confirmed in this stage of analyses. The analysis is begun with assess the structural model for collinearity, which is the estimation of path coefficients in the structural models (Hair, Hult, et al., 2014). This is to assess the significance and relevance of the structural model relationships (Hair, Hult, et al., 2014). The next step of analyses is followed by assess the coefficient of determination (R^2 value) (Hair, Hult, et al., 2014). This gives an indication of nomological validity (Sarker, Echambadi, Cavusgil, & Aulakh, 2001). The effect size (f^2) is examined to evaluating the R^2 value of all endogenous constructs (Hair, Hult, et al., 2014). In addition to evaluating the magnitude of the R^2 values as a criterion of predictive accuracy, the predictive relevance (Q^2) is examined (Stone, 1974; Geisser, 1975; Hair, Hult, et al., 2014).

Similar to the f^2 effect size approach for assessing R^2 values, the relative impact of Q^2 can be compared by means of the measure to the q^2 effect size (Stone, 1974; Hair, Hult, et al., 2014). As frequently examined in prior studies, goodness of fit criterion for PLS-SEM is discussed in this study as well. Some relevant statistics are now briefly discussed on the following sections to aid the interpretation of PLS results that presented in Chapter Five of this study.

4.11.2.1 Coefficient of Determination (R^2)

The frequently used measure to evaluate the structural model is R^2 value. The coefficient is a measure of the model's predictive accuracy and is calculated as the squared correlation between a specific endogenous construct's actual and predictive values (Hair, Hult, et al., 2014). Basically, the R^2 value ranges from zero to one in which the higher value indicating higher levels of predictive accuracy. At the beginning of the research study, Cohen and Cohen (1983) define R^2 value 0.25 as large, 0.09 as medium and 0.01 as small. Afterward, Chin (1998) defined R^2 value 0.70 as strong, 0.30 as moderate, and 0.20 as weak. Nowadays, Hair et al. (2014) define R^2 value 0.75 as substantial, 0.50 as moderate, and 0.25 as weak. The Hair et al. (2014) classification is preferred in this study as it is based around the PLS methods.

4.11.2.2 Effect Size (*F²*)

The effect size (f²)is used to evaluate the change in the R^2 value when a specific exogenous construct is omitted or added to the model (Cohen, 1988). It can show whether the omitted construct has a substantive impact on the endogenous constructs (Hair, Hult, et al., 2014). Cohen (1988) defined f² value 0.35 as large, 0.15 as medium, and 0.02 as small effect. The effect size can be calculated by using Equation 4.4 as follows.

$$F^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

Equation 4.4
Effect Size (F²)

The utility for inclusion can be assessed through the contribution of each construct in the model. Initially, the R^2 value of full model needs to be noted. Practically, in this study, the next step is removed the construct of supply chain technology adoption from the model and the corresponding effect size is calculated via the new and original R^2 value. The change in the R^2 value reflects the explanatory power of the omitted construct on supply chain operational performance (Chin, 1998). In this case, the effectiveness of supply chain technology adoption as mediating construct in the model of this study is examined.

4.11.2.3 Predictive Relevance (*Q²*)

The predictive ability of the model is equally important to be examined. The Stone-Geisser Q^2 statistic is an indicator of the model's predictive relevance (Geisser, 1974, 1975; Stone, 1974). This is used to measures the predictive ability of the model after

omitting observations. Besides, the predictive quality of the model also can be assessed (Dijkstra, 1983). The Q^2 value more than 0 is suggested that the model has sufficient predictive relevance for the endogenous construct, while the Q^2 value less than 0 indicates the model lacks predictive relevance (Apel & Wold, 1982; Fornell & Bookstein, 1982). Apel and Wold (1982) suggested that the Q^2 value in the range 0.40 to 0.60 as acceptable and 0.70 to 0.80 as exceptional. This means that Q^2 values equal to one indicates the supply chain operational performance being perfectly able to be reconstructed.

As a summary for the section, Table 4.7 presents the rule of thumb for evaluating reflective measurement models. Figure 4.4 illustrates the summary of PLS-SEM assessment procedure.

Table 4.7
Rules of Thumb for Evaluating Structural Models

Assessment	Threshold value
Collinearity	Tolerance (VIF) should be higher than 0.20 , but lower than 5
Critical values for a two-tail test	±1.65 (α = 0.10), ±1.96 (α = 0.05), or ±2.58 (α = 0.01)
Critical values for a one-tail test	±1.28 (α = 0.10), ±1.65 (α = 0.05), or ±2.33 (α = 0.01)
Coefficient of determination (R^2)	0.25 (weak), 0.50 (moderate), 0.75 (substantial)
Effect size (f^2)	0.02 (small), 0.15 (medium), 0.35 (large)
Predictive relevance (Q^2)	0.40-0.60 (acceptable), 0.70-0.80 (exceptional), 1.00 (being perfectly able to be reconstructed) Q^2 values larger than 0 indicate that the exogenous constructs have predictive relevance for the endogenous construct under consideration.
Predictive relevance (q^2)	0.02 (small), 0.15 (medium), 0.35 (large)
Goodness of Fit (GoF)	0.1 (small), 0.25 (medium), 0.36 (large)

Source. Adapted from Hair et al. (2014), Chin (1998), Cohen (1988), Hair et al. (2011), Henseler et al. (2009), Ringle et al. (2006), Tenenhaus et al. (2005), and Hair et al. (2012)

4.12 Chapter Summary

The quantitative research design is selected for this study. Thus, a survey questionnaire is prepared for data collection on Malaysia textile and apparel companies listed in FMM Directory (2013) and MATRADE directory (2013). Therefore, the unit of analysis was organization. A pilot study was conducted before the distribution of the final survey questionnaire to the full scale of the sample in an attempt to avoid time and money wasted on inadequate design. The survey package was distributed by post and online. The total data collection time was two months period. The obtained data was analyzed by SPSS version 20 and SmartPLS version 2.0 M3.

CHAPTER FIVE

DATA ANALYSIS AND FINDINGS

5.1   Introduction

This chapter discusses the data analysis and findings of the study in numerous sections to clearly present the results. A series of statistical analyses was applied on the collected data to accumulate information from the responded surveys. The statistical analysis starts by an overview of the data collected, in which the response rate is presented. The statistical analysis is followed by the demographic profile of organizations and respondents as well as the willingness to participate in future research is indicated. Data screening is a must process to enable the further analyses conducted, which include analysis of non-response bias, missing values, common method variance, outliers, and fundamental statistical assumptions such as test of normality, and homoscedasticity. The analysis is followed by the descriptive statistics of the study variables, confirmatory factor analysis, and model's evaluations. The assessment of measurement model (i.e. internal consistency or reliability, construct validity, convergent validity, and discriminant validity) and structural model (i.e. main effects, effect size, predictive relevance, goodness of fit, mediation effects, and power of analysis) is to evaluate the overall model of the study. A summary of hypothesis testing is presented to simplify the results and findings of the study. Lastly, a chapter summary is provided at the end of this chapter as an overview of this chapter.

5.2 Overview of Data Collected

The overview of data collected is presented in the beginning of this chapter. This is to give the very first introduction to the data collected. By this section, the reader would understand the data collection method of this study.

5.2.1 Response Rate

As described in the previous chapter, data were collected through postal and electronic mail, questionnaire survey. The sources of targeted respondents are selected from the FMM directory (2013) and MATRADE directory (2013), who are responsible to supply chain/ operation/ purchasing/ warehousing/ logistics/ inventory/ customer service in the designation of managing director/ manager/ executive/ officer. Specifically, one of the employees whose most responsible for SCM or direct deal with a buyer, supplier, and inventory control of the rated organization represented their organization to participate in the survey.

According to Cooper and Schindler (2007) and Zikmund (2005), the data collected from questionnaires survey was subjected to examine the demographic variables through descriptive analysis. The total of 125 responses received from the total of 201 questionnaires distributed through mail and email in two waves during the month of January to March 2014 and from April to June 2014. From the responses received, four responses were rejected due to incomplete information, which could be due to no commitment from respondents or the respondents may not have sufficient experience to answer the survey questionnaires. From the total of four rejected questionnaires, two of the questionnaires left a page or two unanswered and two of the questionnaires

have over 50% of their responses in multiple or no answers. Hence, the remaining 121

questionnaires were certified to be complete, accurate eligible, and consistent to

analyses. Table 5.1 shows the distribution of the questionnaires and the response rate

as well. The response rate is computed by dividing the total number of valid responses

with total distribution as Equation 5.1.

$$Response\ Rate\ =\ \frac{Total\ response\ received\ -\ Rejected\ response}{Total\ distribution}$$

Equation 5.1
Response Rate

According to Babbie (1990), response rate measures researcher's success in

persuading respondents to return the questionnaire. About 180 out of 201 organizations

were contacted, but only 125 companies returned the survey questionnaire. Based on

the assumption, the effective response rate is 60.20% [(125-4)/201]. However, based

on Babbie (1990) and Zikmund (2005) recommendation, such response rate is

adequate for the analyses and reporting as they advocated for a minimum of 50%

response rate.

Table 5.1
Response Rate According to Data Collection Method

Data Collection Method	Mail Questionnaires	Electronic Questionnaires	Total
No. of Questionnaires	201	201	201
Questionnaires Returned	66	59	125
Questionnaires Not Valid	4	0	4
Questionnaires Valid	62	59	121
Response Rate	32.84%	29.35%	62.19%
Valid Response Rate	30.85%	29.35%	60.20%

5.3 Data Screening

The purpose of data screening is to ensure the reliability, usability, and trustworthiness of data obtained from the survey. The data screening also known as a preliminary test that using different methods of analyses in SPSS. This processes is performed before the assessments of measurement and structural models in PLS. Commonly, the data obtained by researchers always problematics such as outliers, missing values, and extreme cases. These problems might lead to a number of data reliability issues such as linearity, normality, homoscedasticity assumption. In order to avoid the problems in affecting the analyses result of this study, the data obtained has been screened by series of test. Particularly, this study goes through all the test in data screening, which include non-response bias test, missing data imputation, outlier detection and treatment, and common method bias test. The further discussions are as follows.

5.3.1 Non-Response Bias Test

The purpose of non-response bias test is to highlight the different between respondents and their counterparts (Armstrong & Overton, 1997). In this study, the non-response bias test was conducted to show whether the finding can be generalized to the whole population of rated industry, known as Malaysian textile and apparel industry. Some distributed survey questionnaires get responded early while some were followed up with a series of soft reminders. The friendly reminders were imperative to increase the participations. This is because most of the communicated representatives have indicated their willingness to participate during the initial phone called. For this study, the first wave yielded 83 responses and the second wave yielded 38 responses as shown

in Table 5.2. In time frame perspective, it can be categorized into two in which first wave response is known as early response, while a second wave response is known as late response.

Non-response bias test is conducted through the mean comparison, the mean of the first and the second wave response were compared in all primary variables. In this test, the second wave respondents were assumed to have similar characteristics to non-respondents. In doing so, test of independent-samples t-test was conducted and the results are interpreted as Table 5.2. According to Pallant (2011), if the Levene's test was not significant at $p>0.05$, the equal variances assumed line was used. Conversely, if the Levene's test was significant at $p \leq 0.05$, the equal variances not assumed line was used. The Levene's test of this study show that there is no statistical significant, so the equal variances assumed line was used. Based on the t-test result, there is no statistical significant different between the first and the second wave response for all primary variables in this study. It means that the null hypothesis (H_o) cannot be rejected because all the variables were not significant. As a summary, there is no non-response bias between first and second wave response of this study. In simple layman words, this can be understood as no difference between two parameters that could affect the generalization of the findings. Therefore, the findings of this study were not only restricted to the sample, but it could be generalized to the whole population of textile and apparel industry in Malaysia. Hence, all the 121 responses were utilized for further data analyses. The full results of non-response bias test were shown in **Appendix K**.

Table 5.2
Non-response Bias Test for Major Variables

	1st Wave (Mean) n=83	2nd Wave (Mean) n=38	Levene's Test for Equality of Variances		t-test for Equality of Means			
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
RC	4.046	3.964	0.008	0.928	0.581	119	0.562	0.081
ITC	3.694	3.622	0.002	0.968	0.399	119	0.690	0.072
OCC	3.961	3.887	1.645	0.202	0.431	119	0.667	0.074
SCTA	3.655	3.624	0.660	0.418	0.206	119	0.837	0.031
SCOP	4.863	4.529	0.060	0.807	1.800	119	0.074	0.334

Note: (*) significant at p<0.05

5.3.2 Missing Value Imputation

According to Tabachnick and Fidell (2007), there are two key steps in testing the missing values. First step is to assess the total amount of missing value, while the next step is to detect the possible patterns of missing values, whether it happens randomly or relates to particular items. This is because the missing value could threaten the generalizability of the research findings (Hair, Black, Babin, Anderson, & Tatham, 2007).

Missing value also known as missing data. In survey research, it has become a common and serious issue of concern. Table 5.3 summarizes the missing value observation based on individual constructs of this study. The result reveals that out of the 116 relevant individuals construct, only 29 individual constructs possessed missing data and only 55 items missing data found in the overall data set. Based on the total numbers of missing data found, it is accounted for below 5% of overall data set. Acuna and Rodriguez (2004) recommended that the missing value below 1% is common and acceptable; below 5% is acceptable and manageable; above 15% is abnormal and

needs a drastic measure with a sophisticated technique to resolve it. However, the statement of Acuna and Rodriguez (2004) was argued by Hair et al. (2007), they noted that the researcher judgment is important in determining the issue of missing data. Thus, Hair et al. (2007) develop a rule of thumb with the suggestion that "*missing data under 10% for an individual case or observation can generally be ignored except when the missing data occurs in a specific non-random fashion*". Though, all of the missing values in this study were below 5%. Therefore, no individual construct was deleted at this stage and can be included in further statistical analyses since the missing values were not affected the interpretation of the results.

Based on Hair et al. (2007) recommendation, missing value can be deal with list-wise deletion (also known as complete case approach), pairwise deletion and imputation methods. List-wise deletion technique entirely excluded each case with missing values in all the analysis (Acock, 2005), while pair-wise deletion technique excluded only the case with missing values in the specific analysis (Roth, 1994). Imputation methods are the most common solution for the study that with limited case and missing value. There are several imputation methods which including case substitution, hot and cold desk imputation, mean substitution, regression imputation, expectation maximization and multiple imputation (Hair et al., 2007; Tabachnick & Fidell, 2007). However, Magnani (2004) provides the simpler techniques of handling missing data with only two categories, which include pre-replacing methods and embedded methods. Pre-replacing methods are used to handle missing data issues at the first phase of data preparation, whereas the embedded methods are used to handle the missing data much later mainly at the data mining phase.

Although there are several methods for dealing with missing data, but there is no the best method. It is totally depended on the nature of analysis, cost, and time constraint. Based on the presented rationale however, the missing data of this study was treated by replacing the values with pre-replacing and mean substitution imputation method. The mean of the nearest neighbors was selected to replace the missing values because of its ease of use (Roth, 1994; Hair et al., 2007) and unique ability in terms of both quantitative and qualitative attributes (Liu, Lei, & Zhang, 2004). The results of missing value analysis are as follows. The full results of missing value test were shown in **Appendix L**.

Table 5.3
The Summary of Missing Value Observation Based on Individual Constructs

Individual Constructs	N	Mean	Std. Deviation	Missing Value	
				Frequency	Percent
RCSP2	120	3.85	1.14	1	0.83
RCIQ1	120	3.83	0.96	1	0.83
RCIQ8	120	3.98	0.85	1	0.83
ITCP1	120	3.75	1.00	1	0.83
ITCK2	120	3.55	1.15	1	0.83
ITCK4	120	3.85	1.08	1	0.83
ITCR2	120	3.68	1.09	1	0.83
ITCR4	120	3.63	1.10	1	0.83
ITCR5	120	3.62	1.20	1	0.83
OCCInv1	120	4.00	0.93	1	0.83
OCCInv2	120	4.04	0.95	1	0.83
SCTAUse1	120	3.77	1.44	1	0.83
SCTAUse2	118	2.88	1.59	3	2.48
SCTAUse3	117	2.85	1.41	4	3.31
SCTAUse4	117	3.50	1.34	4	3.31
SCTAUse5	116	3.34	1.38	5	4.13
SCTAUse6	117	3.15	1.45	4	3.31
SCTAUse7	120	4.00	1.25	1	0.83
SCTAUse8	117	3.42	1.39	4	3.31
SCTAUse9	117	3.49	1.42	4	3.31
SCTAUse10	118	3.01	1.62	3	2.48
SCTAUse11	117	2.85	1.39	4	3.31
SCTAUse12	120	3.72	1.49	1	0.83
SCTUseful2	120	4.03	0.96	1	0.83
SCTUseful5	120	4.03	0.90	1	0.83
SCOPRel5	120	4.80	1.12	1	0.83
SCOPRel7	120	4.87	1.07	1	0.83
SCOPRes1	120	5.02	0.94	1	0.83
SCOPAgi4	120	4.63	1.22	1	0.83
Total	n=29			55	

Note:　* The percentage of missing value is less than 5%

5.3.3 Common Method Bias Test

Another potential issue in statistical analysis is common method bias also known as common method variance (CMV). CMV is the "*variance that is attributable to the measurement method rather than to the constructs the measures represent*" (Podsakoff et al., 2003). This also can be understood as systematic measurement errors. In this study, Harman's single factor test was employed to test the CMV (Podsakoff et al., 2003). The functions of Harman's single factor test is to identify the loading of all items are loaded into a single factor. EFA was employed in the early stages of data analysis to gather information about the interrelationships among a set of variables. All items of all variables are tested simultaneously by using unrotated EFA. Based on Tabachnick and Fidell (2007) recommendation, factor analysis (FA) is used to theoretical solution uncontaminated by unique and error variability, while PCA is used to obtain and empirical summary of the data set. Based on the rational of the analysis, therefore, PCA technique was employed. The results of CMV are shown in Table 5.4 as follow.

Table 5.4
Common Method Variance

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative % of Variance	Total	% of Variance	Cumulative % of Variance
1	11.96	66.44	66.44	11.96	66.44	66.44
2	1.04	5.80	72.23	1.04	5.80	72.23
3	0.98	5.44	77.68			
4	0.77	4.25	81.93			
5	0.58	3.24	85.17			
6	0.43	2.36	87.53			
7	0.33	1.85	89.38			
8	0.30	1.69	91.07			
9	0.28	1.53	92.60			
10	0.25	1.39	93.99			
11	0.21	1.16	95.15			
12	0.20	1.09	96.24			
13	0.17	0.93	97.17			
14	0.13	0.73	97.90			
15	0.12	0.65	98.54			
16	0.10	0.57	99.12			
17	0.09	0.50	99.61			
18	0.07	0.39	100.00			

Note. The result from unrotated principle component analysis to determine the presence of common method variance

Based on the results as Table 5.4, the unrotated PCA resulted in all the items forming two factors with the total variance of 72.23% at eigenvalues 1.04, and the largest factor accounting for 66.44% of the variance. CMV come in mostly are because of the study collected data from single source. However, the results of PCA indicate that statistically CMV does not exist among the measurement items in this study. The results further show that the total of 18 factors can be reduced to two factors, while retaining 72.23% of variance. This means that 27.77% of variance is lost, if reduce to two factors. The full results of common method bias test were shown in **Appendix M**.

5.3.4 Outliers Detection and Treatment

Outliers' detection and treatment was another potential issue in statistical analyses. It embarked after the missing value imputation and CMV test. Normally, outliers are the cases with values well above or well below the majority of other cases (Pallant, 2011). Therefore, the examination of univariate and multivariate outliers is a prerequisite step on initial data analysis for every study. Without the detection and treatment of outliers, the statistical tests can be seriously distorted (Hair et al., 2007) and further lead to not generalize the results (Tabachnick & Fidell, 2007).

In statistical analysis indeed, it is normal to have abnormal and unusual values presented in the raw data. Human error or data entry error is one of the reasons for outlier. Mahalanobis' distance frequently used by researcher to detect outliers through the determination of the isolation of an observation from the center of the data. However, there are many other ways of using distance measure in detecting outliers which included modification of the Akaike's information criterion (Ueda, 2009), robust scale and location estimators (Vendhan & Suresh, 2011) and order statistics such as the quartile or median (Liu et al., 2004). This study was employed Mahalanobis' distance in detecting outliers. This is because it possesses the capability of detecting observations that are positioned away from the center of the data. Besides, it giving less influence to variables that have highly interrelated variables (Chambers, 1986; Bruggena, Spannb, Lilienc, & Skiera, 2010). Based on the concerned of this study, the researcher followed the argument of Hair et al. (2010) who recommended to create a response numbering or case numbering is appropriated and required. In view of that, the statistical chi-square table was used to figure out the empirical optimal values.

As Hair et al. (2010) suggested, the new case number is used as the dependent variable and all other items (excluded demographic items) as the independent variables in simple linear regression analysis. The analysis was provided a new Mahalanobis' output for each case to be able to compare with the chi-square values. Table 5.5 illustrates that there are seven items (6.03%) from the total of 116 items respondents fall under outliers. The results are get from the chi-square table, those Mohalanobis' outputs that does not fall in the range between 91.2422 and 141.0297 are the outliers. However, this study follows the argument of Iglewicz and Hoaglin (1993) in which the outliers were retained for further analyses since SmartPLS 2.0 M3 capable in handling this issue and the data would not be distorted (Ringle, Wende, & Will, 2005). Hair, Christian, and Marko (2011) further noted that the SmartPLS 2.0 M3 is capable in producing sensible results even with the existing of little outliers. The full results of outlier detection were shown in **Appendix N**.

Table 5.5
Summary of Outliers Detection

Case Number	Mahalanobis'
1	58.986
3	58.986
45	58.942
46	58.942
55	54.216
98	46.129
108	46.129

Note. 91.2422 > Outlier > 141.0297

5.4   Descriptive Statistics of the Study Variables

Descriptive analysis can be started after the confirmation of the data file is free of errors. It is used to describe the characteristics of the respondents, examined the statistical values of all the study variables (dependent, independent, and mediating) whether violations of assumptions are made by the individual tests, and addressed specific research questions (Pallant, 2011). Table 5.6 shown the minimum and maximum scores, the values of mean and standard deviation of the study variables. As earlier mentioned in Chapter Four, the questionnaire of this study was designed on a five-point Likert scale at independent and mediating variables, while six-point Likert scale at dependent variable. The mean scores for the independent and mediating variables are within the range of 3.65 to 4.02, and the standard deviation is within the range of 0.71 to 0.92, while the mean of dependent variable is 4.76 and the standard deviation is 0.96. As revealed from the Table 5.6, RC has the highest mean value of 4.02 and the least value of standard deviation at 0.71.

Table 5.6
Summary of Descriptive Analysis

Variables	Number of Items	N	Minimum	Maximum	Mean (μ)	Standard Deviation (σ)
RC	25	121	1	5	4.02	0.71
ITC	23	121	1	5	3.67	0.92
OCC	23	121	1	5	3.94	0.88
SCTA	21	121	1	5	3.65	0.76
SCOP	24	121	1	6	4.76	0.96

5.4.1 Demographic Profile

This section illustrates the characteristics of the responding organizations (subsector, types of business, company ownership, geographic scope, number of employee, and age of company) and the respondents (designation, area of responsibility, education level, length of designation in the company, and length of service the industry).

5.4.1.1 Demographic Profile of Organizations

Table 5.7 summarizes the demographic profile of sample and responding organization's characteristics. Based on the table, there is some incomplete information in sample organizations of this study. However, the finding of this study successfully obtained the complete information from responding organization. The details of which are as follows.

Subsector. The textile or fabric and assorted sector between textile and apparel constituted 11.60% respectively whereas the apparels, garments, or clothing sector possessed the highest score in which constituted 65.30%. Besides, accessories and leather sector constituted 1.70% respectively. Furthermore, footwear and home fabric or car fabric constituted 5.80% and 2.50% respectively.

