

INFORMATION SHARING ALONG SUPPLY
CHAIN IN MALAYSIAN MANUFACTURING
COMPANIES

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**INFORMATION SHARING ALONG SUPPLY
CHAIN IN MALAYSIAN MANUFACTURING
COMPANIES**

by

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DEDICATION

I dedicate my humble effort to

My Parents

for their encouragement, support, and
wisdom over many years.

Thank you

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In the name of God, the Most Gracious, the Most Merciful

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TABLE OF CONTENTS

ACKNOWLEDGEMENT	ii
LIST OF TABLES	ix
LIST OF FIGURES	xi
LIST OF APPENDICES	xii
ABSTRAK	xiii
ABSTRACT	xv
CHAPTER 1	1
1.0 Introduction	1
1.1 Background of the Study	3
1.1.1 The Importance of Supply Chain Management (SCM)	3
1.1.2 The Importance of Information Sharing in Supply Chain Management	5
1.1.3 Malaysia in Context	7
1.2 Research Problem	10
1.3 Research Objectives	14
1.4 Research Questions	15
1.5 Scope of the Study	15
1.6 Significance of the Study	16
1.7 Theoretical Contributions	17
1.8 Practical Implications	19

1.9	Definitions of Key Terms	20
1.10	Summary of the Chapter	22
CHAPTER 2		23
2.0	Introduction	23
2.1	Theoretical Background	23
2.1.1	Resource Based View (RBV)	24
2.1.2	Relational View an Extension of RBV	26
2.1.3	Knowledge-Based View an Extension of RBV	28
2.1.4	Linking of RBV, Relational View, and KBV in the Research Framework	29
2.2	Information Quality	29
2.3	Information Technology (IT)	31
2.4	Information Security	33
2.5	Information Sharing	35
2.6	Supply Chain Performance	39
2.7	Information Security Culture (ISC)	41
2.8	Information Security Technology	42
2.9	Information Leakage	43
2.10	Control Variable	45
2.11	Literature Gaps	45
2.12	Theoretical Framework	48
2.13	Hypothesis Development	54

2.13.1	Information Quality and Information Sharing	54
2.13.2	Information Technology and Information Sharing	55
2.13.3	Information Security and Information Sharing	56
2.13.4	Information Sharing and Supply Chain Performance	57
2.13.5	Information Security Culture as a Moderator between Information Security and Information Sharing	59
2.13.6	Information Security Technology as a Moderator between Information Technology and Information Sharing	61
2.13.7	Information Leakage as a Moderator between Information Sharing and Supply Chain Performance	62
2.14	Summary of the Chapter	64
CHAPTER 3		65
3.0	Introduction	65
3.1	Justification of Choosing Positivism Paradigm for This Research	65
3.2	Research Design	68
3.2.1	Population, Sample Design, and Unit of Analysis	68
3.3	Measurement of the Variable	71
3.4	Data Collection	72
3.4.1	The Ethics of Data Collection	74
3.5	Preliminary Analysis	75
3.5.1	Missing Value, Unengaged Responses, and Outliers	75
3.5.2	Common Method Bias (CMB)	76

3.6	Statistical Analysis Technique	76
3.6.1	Justification in Selecting PLS-SEM	78
3.6.2	Reflective versus Formative Indicators	81
3.7	Evaluation of PLS Path Model Results	82
3.7.1	Measurement Model (Outer Model)	82
3.7.2	Structural Model (Inner Model)	84
3.7.3	Collinearity Assessment among the Constructs	84
3.7.4	Structural Model Path Coefficients	84
3.7.5	Coefficient of Determination (R^2 value)	85
3.7.6	Effect Size f^2	86
3.7.7	Predictive Relevance Q^2 and Blindfolding	86
3.8	Testing Moderating Effect in PLS	88
3.9	Summary of the Chapter	89
	CHAPTER 4	90
4.0	Introduction	90
4.1	Sample Descriptive Statistics	90
4.2	Data Distribution	93
4.3	Control Variable	94
4.4	Preliminary Analysis	95
4.4.1	Missing Value, Unengaged Responses, and Outliers	95
4.4.2	Pilot Testing	95
4.4.3	Common Method Bias (CMB)	96

4.5	Measurement Model (Outer Model)	97
4.5.1	Construct Validity and Reliability	97
4.5.2	Discriminant Validity	98
4.6	Structural Model (Inner model)	101
4.6.1	Collinearity Assessment	101
4.6.2	Structural Model Path Coefficients	102
4.6.3	Coefficient of Determination (R^2 Value)	102
4.6.4	Hypothesis Testing (Test of Direct Effect)	105
4.6.5	Hypothesis Testing (Moderating Effect)	105
4.6.6	Effect Size f^2	109
4.6.7	Predictive Relevance Q^2 and Blindfolding	110
4.6.8	The PLS-SEM Importance-Performance Matrix Analysis (IPMA)	111
4.7	Summary of the Chapter	113
CHAPTER 5		115
5.0	Introduction	115
5.1	Recapitulation and Summary of Findings	115
5.2	Discussion of Findings on Direct Relationships	120
5.2.1	The Relationship between Information Quality and Information Sharing	120
5.2.2	The Relationship between Information Technology and Information Sharing	121