Type of business. Based on the responding organizations, the highest responses received from manufacturer and retailer which accounted for 51.20% and 34.70% respectively. The rest responses were received from distributor, service provider, and assorted businesses, which constituted 7.40%, 5.00%, and 1.70% respectively.

Company ownership. Based on the responding organizations, the highest responses received from Malaysian owner accounted for 52.90% whereas the remaining 40.50% and 6.60% are owned by foreigners and joint venture respectively.

Geographic scope. There were 13.20% of companies doing local business, while the 7.40% and 19.00% of the companies doing regional and national business. Though, most of the responding organization doing international business in which constituted 57.90%.

Size of organization. 57.00% of the organizations have more than 200 employees which can be considered as large enterprise, whereas small and medium size enterprise constituted 24.00% and 15.70% respectively. However, 3.30% of the organizations were micro enterprise.

Age of organization. There were 52.10% of the organizations have existence more than 20 years while 19.80% of the organizations have existence for 16 to 20 years. The other 9.90%, 10.70%, and 7.40% were 11 to 15 years, 6 to 10 years, and less than 5 years respectively.

Table 5.7
Demographic Profile of Organizations

Demographics	Characteristics	Sample Organizations		Participated Organizations	
		Frequency	Percent	Frequency	Percent
Subsector	Textile/ Fabric	10	5.00	14	11.60
	Apparels/ Garments/ Clothing	116	57.70	79	65.30
	Accessories	3	1.50	2	1.70
	Leather	1	0.50	2	1.70
	Footwear	3	1.50	7	5.80
	Home fabric/ Car fabric	6	3.00	3	2.50
	Assorted	62	30.80	14	11.60
Type of business	Manufacturer	117	58.20	62	51.20
	Retailer	-	-	42	34.70
	Distributor/ Trading	84	41.80	9	7.40
	Service Provider	-	-	6	5.00
	Assorted	-	-	2	1.70
Company ownership	Malaysia owned	-	-	64	52.90
	Foreign owned	-	-	49	40.50
	Joint Venture	-	-	8	6.60
Geographic scope	Local (state)	-	-	16	13.20
	Regional	-	-	9	7.40
	National	-	-	23	19.00
	International	-	-	70	57.90
	Assorted	-	-	3	2.50
Size of organization	Less than 5	-	-	4	3.30
	5 to 74	4	2.00	29	24.00
	75 to 200	9	4.50	19	15.70
	More than 200	7	3.50	69	57.00
	Unknown	181	90.00	0	0.00
Age of organization	Less than 5 years	41	20.40	9	7.40
	6 to 10 years	35	17.40	13	10.70
	11 to 15 years	37	18.40	12	9.90
	16 to 20 years	21	10.40	24	19.80
	More than 20 years	56	27.90	63	52.10
	Unknown	11	5.50	0	0.00

Note: ' - ' = unknown

5.4.1.2 Demographic Profile of Respondents

Table 5.8 summarizes the demographic profile of respondent's characteristics. The details of which are as follows.

Designation. Most of the respondents were from executive and department manager position, which constituted 34.70% and 16.50% of the total respondents respectively. Besides, 5.80% were from senior manager, general manager, and director position respectively. The remaining respondents were vice president, managing director, plant manager, officer, and other positions constituted 5.00%, 4.10%, 2.50%, 7.40%, and 12.40% of the total respondents respectively.

Job function. Supply chain and operation function constituted 3.90% and 38.90% of the total respondents respectively. The remaining respondents were purchasing warehouse, logistics, inventory, and other functions constituted 4.10%, 0.80%, 0.80%, 5.00%, and 16.5% of the total respondents respectively. Most of the other function respondents were from customer service.

Education level. Majority of the respondents has a bachelor's degree level of education which accounted for 45.50% of the total respondents, while high school or equivalent and associate's degree level of education constituted 30.60% and 13.20% respectively. This is followed by the master's or specialist's degree, technical school certification, and doctoral degree constituted 5.00%, 3.30%, and 2.50% respectively.

Years of experience in the company. Majority of the respondents has 2 to 5 years working experience in the company which accounted for 40.50% of the total respondents, while 19.00% of the total respondents have 6 to 10 years of working experience. Whereas, the respondents from the category of 11 to 15 years and 16 to 20

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years of working experience constituted 11.60% respectively. The remaining respondents were less than 1 year and more than 20 years of working experience constituted 10.70% and 6.60% respectively.

Years of experience in the industry. Majority of the respondents has 2 to 5 years of working experience in textile and apparel industry, while 18.20% of the total respondents have 6 to 10 years of working experience in the industry. Whereas, higher working experience in the industry were the respondents from the category of 11 to 15 years, 16 to 20 years, and more than 20 years constituted 10.705, 16.505, and 13.20% respectively. Minority of the respondents has less than 1 year of working experience in the industry in which constituted 7.50%.

Table 5.8
Demographic Profile of Respondents

Variables	Measures	Frequency	Percent
Designation	Vice President	6	5.00
	Managing Director	5	4.10
	Director	7	5.80
	General Manager	7	5.80
	Plant Manager	3	2.50
	Senior Manager	7	5.80
	Department Manager	20	16.50
	Executive	42	34.70
	Officer	9	7.40
	Other	15	12.40
Job function	Supply Chain	41	33.90
	Operation	47	38.90
	Purchasing	5	4.10
	Warehousing	1	0.80
	Logistics	1	0.80
	Inventory	6	5.00
	Other	20	16.50
Education level	Doctoral degree	3	2.50
	Master's or Specialist's degree	6	5.00
	Bachelor's degree	55	45.50
	Associate's degree	16	13.20
	Technical school certification	4	3.30
	High school or equivalent	37	30.60
Length of designation	Less than 1 year	13	10.70
	2 to 5 years	49	40.50
	6 to 10 years	23	19.00
	11 to 15 years	14	11.60
	16 to 20 years	14	11.60
	More than 20 years	8	6.60
Length of service	Less than 1 year	9	7.50
	2 to 5 years	41	33.90
	6 to 10 years	22	18.20
	11 to 15 years	13	10.70
	16 to 20 years	20	16.50
	More than 20 years	16	13.20

5.4.1.3   Willingness to Future Research

Table 5.9 summarizes the willingness of respondents to participate in future research. Besides, the willingness to receive a copy of executive summary of this study was also presented in the same table. This summary shows the interest of the respondents to this study. From the total of 121 respondents, only 10 respondents represent for 8.30% of the total respondents indicated that they are interested to participate in future research of this study. Therefore, the respondents would become the sampling of qualitative data collection of this study to form a triangulation. However, there were 18.20% of the total respondents indicated that they would like to receive a copy of executive summary of the study.

Table 5.9
Willingness to Participate in Future Research

Item	Willingness	Frequency	Percent
Participate for future research	Yes	10	8.30
	No	111	91.70
Receive a copy of executive summary	Yes	22	18.20
	No	99	81.80

5.4.2   Fundamental Statistical Assumptions

There are some basic assumptions (i.e. linearity, normality, and homoscedasticity) that apply to all of the current statistical analyses (Hair et al., 2007, 2010; Pallant, 2011) regarding the variables to be able to confirm the results. Besides, they are always a possibility of reaching wrong conclusions. By some basic assumptions, it is effectively deal with the incidence of errors such as Type I and Type II errors that normally reach by the researcher. Type I error is in the condition of reject the null hypothesis when it

is in fact true, while Type II error is in the conditions of fail to reject a null hypothesis when it is in fact false (Pallant, 2011). The further discussions on fundamental statistical assumptions are highlighted as follows.

5.4.2.1   Linearity Test

Linearity assumption refers to "*the presence of a straight line relationship between each pair of variables*" (Pallant, 2011). According to Pallant (2011), linearity can be examined through several ways. The most common of which is to generate a matrix of scatterplots between each pair of variables. The scatterplots matrix can be assessed through legacy dialogs in which move all the continuous variables into the matrix variables box and move the early and late response variable into the rows box. The results as shown in Figure 5.1 indicated that there is no obvious evidence of non-linearity. Hence, the assumption of linearity is satisfied.
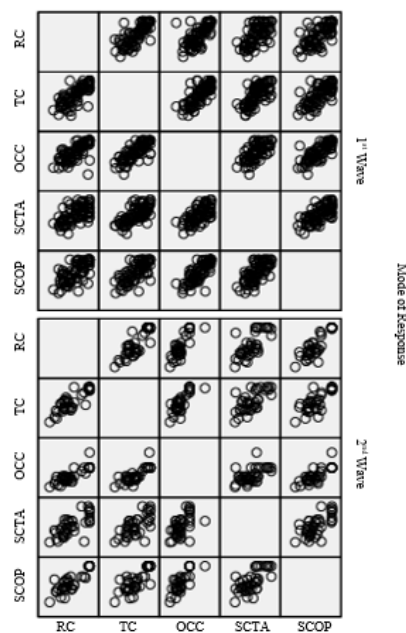
Figure 5.1
Matrix of Scatterplots

5.4.2.2 Normality Test

Normality was an important assumption for most statistical test. It is refers to "*the shape of the data distribution for an individual metric variable and its correspondence to the normal distribution, the benchmark for statistical methods*" (Hair et al., 2007). Graphical and statistical methods were applied to test the normality of the variables (Tabachnick & Fidell, 2007). Graphical investigation were accomplished through inspecting histograms initially and followed by inspecting 'normal probability plots' which also known as 'normal Q-Q plots' for all metric variables (Hair et al., 2007). Hair et al.(2007) suggested that referring to the normal Q-Q plots was more reliable for normality test. The observed value for each score is plotted against the expected value from the normal distribution (Hair et al., 2007; Tabachnick & Fidell, 2007). The bell shape of the histogram appears to be reasonably normal distributed, while a reasonably straight line in normal Q-Q plot means normal distribution (Pallant, 2011). One of the results of the histogram which is from SCTA variable is presented in Figure 5.2, whereas the normal Q-Q plot is presented in Figure 5.3.
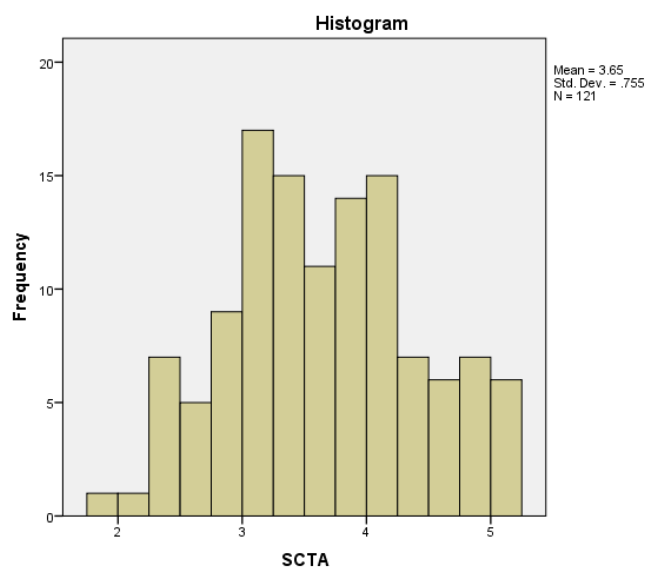
Figure 5.2
Histogram of SCTA

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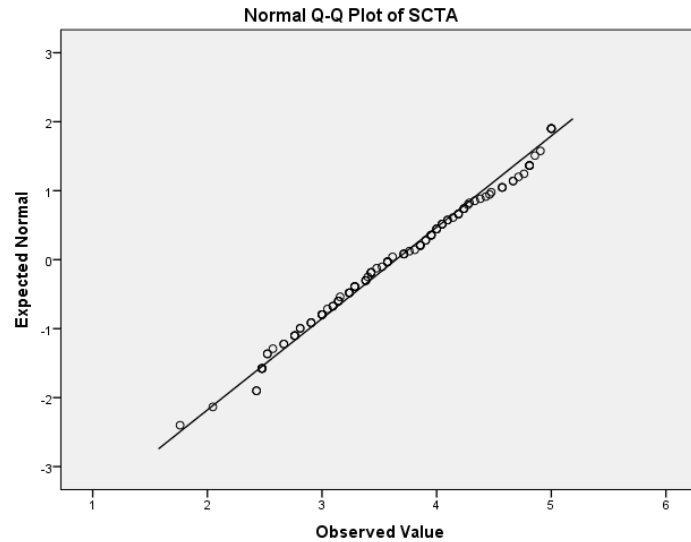
Figure 5.3
Normal Q-Q Plot of SCTA

For further investigation on univariate normality, the shape of the graphical distributions can be inspected through skewness and kurtosis (Hair et al., 2007; Tabachnick & Fidell, 2007). Skewness value provides information about the symmetry of the distribution, whereas kurtosis value provides information about the 'peakedness' or 'flatness' of the distribution (Pallant, 2011). Therefore, the positive or negative skewed value indicated the distribution of the histogram was not in the center, whereas the positive or negative kurtosis value indicated the score is overly peaked or flat (Tabachnick & Fidell, 2007; Field, 2009). The values of normal distribution for skewness and kurtosis should be zero. If the skewness or kurtosis values of a variable higher than $\pm$ 2.58 indicated the violated normality exist on the variable (Hair et al., 2007). Besides, Z-values calculated from skewness and kurtosis scores exceeding a critical value of ±2.58 (0.01 significance level) indicate deviation from normal distribution (Hair et al., 2007; Tabachnick & Fidell, 2007; Field, 2009).

This study however achieves normality because all the variables as shown in the Table 5.10 does not have the problem of normality except RC in which z-value=-2.712 slightly exceeding the critical value of ±2.58. The violation of the assumption of normality is common in the larger samples. The full results of normality test were shown in **Appendix O**.

Table 5.10
Normality Test

Variable	Mean	Std. Deviation	Skewness			Kurtosis		
			Statistic	Std. Error	z-value	Statistic	Std. Error	z-value
RC	4.020	0.714	-0.067	0.220	-0.307	-1.184	0.437	**-2.712**
ITC	3.672	0.918	-0.231	0.220	-1.050	-0.968	0.437	-2.217
OCC	3.938	0.878	0.158	0.220	0.718	0.283	0.437	0.648
SCTA	3.645	0.755	0.009	0.220	0.040	-0.713	0.437	-1.633
SCOP	4.758	0.957	-0.173	0.220	-0.788	-1.072	0.437	-2.456

Note. N=121; The z-values were calculated by dividing the statistics by the standard errors (Hair et al., 2007); Scores exceeding critical value of ±2.58 (0.01 significance level) are marked bold; Skewness and Kurtosis values range between ±2.58

5.4.2.3 Homoscedasticity Test

In order to assess possible deviation from multivariate analysis, the homoscedasticity assumption was applied. Homoscedasticity assumption refers to "*the variability in scores for one continuous variable is roughly the same at all values for another continuous variable*" (Tabachnick & Fidell, 2007). However, Hair et al.(2007) defined homoscedasticity assumption in more detail in which "*dependent variable(s) exhibit equal levels of variance across the range of predictor variable(s)*". Tabachnick and Fidell (2007) noted that the violation of homoscedasticity does not fatal the analysis, it might just weaken the analysis. In this study, there is no existence of homoscedasticity because none of the exogenous variables possess offending estimates as shown in Table 5.11. Hence, free from committing Type I error.

Table 5.11

Correlations between Exogenous and Endogenous Variables

Correlation	Standardized Estimates
RC – SCTA	0.647
RC – SCOP	0.761
ITC – SCTA	0.702
ITC – SCOP	0.745
OCC – SCTA	0.633
OCC – SCOP	0.808
SCTA - SCOP	0.694

Note. None of the exogenous variables possess offending estimates
       *Correlation is significant at the 0.01 level (2-tailed).

5.4.2.4 Multicollinearity Test

Multicollinearity refers to the relationship between two or more indicators (Hair et al., 2007; Hair, Hult, et al., 2014). In fact, multicollinearity can give several effects on analysis which including the predictive ability of the regression model, the estimation of the regression coefficients, the statistical significance tests (Hair et al., 2007) and limit the size of correlation coefficients (Field, 2009). The increase of multicollinearity value would increase the standard errors of regression coefficients and consequently the statistical significance of these coefficients becomes less trustworthy (Tabachnick & Fidell, 2007; Field, 2009).

Basically, multicollinearity was tested by examining the tolerance values and the variance inflation factor (VIF) (Hair et al., 2007). Hair et al. (2007) defined tolerance value as "*the amount of variability of the selected independent variable not explained by the other independent variable*", while VIF can be understand as the inverse of the tolerance value. Nonetheless, an assessment of multicollinearity was done as shown in Table 5.12. Based on the results, there is no multicollinearity exist. This is because all variables have obtained the standard values in which tolerance greater than 0.20 and

VIF less than 5. For further assessment on multicollinearity, Figure 5.4 and Figure 5.5

exhibited the histogram and P-P plot for the multicollinearity diagnostic.

Table 5.12
Multicollinearity Test

Variable	Collinearity Statistics	
	Tolerance	VIF
RC	0.284	3.526
ITC	0.243	4.122
OCC	0.251	3.978
SCTA	0.439	2.278
SCOP	0.268	3.729

Note.   Tolerance > 0.2 and VIF < 5
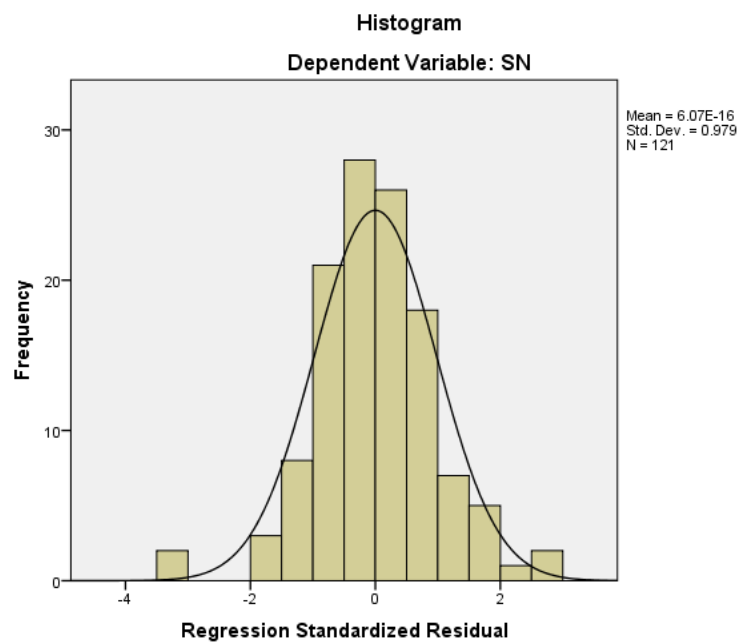
Figure 5.4
Histogram showing Multicollinearity Diagnostics
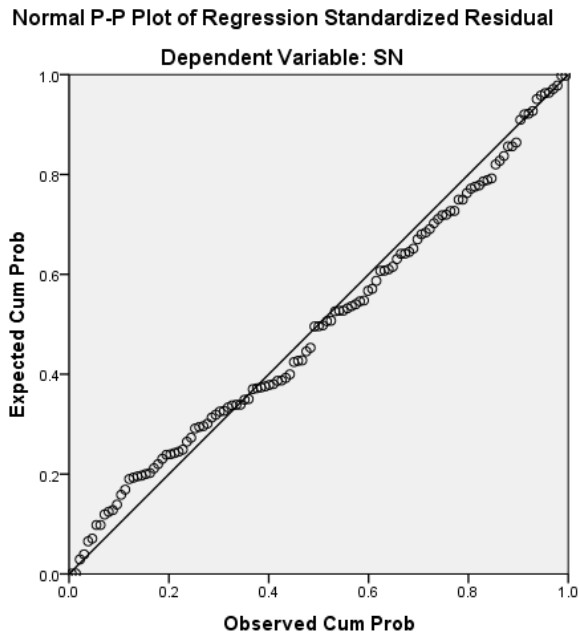
Figure 5.5
Normal P-P Plot for the Multicollinearity Diagnostics

As a summary for the section, the assumption of multivariate analysis in normality test has shown some possible problems in skewness and kurtosis. These issues occurred might due to the small sample size in this study. Based on the rational on the discussion issues therefore, the PLS-SEM was employed for hypothesis testing rather than CB-SEM. According to Hair et al. (2011) "*in comparison with CB-SEM results, which can be highly imprecise when the assumptions are violated, PLS-SEM often provides more robust estimations of the structural model*". This is because PLS-SEM able to provide more robust estimations of the structural model. For that reason, the violation of the assumptions of multivariate analysis was not a concern. Therefore, there is no data transformation technique required at this stage.

5.5   Confirmatory Factor Analysis (CFA)

CFA is referred to "*a more complex and sophisticated set of techniques used later in the research process to test or confirm specific hypotheses or theories concerning the structure underlying a set of variables*" (Pallant, 2011). In this study, PCA technique was applied to presents the results of CFA. This is utilized the technique of PCA to transform the original variables into a smaller set of linear combinations (Pallant, 2011). Since all the items of this study were adopted and adapted from past studies as discussed in Chapter Four thus, CFA is appropriate and applied. Consequently, PLS-SEM was suitable and been employed to take care the CFA (Ringle et al., 2005).

5.6   Models Evaluations

Following the examination of data screening and descriptive statistic, the measurement model was assessed in the next step. Small sample size and non-normal distributed data are the most issues faced by the researcher who are targeted organization as unit of analysis. Basically, this study was facing the same issues. Owing to the reason, PLS-SEM was selected as an ideal statistical technique for this study, while CB-SEM was not an option. Based on the recommendation of Hair et al. (2011), the sample size of 121 was sufficient to assess with PLS-SEM.

Nonetheless, there is a similarity between CB-SEM (Anderson & Gerbing, 1982, 1988) and PLS-SEM (Anderson & Gerbing, 1988; Deal, 2006; Ringle et al., 2006; Tabachnick & Fidell, 2007; Henseler et al., 2009; Hair et al., 2011) in which both are adopted two-step approach. PLS-SEM path model begins by the assessment of the estimation of the measurement model and it is followed by the assessment of the path

relations of the structural model (Deal, 2006; Henseler et al., 2009). The assessment of both outer model and inner model of this study was discussed in detail as following sections.

5.6.1   Assessment of the Measurement Model/ Outer Model

Evaluation of measurement model is referred to the assessment of statistical elements of the model. This is to ensure the measurement model is good enough and qualified for further statistical test. In order to proceed for further statistical test, the measurement model of this study has been examined through internal consistency or reliability, construct validity, convergent validity, and discriminant validity by using SmartPLS. Figure 5.6 and Figure 5.7 illustrate the linkage between manifest variable (MV) and latent variable (LV) of the study using SmartPLS as a medium of the analysis. Specifically, Figure 5.6 exhibited the original structural model (**Refer to Appendix P**), while Figure 5.7 exhibited the structural model after the deletion (**Refer to Appendix Q**) of three low loading items, which are SCTAUse2, SCTAUse9, and OCCA4 that held the loading of 0.382, 0.369, and 0.391 respectively.
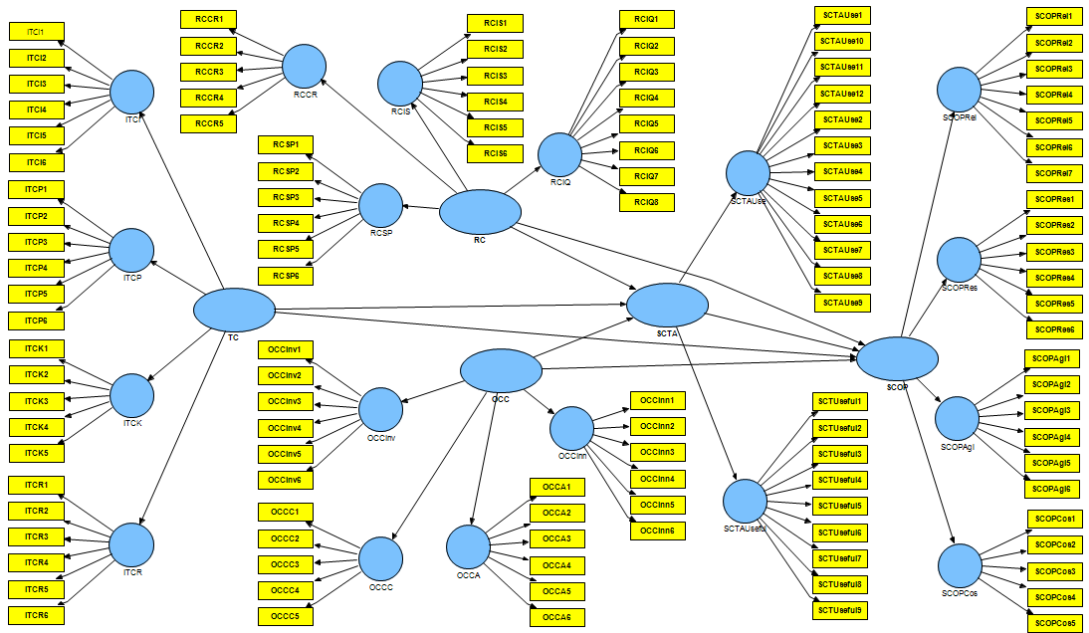
Figure 5.6
The Second Order Structural Model for Individual Latent Variable in First Stage
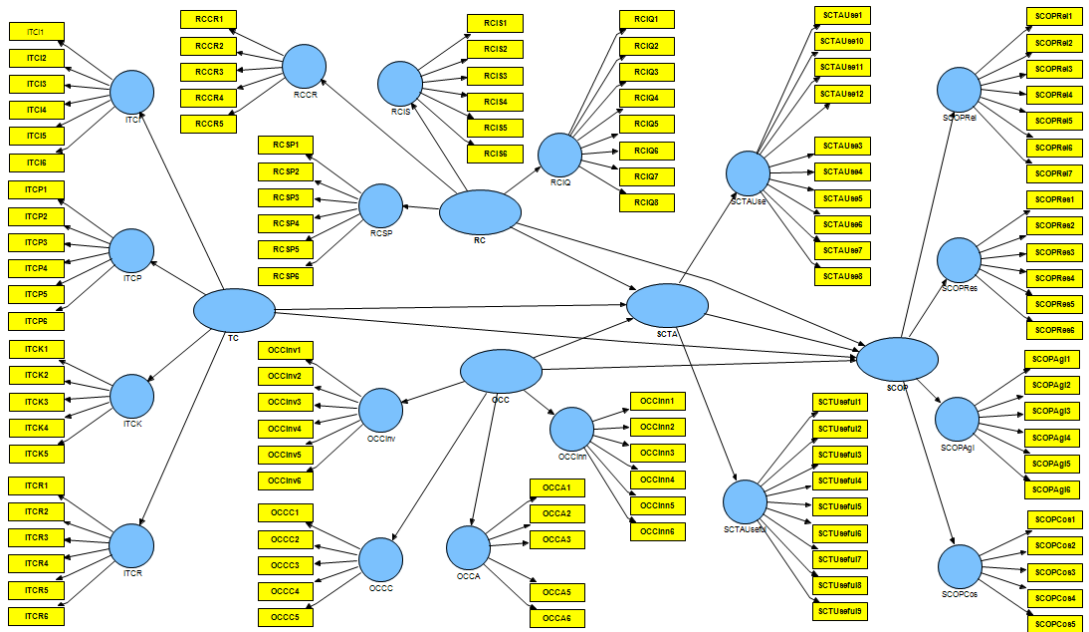
Figure 5.7
The Second Order Structural Model for Individual Latent Variable after Deletion
Note.   Item SCTAUse2, SCTAUse9, and OCCA4 been deleted.

After the deletion of the low loading items, the next step is to create a second order construct, however, it is totally depended to the specifications of the model. In this study, the second order construct was generated through the values of latent variable score (unstandardized) as exhibited in Figure 5.8 (**Refer to Appendix R**).
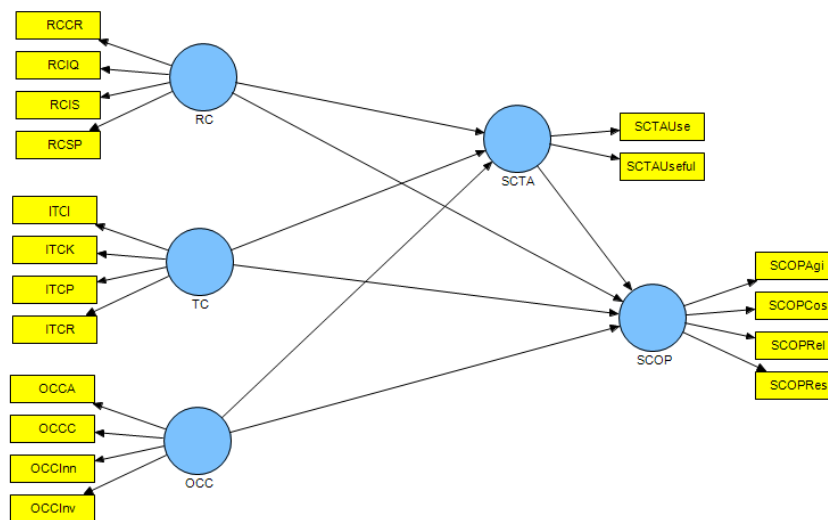
Figure 5.8
The Second Order Structural Model for Individual Latent Variable in Second Stage

5.6.1.1 Internal Consistency Reliability

Reliability can be seen as a prerequisite of validity. It is concerned with the extent to which measures are "*free from errors and therefore yield consistent results*" (Peter, 1979). The reliability is stressed due to the defective impact in which unreliable measures weaken the correlation between measures. Therefore, multi-item scales measurement was recommended by Peter (1979) to handle the issues of measurement errors. With the multi-item scales, researcher is allowed to delete the items with measurement errors to improve the reliability of the scale. However, this study was free from the concerned, since all the measurements were measured by at least five items.

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Internal consistency is a method that used to test for reliability through homogeneity of a set of items (Peter, 1979; Hair et al., 2007). This is to assess the degree to which the items of one scale capture the same construct (DeVellis, 2003). Composite reliability (CR) is frequently used to assess the internal consistency or the reliability of the constructs (Cronbach, 1951; Hair et al., 2007). It is generally interpreted in the same way as Cronbach's alpha (CA). In Table 5.13, the result of Cronbach's alpha shown that all reliability values were above the recommended threshold value of 0.70 (Ringle et al., 2006; Henseler et al., 2009; Hair et al., 2011) which indicates high internal consistency in each construct. Therefore, no items were dropped at this stage.

Table 5.13
Composite Reliability Test

Construct	Number of indicators	Composite Reliability
RC	25	0.932
ITC	23	0.961
OCC	22	0.952
SCTA	20	0.822
SCOP	24	0.964

Note. CR<0.60 (lack of internal consistency reliability), CR=0.60-0.70 (acceptable in exploratory research), CR>0.70 (high internal consistency reliability)

Based on Nunnally and Bernstein (1994) recommendation, the reliability values between 0.70 and 0.90 regarded as satisfactory. However, the values above 0.90, especially above 0.95 are not desirable because there is a probability that most of the indicator variables are measuring the same or similar phenomenon (Hair, Hult, et al., 2014).

5.6.1.2 Construct Validity

Generally, the construct validity is well assessed through convergent and discriminant validity. An examination of the loadings and cross loadings is not only to ensure the validity of particular items in the constructs but also serves as a prerequisite for ascertaining the convergent validity. The item highly loaded under its owned construct is considered a good indicator for that construct whereas, the item highly loaded under different construct indicates a potential problem with that item. Based on Hair et al. (2007) recommendation, an outer model loading 0.50 and above considered valid and acceptable, while an outer model loading lower than 0.50 needs to be deleted one by one start by the lowest loading to improve the quality of data. Table 5.14 presents the loading values according to the indicator and construct of this study. As far this study is concerned, the results shown that all of the indicators were highly loaded to their owned construct, ranging from 0.749 to 0.950. This confirms the construct validity of the measurement model.

Table 5.14
Factor Loading and Cross Loading

Indicator	OCC	RC	SCOP	SCTA	ITC
ITCI	0.753	0.812	0.702	0.756	**0.930**
ITCK	0.777	0.720	0.720	0.706	**0.942**
ITCP	0.677	0.668	0.601	0.662	**0.901**
ITCR	0.799	0.748	0.737	0.704	**0.936**
OCCA	**0.854**	0.663	0.643	0.623	0.613
OCCC	**0.943**	0.698	0.797	0.677	0.757
OCCInn	**0.919**	0.758	0.783	0.731	0.802
OCCInv	**0.927**	0.682	0.769	0.654	0.777
RCCR	0.568	**0.836**	0.533	0.581	0.554
RCIQ	0.767	**0.919**	0.722	0.727	0.818
RCIS	0.716	**0.896**	0.715	0.715	0.772
RCSP	0.635	**0.867**	0.658	0.671	0.627
SCOPAgi	0.794	0.713	**0.964**	0.742	0.704
SCOPCos	0.670	0.649	**0.871**	0.699	0.596
SCOPRel	0.822	0.743	**0.942**	0.736	0.758
SCOPRes	0.777	0.701	**0.950**	0.719	0.718
SCTAUse	0.441	0.401	0.485	**0.749**	0.521
SCTAUseful	0.743	0.811	0.769	**0.915**	0.730

Note. The items bolded belong to a construct on the same column and they possess a high loading of >0.50

5.6.1.3 Convergent Validity

Convergent validity is refers to the fact that "*a set of indicators represents one and the same underlying construct, which can be demonstrated through their unidimensionality*" (Henseler et al., 2009). The purpose of convergent validity is "*to examine the ability of an item to correlate with other items under the same construct to measure the same concept*" (Zikmund, 2003). Fornell and Larcker (1981) suggest to assess the average variance extracted (AVE) as a criterion with values greater than 0.50. However, Hair et al. (2011) suggested assessing the factor loadings, composite reliability (CR), and AVE as a criterion with values of loadings greater than 0.70, CR greater than 0.70, and AVE greater than 0.50. An AVE value of 0.50 can be interpreted

as the fact that half of the variance of the manifest variable is explained by the latent variable on average (Henseler et al., 2009).

The results presented in the Table 5.15 illustrated that the loading of all items are greater than 0.70 and composite reliability value of all constructs greater than 0.70, while the AVE values of all constructs greater than 0.50, ranging from 0.699 to 0.869. Based on the results presented, it is statistically fulfilled the convergent validity criteria suggested by Hair et al. (2011). In addition to the presumption, it can be interpreted as all the constructs used are capable to measure the actual concepts of the study. The way to manual calculated the AVE and CR was illustrated in the **Appendix S**.

Table 5.15
Convergent Validity

Construct	Item	Loading	AVE	CR
RC	RCCR	0.836	0.774	0.932
	RCIQ	0.919		
	RCIS	0.896		
	RCSP	0.867		
ITC	ITCI	0.930	0.860	0.961
	ITCK	0.942		
	ITCP	0.901		
	ITCR	0.936		
OCC	OCCA	0.854	0.831	0.951
	OCCC	0.943		
	OCCInn	0.919		
	OCCInv	0.927		
SCTA	SCTAUse	0.749	0.699	0.821
	SCTAUseful	0.915		
SCOP	SCOPAgi	0.964	0.869	0.964
	SCOPCos	0.871		
	SCOPRel	0.942		
	SCOPRes	0.950		

Note: SCTAUse2, SCTAUse9, and OCCA4 was deleted due to low loadings.
 AVE=Average Variance Extracted, CR=Composite Reliability.
 AVE > 0.50; Composite reliability > 0.70

5.6.1.4 Discriminant Validity

Discriminant validity is a sister measurement of convergent validity. It is used to check the dissimilarity in the measurement tools of different constructs. In PLS-SEM, there are two measures for discriminant validity. The assessment of discriminant validity was performed to ascertain the external consistency of the model. Fornell and Larcker (1981) noted that discriminant validity was confirmed when the square root of each construct higher than its highest correlation with any other construct. Table 5.16 presented the result of discriminant validity with the values of square root of AVE of each construct in which RC=0.880; ITC=0.927; OCC=0.912; SCTA=0.836 and SCOP=0.932 (**Refer to Appendix T**). The results further express that the measures of all the variable represent the true measures of their individual variables. The assessment of reflective measurement model is completed after the discriminant validity is assessed and all the assumptions are met.

Table 5.16
Discriminant Validity of Construct

Latent Variable	1	2	3	4	5
OCC	**0.912**				
RC	0.769	**0.880**			
SCOP	0.824	0.753	**0.932**		
SCTA	0.738	0.770	0.776	**0.836**	
ITC	0.813	0.797	0.746	0.764	**0.927**

Note. Diagonals (bolded) represent the square root of the average variance extracted (AVE) and off-diagonals represent latent variable correlations.

At the beginning of measurement model assessment, the full model and the links of the relationship were discussed. This perhaps has to be revised and modified throughout the processes of measurement model assessment. This is so because the CFA prompted the deletion of some items. However, none of the variables were dropped because the entire variables retained at least five items as a condition not to

be deleted (Hair, Hult, et al., 2014). At the end of measurement model assessment, a revised statistical model was exhibited in Figure 5.9 as below.
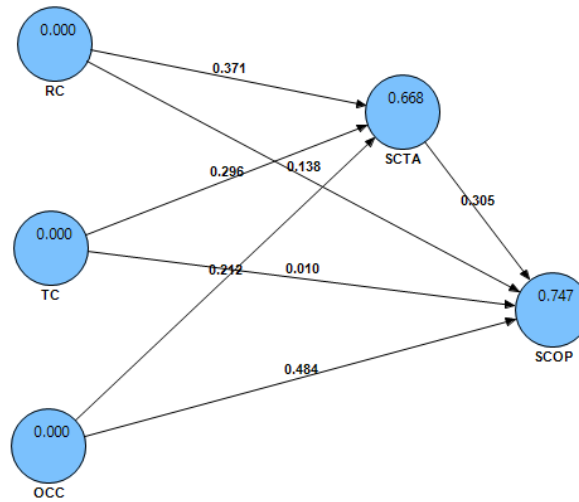
Figure 5.9
Revised Statistical Model of this Study

5.6.2   Assessment of the Structural Model/ Inner Model

The assessment of structural model only can be started after the completion of the measurement model examinations. It is to examine the assumption of regression and correlation of variables. As Hair et al. (2014) recommended, there are five steps of structural model assessment procedure. First, the collinearity issue was assessed, and then followed by the assessment of the significance and relevant of the structural model relationships. This is continued by the assessment of coefficient (R^2) level and effect size (F^2). The assessment of predictive relevance (Q^2), and the q^2 effect sizes were the last step of structural model examinations. In addition for this study, the assessment of mediation effects were examined before the end of the data analysis. The assessment of structural model of this study was discussed in detail as following sections.

5.6.2.1 Collinearity Assessment

The first step in the assessment of structural model is to examine the collinearity issues. Collinearity refers to the high correlation between two indicators (Hair, Hult, et al., 2014). Based on the results explained in Table 5.12, all variables have assessed the threshold values of collinearity in which tolerance greater than 0.20 and VIF less than 5 thus, there is no multicollinearity existed. Specifically, the tolerance and VIF of all variables are fall into the range between 0.243 and 0.439, and between 2.278 and 4.122 respectively.

5.6.2.2 Structural Model Path Coefficients

Subsequent to the collinearity assessment, the next step is to assess the significance and relevance of the structural model relationship. As Hair et al. (2014) noted, the examination of structural model path coefficients is to test the hypothesized relationships among constructs. In PLS-SEM, structural model brings to force the directional relationship between the constructs and their t-values as well as the path coefficient. The path coefficient in PLS-SEM is similar to the standardized beta coefficient in regression analysis. Figure 5.10 and Figure 5.11 shown the results of the direct relationships on the hypothesized model of this study. Based on the results, seven hypotheses that posed a direct relationship in this study were tested out of which six were supported and one was not supported (H_{1b}, ITC→SCOP).
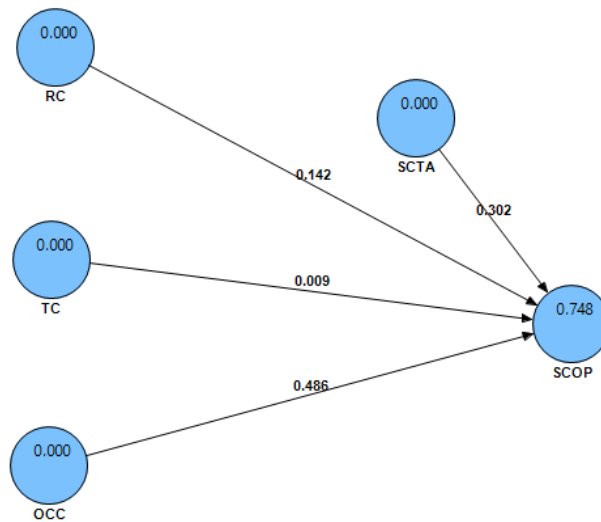
Figure 5.10
Direct Effect on SCOP
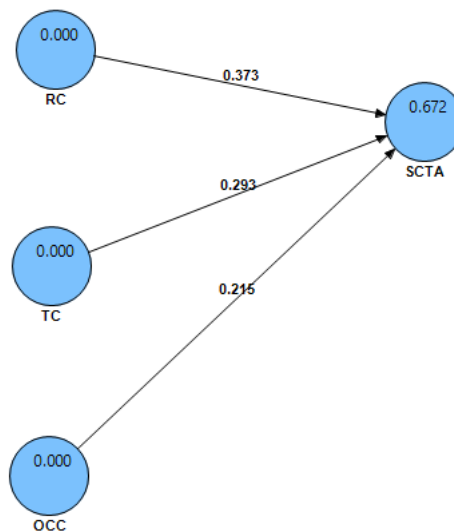
Figure 5.11
Direct Effect on SCTA

In order to clearly explain the results of Figure 5.10 and Figure 5.11, Table 5.17 was

provided. The more detail and specific information such as path coefficients, t-values,

and standard error at which the hypotheses were supported or not were displayed

undoubtedly. In this study, the t-values were calculated using 5000 resampling

iterations through bootstrapping as suggested by Hair et al. (2014). 5000 bootstrap

samples were selected to ensure that every model parameter has empirical sampling

distribution and the standard deviation of the distribution is serve as proxy of the parameter's empirical standard error (Hair et al., 2012). In order to determine the significance level, the critical values for one-tailed test was used, 2.33 (significance level = 1%), 1.65 (significance level = 5%), and 1.28 (significance level = 10%). Based on the results, seven hypotheses that posed a direct relationship in this study were tested out of which six were supported (*t*-value>1.28) and one was not supported (*t*-value<1.28; H_{1b}, ITC→SCOP).

Table 5.17
Hypothesis Testing

Hypotheses	Relationship	Full Model			Decision
		Beta	Standard Error	t-value	
H_{1a}	RC -> SCOP	0.138	0.094	1.469*	Supported
H_{1b}	ITC -> SCOP	0.010	0.101	0.101	Not Supported
H_{1c}	OCC -> SCOP	0.484	0.093	5.182***	Supported
H_{2a}	RC -> SCTA	0.371	0.093	4.012***	Supported
H_{2b}	ITC -> SCTA	0.296	0.112	2.642***	Supported
H_{2c}	OCC -> SCTA	0.212	0.120	1.768**	Supported
H_3	SCTA -> SCOP	0.305	0.088	3.485***	Supported

Note. ***p<0.01, **p<0.05, *p<0.1
Seven hypotheses are accepted based on their t-value and no evidence to support one hypothesis

5.6.2.3 Coefficient of Determination (R^2 value)

The coefficient is an assessment of the model's predictive accuracy. It is computed through the squared correlation between a particular actual and predicted values of endogenous construct. The coefficient represents the exogenous latent variables' combined effects on the endogenous latent variable (Hair, Hult, et al., 2014). Basically, the R^2 value ranges from zero to one in which the higher values representing higher levels of predictive accuracy. There is no rule of thumb for the threshold value. However, Henseler et al. (2009) and Hair et al. (2011) suggested that R^2 value of 0.75

as substantial, 0.50 as moderate, and 0.25 as weak. Nonetheless, the more paths pointing toward a target construct, the higher R^2 value the targeted construct has. In research, most of the researcher are looking to the model called parsimonious, which is a model that are good at explaining the data with fewer exogenous constructs. Based on the results as shown in the Figure 5.12, the R^2 value of SCOP is slightly lower than the substantial which is 0.718 therefore, considered as moderate predictive accuracy.
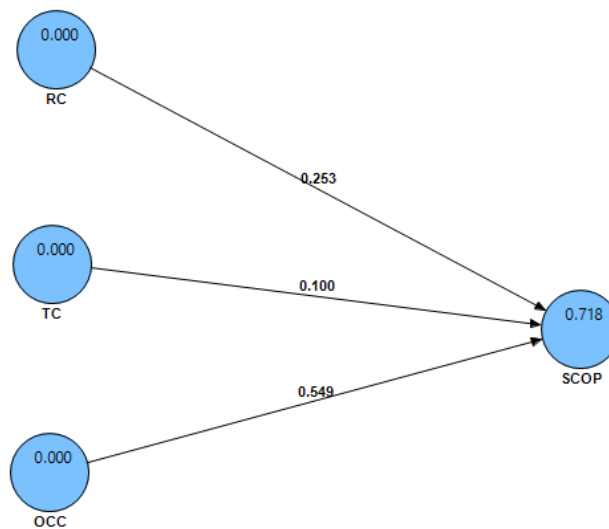
Figure 5.12
Holistic Effect

Figure 5.12 was fully explained in Table 5.18 which displays the holistic effect of all the three supply chain capabilities on SCOP. The R^2 value indicates that all the three supply chain capabilities (i.e., relational capability, IT capability, and organizational culture capability) put together are capable of influencing 71.8% of the changes in the SCOP.

Table 5.18
Holistic Effect of the Three Capabilities on SCOP

SCC	R Square (R^2)
RC	
ITC	
OCC	
SCOP	0.718

Note: All the Three SCC explained 71.80% variance in SCOP

5.6.2.4 Determining the Effect Size (f^2)

Subsequent the determination of the holistic effect, there are needs to determine individual contribution of all the exogenous latent variables to the endogenous latent variable through the calculation of the effect size of the exogenous latent variables. This section reports only the results of the effect size F^2 of the six hypotheses that were statistically supported. Following the recommendation by Cohen (1988), the effect size F^2 is calculated through the formula as Equation 5.2.

$$F^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

<div align="right">

Equation 5.2
Effect Size (F^2)

</div>

Where R^2 included and R^2 excluded represented the R squares on the dependent variable when the independent variable is present (R^2 included) or when it is withheld (R^2 excluded). This perhaps translates the effect of the variance of every supported relationship with their respective ratings as shown in Table 5.19. Cohen (1988) recommended that the F^2 value of 0.35 considered large effect, 0.15 considered medium effect, and 0.02 considered small effect. The results indicated that out of six statistically supported hypotheses, five possess a small strength of F^2 and one indicates a medium strength F^2. This does not mean that those hypothesized relationships with small F^2 are not statistically important. This is argued by Chin et al. (2003), the endogenous latent variable can be influenced by the exogenous latent variable that possesses only minutest strength of F^2. The full results of effect size were shown in **Appendix U**.