5.2.3	The Relationship between Information Security and Information Sharing	122
5.2.4	The Relationship between Information Sharing and Supply Chain Performance	123
5.3	Discussion of Findings on Moderation	124
5.3.1	The Moderating Role of Information Security Culture between Information Security and Information Sharing	125
5.3.2	The Moderating Role of Information Security Technology between Information Technology and Information Sharing	126
5.3.3	The Moderating Role of Information Leakage between Information Sharing and Supply Chain Performance	127
5.4	Theoretical Implications	129
5.5	Practical Implications	130
5.5.1	Information Quality, Information Technology, and Information Security	131
5.5.2	Information Security Culture, Information Security Technology, and Information Leakage	132
5.5.3	Information Sharing and Supply Chain Performance	134
5.6	Limitations and Direction for Future Studies	135
5.7	Concluding Remarks	137
	REFERENCES	139

APPENDICES

LIST OF TABLES

	Page
Table 2.1	Summary of definition for the term “Information Sharing”. 35
Table 2.2	Summary of information types and their effects on supply chain performance 39
Table 2.3	Selected studies on supply chain security, supply chain information system, and supply chain performance. 51
Table 3.1	Summary of three major research paradigms. 67
Table 3.2	Summary of Questionnaire Constructs 72
Table 3.3	Rules of Thumb for Choosing between PLS-SEM and CB-SEM 80
Table 3.4	Assessing Reflective Measurement Models. 83
Table 3.5	Summaries of Validity Guidelines for Assessing Reflective Structural Model 87
Table 4.1	Respondents’ Background Information 91
Table 4.2	Descriptive Analysis 93
Table 4.3	Skewness and Kurtosis 94
Table 4.4	Summary of Results for Control Variable 95
Table 4.5	Summary of Construct Validity and Reliability 98
Table 4.6	Discriminant Validity of Construct – Fornell-larcker Criterion 100
Table 4.7	Heterotrait-Monotrait Ratio (HTMT) 100
Table 4.8	Collinearity Assessment 101
Table 4.9	Hypothesis testing 105
Table 4.10	Hypothesis testing (Moderating effect) 106
Table 4.11	Effect Sizes (f^2) of the Latent Variables 109
Table 4.12	Predictive Relevance Q^2 110

Table 4.13	Index Values and Total Effects for the Information Sharing	112
Table 4.14	Summary of Hypotheses Testing	114

LIST OF FIGURES

	Page	
Figure 1.1	Malaysia's Exports by Main Sectors, 2016	9
Figure 2.1	Literature Gaps	48
Figure 2.2	Research Framework	50
Figure 4.1	Measurement Model Framework	104
Figure 4.2	Information Security Culture (ISC) two-way interaction effects	107
Figure 4.3	Information Leakage (IL) two-way interaction effects	107
Figure 4.4	Results of Structural Model	108
Figure 4.5	IPMA Representation of Information Sharing (IFSH)	113

LIST OF APPENDICES

- APPENDIX A: Questionnaire
- APPENDIX B: Common Method Bias (CMB)
- APPENDIX C: Cross Loadings
- APPENDIX D: HTMT Inference
- APPENDIX E: Construct Cross Validated Redundancy (Q^2)
- APPENDIX F: Boxplot