Table 5.19
Effect Size and Rating

Relationship	R^2 included	R^2 excluded	F^2	Rating
OCC -> SCOP	0.747	0.680	0.265	Medium
OCC -> SCTA	0.668	0.654	0.042	Small
RC -> SCOP	0.747	0.741	0.024	Small
RC -> SCTA	0.668	0.620	0.142	Small
SCTA -> SCOP	0.747	0.718	0.115	Small
ITC -> SCTA	0.668	0.650	0.054	Small

Note: Only the 6 supported relationships are considered.
According to Cohen (1988), $F^2 = 0.02$ (small effect); $F^2 = 0.15$ (medium effect); $F^2 = 0.35$ (large effect)

5.6.2.5 Determining the Predictive Relevance (Q^2)

Subsequent the determination of the effect size, it is necessary to examine the predictive relevance of the model. This is aims to examine the predictive capacity of the model. As Hair et al. (2012) noted, Q^2 value is an indicator of the model's predictive relevance. As Hair et al. (2012, 2014) pointed out, Q^2 value above zero indicates the path model's predictive relevance, whereas Q^2 value below zero indicates the path model's has no predictive relevance. This procedure is only for reflective endogenous construct or endogenous single item construct, formation endogenous construct is not required. As Hair et al. (2012, 2014) suggested, Q^2 was calculated through blindfolding procedure as shown in Table 5.20. Blindfolding can be understood as"*an iterative process that repeats until each data point has been omitted and the model reestimated*" (Hair et al., 2012; Hair, Hult, et al., 2014). The results indicated that Q^2 of the model shows an outstanding relevance in which 0.637 for the SCOP and 0.430 for the SCTA. This perhaps indicates that the model of this study has a predictive relevance therefore, demonstrates the quality of the model.

Table 5.20
Construct Cross Validated Redundancy

Total	SSO	SSE	1-SSE/SSO (Q²)	Remark
SCOP	484	175.886	0.637	Significance
SCTA	242	137.826	0.430	Significance

Note. Significance at $Q^2 > 0$

5.6.2.6 Determining the Goodness of Fit (GoF)

Having determined the predictive relevance, the test of goodness of fit (GoF) takes precedence. PLS-SEM does not accentuate on goodness of fit information, but emphases more on nonparametric measures (Ringle et al., 2005). In PLS-SEM, most of the researcher determined the fitness based on the power of R^2, F^2, Q^2, AVE and bootstrapping (Fornell & Larcker, 1981). However, this study followed the arguments of Tenenhaus et al. (2005) and Hair et al. (2012) where certified goodness of fit in PLS-SEM is recommended. In order to authenticate the overall fitness of the model, the results of measurement model and structural model were combined. In PLS-SEM, GoF is considered the geometric mean of communality and R^2. The GoF value was calculated and obtained using the formula as shown in Equation 5.3. Whereby *Geomean* symbolizes the geometric mean and R^2 is the coefficient value. Tenenhaus et al. (2005) and Hair et al. (2012) recommended that the GoF value of 0.36 and above as large fitness, 0.25 and above as medium fitness, and 0.10 and above as small fitness.

$$GoF = \sqrt{Geomean\ of\ R^2\ x\ Geomean\ of\ Communality}$$

Equation 5.3
Goodness of Fit (GoF)

Table 5.21 displays the geometric means and GoF value. The results shown the geometric mean values 0.804 of average communality and 0.706 of average R^2. The Equation 5.3 is employed to calculate the GoF value for the model. The result shows the GoF value 0.754 as overall fitness of the model. Based on the argument posed by Tenenhaus et al. (2005) and Hair et al. (2012), the GoF value 0.754 represents a large fitness of the model.

Table 5.21
GoF and Geometric Means

Construct	Communality / AVE	Composite Reliability	R^2
OCC	0.831	0.951	
RC	0.774	0.932	
SCOP	0.869	0.964	0.747
SCTA	0.699	0.821	0.668
ITC	0.860	0.961	
Geomean	**0.804**		**0.706**
			0.568
		GoF	**0.754**

Note: GoF values 0.10 above = small; 0.25 above = medium; 0.36 above = large

5.6.2.7   Mediation Effects

A test of mediation effects is to examine the extends of the mediator variable influence the relationship between the independent variable and dependent variable (Ramayah, Lee, & In, 2011). There is series of techniques for mediation test, a commonly used approach is such as the Sobel (1982) test and Preacher and Hayes (2004, 2008). As far as this study is concerned, however, Preacher and Hayes (2004, 2008) and bootstrapping (Hayes, 2009) techniques were used. This is because Preacher and Hayes (2004, 2008) and bootstrapping perfectly suited for PLS-SEM in which no assumption on data distribution and more confidence applied to small sample sizes in condition where the direct effect must be significant as shown in Figure 5.10 and Table

5.17. Based on the results shown in Table 5.17, all of the direct effects of the model were significant. In order to get the mediation effects, the values of path coefficients as shown in **Appendix V** is referred for the purpose of *t*-values calculation. According to Preacher and Hayes (2004, 2008), *t*-value have to be calculated using Equation 5.4 as below.

$$T_{ab} = \frac{a * b}{S_{ab}}$$

Equation 5.4
t-value

Whereby *a* symbolizes the value of relationship between independent variable and the mediator, *b* is the value of the relationship between mediator and the dependent variable, and S_{ab} is the standard deviation of the *a* and *b*.

Having calculated the *t*-value of the mediation effect, the result of mediating effect of SCTA on the relationships between SCC and SCOP is presented in Table 5.22. The results indicated that there is an indirect effect in all the relationships in the model however, it is still significance as mediation. In that regard, all variables show mediation, specifically a *t*-value 5.149 of H_{4a}, 4.234 of H_{4b}, and 2.841 of H_{4c} were significant at 99% confidence intervals. The full results of mediation test of SCTA were shown in **Appendix V**.

Table 5.22
Mediation Test of SCTA

	Hypotheses	Indirect Effect (a*b)	Standard Deviation (S)	*t*-value (t)	Decision
H_{4a}	RC > SCTA > SCOP	0.381	0.074	5.149***	Supported
H_{4b}	ITC > SCTA > SCOP	0.368	0.087	4.234***	Supported
H_{4c}	OCC > SCTA > SCOP	0.273	0.096	2.841***	Supported

Note: t-values significant at 1.65 for 90% confident intervals, *t*-value 1.65 (*p<0.10), 1.96 (**p<0.05), 2.58 (***p<0.01)

Having determined the *t*-value of the mediation effect, the test of variance accounted for (VAF) is required to determine the extent of the mediator variable absorbs. VAF is used "*to determine the size of the indirect effect in relation to the total effect*". Based on the definition, VAF has to be calculated using Equation 5.5 as below.

$$VAF = \frac{Indirect\ Effect}{Total\ Effect} = \frac{a * b}{a * b + c}$$

Equation 5.5
Variance Accounted For (VAF)

Whereby *a* symbolizes the value of relationship between independent variable and the mediator, *b* symbolizes the value of the relationship between mediator and the dependent variable, and *c* is the value of the relationship between independent variable and the dependent variable, also known as total effect.

Based on Hair et al. (2014), VAF value of 0.20 or below considered as almost or no mediation takes place, VAF value between 0.20 and 0.80 considered as partial mediation, while VAF value of 0.80 or above considered as full mediation. Table 5.23 illustrates the results of direct effect, indirect effect, total effect, and VAF. The results indicated that partial mediation existed in all the relationships between the independent variable and the dependent variable.

Table 5.23
Direct, Indirect, Total Effect, and Variance Accounted For (VAF)

	Hypothesis	*a*	*b*	*c'*	*c*	**VAF**	**Results**
H$_{4a}$	RC > SCTA > SCOP	0.776	0.491	0.373	0.755	0.335	Partial Mediation
H$_{4b}$	ITC > SCTA > SCOP	0.761	0.484	0.378	0.749	0.330	Partial Mediation
H$_{4c}$	OCC > SCTA > SCOP	0.737	0.370	0.551	0.825	0.248	Partial Mediation

Note. VAF=variance accounted for, VAF>0.80 (full mediation), 0.80>VAF>0.20 (partial mediation), VAF<0.20 (no mediation), a = the value of relationship between independent variable and the mediator, b = the value of the relationship between mediator and the dependent variable, c = the value of the relationship between independent variable and the dependent variable where the mediator is not included in the model (total effect), c' = the value of the relationship between independent variable and the dependent variable where the mediator is included in the model (direct effect)

5.6.2.8 Summary of Hypotheses Testing

The assessments of the structural model are summarized in Table 5.24. A recapitulation of hypotheses testing is presented as follows.

Table 5.24
Recapitulation of the Study Findings

Hypotheses	Statement of Hypotheses	Values	Remarks
H_1	Supply chain capabilities are positively related to supply chain operational performance.		Partially Supported
H_{1a}	Relational capability is positively related to supply chain operational performance.	$\beta = 0.138$ t-value = 1.469	Supported
H_{1b}	IT capability is positively related to supply chain operational performance.	$\beta = 0.010$ t-value = 0.101	Not Supported
H_{1c}	Organizational culture capability is positively related to supply chain operational performance.	$\beta = 0.484$ t-value = 5.182	Supported
H_2	Supply chain capabilities are positively related to supply chain technology adoption.		Supported
H_{2a}	Relational capability is positively related to supply chain technology adoption.	$\beta = 0.371$ t-value = 4.012	Supported
H_{2b}	IT capability is positively related to supply chain technology adoption.	$\beta = 0.296$ t-value = 2.642	Supported
H_{2c}	Organizational culture capability is positively related to supply chain technology adoption.	$\beta = 0.212$ t-value = 1.768	Supported
H_3	Supply chain technology adoption is positively related to supply chain operational performance.	$\beta = 0.305$ t-value = 3.485	Supported
H_4	Supply chain capabilities affect supply chain operational performance directly and indirectly through supply chain technology adoption as a mediator variable.		Supported
H_{4a}	Relational capability affects supply chain operational performance directly and indirectly through supply chain technology adoption as a mediator variable.	VAF = 0.335 t-value = 3.888	Supported
H_{4b}	IT capability affects supply chain operational performance directly and indirectly through supply chain technology adoption as a mediator variable.	VAF = 0.330 t-value = 2.696	Supported
H_{4c}	Organizational culture capability affects supply chain operational performance directly and indirectly through supply chain technology adoption as a mediator variable.	VAF = 0.248 t-value = 1.372	Supported

Note. B=beta, VAF=variance accounted for

5.6.2.9 Modified Framework

Based on the results of structural model assessments, a final model for the study is presented in Figure 5.13 as follows.
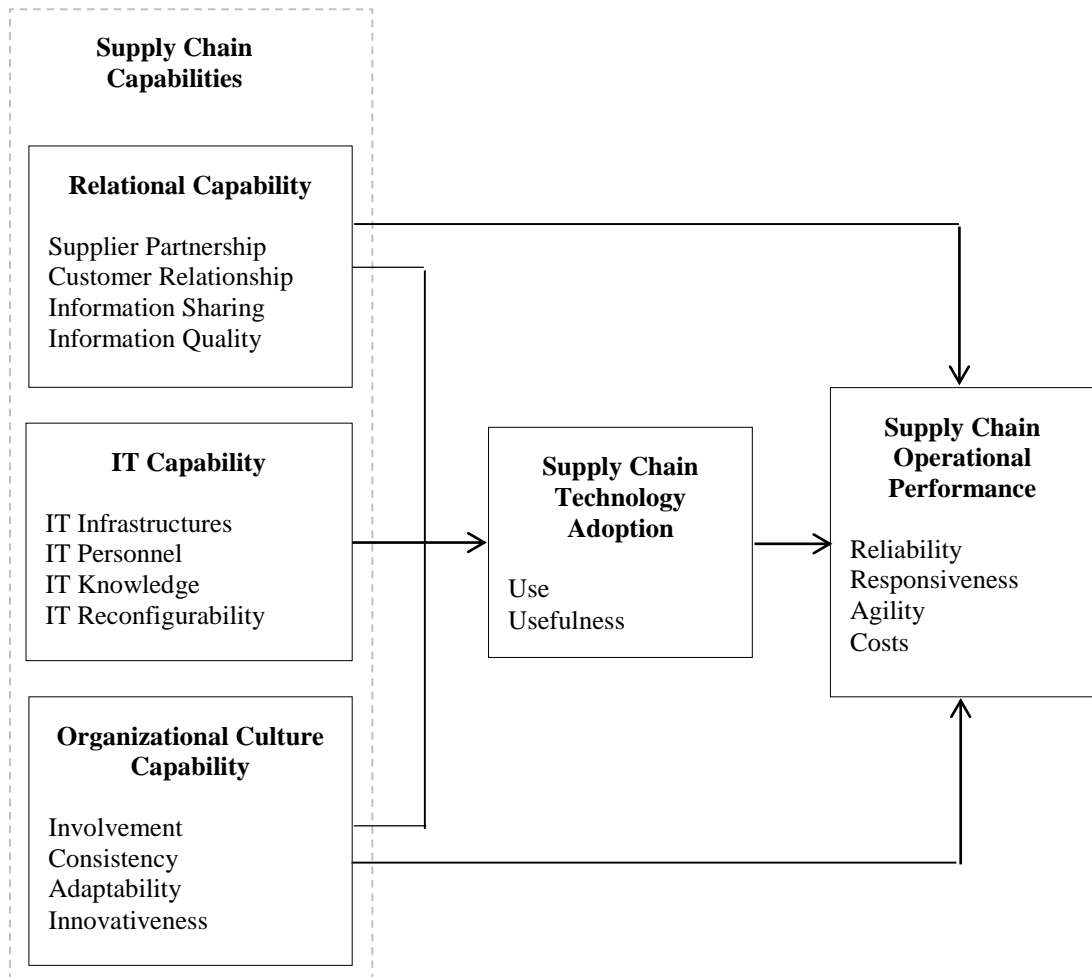
Figure 5.13
Modified Framework of the Study

5.7   Chapter Summary

This chapter gave a detailed description of the results of the questionnaires that were retrieved from the respondents. The results were subjected to series of techniques of analyses. For instance, the loadings and cross loadings confirmed this study has achieved convergent validity. The true representation of the items measure hence confirmed the achievement of sound discriminant validity. Tests of normality, linearity, and homoscedasticity were also undertaken and the results also revealed no threat of non-normal distribution of the data. Following the assessment of measurement model and structural model, the hypotheses were tested through PLS-SEM. Six out of the seven direct hypotheses were supported and one was not supported. However, all mediating hypotheses were supported and further indicate a partial mediation existed in the relationship between supply chain capabilities and supply chain operational performance. All the findings are summarized in the tables and supported by discussion.

CHAPTER SIX

TRIANGULATION OF RESEARCH FINDINGS

6.1 Introduction

This chapter focused on a better understanding of the model through strategy of case studies. The case study has been chosen to best represents the model is illustrated and explained for the purpose of triangulation. It provides validation for empirical findings of this research through the respondents who volunteered to contribute their opinions on the final results. The researcher believed that the triangulation can provide support to the results of quantitative data analysis to produce a potent conclusion for this study. This chapter is organized into several sections; which includes case study data collection method, company and respondent background, qualitative information, and analysis of the alignment or misalignment. A chapter summary is provided at the end of this chapter as an overview of this chapter.

6.2 Qualitative Research Methodology

Qualitative research demonstrated a different method to social science research. Qualitative research applied different philosophical assumptions, different strategies of inquiry, different methods of data collection, different methods of data analysis, and different methods of interpretation (Creswell, 2009). The processes of qualitative

research are similar to quantitative research. However, qualitative research is relied on text and image data thus, exclusive procedures needed in data analysis and interpretation (Creswell, 2009). The qualitative research of this study is used to in-depth explains, interpret, understand, and triangulate the results of quantitative analysis (Creswell & Plano-Clack, 2011). As Zhu (2010) suggested, the evaluation method of supply chain performance should focus on the combination of quantitative and qualitative analysis, if not, the possible insights and findings of other methods might missed.

6.2.1   Case Study as Triangulation of Research Finding

The case study is familiar to social scientists because of the popularity across many disciplines. The case study is significantly contributed to the better understanding of the root cause of problems under investigation. Kotzab et al.(2005) suggested that case study was appropriate for analyzing supply chains and managerial issues because this method allows flexibility in data collection. Creswell (2007) defined case study as

> "*a qualitative approach in which the researcher explores a single case or multiple cases over time, through detailed and in-depth data collection involving multi sources of information such as interviews, observations, audiovisual material, documents, and report*".

Creswell and Plano-Clack (2011) noted that one method alone was not sufficient enough to capture the trends and details of complex situation such as investigation of the relationship of supply chain capabilities and supply chain technology adoption toward supply chain operational performance. The use of exploratory methodology

through case study analysis can be triangulated to provide answer to "why" or "how" questions (Yin, 2003). Several researchers have used exploratory study to provide answers on the supply chain technology adoption towards supply chain performance (Warkentin, Sayeed, & Hightower, 1997; Akkermans, Bogerd, Yucesan, & Wassenhove, 2003; Lockamy & McCormack, 2004b).

6.2.2   Population and Sampling

The population of the second phase of this study is based on the company who participated the survey of this study in the first phase. Only those participated organizations were selected into the population list.

6.2.2.1   Unit of Analysis

 The unit of analysis in the second phase of this study was organization. The targeted case study subjects were selected based on the company who had participated the survey of this study to represent their organization to share information and experience in order to maximize the validity for this research content. Therefore, middle level employees in Malaysian textile and apparel companies were considered appropriate to participate in this study.

6.2.2.2 Sample size

There is no rule of thumb guide to identify the sample in a qualitative study (Lincoln & Guba, 1985; Merriam, 2009). Therefore, it is totally depended on the questions being asked, and information being gathered, and availability of resources to support the study (Merriam, 2009). Meanwhile, Lincoln and Guba (1985) suggested that number of participants to interview and the number of sites to visit is limited until all the questions and information is answered and achieved. Hence, this study was expected to have four samples from respective sector such as textile manufacturer, apparel manufacturer, fashion retailer, and service provider who volunteered to contribute their opinion on multiple cases studies data collection. In fact, this study managed to conduct four interviews with the targeted sample. However, the number of questions in semi-structured interview was collected from adequate number of participants until the saturation point is achieved.

6.2.2.3 Sampling Techniques

For the second phase of this study, the cluster sampling technique was adopted. Cluster sampling was chosen with the reason of it able to "*gathers sample in groups or chunks of elements that, ideally, are natural aggregates of elements in the population, where there is homogeneity within each group and heterogeneity across groups*" (Sekaran & Bougie, 2010). Meaning that the researcher able to select the respondents to be participate from each sector in Malaysian textile and apparel industry, since this study is looking to the whole supply chain in Malaysian textile and apparel industry, including manufacturer, retailer, and service provider. Cluster sampling offers much

efficiency in terms of precision or confidence in the result. Besides, it is least costs and convenience to apply. Thus, this is suitable and the best approach for this study to select the company from the participants list of survey to be interview. However, cluster sampling is not common in organizational research if compared to marketing research.

6.2.3 Data Collection Method

In research, data collect in words or image forms are qualitative study, whereas data collect in number form is quantitative study. There are several types of qualitative data. First, the data obtained from interviews is "*direct quotation from people about their experiences, opinions, feelings, and knowledge*" (Patton, 2002). The next data in qualitative study can be collect through observations which is the record of "*detailed descriptions of people's activities, behaviors, and actions*" (Patton, 2002). Besides, various types of documents also can be the source of qualitative study such as "*excerpts, quotations, or entire passages*" (Patton, 2002). In addition, audiovisual materials or records can be the source of qualitative study such as photographs, audio recordings, art objects, and computer software (Creswell, 2007). In fact, the interview of this study is assisted by potographs and audio recording. This is to ensure the complete data obtained throughout the interview session. In qualitative research, data collection through interviews is probably the most common. However, for some qualitative study, the source obtained from interview probability is the only source of data.

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6.2.3.1 Interview

Interviews are rich source of primary data collection method in qualitative research (Sekaran & Bougie, 2010). In order to clearly understand the meaning of interview, DeMarrais (2004) provide a definition of interview which is "*a process in which a researcher and participant engage in a conversation focused on questions related to a research study*". Normally, an interview is conducted by a researcher with a participant in which the researcher elicits information from the participant (Merriam, 2009) through face to face, telephone, or online conversation (Sekaran & Bougie, 2010). However, sometime, group or collective interview also applied in data collection of qualitative study (Merriam, 2009). The interview can be assisted by unstructured, structured, or semi-structured interview protocol (Sekaran & Bougie, 2010). Regardless which type of interview is used or conducted, the interview is aims to obtain a special kind of information (Dexter, 1970) on the issues of interest (Merriam, 2009) that is "*in and on someone else's mind that cannot observed directly*" such as feelings, thoughts, and intentions (Patton, 2002). Hence, the role of the researcher in conducting an interview is crucially important to minimize the interviewer bias such as voice inflections, differences in wording, and interpretation (Sekaran & Bougie, 2010).

6.2.3.2 Interview Protocol

Basically, the type of an interview can be decided through the amount of structure required in the interview. Table 6.1 illustrates three types of interviews that normally used in social science study. The semi-structured interview is in the middle which between highly structured and unstructured interviews. The types of interviews can be differentiated through the amount of structure required in the interview. The amount of the structure required can be ranged from highly structured to unstructured. However, the similarities of these conversational formats are asking open-ended questions in the interview.

Table 6.1
Interview Structure Continuum

Highly Structured/ Standardized	Semi-structured	Unstructured/ Informal
• Wording of questions is predetermined • Order of questions is predetermined • Interview is oral form of a written survey • In qualitative studies, usually used to obtain demographic data (age, gender, ethnicity, education, etc.) • Examples: U.S. Census Bureau survey, marketing surveys	• Interview guide includes a mix of more and less structured interview questions • All questions used flexibly • Usually specific data required from all respondents • Largest part of interview guided by list of questions or issues to be explored • No predetermined wording or order	• Open-ended questions • Flexible, exploratory • More like a conversation • Used when researcher does not know enough about phenomenon to ask relevant questions • Goal is learning from this interview to formulate questions for late interviews • Used primarily in ethnography, participant observation, and case study

Source. Adopted from Merriam (2009)

Interview protocol (**Refer to Appendix I**) was prepared to guide the discussion in semi-structured interview which is a face-to-face interview with organizations to collect primary data. The semi-structured interview is chosen because it provides a flexible instrument and flexible in data gathering (Yin, 2003). The questions or case study was developed based on the factors found to be significant or contradicting with

the hypothesis in the quantitative phase. However, the semi-structured interview questions were slightly adjusted due to the differing type of company interviewed. It is actually functions as extension questions or clarifying questions from the quantitative phase. The interview was conducted an in-depth case study with four individuals which from different companies and supply chain to get each person's in-depth experiences and perceptions. Besides, this format is popular in research study, because it allows the researcher to react to the current situation; to the emerging worldview of the respondent; and to the new ideas on the topic. The researcher believed that semi-structured formats enable individual respondents to give their unique response to the study. In order to build the confidence level of the interviewee in providing more in-depth information, a research consent form is provided (**Refer to Appendix J**).

6.2.4   Data Analysis

The main data collection method used in the case study is semi-structured interviews. Thus, the result of the interview was written into words form. According to Creswell (2007), there is no single rule of thumb regarding the analysis steps of qualitative data. However, in making sense the qualitative data, the four steps were conducted in analyzing the qualitative data. There are (1) data managing; (2) reading and memoing; (3) describing, classifying, and interpreting; and (4) representing and visualizing the data. The steps of qualitative data analysis are exhibited in Figure 6.1 as below.

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┌─────────────────────────────────────────────────────────────────────────┐
│                   Data Collection (text, image, sound)                    │
└─────────────────────────────────────────────────────────────────────────┘
                                    ▼
┌─────────────────────────────────────────────────────────────────────────┐
│                       Step 1: Data Managing                               │
├─────────────────────────┬─────────────────────┬─────────────────────────┤
│          Files          │        Units        │       Organizing        │
└─────────────────────────┴─────────────────────┴─────────────────────────┘
                                    ▼
┌─────────────────────────────────────────────────────────────────────────┐
│                     Step 2: Reading & Memoing                             │
├─────────────────────────┬─────────────────────┬─────────────────────────┤
│        Reflecting       │    Writing notes    │     Across questions    │
└─────────────────────────┴─────────────────────┴─────────────────────────┘
                                    ▼
┌─────────────────────────────────────────────────────────────────────────┐
│        Step 3: Describing, Classifying, & Interpreting (Coding and Themes)│
├─────────────────────────┬─────────────────────┬─────────────────────────┤
│         Context         │      Categories     │       Comparisons       │
└─────────────────────────┴─────────────────────┴─────────────────────────┘
                                    ▼
┌─────────────────────────────────────────────────────────────────────────┐
│                  Step 4: Representing & Visualizing                       │
├─────────────────────────┬─────────────────────┬─────────────────────────┤
│         Matrix          │        Trees        │       Propositions      │
└─────────────────────────┴─────────────────────┴─────────────────────────┘
                                    ▼
┌─────────────────────────────────────────────────────────────────────────┐
│                              Account                                      │
└─────────────────────────────────────────────────────────────────────────┘
```
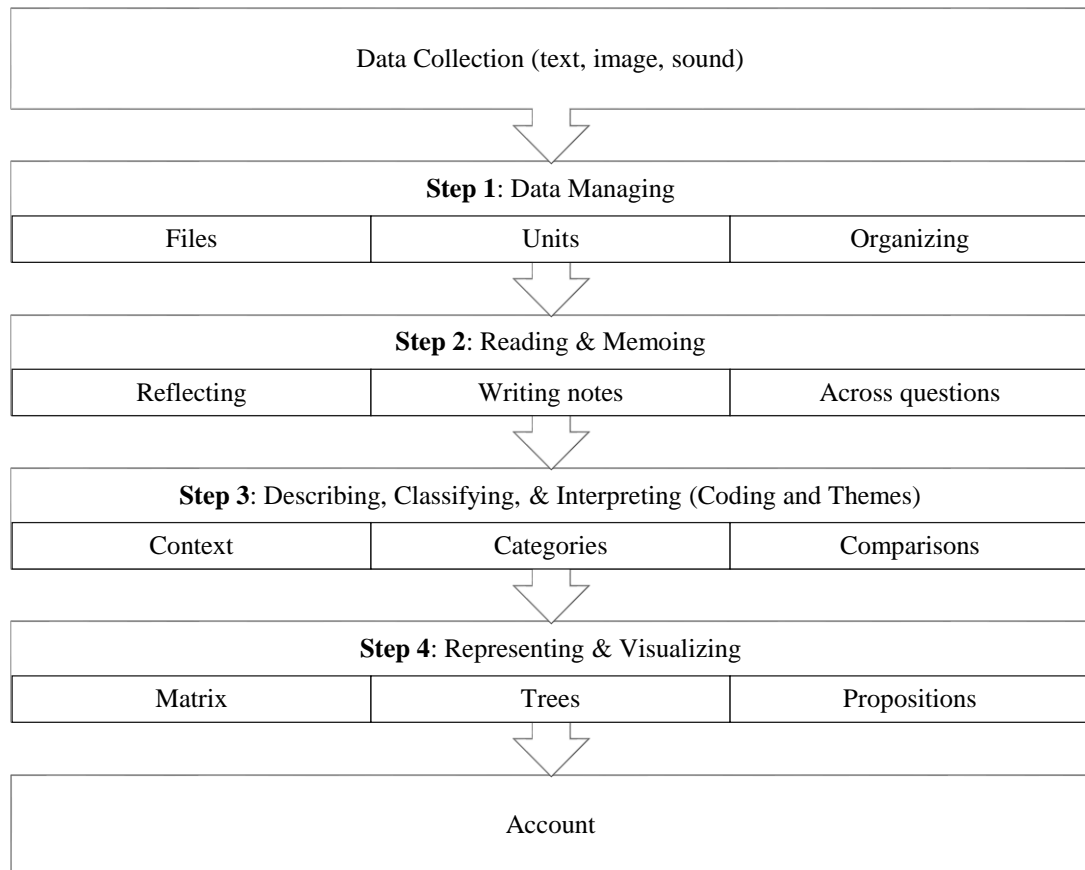
Figure 6.1
Flow of Qualitative Data Analysis
Source.   Adapted from (Creswell, 2007)

6.2.4.1   Validity and Reliability of Case Study

The validity and reliability tests are to test the trustworthiness, credibility, confirmability, and dependability of the data obtained. Yin (2003) suggested that quality of the research design is a critical step in case study which should be assessed in terms of external validity, reliability, constructs validity, and internal validity. Therefore, this study will go through the entire test as illustrated in Table 6.2 to ensure the quality of the case study.

Table 6.2
Case Study Tactics for Four Design Tests

Tests	Case Study Tactic	Phase of research in which tactic occurs
External validity	• Use theory in single-case studies • Use replication logic in multiple-case studies	Research design Research design
Reliability	• Use case study protocol • Develop case study database	Data collection Data collection
Construct validity	• Use multiple sources of evidence • Establish chain of evidence • Have key informants review draft case study report	Data collection Data collection Composition
Internal validity	• Do pattern-matching • Do explanation-building • Address rival explanations • Use logic models	Data analysis Data analysis Data analysis Data analysis

Source.   Adopted from Yin (2003)

The construct validity is to establish correct operational measures for the concepts being studied. The construct validity can be increased through the use of multiple sources of evidence and establish a chain of evidence during the data collection. A request to key informants to view the draft case study reports also potential to increase the construct validity. Besides, internal validity is only concern for causal or explanatory case studies. The internal validity can be increased through pattern-matching, explanation-building, address rival explanations, and use the logic models during data analysis. While, external validity is to establish a generalization of findings which the same results should obtain. During research design, the external validity can be tested by a theory in a single case study, and replication logic in multiple case studies. Lastly, reliability is to minimize the errors and biases in a study. Therefore, the reliability is to ensure that the findings or results should be the same even the data collection procedures are repeated for a number of times. The reliability can be increased through the use of case study protocol and develop a case study database during data collection. Table 6.3 illustrates the summary of quantitative and qualitative research of the study.

Table 6.3
Summary of Quantitative and Qualitative Research of the Study

Research Aspect	Quantitative	Qualitative
Focus	Quantity	Quality
Data	Numbers	Words
Purpose	Test hypothesis or specific research questions	Understand in depth, case study as triangulation of research finding
Approach	Measure and test	Observed and interpret
Sample	201, generalizable	4, often in nature setting
Instrument	Survey questionnaire	Interview protocol, semi-structured questionnaire
Data collection method	Postage and online survey	Face to face interview
Analytical tools	SPSS, Smart PLS	ATLAS.ti
Findings	Precise, numerical	Comprehensive, richly descriptive
Result	Objective, presented in Chapter Five	Subjective, presented in Chapter Six

6.3   Qualitative Data Analysis and Findings

This section discusses the qualitative data analysis and findings of the study in numerous subsections to clearly present the results. A series of analyses such as determining themes and significant statement and coding and thematic analysis was applied on the collected data to accumulate information from the interview. The function of ATLAS.ti is employed to aid researcher in data analysis and findings process. The analysis starts by an overview of demographic profiles of organizations and respondents. The analysis is followed by the detail discussion on the qualitative information that contributed by the respondents through determining significant statements and coding and thematic. A summary of interview findings is presented to simplify the results and findings of the study. Lastly, a chapter summary is provided at the end of this chapter as an overview of this chapter.

6.3.1 Overview of Demographic Profile

In this study, demographic profile was discussed in two subsections, which is company demographic and participant demographic. It provides an overview of participated company and participant. In general, the data was collected from four employees who represented their companies as participants in providing information for this study. In this study, four participants were sufficient and the saturation point is achieved. The further discussions are as follows.

6.3.1.1 Company Demographics

This study involved four volunteer companies, including an apparel manufacturer, a textile manufacturer, a fashion service provider, and an apparel retailer owned by three different country, which is Hong Kong, Malaysia, and Japan. All companies are doing business at international scope, excepted Company B. The companies ranged in size from small to large enterprise and majority had more than 20 years of operation in Malaysian textile and apparel industry. Table 6.4 clearly presented the companies' demographic characteristics. In order to protect companies' identity and kept confidentiality as promised in the research consent form hence, pseudonyms is used.

Table 6.4
Companies' Demographic Characteristics

Pseudonym	Company A	Company B	Company C	Company D
Subsector	Apparel	Fashion	Apparel	Textile
Business Type	Manufacturer	Service Provider	Retailer	Manufacturer
Ownership	Hong Kong	Malaysia	Malaysia	Japan
Geographic Scope	International	National	International	International
Number of Employees	Over 1000	70	More than 200	Over 1000
Years of Operation	More than 20 years	15 years	More than 20 years	More than 20 years

6.3.1.2   Participant Demographics

This study involved four volunteer employees, three women and a men from textile and apparel industry at the manager and executive level. Respondent A is represented Company A in providing information to the case study, while Respondent B is represented Company B in providing information, the same for the rest. The participants ranged in education level from high school to master degree and had been varying lengths of designation experience with particular responsibility such as supply chain, operation, and purchasing in Malaysian textile and apparel industry. Table 6.5 clearly presented the participants' demographic characteristics. In order to protect participants' identity and kept confidentiality as promised in the research consent form hence, pseudonyms is used.

Table 6.5
Participants' Demographic Characteristics

Pseudonym	Respondent A	Respondent B	Respondent C	Respondent D
Gender	Female	Female	Female	Male
Designation	Senior Executive	Executive	Shop Manager	Manager
Responsibility	Supply Chain	Operation	Operation	Purchasing
Education Level	High School	Master Degree	Technical School Certification	Bachelor's Degree
Years of Designation	Over 20 years	5 years	6 years	Over 20 years
Years of Experience	Over 20 years	5 years	6 years	Over 20 years

Note.   Respondent A represented Company A, Respondent B, represented Company B, Respondent C represented Company C, Respondent D represented Company D

6.3.2 Themes and Significant Statements

A semi-structured questionnaire with open-ended questions was used to obtain the experiences of each participant emerged as a result of an in-depth interview. As discussed in the previous section, the first step of interview data analysis was data managing in which all the audio records are well organize, files, and units. The analyses process was followed by transcripts in which all the audio record were transcripts into words form for reading and memoing purposes. Subsequently, the full transcripts or draft case study report of each company was sent to the key informants for review to get higher construct validity. This is to avoid misinterpretation during the translation of dual language data into a pure English version, since there is dual language used during the interview. Afterwards, the process of describing, classifying and interpreting, also known as coding and themes only discussed, while representing and visualizing were discussed at the end of every subsection as a summary of findings. An inductive approach was used to construct the meaning of the interview statement. Each participant's significant statements that contributed to the overall meaning of the collective experience were discussed. To comprehend the significant statement and formulated meanings process, an example of Company A is provided as shown in Table 6.6. The significant statements and formulated meanings for the other three companies are presented in **Appendix W**.

Table 6.6

Company's A Interview: Significant Statement and Formulated Meanings

Significant Statement	Formulated Meaning
Relational Capability ─ Supply Chain Operational Performance	
• M3 can be also understand as ERP system. Because M3 is a global system. So the data in M3 can be viewed by global. It means everybody that used this system in our company can view the data anywhere in the world. It is up-to-date information available to our sister company to view the information. For example, our sister company knows what we are purchases currently and thus sister company known what stock available in our factory. It is more convenience our daily operation. • So you can view all the history of purchasing and all information such as price, the date of previous purchase, many more details of the purchase we can view from the system. So you can view the previous quotation as well. Therefore, we can do our own comparison between the vendors before the purchase is made.	Relational capability is positively related to supply chain operational performance
IT Capability ─ Supply Chain Operational Performance	
• IT is playing as the role of support us and provide us the system that can assist us in the operating the business operation.	IT capability is positively related to supply chain operational performance
Organizational Culture Capability ─ Supply Chain Operational Performance	
• Then, the rest system we follow the standard of our company, since we have several factories in Malaysia or even other country. I mean we have many sister company. So we must do something standardized. • For sure, we have to follow the instruction that giving to us, since we are working for the company. So we have to take responsibility on it once we are assigned to take care on the particular project. If you're not take a good care on it, if the project happening some issues or problems, then it is also our responsibility. We have to accountable for it. • We apply an IPS system that the information is just available for our own factory purpose only. So you can view all the history of purchasing and all information such as price, the date of previous purchase, many more details of the purchase we can view from the system. So you can view the previous quotation as well. Therefore, we can do our own comparison between the vendors before the purchase is made.	Organizational culture capability is positively related to supply chain operational performance
Relational Capability ─ Supply Chain Technology Adoption	
• J.Hilburn always liked to suggest the new software for the company to adopt or implement according to their advice or request. Then request the manufacturer to follow accordingly. • This is the case of customer requests. This is the special case. They always request their customer to follow the system that they have suggested or needed. All the suggestion must follow accordingly. • Just a minority part of the system is from buyers such as J.Hilburn. Because this buyer is more particular. They want to use their owned system.	Relational capability is positively related to supply chain technology adoption

Significant Statement	Formulated Meaning
• So our company has to crop to their system. • They insist to use their own system as at today. Even, the buyer goes to our company HQ at Hong Kong to discuss about their request in the function of the system that uses to perform their business activities. So, our HQ also has to crop to their request as well. • M3 can be also understand as ERP system. Because M3 is a global system. So the data in M3 can be viewed by global. It means everybody that used this system in our company can view the data anywhere in the world. It is up-to-date information available to our sister company to view the information. For example, our sister company knows what we are purchases currently and thus sister company what stock available in our factory. It is more convenience our daily operation. • So you can view all the history of purchasing and all information such as price, the date of previous purchase, many more details of the purchase we can view from the system. So you can view the previous quotation as well. Therefore, we can do our own comparison between the vendors before the purchase is made. • In IPS, we have our own record of the suppliers who registered in our company. So we can view the quotation before ask for a new quotation. Then you only choose the best within the existing supplier. • Because too much or thousands of things they want to purchase. Even though a piece of pin they want to purchase. We have to follow the ISO quality measurement, cannot buy the finished goods form elsewhere. It is seemed like does not make sense if request the supplier to send the sample and the quotation for a pin purchase. So we have to find out the history data, where we purchase last time, and is there any stock available in our factory. So the system is very useful for this kind of problem. So the maintain of soft documentations are very importance too. • It is just for the employees within our company instead of world conversation or public. Thus, we can do announcement and message to somebody in the list. The software will implement in 2014, 15th November.	

IT Capability ─ Supply Chain Technology Adoption	
• IT is playing as the role of support us and provide us the system that can assist us in the operating the business operation. • All systems are from the IT department • Of course, our company would conduct a training for us to learn the technology or system. Normally, IT department would give the training. Alternatively, sometime the expert from our IT department at Hong Kong HQ would come to our company to provide us the training. • IT department would be more expert on the system application. • Since we are not studied about the software development. We just know how to use it. • While the IPS is the system that uses in purchasing currently. • Because too much or thousands of things they want to purchase. Even though a piece of pin they want to purchase. We have to follow the ISO quality measurement, cannot buy the finished goods form elsewhere. It is seemed like does not make sense if request the supplier to send the sample and the quotation for a pin purchase. So we have to find out the history data, where we	IT capability is positively related to supply chain technology adoption

Significant Statement	Formulated Meaning
purchase last time, and is there any stock available in our factory. So the system is very useful for this kind of problem. So the maintain of soft documentations are very importance too. • It is just for the employees within our company instead of world conversation or public. Thus, we can do announcement and message to somebody in the list. The software will implement in 2014, 15th November.	

Organizational Culture Capability ─ Supply Chain Technology Adoption

• Then, the rest system we follow the standard of our company, since we have several factories in Malaysia or even other country. I mean we have many sister company. So we must do something standardized. • The system will set the lead time for purchase material or payment. So totally fixed for us. So it is very important and helps us a lot actually. • Of course, we are not expert in the IT knowledge, but we are able to use the existing technology to perform our business activities effectively and efficiently. • We apply an IPS system that the information is just available for our own factory purpose only. So you can view all the history of purchasing and all information such as price, the date of previous purchase, many more details of the purchase we can view from the system. So you can view the previous quotation as well. Therefore, we can do our own comparison between the vendors before the purchase is made. • Because too much or thousands of things they want to purchase. Even though a piece of pin they want to purchase. We have to follow the ISO quality measurement, cannot buy the finished goods form elsewhere. It is seemed like does not make sense if request the supplier to send the sample and the quotation for a pin purchase. So we have to find out the history data, where we purchase last time, and is there any stock available in our factory. So the system is very useful for this kind of problem. So the maintain of soft documentations are very importance too.	Organizational culture capability is positively related to supply chain technology adoption

Supply Chain Technology Adoption ─ Supply Chain Operational Performance

• Our company has a lot of systems that assist us in terms of our business operation such as notified the shipment date with the suggestion arrival date of the purchased material. So that we would not purchase the wrong things. • The system will set the lead time for purchase material or payment. So totally fixed for us. So it is very important and helps us a lot actually. • In IPS, we have our own record of the suppliers who registered in our company. • Yes. Sure. It is so useful. I can say that it is very useful for me. It is very hard to explain in detail. But I can give an example like I have been told you just now. Efficient the process of operation while we want to look at the previous record of purchasing. All detail can be viewed through the record, such as who is the supplier, what is the price, when to purchase, what quality is the finished good. So reduce repeated work. More efficient way for us to perform or job. It is a very efficient tool in working.	Supply chain technology adoption is positively related to supply chain operational performance

Significant Statement	Formulated Meaning
• Because too much or thousands of things they want to purchase. Even though a piece of pin they want to purchase. We have to follow the ISO quality measurement, cannot buy the finished goods form elsewhere. It is seemed like does not make sense if request the supplier to send the sample and the quotation for a pin purchase. So we have to find out the history data, where we purchase last time, and is there any stock available in our factory. So the system is very useful for this kind of problem. So the maintain of soft documentations are very importance too.	
• It is more time savings.	
• The exciting function of the email is similar to the function of the Facebook. Very interesting software. Hope that I could improve our job performance and operation performance of the company	
• Yes. I am agreed. Save time and save costs. Actually save time is directly lead to save costs.	
• Sometime we are facing the obsolete inventory problem which is not tally with the system figure.	
• The stock or inventory is actually available at factory warehouse. But just cannot confirm the location of the products freeze for a long time.	
• Which means that the issue is not caused by the existing supply chain technology. The usage of the technology is good enough and not caused to any other issues.	
• We no needs to find it physically. We can identify all the detail on the product or the purchase of the product easily through the product code.	
• Actually, system helped us a lot in operation. We can know when we do the purchase, and how much left over we still have in store and aging of the stocks as well.	

Relational Capability — Supply Chain Technology Adoption — Supply Chain Operational Performance	
• Our company has a lot of systems that assist us in terms of our business operation such as notified the shipment date with the suggestion arrival date of the purchased material. So that we would not purchase the wrong things.	Relational capability affects supply chain operational performance indirectly through supply chain technology adoption
• So you can view all the history of purchasing and all information such as price, the date of previous purchase, many more details of the purchase we can view from the system. So you can view the previous quotation as well. Therefore, we can do our own comparison between the vendors before the purchase is made.	
• In IPS, we have our own record of the suppliers who registered in our company. So we can view the quotation before ask for a new quotation. Then you only choose the best within the existing supplier.	
• M3 is globalized system, is for a group of the company to view, even Hong Kong HQ would know our up-to-date data in our factory. It is also executed by everybody within the group of our company.	
• IPS cannot see by global and only available for local user purpose and it is a new software of the system in our company.	
• Oh… cannot… We also cannot work, if all of the supply chain technology can't work in one day. Can't do anything anymore. Something like cannot have performed anything at all.	
• Yes. For sure improve the operation performance of the supply chain. Because you have all the record in your hand. So very easy to help you in find out the related information. And it can be categories	

Significant Statement	Formulated Meaning
to several categories, so easier for you to determine the information that you want to search.	

IT Capability ─ Supply Chain Technology Adoption ─ Supply Chain Operational Performance

• Our company has a lot of systems that assist us in terms of our business operation such as notified the shipment date with the suggestion arrival date of the purchased material. So that we would not purchase the wrong things. • IT is playing as the role of support us and provide us the system that can assist us in the operating the business operation. • Oh… cannot… We also cannot work, if all of the supply chain technology can't work in one day. Can't do anything anymore. Something like cannot have performed anything at all. • Yes. For sure improve the operation performance of the supply chain. Because you have all the record in your hand. So very easy to help you in find out the related information. And it can be categories to several categories, so easier for you to determine the information that you want to search.	IT capability affects supply chain operational performance indirectly through supply chain technology adoption

Organizational Culture Capability ─ Supply Chain Technology Adoption ─ Supply Chain Operational Performance

• Our company has a lot of systems that assist us in terms of our business operation such as notified the shipment date with the suggestion arrival date of the purchased material. So that we would not purchase the wrong things. • The system will set the lead time for purchase material or payment. So totally fixed for us. So it is very important and helps us a lot actually. • Of course, we are not expert in the IT knowledge, but we are able to use the existing technology to perform our business activities effectively and efficiently. • We apply an IPS system that the information is just available for our own factory purpose only. So you can view all the history of purchasing and all information such as price, the date of previous purchase, many more details of the purchase we can view from the system. So you can view the previous quotation as well. Therefore, we can do our own comparison between the vendors before the purchase is made. • Oh… cannot… We also cannot work, if all of the supply chain technology can't work in one day. Can't do anything anymore. Something like cannot have performed anything at all. • Yes. For sure improve the operational performance of the supply chain. Because you have all the record in your hand. So very easy to help you in find out the related information. And it can be categories to several categories, so easier for you to determine the information that you want to search.	Organizational culture capability affects supply chain operational performance indirectly through supply chain technology adoption

Emerging Theme: The Power of Supply Chain Technology Adoption

• Oh… cannot… We also cannot work, if all of the supply chain technology can't work in one day. Can't do anything anymore. Something like cannot have performed anything at all. • Really… cannot move anymore. Because too much or thousands of things they want to purchase. • Yes. For sure improve the operation performance of the supply chain. Because you have all the record in your hand. So very easy to	The power of supply chain technology adoption as mediating variable.

Significant Statement	Formulated Meaning
help you in find out the related information. And it can be categories to several categories, so easier for you to determine the information that you want to search.	

Emerging Theme: Supply Chain Technology Adoption ─ Human Support ─ Supply Chain Operational Performance.	
• Sometime we are facing the obsolete inventory problem which is not tally with the system figure. So the final verification must be done by the warehouse person in charge. • The stock or inventory is actually available at factory warehouse. But just cannot confirm the location of the products freeze for a long time. • I few realized that product in purchase for a longtime such as 10 years ago. So we have to ask the store keeper to find out the product at the back location of the store, since old inventory. • Sometimes it is caused by the store keeper or warehouse management. So I think it is a normal issue for a factory.	Human support moderates the supply chain technology adoption towards supply chain operational performance.

The following sections discuss the findings of the coding and thematic analysis used to interpret the work experience of the participants. Basically, the findings can be discussed in four broad categories as follows.

1) Finding related to the relationship of supply chain capabilities on supply chain operational performance.

2) Finding related to the relationship of supply chain capabilities on supply chain technology adoption.

3) Finding related to the relationship of supply chain technology adoption on supply chain operational performance.

4) Findings related to the mediating effect of supply chain technology adoption on the relationship between supply chain capabilities and supply chain operational performance.

6.3.3 Coding and Thematic Analysis

The total of seven axial codes or structural themes created for the study which consist of five existing themes and two emerging themes. The five existing themes were consisted of relational capability, IT capability, organizational culture capability, supply chain technology adoption, and supply chain operational performance, while the two emerging themes were consisted of human support and work experience. To simply the understanding, Table 6.7 identifies the codes, themes, and sub codes for the study.

Table 6.7
Codes, Themes, and Elements Related to the Study

Family Code/ Finding	Axial Codes/ Structural Themes	Sub Code/ Element
Supply Chain Capabilities	Relational Capability	• Supplier Partnership • Customer Relationship • Information Sharing • Information Quality
	IT Capability	• IT Infrastructure • IT Personnel • IT Knowledge • IT Reconfigurability
	Organizational Culture Capability	• Involvement • Consistency • Adaptability • Innovativeness
Supply Chain Technology	Supply Chain Technology Adoption	• Use • Usefulness
Supply Chain Performance	Supply Chain Operational Performance	• Reliability • Responsiveness • Agility • Costs
Emerging Themes	Human Support	
	Work Experience	

6.3.4 Finding 1: Supply Chain Capabilities were Positively Related to Supply Chain operational performance

Aspects of supply chain capabilities, including relational capability, IT capability, and organizational culture capability acted as a factor for improving supply chain operational performance. This finding had three axial or structural themes, which including (1) relational capability and supply chain operational performance, (2) IT capability and supply chain operational performance, and (3) organizational culture capability and supply chain operational performance.

6.3.4.1 Theme 1a: Relational Capability ─ Supply Chain Operational Performance

This element involved four companies who had experienced in the link of relational capability and supply chain operational performance. For instance, Company A stated, "*the data in M3 (system) can be viewed by global. It means everybody that used this system in our company can view the data anywhere in the world. It is up-to-date information available to our sister company to view the information. It is more convenience our daily operation*". The company further stated that to efficient the operation process and that "*we can do our own comparison between the vendors before the purchase is made*". Three companies had similar experienced in which Company B, Company C, and Company D simultaneously noted that "*the relational capability is very important to improve our operation performance*". Company B further stated that "*when customers are not satisfy, we will also loose in our performance. When customer not satisfy, all will be effected and reflect to the whole organization*". Thus, it is important to share information as well as quality's information with customer and

supplier as stated by Company D, "all are linked. We *linked all the processes from the production floor until the final process of deliver goods*".

6.3.4.2 Theme 1b: IT Capability ─ Supply Chain Operational Performance

This element involved four companies who had experienced in the link of IT capability and supply chain operational capability. For instance, Company A stated, "*IT is playing as the role of support us and provide us the system that can assist us in the operating the business operation*". Company B similarly stated that "*if talk about business, the most important is IT capability. Because we want business, the knowledge and skill of IT is the most important*". While Company C and Company D simultaneously stated that "*there is equally important and equally give the same effect*" to supply chain operational performance.

6.3.4.3 Theme 1c: Organizational Culture Capability ─ Supply Chain Operational Performance

This element involved four companies who had experienced in the link of organizational culture capability and supply chain operational performance. This theme gets the most attention from the practitioners with the most commends within the Finding 1. For instance, Company A noted that they are using the same system within headquarter and branches in order to provide the consistent operation and stated that "*we are follow the standard of our company, since we have several factory in Malaysia or even other country. I mean we have many sister company. So we must doing something standardized*". Company A noted that the employees in the company

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always keep involvement, consistency, and adaptability in working and stated that "*for sure we have to follow the instruction that giving to us, since we are working for the company. So we have to take responsibility on it once we are assign to take care on the particular project*". The company further noted that they always work innovatively and stated "*we can view the previous quotation from the system and do our own filter or comparison between the vendors before ask for the new quotation or the purchase is made*". However, Company D noted that the employee in their company can be categorized into two different categories, which is young generation and experience people. The company further stated that the young generation are more innovative, adaptability, and involvement in working while, experience people are more consistency in working.

Besides, Company B and Company C more emphasized on organizational culture capability to improve the supply chain operational performance. Company B stated that "*If we talk about the company aspect, the most important is organizational culture capability*". The company further provided the reason from the previous commend and stated "*because when we have a team work, every project can be develop and done perfectly*". Additionally, Company C noted that there is variety of organizational culture in their company and stated that "*the staff have to follow my style while working with me, and they have to follow the other style while working with another shop manager. These kinds of organizational culture have their benefits and also weaknesses. It is more flexible, but at the same difficult to crop*". For instance, Company C stated that "*we do have our own arrangement in the store. We will arrange the item according to the brand and then follow by the pattern or style of the item and continue with the coding and size. It is to convenience the process of finding the item*

when customer request. However, we do have our different method of arrangement in particular outlet. Different store different method, depend to the management style."

In this perspective, the employees in Company C must possess a very strong organizational culture capability such as involvement, consistency, adaptability, and innovativeness in working towards better supply chain operational performance.

6.3.4.4   Summary of Finding 1

As a section summary, Table 6.8 exhibits the key area and axial codes for Finding 1. It is further displays the experienced of each company across the Finding 1.

Table 6.8
Summary of Codes for Finding 1

Family Code/ Finding	Key Area	Axial Codes/ Structural Themes	Company A	Company B	Company C	Company D
Supply chain capabilities were positively related to supply chain operational performance	H1a RC – SCOP	Relational Capability • Supplier Partnership • Customer relationship • Information Sharing • Information Quality Supply Chain Operational Performance • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲
	H1b ITC – SCOP	IT Capability • IT Infrastructure • IT Personnel • IT Knowledge • IT Reconfigurability Supply Chain Operational Performance • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲
	H1c OCC – SCOP	Organizational Culture Capability • Involvement • Consistency • Adaptability • Innovativeness Supply Chain Operational Performance • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲

Note.   ▲ indicates code was experienced by the participant, ○ indicates code was not mentioned by the participant

6.3.5 Finding 2: Supply Chain Capabilities were Positively Related to Supply Chain Technology Adoption

Aspects of supply chain capabilities, including relational capability, IT capability, and organizational culture capability acted as a factor for increasing the adoption of supply chain technology. This finding had three axial or structural themes, which including (1) relational capability and supply chain technology adoption, (2) IT capability and supply chain technology adoption, and (3) organizational culture capability and supply chain technology adoption.

6.3.5.1 Theme 2a: Relational Capability ─ Supply Chain Technology Adoption

This element involved three companies who had experienced in the link of relational capability and supply chain technology adoption. For instance, Company A noted that customer relationship possess a strong effect to supply chain technology adoption and stated that "*J.Hilburn always like to suggest the new system for the company to adopt or implement according to their advice or request. Then request the manufacturer to follow the suggestion accordingly.*" Company D similarly stated that "*the customer is even more brilliant, he said that I don't want to come to see your data and don't want to see your report. Why not your company creates a system and sends it to me through EDI. So we do an EDI for them.*".

Besides, Company A stated that "*M3 can be also understand as ERP system. Because M3 is a global system. So the data in M3 can be viewed by global. It means everybody that used this system in our company can view the data anywhere in the world. It is up to date information available to our sister company to view the information.*" The

company further stated that "*in IPS, we have our own record of the suppliers that registered in our company. So we can view the quotation before ask for a new quotation. Then only choose the best within the existing supplier. It is seemed like does not make sense if request the supplier to send the sample and the quotation for a pin purchase. So we have to find out the history data, where we purchase last time, and is there any stock available in our factory. So the system is useful for this kind of problem.*"

Additionally, Company C noted the some system is used to information sharing purposes and stated that "*all retail outlet in our company can just view the data, the retail shops are not allow to edit or modify the data or information in the system*" to control the quality of the information. Furthermore, Company D noted that the supplier and customer are also influence the company to adopt supply chain technology and stated that "*it is not only link to supplier, but also link to customer or buyer*". In order to share information throughout the company, the supply chain technology is adopted as Company D stated, "*the kiosk shown all the things that we have through a monitor or TV at the strategic places in our factory. The majority function of this kiosk is to disseminate the information throughout the company.*" and all the information shared are real time and critically stated that "*it is too late. Life. Life meaning to say that on time and real time*". Thus, Company A further noted that the real time information is shared to some supplier and customer in their company and stated that "*our supplier and customer can be accessed to our system also. They can login and come to our system and see some of the restricted data. The majority would be the customer.*". The aforementioned discussions revealed that the relational capability which includes supplier partnership, customer relationship, information sharing, and information quality were crucially influenced the supply chain technology adoption.

6.3.5.2 Theme 2b: IT Capability ─ Supply Chain Technology Adoption

This element involved three companies who had experienced in the link of IT capability and supply chain technology adoption. For instance, Company A stated, "*IT department is playing as the role of support us and provide us the system that can assist us in the operating the business operation.*". In order to successfully adopted and implemented the new system, the training is provided by the IT department. Company A stated "*our company would conduct a training for us to learn the technology or system. Normally, IT department would give the training. Or sometime the expert from IT department at Hong Kong headquater would come to our company to provide us the training.*". In the same way stated by Company D, "*everything is fully computerize monitor by our IT department and they will help to provide training for the user about the necessary knowledge to use the system in order to link all the processes. Sometime, they will pick people or select people to training. Sometime also send them for external courses and internal courses*". However, Company D further stated that some of the experience workers are "*refused to learn and refused to change*".

Nonetheless, Company C stated that "*the superior of the shop manager would give the training to the shop manager at the beginning to use the system*". Company A and Company C further stated that "*the IT department would more expert on the system application. However, as an employee, we just know how to use a particular system.*" While, IT department would responsible to solve most of the issues in IT. Therefore, Company D stated that "*IT department is the most important, because they are the one who monitor and set up the floor, like put up the first fuse pillar, like you build up a house, they are the one who put the first pill pillar to set up the whole system. They go there and implement set up everything for everyone. And then from there, we operate.*

So, we used the system and the program that they have prepared before for us, by the production, sales, account, etc. We are using all the thing that they are set up before. In other words, we can say that they play an important role in two parts, one is helping use to implementing, and the other part is helping us to be a police man. Do you know why I said they are police man? They set up the program to check us, to check the performance of each machine, they check and they go about to monitoring the performance of our production processes, machine operation, and also at the same time for account and for sales. Also we have certain system that we have to follow, certain thing that we can do and we cannot do. These are the things that they are definitely monitor and check. So, they are very important for us.". From the aforementioned discussions, the IT capability which includes IT infrastructure, IT personnel, IT knowledge, and IT reconfigurability were significantly influenced the adoption of supply chain technology.

6.3.5.3 Theme 2c: Organizational Culture Capability ─ Supply Chain Technology Adoption

This element involved four companies who had experienced in the link of organizational culture capability and supply chain technology adoption. For instance, Company A is emphasized on the consistency of work and stated that "*we have many sister company. So we must doing something standardized*.". This information revealed that the adoption of supply chain technology is because of the consistency of work. While not all the system is accessible by all level of employees, Company C stated that "*it is only allow shop manager to operate the system. The others workers are not allow and do not have authority to use the system*.". However, Company D

further stated that some of the experience workers are "*refused to learn and refused to change*". From the aforementioned discussions, the organizational culture capability which includes involvement, consistency, adaptability, and innovativeness were influenced the adoption of supply chain technology.

6.3.5.4   Summary of Finding 2

As a section summary, Table 6.9 exhibits the key area and axial codes for Finding 2. It is further displays the experienced of each company across the Finding 2.

Table 6.9
Summary of Codes for Finding 2

Family Code/ Finding	Key Area	Axial Codes/ Structural Themes	Company A	Company B	Company C	Company D
Supply chain capabilities were positively related to supply chain technology adoption	H2a RC – SCTA	Relational Capability • Supplier Partnership • Customer relationship • Information Sharing • Information Quality Supply Chain Technology Adoption • Use • Usefulness	▲	○	▲	▲
	H2b ITC – SCTA	IT Capability • IT Infrastructure • IT Personnel • IT Knowledge • IT Reconfigurability Supply Chain Technology Adoption • Use • Usefulness	▲	○	▲	▲
	H2c OCC – SCTA	Organizational Culture Capability • Involvement • Consistency • Adaptability • Innovativeness Supply Chain Technology Adoption • Use • Usefulness	▲	▲	▲	▲

Note. ▲ indicates code was experienced by the participant, ○ indicates code was not mentioned by the participant

6.3.6 Finding 3: Supply Chain Technology Adoption was Positively Related to Supply Chain Operational Performance

Aspects of supply chain technology adoption acted as a factor for increasing supply chain operational performance. This finding had one axial or structural theme, which is supply chain technology adoption and supply chain operational performance.

6.3.6.1 Theme 3a: Supply Chain Technology Adoption ─ Supply Chain Operational Performance

This element involved four companies who had experienced in the link of supply chain technology adoption and supply chain operational performance. Most of the information from the multiple case studies revealed the positive influenced of the supply chain technology adoption to the supply chain operational performance. For instance, Company A stated, "*our company have a lot of system that assist us in term of our business operation such as notified the shipment date with the suggestion arrival date of the purchased material. So that we would not purchase the wrong things.*".

There are some positive comments from the most of the companies that have been interviewed. For instance, Company A stated, "*it is so useful. It is very hard to explain in detail. But I can give an example like I have been told you just now. Efficient the process of operation while look at the previous record of purchasing. All detail can be viewed through the record, such as who is the supplier, what is the price, when to purchase, what quality is the finished good. So reduce repeated work. More efficient way for us to perform our job. It is a very efficient tools in working.*". As a result of above information, Company A further stated that the adoption of supply chain technology is led to "*time saving and thus costs saving*". This is agreed by the

Company C and given the same comment on it and further stated *"with the supply chain technology adoption, our operation performance would be obviously increase. The most obvious part is the efficiency in working. It will speed up our operating processes. It is very difficult and very time consuming if we do it manual calculation on the promotion item. What I can say is working manually is not the way to do business in current decade."*.

However, Company A points out some issues that related to the supply chain technology used, for instance, *"sometime we are facing the obsolete inventory problem which is not tally with the system figure."*. The company give further explanations of the issues and stated that *"the stock or inventory is actually available at factory warehouse. But just cannot confirm the location of the products freeze for a long time."*. The company further clarified and stated that *"the issues is not caused by the existing supply chain technology. The usage of the technology is good enough and not caused to any other issues."*. Company C is agreed the statement given by Company A and stated that *"the system is accurate except you are not follow the standard operation procedure of the system"*. This is also supported by the Company D with the rational statement toward the issues happen and stated that *"program error also is, human error also equally is"*. Why Company A do emphasize on the useful of the supply chain technology? To answer the question, Company A stated that *"we no need to find it physically. We can identify all the detail on the product or the purchase of the product easily through the product code."*. As a final comments on the adoption of supply chain technology, Company A stated, *"actually system is help us a lot in operation"*.

Company B is agreed the information provided by the Company A and Company C and stated that "*the adoption of supply chain technology give a certain impact to the performance of supply chain operation*". Company D provides a statement to support the statement given by the Company B and stated that "*we have the system whereby it has been build 20 years. It is still okay, you know. It is still functioning. Why you see we are spending million moves from B2B to the Oracle system? This is because it is something that can improve all the performance of our company. This is why our company to chosen this to further improve to this system.*". However, when come to the question how if the system or technology cannot be well-functioning in one day and what is the impact toward the supply chain operational performance? Company D answer the question confidently and stated "*definitely drop. It will give big effect on it. For example, we store our company information somewhere else. So we always have a backup. So, even this factory burnout or something happens. We always do a backup. So that other system capable to doing something for us.*" From the aforementioned discussions, the used and usefulness of supply chain technology adoption was critically influenced the performance of supply chain operation in a broad angle.

6.3.6.2 Summary of Finding 3

As a section summary, Table 6.10 exhibits the key area and axial codes for Finding 3.

It is further displays the experienced of each company across the Finding 3.

Table 6.10
Summary of Codes for Finding 3

Family Code/ Finding	Key Area	Axial Codes/ Structural Themes	Company A	Company B	Company C	Company D
Supply chain technology adoption was positively related to supply chain operational performance	H3 SCTA – SCOP	Supply Chain Technology Adoption • Use • Usefulness Supply Chain Operational Performance • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲

Note. ▲ indicates code was experienced by the participant, ○ indicates code was not mentioned by the participant

6.3.7 Finding 4: Supply Chain Capabilities Affect Supply Chain Operational Performance Indirectly Through Mediating Effect of Supply Chain Technology Adoption

Aspects of supply chain technology adoption acted as a mediator for supply chain capabilities to increase the supply chain operational performance. This finding had three axial or structural theme, which including (1) the mediating effects of supply chain technology adoption to relational capability and supply chain technology adoption, (2) the mediating effects of supply chain technology adoption to IT capability and supply chain technology adoption, and (3) the mediating effects of supply chain technology adoption to organizational culture capability and supply chain technology adoption.

It is so fantastic to get the same answer and similar response from the four companies toward the supply chain technology adoption, Company A stated, "*oh… cannot… We also cannot work, if all of the supply chain technology can't work in one day. We also can't do anything anymore. Something like cannot perform anything at all.*" While Company B stated, "*cannot perform anymore. The business will be stuck. The performance for sure will decrease dramatically. For sure. For sure. Cause we have experience in our company. We were in the office, but we could not perform our job. The role of supply chain technologies are too important.*" In fact, Company B stated that "*internet is the most important supply chain technology for our company. Because our company cannot operate without the internet connection.*" The same feedback get from Company C in which stated "*oh my god, then this will be a big problem for us. All need to do manually. Bring very inconvenience to our operation. This feel like the operation cannot without the electronic, the Internet, and the technology tools. If these systems down, we are also down. Difficult to operate manually nowadays.*" Company D similarly stated that "*cannot work, cannot communicate with each other. Basically cannot do business.*"

6.3.7.1 Theme 4a: Relational Capability ─ Supply Chain Technology Adoption ─ Supply Chain Operational Performance

This element involved four companies who had experienced the mediating effect of supply chain technology adoption in the link of relational capability and supply chain technology adoption. For instance, Company A stated, "*our company have a lot of system that assist us in term of our business operation such as notified the shipment date with the suggestion arrival date of the purchased material. So that we would not purchase the wrong things.*" Therefore, nowadays, the business operation cannot function without the supply chain technology as stated by Company C, "*we have to login to the system every day. Because we have to clear all the stock of the day one day before the day.*" This is to enable up to date information available at all the time as Company C stated, "*all of the outlet able to view the data in the system*". Based on these statement Company C provide an additional work experience on this context and stated that "*definitely useful. We cannot work without the systems. The barcoding system is the most important system for our business. It is more convenience for our operation and being more efficient toward the performance.*". Company D provides an additional explanation on this context and stated that "*if you want to know the performance of the factory, you can just key in by each department, whether they are behind time or follow time or not according to the schedule. Everything are all monitored.*". From the aforementioned discussions, the supply chain technology adoption was acted as a mediator for relational capability to increase the supply chain operational performance.

6.3.7.2 Theme 4b: IT Capability － Supply Chain Technology Adoption － Supply Chain Operational Performance

This element involved four companies who had experienced the mediating effect of supply chain technology adoption in the link of IT capability and supply chain technology adoption. For instance, Company A stated, "*IT is playing as the role of support us and provide us the system that can assist us in operating the business operation.*". By having the IT infrastructure, It personnel, IT knowledge, and IT reconfigurability, Company B stated that if without the supply chain technology, "*we still can perform some of the job. But it totally different. Definitely huge different as usual performance that we can achieve. Huge effect to the operation and also organization. The role of supply chain technologies are too important.*". While Company C stated that "*we need to manually write up the receipt for the customer. At the end we still have to key in the sales of the day one by one into the system.*". Company C noted that it is important to have up-to-date IT knowledge and IT reconfigurability, they replace the used of fax machine to Skype communication software. As the Company mentioned "*it is faster and convenience*". If something happen to the system, Company D stated, "*maybe to 24 or 48 hours we are not be able to function. Maybe after that our IT person will show us and back to our business again.*". From the aforementioned discussions, the supply chain technology adoption was acted as a mediator for IT capability to increase the supply chain operational performance.

6.3.7.3 Theme 4c: Organizational Culture Capability ─ Supply Chain Technology Adoption ─ Supply Chain Operational Performance

This element involved four companies who had experienced the mediating effect of supply chain technology adoption in the link of organizational culture capability and supply chain technology adoption. For instance, Company A stated, "*the system will set the lead time for purchase material or payment. So totally fixed for us. So it is very important and help us a lot actually.*". Furthermore, by showing the innovativeness and adaptability, Company A stated, "*we are able to use the existing technology to perform our business activities effectively and efficiently.*". While, Company B stated that "*we still can perform some of the job. But it totally different. Definitely huge different as usual performance that we can achieved.*". Despite the fact, Company C stated, "*we manually write up the receipt for the customer during the system down. At the end, we still have to key in the sales of the day one by one into the system. It has become a common tool for us in operating the business. It is difficult to operate manually nowadays.*" Company D similarly stated that "*if you want to know the performance of the factory, we can just key in by each department, whether they are behind time or follow time or not according to the schedule. Everything are all monitored.*". From the aforementioned discussions, the supply chain technology adoption was acted as a mediator for organizational culture capability to increase the supply chain operational performance.

6.3.7.4 Summary of Finding 4

As a section summary, Table 6.11 exhibits the key area and axial codes for Finding 4. It is further displays the experienced of each company across the Finding 4.

Table 6.11
Summary of Codes for Finding 4

Family Code/ Finding	Key Area	Axial Codes/ Structural Themes	Company A	Company B	Company C	Company D
Supply chain capabilities affect supply chain operational performance indirectly through mediating effect of supply chain technology adoption	H4a RC – SCTA – SCOP	**Relational Capability** • Supplier Partnership • Customer relationship • Information Sharing • Information Quality **Supply Chain Technology Adoption** • Use • Usefulness **Supply Chain Operational Performance** • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲
	H4b ITC – SCTA – SCOP	**IT Capability** • IT Infrastructure • IT Personnel • IT Knowledge • IT Reconfigurability **Supply Chain Technology Adoption** • Use • Usefulness **Supply Chain Operational Performance** • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲
	H4c OCC – SCTA – SCOP	**Organizational Culture Capability** • Involvement • Consistency • Adaptability • Innovativeness **Supply Chain Technology Adoption** • Use • Usefulness **Supply Chain Operational Performance** • Reliability • Responsiveness • Agility • Costs	▲	▲	▲	▲

Note.　▲ indicates code was experienced by the participant, ○ indicates code was not mentioned by the participant

6.3.8 Finding 5: Human Support Moderates the Supply Chain Technology Adoption towards Supply Chain Operational Performance

Aspects of human support acted as a moderator for supply chain technology adoption to increase the supply chain operational performance. This finding had one axial or structural theme, which is the moderating effects of human support in the link of supply chain technology adoption and supply chain operational performance.

6.3.8.1 Emerging Theme: Supply Chain Technology Adoption ─ Human Support ─ Supply Chain Operational Performance

This element involved two companies who had experienced the moderating effect of human support in the link of supply chain technology adoption and supply chain operational performance. For instance, Company A stated, "*sometime we are facing the obsolete inventory problem which is not tally with the system figure. So the final verification must be done by the warehouse person in charge*". Company A further explains and stated that "*sometime is caused by the store keeper or warehouse management. So I thinks it is a normal issue for a factory*". Company C is agreed the statements from Company A and stated that "*the information in the system is accurate except you are not follow the standard operation procedure of the system*". Company C points out the important role of shop manager in retail store and stated that "*the shop manager is quite important. Because it will affect the whole performance of the company. The shop manager need to take care all the staff, how to doing sales, how to serve the customer, how to use the system, and everything need to be known and expert*". From the aforementioned discussions, the human support was moderated the

used and usefulness of supply chain technology adoption in a certain level towards the performance of supply chain operation.

6.3.8.2 Summary of Finding 5

As a section summary, Table 6.12 exhibits the key area and axial codes for Finding 5. It is further displays the experienced of each company across the Finding 5.

Table 6.12
Summary of Codes for Finding 5

Family Code/ Finding	Key Area	Axial Codes/ Structural Themes	Company A	Company B	Company C	Company D
Human support moderates the supply chain technology adoption towards supply chain operational performance	SCTA – HS – SCOP	Supply Chain Technology Adoption • Use • Usefulness Human Support Supply Chain Operational Performance • Reliability • Responsiveness • Agility • Costs	▲	○	▲	○

Note. ▲ indicates code was experienced by the participant, ○ indicates code was not mentioned by the participant

6.3.9 Finding 6: Work Experience Moderates the Supply Chain Technology Adoption toward Supply Chain Operational Performance

Aspects of work experience acted as a moderator for supply chain technology adoption to increase the supply chain operational performance. This finding had one axial or structural theme, which is the moderating effects of work experience in the link of supply chain technology adoption and supply chain operational performance.

6.3.9.1 Emerging Theme: Supply Chain Technology Adoption ─ Work Experience ─ Supply Chain Operational Performance

This element involved a company who had experienced the moderating effect of work experience in the link of supply chain technology adoption and supply chain operational performance. For instance, Company D stated, "*I think experience people are more difficult however, the new or young employees are more success able, I means they are more open to this new technology and all that, but the older once you known… it is more difficult, they think they know a lot and they think they already work for so long and they always said that we have been doing for so long and they said that they have been doing the same things and the old way without IT and without this and that for 20 years 25 years. We did okay what right? So why you suddenly want us to change and everything we need to key in and everything we need to do this and that.*" As a summary for above statement, Company D stated that "*the younger generations are more expose to new technology, while some of the experience workers are refused to learn and refused to change*". From the aforementioned discussions, the work experience was influenced the used and usefulness of supply chain technology adoption in a certain level towards the performance of supply chain operation.

6.3.9.2 Summary of Finding 6

As a section summary, Table 6.13 exhibits the key area and axial codes for Finding 6.

It is further displays the experienced of each company across the Finding 6.

Table 6.13
Summary of Codes for Finding 6

Family Code/ Finding	Key Area	Axial Codes/ Structural Themes	Company A	Company B	Company C	Company D
Work experience moderates the supply chain technology adoption toward supply chain operational performance	SCTA — WE — SCOP	Supply Chain Technology Adoption • Use • Usefulness Work Experience Supply Chain Operational Performance • Reliability • Responsiveness • Agility • Costs	○	○	○	▲

Note. ▲ indicates code was experienced by the participant, ○ indicates code was not mentioned by the participant

6.3.10 Summary of Findings

The multiple case studies were reviewed four textile and apparel company's experience in SCM to determine the effects of supply chain capabilities and supply chain technology adoption toward supply chain operational performance. The emerging finding from the multiple case studies revealed that the variable of human support and working experience can be the moderating variables for the model of present study. The study's finding are summarized in Table 6.14.

Table 6.14
Recapitulation of Findings

No.	Key Area	Findings
1.	Supply chain capabilities and supply chain operational performance	Supply chain capabilities were positively related to supply chain operational performance.
2.	Supply chain capabilities and supply chain technology adoption	Supply chain capabilities were positively related to supply chain technology adoption.
3.	Supply chain technology adoption and supply chain operational performance	Supply chain technology adoption was positively related to supply chain operational performance.
4.	The mediating effect of supply chain technology adoption	Supply chain capabilities affect supply chain operational performance indirectly through mediating effect of supply chain technology adoption.
5.	The moderation effect of human support	Human support moderates the supply chain technology adoption towards supply chain operational performance.
6.	The moderation effect of work experience	Work experience moderates the supply chain technology adoption toward supply chain operational performance.

Note. Finding 5 and Finding 6 was emerging findings of the study.

6.4 Chapter Summary

The multiple case studies depicted the importance of triangulation of research findings. This is to provide in-depth understanding of various relationships between variables under study. The findings from the case studies are supported the main research findings of the study. Additionally, the findings from the case study have suggested human support and work experience as moderating variables for the model. It is enhanced and provides further explanation to empirical analysis of survey research findings. The further discussions and conclusion of the study are presented in next chapter.

CHAPTER SEVEN

DISCUSSIONS AND CONCLUSION

7.1 Introduction

This chapter is focused on the discussions and conclusion of the findings of data analysis. This chapter was begun with a recapitulation of the study's findings. The findings of this research are discussed by compared with previous literatures to explain the relationships that were supported and vice versa. The implications of this study which include theoretical implications and practical implications are discussed to provide comprehensive insights on the present trend of SCM. The limitations of the study are presented and recommendations for further research are indicated as well. This chapter and also this study ends with a conclusion of the findings.

7.1.1 Recapitulation of the Study's Findings

The importance of supply chain technology adoption among Malaysian textile and apparel companies has lacked of adequate attention, although this is an opportunity for performance improvement. Even though technology is widely implemented and studied in many industries by researchers, adoption of supply chain technologies in Malaysian textile and apparel industry is limited and indicated a major gap in supply chain performance studies. Furthermore, evolution of supply chain capabilities which

including relational capability, IT capability, and organizational culture capability highlights the importance of supply chain technology adoption in SCM. Hence, the company that disengaged themselves from supply chain technology adoption will lose the competitive advantage.

Based on the discussion on the previous chapter, a recap on problem statements, research questions, research objectives, and a brief summary of the study's findings were provided in Table 7.1 to serve as a reference for further discussion on the research findings.

Table 7.1

Recapitulation of the Study Findings

No.	Problem Statements	Statement of Research Questions	Statement of Research Objectives	Statement of Hypotheses	Remarks
1.	Supply chain capabilities are important to be competitive, and its effects on performance remain much disputable.	What is the relationship of SCCs (RC, ITC, and OCC) on SCOP?	To investigate the relationship of SCCs (RC, ITC, and OCC) on SCOP.	H_1: SCCs are positively related to SCOP. H_{1a}: RC is positively related to SCOP. H_{1b}: ITC is positively related to SCOP. H_{1b}: OCC is positively related to SCOP.	Partially Supported Supported Not Supported Supported
2.	Supply chain capabilities are important to be competitive, and its effects on the adoption of SCT remain much disputable.	What is the relationship of SCCs (RC, ITC, and OCC) on SCTA?	To investigate the relationship of SCCs (RC, ITC, and OCC) on SCTA.	H_2: SCCs are positively related to SCTA. H_{2a}: RC is positively related to SCTA. H_{2b}: ITC is positively related to SCTA. H_{2c}: OCC is positively related to SCTA.	Supported Supported Supported Supported
3.	SCT adoption was not beyond reproach and its effect on performance is remain debatable.	What is the relationship of SCTA on SCOP?	To examine the relationship of SCTA on SCOP.	H_3: SCTA is positively related to SCOP.	Supported
4.	The role of SCT adoption in SCM has not been fully agreed and remain controversial.	Does SCTA mediating the relationship between SCCs (RC, ITC, and OCC) on SCOP?	To analyze the mediating effect of SCTA on the relationship between SCCs (RC, ITC, and OCC) and SCOP.	H_4: SCCs affect SCOP directly and indirectly through SCTA as a mediator variable. H_{4a}: RC affect SCOP directly and indirectly through SCTA as a mediator variable. H_{4b}: ITC affect SCOP directly and indirectly through SCTA as a mediator variable. H_{4c}: OCC affect SCOP directly and indirectly through SCTA as a mediator variable.	Supported Supported Supported Supported
5.	There is still lacked of theoretical support for understanding and explaining the reality or the boundaries of SCM.		To propose a model by examining the mediating effect of SCTA on the relationship between SCCs (RC, ITC, and OCC) and SCOP.		Case study: The moderation effect of human support and work experience on the relationship between SCTA and SCOP.

Note. RO=research objective; H=hypothesis; SCC=supply chain capabilities; RC=relational capability; ITC=IT capability; OCC=organizational culture capability; SCTA=supply chain technology adoption; SCOP=supply chain operational performance

For the first research objective, this study found that relational capability and organizational culture capability are related to supply chain operational performance whereas IT capability is not significant association with supply chain operational performance. The results from statistical tests revealed that two out of three relationships are statistically significant and provided partially support to the first hypothesis.

With reference to the second, third, and fourth research objective, the results from statistical tests revealed that all relationships were statistically significant and fully supported the hypothesis two, hypothesis three, and hypothesis four. Specifically, in regard to the second research objective, this study found that supply chain capabilities which including relational capability, IT capability, and organizational culture capability are related to supply chain technology adoption, while the effect of supply chain technology adoption on the supply chain operational performance is supported hypothesis three. For the fourth research objective, the statistical results supported the hypothesis four which related to the mediating effects of supply chain technology adoption on the relationship between supply chain capabilities and supply chain operational performance. In detail, supply chain technology adoption provided a partial mediating effect to all the relationships in hypothesis four.

Concerning the fifth research objective, the results of empirical analysis and case study supported the research framework of this study. To this end, a total of ten hypotheses were stated and tested, there are nine hypotheses empirically supported and one hypotheses empirically not supported (i.e., H_{1b}). Based on the empirical results obtained, the research model of this study is statistically proved and applicable in SCM research, especially in Malaysian textile and apparel supply chain. However, the

results of case studies revealed that there is two moderations effect within the model. The results of case studies indicated human support and work experience were the moderator in the relationship between supply chain technology adoption and supply chain operational performance. The emerging finding of human support is indicated by the case study of two of the respondent, while work experience is indicated by the case study of one of the respondents.

The following section is discussed with the results obtained from the surveys and interviews, which dwell on whether the results of this study support the hypotheses stated. All hypotheses in this study are discussed based on the justification of previous findings and theories, while insignificant and contradictory findings are discussed with possible reasons and justifications.

7.2   Discussion of Findings

The findings of this study are discussed accordingly to the sequence of research questions, research objectives, and hypotheses. Specifically, the effects of supply chain capabilities, including relational capability, IT capability, and organizational culture capability on supply chain operational performance were discussed in the beginning. This is followed by the discussion about the effect of supply chain capabilities on supply chain technology adoption. The effect of supply chain technology adoption on supply chain operational performance was discussed before the last discussion of findings, which is the mediating effect of supply chain technology adoption in the relationship between supply chain capabilities and supply chain operational performance.

It is interesting to note that in all ten hypotheses of this study nine were supported, and one was not supported. This led to the supply chain capabilities somewhat significantly associated with supply chain operational performance. Furthermore, the findings from the case study supported all the hypotheses of this study and additionally revealed the emerging themes of human support and work experience were the moderator in the relationship of supply chain technology adoption and supply chain operational performance. However, the statistical significance and the model fit are not the ultimate goals in academic research. The primary aim of a researcher is to investigate and discover new relationship of the subject matter. The following sections provide the additional discussion on the empirical findings from surveys and interviews that were statistically and deeply presented in Chapter Five and Chapter Six respectively.

7.2.1 Effects of Supply Chain Capabilities on Supply Chain Operational Performance

In this section, the first research objective of this study was discussed. There is total of three hypotheses tested to answering the first research question. The statistical analysis showed that this hypothesis is partially supported, specifically two sub-hypotheses were supported, while one sub-hypothesis was not supported. In other words, the results indicated that the variance in the supply chain operational performance is explained by some supply chain capabilities. In overall, the findings revealed that the supply chain operational performance of textile and apparel industry can be improved through relational capability and organizational culture capability. IT capability was the only factor that not give any impacts to textile and apparel supply chain operational performance. The following sections provide in-depth discussion on these results.

7.2.1.1 Effects of Relational Capability on Supply Chain Operational Performance

This relationship is statistically significant with *t*-value of 1.469 at 0.10 significance level as shown in Table 5.17. The relational capability has statistically rated with small effect size of 0.024 to supply chain operational performance during effect size (f^2) analysis as shown in Table 5.19. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of positive relationship between relational capability and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Besides, relational capability provides the capability of supplier partnership, customer relationship, information sharing, and information quality to the organization to improve their supply chain reliability, responsiveness, agility, and costs. This in turn generated optimum supply chain operation performance. This finding further provides empirical evidence to support the idea of Sukati et al. (2012), Narasimhan et al. (2008), Ramayah et al. (2008), and Sezen (2008) in which supplier partnership, customer relationship, and information sharing are part of relational capability to enable the organization to expand their supply chain reliability, responsiveness, and agility, which helps to reduce supply chain costs. The most interesting finding was that information quality is one of the most influential dimension in relational capability for textile and apparel company to improve supply chain operational performance. This finding further support the idea of Charkaoui et al. (2012) in which information quality are influend more to the improvement of supply chain operational performance.

With reference to the findings of this study which corroborate the findings of a great deal of the previous work in this field. As mentioned in the literature review, information quality is part of relational capability by Qrunfleh (2010), Narasimhan et al. (2008), and Sezen (2008). Having supplier partnership, customer relationship, information sharing, and information quality is important relational capability to supply chain operation. This finding is in agreement with similar previous studies in Turkey, United States, and Malaysia countries (Li, Ragu-Nathan, et al., 2006; Narasimhan et al., 2008; Qrunfleh, 2010; Kocoglu et al., 2011; Thoo et al., 2011). This also accords with the earlier observations, which showed that relational capability enable textile and apparel company to be rapid respond to customer needs around the world in the quick change market.

In summary, the finding on relational capability that consists of supplier partnership, customer relationship, information sharing, and information quality is positively associated to supply chain operational performance in Malaysia textile and apparel industry. Information quality was the most important dimension for relational capability to explain the variation.

7.2.1.2 Effects of IT Capability on Supply Chain Operational Performance

As discussed earlier in literature review, the original assumption is that IT capability enables the organization to improve their supply chain reliability, responsiveness, agility, and costs. Surprisingly, this relationship is contrary to expectations. This study did not find a statistically significant difference between IT capability and supply chain operational performance as shown in Table 5.17. Based on the results presented in

Chapter Five, this hypothesis is not statistically supported and there is not enough statistical evidence to prove that IT capability affects supply chain operational performance.

However, based on the results of case studies presented in Chapter Six, this hypothesis is supported in which IT capability positively links to supply chain operational performance. This is supported by all company in the case study of this study. Company A points out that IT infrastructures and IT personnel are playing an important role to enable organizations to perform their business operation better. While Company B provides similar responses where, IT knowledge and IT reconfigurability are equally important to enable organizations to have better business operation. These statements are consistently supported and agreed by Company C and Company D. Nevertheless, it may not be generalized since the results from the survey, and case studies are differed.

Although, this result differs from some published studies (Zhang et al., 2007; Zhang & Wang, 2011), but it is broadly consistent with the studies of Chae et al. (2014) and Liu et al., (2013). This could be due to several reasons for this hypothesis not statistically supported, which includes geographical location issues, dissimilar industry, and the respondents might have no adequate experience and sufficient knowledge to answer the questions. These reasons are given since, all the responses from case studies clearly revealed that IT capability had the ability to influence supply chain operational performance.

This hypothesis is generated from similar studies in furniture and fixtures, fabricated metal products, rubber and plastics, electronic and other electric equipment, industrial and commercial machinery, telecommunication, transportation equipment, computer,

software, machinery, chemical, service technologies, food, material, SMEs, and hotel industries (Li, Ragu-Nathan, et al., 2006; Narasimhan et al., 2008; Kocoglu et al., 2011; Thoo et al., 2011; Zhang & Wang, 2011) from USA, China, and Turkey countries (Li, Ragu-Nathan, et al., 2006; Narasimhan et al., 2008; Kocoglu et al., 2011; Zhang & Wang, 2011; Hassan et al., 2013). The different IT capability possessed by different industry and different country may be part of the reason. This may suggest that IT capability possessed by today's textile and apparel industry in Malaysia may not similar as industries or counties referred.

Moreover, it is approximately 83.5% respondents is from other job functions and only limited respondents from IT related department. Based on the responses of Company A and Company D in the case study, this may be part of the reason since, the most of the employees did not realize the important role play by IT department (i.e., IT capability). Thus, effect of IT capability to supply chain operational performance may not be significant. This is an important issue for future research. Further researches and investigations on this subject matter are therefore recommended.

7.2.1.3 Effects of Organizational Culture Capability on Supply Chain Operational Performance

This relationship is statistically significant with *t*-value of 5.182 at 0.01 level of significance as shown in Table 5.17. The organizational culture capability has statistically rated with medium effect size of 0.265 to supply chain operational performance during effect size (f^2) analysis as shown in Table 5.19. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of positive relationship between organizational culture capability and supply

chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

In addition, organizational culture capability provides the capability of involvement, consistency, adaptability, and innovativeness to the organization to improve their supply chain reliability, responsiveness, agility, and costs. Commonly, organizational culture has been noted as a critical factor to enable organizations to improve performance (Baker & Sinkula, 1999; Cohen & Levinthal, 1990; Slater & Narver, 1995). The findings of the study are consistent with Braunscheidel et al. (2010) and Thoo et al. (2011). This finding further provides empirical evidence to support the idea of Katila and Ahuja (2002), Udomleartprasert and Jungthirapanich (2004), Vanichchinchai (2012), and Feng and Wang (2013) in which involvement of employees to work as a team enables organizations to improve performance in supply chain operation. It is interesting to note that in all four direct relationships on the supply chain operational performance of this study, organizational culture capability has been found to be the most influential factor to explain the variation. In other words, textile and apparel company's involvement, consistency, adaptability, and innovativeness possess the highest ability to improve supply chain operational performance in textile and apparel industry.

Following the current business trend, textile and apparel market accentuated the need of low price and fast change fashion. Therefore, the ability to rapidly adapt to quick-change market is necessitated (Cooper, 2010). As mentioned in the literature review, Tukamuhabwa et al. (2011) and Vanichchinchai (2012) pointed out that innovativeness enables organizations to improve their supply chain performance,

specifically, supply chain agility (Omar *et al.*, 2006) and supply chain costs (Collins *et al.*, 2010). Meanwhile, the ability to consistenly provide high quality and innovative products are demanded (Cooper, 2010).

In summary, this finding shows that organizational culture capability is the most influential variable within the supply chain capabilities to improve the supply chain operational performance of textile and apparel industry. In other words, this study also revealed the importance of the dimensions including involvement, consistency, adaptability, and innovativeness in measuring organizational culture capability with the aims to improve supply chain operational performance.

7.2.2 Effects of Supply Chain Capabilities on Supply Chain Technology Adoption

In this section, the second research objective of this study was discussed. There is total of three hypotheses tested to answering the second research question. The statistical analysis showed that all hypotheses under second research objective were fully supported. The following sections provide in-depth discussion on the relationship between supply chain capabilities and supply chain technology adoption.

7.2.2.1 Effects of Relational Capability on Supply Chain Technology Adoption

This relationship is statistically significant with *t*-value of 4.012 at 0.01 level of significance as shown in Table 5.17. The relational capability has statistically rated with small effect size of 0.142 to supply chain technology adoption during effect size

(f^2) analysis as shown in Table 5.19. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of positive relationship between relational capability and supply chain technology adoption. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Furthermore, this finding supports previous research into this brain area, which showed relational capability is critical to enable supply chain technology adoption (Cegielski et al., 2012). This finding is in agreement with empirical evidence reported by Chong et al. (2009) and Kamaruddin and Udin (2009). Specifically, Chong et al. (2009) found that information sharing does help to adopt supply chain technology, while Kamaruddin and Udin (2009) noted that supplier partnership and customer relationship was critical to supply chain technology adoption. Several researchers are agreed with Kamaruddin and Udin (2009) by provided the contribution of supplier partnership on the adoption of supply chain technology (Ngai et al., 2012; Chan & Chong, 2013). This study also provided empirical evidence that information quality was one of the important factors in influencing organizations' decision to adopt supply chain technology. This is further support the idea of Cao et al. (2013) and Hendarty and Nusantara (2014) which showed positive relationship between information quality and supply chain technology adoption. The high quality information should be the right information that obtained from the right person at the right time, while low quality information might cause numerous errors to the supply chain operational performance such as low reliability, low responsiveness, low agility, and high costs.

In Malaysia's textile and apparel industry, relational capability has found to be significantly explain the variation in the supply chain technology adoption. Moreover, it is the most influential factor within the supply chain capabilities to explain the variation.

7.2.2.2 Effects of IT Capability on Supply Chain Technology Adoption

This relationship is statistically significant with t-value of 2.642 at 0.01 level of significance as shown in Table 5.17. The IT capability has statistically rated with small effect size of 0.054 to supply chain technology adoption during effect size (f^2) analysis as shown in Table 5.19. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of positive relationship between IT capability and supply chain technology adoption. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

A strong relationship between IT capability and supply chain technology adoption has been reported in the literature. As mentioned in the literature, IT knowledge has the power to influence the adoption of supply chain technology (Power & Simon, 2004; Lin & Ho, 2009). The results of this study is accords with the earlier observation in the literature, which showed that IT infrastructure (Chau & Tam, 1997; Tan & Teo, 2000; Mustonen-Ollila & Lyytinen, 2003; Khoumbati et al., 2006), IT personnel (Melville et al., 2004; Wade & Hulland, 2004; Ferratt et al., 2005; Khoumbati et al., 2006; Yeh et al., 2014), IT knowledge (Orlikowski, 1993; Zhu et al., 2003; Brown & Fai, 2006; Kozan et al., 2006; Evangelista et al., 2013; Hendarty & Nusantara, 2014),

and IT reconfigurability (Lim & Istook, 2012; Moin et al., 2013) were IT capability of organizations to adopt supply chain technology. This in turn generated the optimal level of supply chain technology adoption.

This finding further revealed that the IT capability was playing an important role to improve supply chain technology adoption in textile and apparel industry. In other words, IT infrastructure, IT personnel, IT knowledge, and IT reconfigurability are contributed to the adoption of supply chain technology adoption. The present finding seems to be consistent with the study of Crinis (2012) which found textile and apparel industry need skilful employees to well function the adopted technology in the modern business environment.

7.2.2.3 Effects of Organizational Culture Capability on Supply Chain Technology Adoption

This relationship is statistically significant with t-value of 1.768 at 0.05 level of significance as shown in Table 5.17. The organizational culture capability has statistically rated with small effect size of 0.042 to supply chain technology adoption during effect size (f^2) analysis as shown in Table 5.19. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of positive relationship between organizational culture capability and supply chain technology adoption. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

The present study seem to be consistent with other research which found organizational culture has the ability to influence technology adoption (Zammuto & O'Connor, 1992; McDermott & Stock, 1999; Abdullah et al., 2013). This finding provides further support to the idea of Tarokh and Soroor (2006) and Haines and Lafleur (2008) in which employee involvement is the most critical factor for an organization to adopt the right supply chain technology. On the other hand, this finding is in agreement with Kwon and Zmud (1987), Agarwal and Prasad (1998), Webb (2008), Chong et al. (2009), and Ghobakhloo and Tang (2013) in which innovativeness is one of the most common factors to influence the organization to adopt supply chain technology. This study also provided empirical evidence that consistency and adaptability are required to achieve successful adoption of supply chain technology (Rogers, 1995; Tsai et al., 2013).

This finding further supported the earlier observations, which showed that organizational culture capability not only contributed to the use of supply chain technology, but also recognized the usefulness of the adopted supply chain technology. Even though innovativeness in textile and apparel industry in crucially important to be competitive in the volatile market place, but in supply chain capabilities wise, consistency was the most important dimension for organizational culture capability to explain the variation in supply chain technology adoption.

7.2.3 Effects of Supply Chain Technology Adoption on Supply Chain Operational Performance

In this section, the third research objective of this study was discussed. There is total of one hypothesis tested to answering the third research question. The statistical analysis supported the third hypothesis of this study. This relationship is statistically significant with t-value of 3.485 at 0.01 level of significance as shown in Table 5.17. The supply chain technology adoption has statistically rated with small effect size of 0.115 to supply chain operational performance during effect size (f^2) analysis as shown in Table 5.19. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of positive relationship between supply chain technology adoption and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

In addition, the influence of technology adoption towards performance is common in current era. Typically, the present study confirms that supply chain technology adoption is associated with supply chain operational performance. This is consistent with previous research, which found that the adoption of supply chain technology enables the organization to improve supply chain reliability, responsiveness, agility, and costs (Thomas & Griffin, 1996; Bingham et al., 2003; Patterson et al., 2003; Kwon & Suh, 2005; Blankley, 2008; Gunasekaran et al., 2008; Vickery et al., 2010; Collins et al., 2010; Dominguez et al., 2010; Tseng et al., 2011; Ismail & Mamat, 2012; Mizar, 2013). The useful of a supply chain technology can be achieved through the right adoption. Blankley (2008) points out that the adoption of right supply chain technology and at the right timing enables the organization to reach optimal supply chain operational performance. However, the influence of supply chain technology adoption

on the supply chain operational performance is not equally (Fasanghari, 2008). It may effective in one company, but nominal in another company. Therefore, it is important for organization to make informed decisions while adopting the technology, otherwise, the result can be absolutely negative (Singh, 2003; Fantazy et al., 2009; Dietrich & Cudney, 2011).

In consistent with the study of Wang and Zhang (2009), the present finding is particularly valuable to textile and apparel industry. Furthermore, this finding also is in agreement with Lim and Istook (2012) findings, which showed textile and apparel industry extensively utilized the supply chain technology in supply chain activities from the raw materials acquirement to delivery of the final products. The improvement of the supply chain operational performance is achieved through the simplification of textile and apparel supply chain management with the aid of supply chain technology adoption. This seems to be consistent with the study of Hu (2011) which showed the efficiency and effectiveness of CAD, CAM, CIM, and CAT in textile and apparel business operations. Besides, this finding also relevance to the textile and apparel industry in Vietnam, Hong Kong, and US (Thomas & Griffin, 1996; Wang & Zhang, 2009; Chow et al., 2010; Tseng et al., 2011). The findings of those studies further revealed that the failure of adopt the right supply chain technology would be defeated in the supply chain operational performance and further lose competitiveness in current textile and apparel industry.

In summary, the finding on supply chain technology adoption that consist of use and usefulness of supply chain technology is positively associated to supply chain operational performance in Malaysia's textile and apparel industry. Besides, the usefulness is the most important dimension for supply chain technology adoption to

explain the variation in the supply chain operational performance. This finding further revealed that the combination of supply chain technology use and usefulness in measuring supply chain technology adoption is significant to improve the supply chain operational performance of textile and apparel industry.

7.2.4 Mediating Effects of Supply Chain Technology Adoption

In this section, the fourth research objective of this study was discussed. There is total of three hypotheses tested to answering the fourth research question. The statistical analysis showed that all hypotheses under fourth research objective were fully supported. Specifically, this study found three mediating effects of supply chain technology adoption in the relationship between supply chain capabilities and supply chain operational performance. First, supply chain technology adoption mediates the relationship between relational capability and supply chain operational performance. Second, supply chain technology adoption mediates the relationship between IT capability and supply chain operational performance. Third, supply chain technology adoption mediates the relationship between organizational culture capability and supply chain operational performance. This findings revealed that the role of supply chain technology adoption in textile and apparel industry will be therefore be even more important than ever before. The following sections provide an in-depth discussion on these results.

7.2.4.1 Significant Mediation Effects in the Relationship between Relational Capability and Supply Chain Operational Performance

This relationship is statistically significant with *t*-value of 3.888 at 0.01 level of significance as shown in Table 5.22. The supply chain technology adoption has statistically rated with partial mediation of 0.335 variance accounted for in the relationship between relational capability and supply chain operational performance as shown in Table 5.23. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of mediating effect of supply chain technology adoption in the relationship between relational capability and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Prior researchers have revealed the importance of supply chain technology as a mediator in the relationship between relational capability and supply chain operational performance (Lin et al., 2002; Lin, 2008). The current study found that supply chain technology adoption mediates the level of relational capability towards supply chain operational performance. The finding is consistent with the previous research which indicated that supply chain technology is acted as a nerve system or facilitator for the supply chain members to share quality's information on various value added activities along the supply chain (Omar et al., 2006; Lee et al., 2009; Wei et al., 2009; Javanmardi et al., 2012). In this way, it is not only enable the organization to increase the operational performance of the supply chain, but also enable the organization to achieve and remain competitive in the particular industry (Christopher, 2000; Boon-itt, 2009). However, different SCM practices required different supply chain

technology applications (Qrunfleh, 2010) to optimal the benefits (Tavassoli et al., 2009) and minimal the risk of the supply chain operation (Zhang & Wang, 2011).

7.2.4.2 Significant Mediation Effects in the Relationship between IT Capability and Supply Chain Operational Performance

This relationship is statistically significant with *t*-value of 2.696 at 0.01 level of significance as shown in Table 5.22. The supply chain technology adoption has statistically rated with partial mediation of 0.330 variance accounted for in the relationship between IT capability and supply chain operational performance as shown in Table 5.23. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of mediating effect of supply chain technology adoption in the relationship between IT capability and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Moreover, it is interesting to note that the finding of this study in which supply chain technology adoption mediates the level of IT capability towards supply chain operational performance. The present finding is consistent with the previous research, which showed the links between IT infrastructure as a part of IT capability and supply chain performance is mediated by supply chain technology such as SRM and CRM system (Udomleartprasert & Jungthirapanich, 2004). As aforementioned discussions, the finding further support the idea of several researchers, where IT capability has the ability to influence supply chain technology adoption (Khoumbati et al., 2006; Moin et al., 2013; Hendarty & Nusantara, 2014; Yeh et al., 2014) and further influence to

supply chain performance (Tseng et al., 2011; Ismail & Mamat, 2012; Mizar, 2013). This indirectly showed that IT capability of this study has certains power in influencing the organizations to adopt supply chain technology for the purpose of the performance improvement.

7.2.4.3 Significant Mediation Effects in the Relationship between Organizational Culture Capability and Supply Chain Operational Performance

This relationship is statistically significant with *t*-value of 1.732 at 0.10 level of significance as shown in Table 5.22. The supply chain technology adoption has statistically rated with partial mediation of 0.248 variance accounted for in the relationship between organizational culture capability and supply chain operational performance as shown in Table 5.23. Based on the results presented in Chapter Five and Chapter Six, it can empirically be concluded the existence of mediating effect of supply chain technology adoption in the relationship between organizational culture capability and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Additionally, the results of this study indicate that supply chain technology adoption mediates the level of organizational culture capability towards supply chain operational performance. This finding further support the idea of several researchers where organizational culture has the ability to influence supply chain technology adoption (Braunscheidel et al., 2010; Lai & Yusof, 2011; Lin, 2008; Zhang & Tansuhaj, 2007) and further influence to supply chain performance (Braunscheidel et al., 2010;

Thoo et al., 2011). Indirectly, this relation has shown the mediating effect of supply chain technology adoption on organizational culture capability towards supply chain operational performance.

7.2.5   Emerging Themes from Case Study

In this section, the most interesting finding of two moderating variables emerged from the case study were discussed. There are two companies suggested human support as a moderator, while a company suggested work experience as an another moderator. The following sections provide in-depth discussion on the moderating effect of human support and work experience in the relationship between supply chain technology adoption and supply chain operational performance.

7.2.5.1   Moderating Effect of Human Support

Based on the results presented in Chapter Six, it can empirically be concluded the existence of moderating effect of human support in the relationship between supply chain technology adoption and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Through the case study interviews to the subject matter, the researcher found that human support is an important factor that moderates the relationship of supply chain technology adoption to supply chain operational performance. This is supported by the case study from Company A and Company C. Company A explained the case in

general with real practices, where the system accuracy is depended to worker to provide and maintains the precision information between system and physical figure such as physical stock count. Company C has an unanimous practice towards the experience of Company A. Company C further explains that follow the standard operation procedure of the system improved the use and the useful of particular system and thus enhance the operation performance of supply chain. In textile and apparel retail, the shop manager acted as an important role to moderate the supply chain technology adoption towards supply chain operational performance.

7.2.5.2 Moderating Effect of Work Experience

Based on the results presented in Chapter Six, it can empirically be concluded the existence of moderating effect of work experience in the relationship between supply chain technology adoption and supply chain operational performance. The finding of this study contributed and strengthened previous theories and conceptual models, especially in the context of Malaysia's textile and apparel industry.

Through the case study interviews to the subject matter, the researcher found that work experience is an important factor that moderates the relationship of supply chain technology adoption to supply chain operational performance. This is supported by the case study from Company D and explained with the real circumstance of the company. The result of case studies shown that the younger generations are more exposed to new technology, while some of the experience workers are refused to learn and refused to change. This circumstance exists because of the fact of working experience. In short, the case can be understood as the higher the working experience, the lower the use and

the usefulness of supply chain technology adoption in improving supply chain operational performance. This is supported by the recent study of Hendarty and Nusantara (2014) in a chocolate firm. With the experience of ERP adoption since 1999, the firm's CEO revealed that it is difficult to get employees to change their working style to allow the system function properly.

7.3   Implications of the Study

The combinations of findings of this study were contributed to the current body of knowledge pertaining to the supply chain operational performance. The contributions can be generally divided into two important implications, which is theoretical implications (i.e., academic implications) and practical implications (i.e., managerial implications). Specifically, theoretical implications can be viewed from three aspects, which are empirical implications, conceptual implications, and methodological implications. From the academia perspective, the implications of this study would add value to the current body of knowledge in the subject matter. From the organization perspective, the effect of supply chain capabilities and supply chain technology adoption towards supply chain operational performance as indicated by survey results and supported by the multiple case study results are imperative to textile and apparel companies who pursue supply chain capabilities and supply chain technology adoption as capability to achieve better operational performance. These implications of the study are presented in the following sections.

7.3.1 Theoretical Implications

In general, theoretical implications also known as academic implications and it can be viewed from three aspects, which are empirical implications, conceptual implications, and methodological implications. The further discussions of these implications are presented in the following sub-sections.

7.3.1.1 Empirical Implications

This study is a consolidation of past empirical studies to develop the conceptual research framework on relational capability (Lin et al., 2002; Li, Ragu-Nathan, et al., 2006; Lee, Kwon, et al., 2007; Sezen, 2008; Narasimhan et al., 2008; Lee et al., 2009; Campo et al., 2010; Ramayah & Omar, 2010; Qrunfleh, 2010; Quah, 2010; Gilaninia et al., 2011; Thoo et al., 2011; Kocoglu et al., 2011), IT capability (Broadbent & Weill, 1997; Broadbent et al., 1999; Byrd & Turner, 2000; Masselos et al., 2002; Bryd & Davidson, 2003; Shannon & Chow, 2004; Ravichandran & Lertwongsatien, 2005; Lu, 2006; Jain, 2007; Tsai, 2010; Agan, 2011; Lu & Ramamurthy, 2011; Ismail & Mamat, 2012), organizational culture capability (Etzioni, 1975; Glaser & Zamanou, 1987; O'Reilly et al., 1991; Denison & Mishra, 1995; Fey & Denison, 2003; Udomleartprasert & Jungthirapanich, 2004; Fynes et al., 2005; Xiao, 2008; Robeson, 2009; Li et al., 2011; Ozkaya, 2011; Ismail & Mamat, 2012), supply chain technology adoption (Lin et al., 2002; Neeley, 2006; Slone, 2006; Ramayah et al., 2008; Kamaruddin & Udin, 2009; Niu, 2010; Ho et al., 2011; Charkaoui et al., 2012), and supply chain operational performance (Fynes et al., 2005; Lin et al., 2005; Tarokh & Soroor, 2006; Wang & Wei, 2007; Daley, 2008; Sezen, 2008; Gunasekaran et al., 2008;

Betts & Tadisina, 2009; Qrunfleh, 2010; Quah, 2010; Kim, 2010; Liu, 2011; Ho et al., 2011; Kocoglu et al., 2011; Lee, 2011; Vanichchinchai, 2012; Gligor & Holcomb, 2012b).

Although there are past researched on the supply chain capabilities, supply chain technology adoption, and supply chain operational performance to develop the scales and relationship of certain dimensions, this study developed a comprehensive measurement model for supply chain technology adoption which consists of use and usefulness. Consequently, the empirical study has significant contributions to the body of knowledge where supply chain capabilities, including relational capability, IT capability, and organizational culture capability through supply chain technology adoption improved supply chain operational performance.

From the field of study, this study has contributed to academic knowledge in which the findings of empirical evidence have strengthened the research framework. This study also confirming the path relations of the model that is provides some first evidence of factors that are important and should be taken into consideration by future researchers when developing conceptual frameworks that includes constructs such as relational capability, IT capability, organizational culture capability, supply chain technology adoption, or supply chain operational performance. Since most of the previous studies were conducted in various countries and industry, the empirical evidence of this study was obtained from Malaysia's textile and apparel industry. Therefore, the research model of this study can be replicated and tested on other countries or other industries such as electrical and electronic (E&E), fast moving consumer goods (FMCG), or automotive industry as well. As a foundation and insights,

this study could well be beneficial or guidance for future researchers who are interested in SCM research.

7.3.1.2   Conceptual Implications

This study is consistent to SCM theories on "Resource Based View", "Diffusion of Innovation", and "Technology-Organization-Environment model". The culmination of these theories is referred to the ability of firms to build, integrate, reconfigure, and apply relational assets, internal and external competence, heterogeneous resources, and capabilities (Wernerfelt, 1984, 1995; Grant, 1991; Peteraf, 1993; Barney, 2001; Halldorsson et al., 2007) through organizational innovativeness (Rogers, 1995), technological innovation (Tornatzky & Fleischer, 1990), and reciprocated interactions (Halldorsson et al., 2007) to address quick-change markets and meet new challenges to help firm to continually improved and shaped the performance to gained competitive advantages and further transform the short run competitive advantage into a sustained competitive advantage (Teece, Pisano, & Shuen, 1997).

In this study, the combination of these theories provoked contemporary thinking where the relationship between supply chain capabilities, including relational capability, IT capability, and organizational culture capability must be addressed through supply chain technology adoption to get better supply chain operational performance. To the body of knowledge, this study has significantly reinforced these theories by showing the comprehensive framework.

7.3.1.3 Methodological Implications

The survey instrument of this study captures five imperative elements, which include relational capability, IT capability, organizational culture capability, supply chain technology adoption, and supply chain operational performance. The completed instrument was demonstrated validity and reliability and rigorously tested through a range of statistical analyses. The results proof that there is two keys contribution from this study, which are the combined dimensions of the three supply chain capabilities and the two new merged dimensions of use and usefulness of the supply chain technology adoption. Most of the previous study measured supply chain technology adoption as a whole and only single dimension. These deal provides the world of SCM a new and different perspective. Therefore, future researchers on the related field can leverage these measurement tools to develop a better theoretical framework for their studies.

Additionally, in SCM researches, most of the previous study conducted the research quantitatively and thus, investigated only the relationship and the impact on supply chain performance. Hence, most of the studies only able answer to "what" questions such as what is the relationship and what is the impact towards the supply chain performance. However, the used of exploratory methodology through multiple case study analysis can be triangulated to provide answer to "why" or "how" questions (Yin, 2003). The triangulation of research findings contributed to the existing body of knowledge through in-depth explains, interpret, understand, and triangulate the results obtained from quantitative analysis (Creswell & Plano-Clack, 2011). Such method provides the world of SCM a new and different method to validate the findings from survey research. Consequently, future researchers on the related field can apply the

same method of this research in conducting their research in order to get stronger justification on the research findings. The researcher believes that this could be an expansive and broad new method for future research.

Furthermore, to the best of the researcher's knowledge, most of the previous studies on supply chain performance used traditional analytical techniques such as SPSS, AMOS, etc. There is relatively a handful studies used different analytical techniques. However, this study used SmartPLS 2.0 M3 as the main analytical tool to tests the hypothesized relationships among constructs. Several data features such as predicting ability, model complexity, small sample size, data are non-normally distributed, and uses of different scale types are among the most common listed reasons for using PLS-SEM (Henseler et al., 2009; Hair et al., 2012). Based on the rational on the discussion concerns therefore, the PLS-SEM was demonstrated and it is the best choice for hypothesis testing to get the optimum results for the study.

7.3.2   Practical Implications

In addition to the theoretical contributions as aforementioned, this study offers various practical implications also known as managerial implications for practitioners. The findings of this study have contributed to management practice in three major ways, including (1) revealed the importance of relational capability, IT capability, and organizational culture capability as significant supply chain capabilities; (2) revealed the importance of supply chain technology adoption as a significant reciprocated interactions tool; and (3) revealed the importance of supply chain technology adoption as a significant mediating variable on the relationship between supply chain capabilities and supply chain operational performance.

The findings of this study provide evidence that most of the organization focus on supply chain capabilities and the adoption of supply chain technology to improve supply chain performance. The results shown that approximately 90% of the responding companies have concerned on supply chain operational performance, while approximately 75% and 90% of the responding companies have used and felt useful toward the adoption of supply chain technology on SCM. In addition, approximately 90% of the responding companies shown a great extent towards their companies' supply chain capabilities. The findings offer insight into companies, especially in the textile and apparel industry with the notion of leveraging supply chain capabilities and supply chain technology adoption in their businesses has positive relationship to operation performance.

Apart from presenting statistical evidence, the empirical findings of this study have culminations the conceptual model into a comprehensive framework. The comprehensive framework demonstrates the importance of supply chain capabilities and the adoption of supply chain technology in improving supply chain operational performance. Since most of the companies or industrial practitioners lack of comprehensive understanding on the evaluation of SCM, the research framework of this study is provided for the industrial practitioners as a managerial tool to evaluate their supply chain operational performance. Furthermore, the research framework can be used by the industrial practitioners as a managerial guidance to achieve business goals.

In addition, interviewees not only pointed out that increasing use of supply chain technology might lead to an enhancement in the supply chain operational performance. Particularly, in current business environment, the use and the useful of supply chain

technology acted as a mediator which mediate the relationship between supply chain capabilities and supply chain operational performance. For instance, the researcher received astonishment response from the participants of case study interview which consist of four different type of business companies in Malaysia textile and apparel industry, they consistently pointed out "*if the supply chain technology cannot function in one day, our business operation also cannot function*". Following this perspective, it could be concluded that most of the companies perceived the importance of supply chain technology adoption as well as the mediating effect in business operation. Consequently, practitioners are advised to keep track of the adoption of the supply chain technology or their main competitors. More importance, referring to the fact that the adoption of supply chain technology acted as a mediator in most cases, practitioners are advised to address SCM through the adoption of the right supply chain technology.

Finally, referring to the fact, there is possibly increased in the adoption of supply chain technology, demand for consultancy work on supply chain technology might substantially increase. Thus, the service providers or the products developers of supply chain technology are advised to consider about including the aspect of supply chain capabilities. However, the service providers or the products developers must build up sufficient up to date expertise on particular supply chain technology in order to effectively respond to users' future demands.

7.4   Limitations of the Study

Despite the research presents insightful findings and contributed to both theoretical and practical evidences, but there are some limitations need to be addressed. The limitations are predominantly in respect of methodology and generalizability of the study. Such limitations mostly are caused by time and money constraints. The key limitations of the study are presented in the following sections.

7.4.1   Methodology Limitations

In the early stages of this study, it is clear that the freshness of the research topic of supply chain technology adoption was a critical aspect in SCM context. The extensive literature review revealed that there is no common definition of supply chain technology is universally accepted and thus, no appropriate and strong measurement scales were available. As a consequence of the limited study of supply chain technology adoption, this study might show some shortages. Nonetheless, based on the identified potential of supply chain technology adoption in the current business world, the researcher decided to admit this limitation and to pursue the research with the intention to add knowledge for academicians and practitioners.

In this study, time horizon is one of the methodological limitations. This is because part of this study involves the observation of the use and the usefulness of supply chain technology adoption and the effects on supply chain operational performance. Based on the rational judgment, this research is preferably longitudinal rather than cross-sectional study. The inappropriate time horizon design may affect scientific rigors of

the study and thus, led to certain risk of the findings in which not providing sufficient insight into the cause and effect relationship being analyzed.

In contrast to many other studies at individual consumer level, this study has limitations in small sample size since collect data at an organizational level. It is a nature of Malaysian textile and apparel industry. Particularly, the data from organizational level is generally difficult in obtaining response and thus low response rate. In order to overcome this limitation, the researcher employed PLS-SEM instead of traditional CB-SEM in data analyses. Since, PLS-SEM has been broadly recognized able to produce reliable results for small sample sizes (Lee, 2001; Haenlein & Kaplan, 2004; Tenenhaus et al., 2005; Deal, 2006; Hsu, Chen, & Hsieh, 2006; Ringle et al., 2006; Henseler et al., 2009; Hair et al., 2011; Hair, Hult, et al., 2014). Further justification was provided in Chapter Four of this study.

In addition, the targeted respondents are primarily managers and above position in the area that related to supply chain. This is to get the right person that well-versed in the SCM. In fact, this could be a limitation because not all the company in textile and apparel industry recognizes SCM, especially the small and medium sized enterprises. As shown in the results, approximately 43% of participated companies were small and medium sized. Moreover, the targeted respondents that held manager position or higher were 45.5% in response, while held executive position or lower were 54.5%. This means that a part of participants were not the targeted respondents and normally not recommended. However, based on their working experience in the particular position that closely related to SCM, was considered the best and therefore employed.

7.4.2 Generalizability Limitations

As discussed in the scope of the study, this study was undertaken only textile and apparel industry in Malaysia. Therefore, the generalization for any other industries is not feasible and the findings may not be applicable in other countries in the world as well. Moreover, the findings can only indicate how respondents in the respective company perceive the relational capability, IT capability, organizational culture capability, supply chain technology adoption, and supply chain operational performance within the context of the company. It is contingent upon the condition at that point of time in the company. Hence, almost impossible to make generalization.

7.5 Recommendations for Future Study

Based on the results of triangulation of research findings, suggestions for moderating effect on the relationship between supply chain technology adoption and supply chain operational performance has been provided. As a recommendation, future study can investigate the human support and work experience as moderating variables between supply chain technology adoption and supply chain operational performance. The recommendation is revealed from the multiple case studies. The semi-structured interview results revealed that human support and work experience are potential moderating variables for the relationship between supply chain technology adoption and supply chain operational performance.

The triangulation of research findings of this study indirectly revealed the importance of mixed method research design in doing research. As second recommendation for future study, the researcher may employ mixed method research design in

investigating the supply chain performance in Malaysian textile and apparel industry. The recommendation is provided based on the needs of current context, since there is still limited study employed mixed method research design in Malaysia's textile and apparel industry. This is because the mixed method research design can provide better understanding on the particular issue by using the strengths of one method to overcome the weaknesses of the other method in order to provide stronger justification.

This is a primary study that looking to total supply chain, which is internal and external supply chain processes on textile and apparel industry. This means that this study looking for the total supply chain that contains of supplier, manufacturer, distributor, service provider, wholesaler, retailer, and customer in textile and apparel industry. As third recommendation for future study, the future researchers can narrow the focus on a particular internal supply chain to get deeper information on how supply chain capabilities and supply chain technology adoption contribute to financial performance of a company. This is suggested based on the interest of real business world, since the practitioners are more excited in financial performance in nature.

Last and most importantly, as stated in generalizability limitation of this study, future researches in other industries and different countries would be advisable. This is to increase the conceptualizations, measurement scales, and generalizability of the findings. Even though, a replication of this study would further advance the knowledge on this subject matter, since the model of the study is considered as fresh in the research context. However, more research on this topic needs to be undertaken.

7.6   Conclusion

In today's business environment, the competition is no longer between firms, but between supply chains. The nature of business competition growing the focused on supply chain performance. This practice accentuated the need of supply chain technology adoption to facilitate SCM. To provide a competitive model for current business environment, this study examined the relationship of supply chain capabilities, namely relational capability, information technology capability, and organizational culture capability on supply chain operational performance. This study further investigates whether supply chain technology adoption mediates the relationship between supply chain capabilities and supply chain operational performance. Certainly have no benefits happens instantaneously. The potential benefits can be realized only if the interrelationships between supply chain capabilities are aligned to use and usefulness of supply chain technology adoption.

Quantitative findings with triangulation of research findings offer considerable empirical support for the model under study. Three out of four main research hypotheses have been fully supported, while one research hypothesis has been partial supported. The empirical findings of this study recognized the contribution of relational capability, organizational culture capability, and supply chain technology adoption towards supply chain operational performance. IT capability was the only factor that is not given any relationship to supply chain operational performance. The empirical findings further revealed that supply chain technology adoption appreciated the contribution of supply chain capabilities. In addition to the empirical findings, the mediating effect of supply chain technology adoption successfully contributed to the relationships of supply chain capabilities and supply chain operational performance.

The final model has been agreed by the industry experts with the suggestion of two emerging terms, namely human support and work experience as moderators for future study on the model. These findings are expected to supports Malaysia textile and apparel organizations to continuously invest or reengineer key strategies with internal and external supply chain members.

Consequently, this study has contributed to the literature of SCM through its adoption of resource based view theory, diffusion of innovation theory, and technology-organization-environment theory simultaneously. This in turn suggests useful improvement strategies for Malaysia textile and apparel organization. However, some limitations of this study were identified and recommendations for future study were discussed to extent the knowledge of the model under study in the near future.

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