PERKONGSIAN MAKLUMAT DISEPANJANG RANTAIAN BEKALAN

SYARIKAT PEMBUATAN DI MALAYSIA

ABSTRAK

Perkongsian maklumat di antara rakan kongsi rantaian bekalan adalah penubuhan utama untuk mengeratkan koordinasi dan kerjasama dalam meningkatkan pengurusan pelaksanaan rantaian bekalan dan dalam menguruskan aliran maklumat bagi proses rantaian bekalan. Walaubagaimanapun, kebanyakan firma masih enggan untuk berkongsi maklumat dengan rakan kongsi rantaian bekalan. Dengan ini, kajian ini mengkaji kepentingan perkongsian maklumat dalam konteks syarikat pembuatan di Malaysia dan bagaimana perkongsian maklumat dapat meningkatkan prestasi rantaian bekalan. Kajian ini juga menyiasat hubungan antara kualiti maklumat, teknologi maklumat, keselamatan maklumat dan perkongsian maklumat terhadap rantaian bekalan. Di samping itu, ia juga mengkaji bagaimana budaya keselamatan maklumat disederhanakan oleh perhubungan antara keselamatan maklumat dan perkongsian maklumat. Selain itu, kajian ini menyiasat kesan penyerderhanaan teknologi keselamatan maklumat terhadap perhubungan diantara teknologi maklumat dan perkongsian maklumat. Tambahan pula, kajian ini mengkaji bagaimana kebocoran maklumat disederhanakan oleh perhubungan diantara perkongsian maklumat dan prestasi rantaian bekalan. Teori RBV diaplikasikan dalam model kajian bagi menyokong perhubungan diantara kualiti maklumat, teknologi maklumat, dan keselamatan maklumat sebagai sumber untuk bekalan rantaian kepada perkongsian maklumat iaitu keupayaan. Tambahan lagi, RBV menyokong perhubungan diantara perkongsian maklumat sebagai keupayaan kepada prestasi rantaian bekalan sebagai kelebihan daya saing. Data sebanyak 238 dari syarikat berjaya dikumpul melalui

borang soal selidik yang telah dibina berdasarkan tinjauan kajian yang berkaitan. Data yang dikumpul dianalisis menggunakan model persamaan struktur SmartPLS versi 3.2. Penemuan kajian mendapati bahawa kualiti maklumat, teknologi maklumat, dan keselamatan teknologi mempunyai kesan signifikan terhadap perkongsian maklumat. Bagi hubungan antara perkongsian maklumat dan prestasi rantaian bekalan, kajian ini mendapati perkongsian maklumat mempunyai kesan signifikan keatas prestasi rantaian bekalan. Keputusan menunjukkan bahawa budaya keselamatan maklumat mempunyai penyederhanaan positif terhadap perhubungan diantara keselamatan maklumat dan perkongsian maklumat. Manakala, teknologi keselamatan maklumat tidak mempunyai perhubungan penyederhanaan diantara teknologi maklumat dan perkongsian maklumat. Tambahan pula, kajian ini mendapati kebocoran maklumat mempunyai penyederhanaan negatif terhadap perhubungan diantara perkongsian maklumat dan prestasi rantaian bekalan. Dari sudut pandangan pengurusan, penemuan kajian ini mendapati kepentingan pemahaman dan mempertimbangan konteks rantaian bekalan dalam membuat keputusan dan memulakan aktiviti perkongsian maklumat. Kajian ini mempunyai kepentingan implikasi kepada pengamal, terutamanya bagi mereka yang terlibat dalam menguruskan organisasi integrasi antara firma dan perkongsian maklumat, usaha rantaian bekalan dan aktiviti, keselamatan maklumat, dan secara umumnya, dapat memberi kepentiingan kepada mereka yang terlibat dalam tanggungjawab pengurusan. Seperti kajian lain, kajian ini juga mempunyai batasan tetapi hanya beberapa kepentingan batasan dibentangkan. Kebolehpercayaan, keratan-rentas, dan saiz syarikat merupakan batasan utama dalam kajian ini, diimana ia dijelaskan selanjutnya.

INFORMATION SHARING ALONG SUPPLY CHAIN IN MALAYSIAN MANUFACTURING COMPANIES

ABSTRACT

Information sharing between supply chain partners is the key establishment for close coordination and cooperation in the accomplishment of supply chain management (SCM) execution and managing the flow of information in the supply chain process. However, many firms are still reluctant to share information with other supply chain partners. Therefore, this study examined the relevance of information sharing in the context of manufacturing companies in Malaysia and how information sharing can enhance supply chain performance. This study also investigates the relationship between information quality, information technology, information security and information sharing across the supply chain. In addition, it also examined how information security culture moderates the relationship between information security and information sharing. Moreover, this study investigates the moderating effect of information security technology on the relationship between information technology and information sharing. In addition, this study examined the moderating effect of information leakage on the relationship between information sharing and supply chain performance. RBV theory has been applied in the research model to support the relationships between information quality, information technology, and information security as resources of the supply chain to information sharing which is the capability. Moreover, RBV supports the relationship between information sharing as a capability to the supply chain performance as a competitive advantage. Data were collected from 238 manufacturing companies via survey questionnaire developed from related literature. The data collected were then analyzed using structural equation

modeling via SmartPLS version 3.2 software. Findings indicate that information quality, information technology, and information security had a significant impact on information sharing. As for the relationship between information sharing and supply chain performance, this study found that information sharing had a significant impact on supply chain performance. The results showed that information security culture positively moderated the relationship between information security and information sharing. Surprisingly, information security technology was not moderating the relationship between information technology and information sharing. Moreover, findings of this study showed that information leakage negatively moderated the relationship between information sharing and supply chain performance. From a managerial view, the findings of this study highlight the importance of understanding and considering the supply chain context when deciding and embarking information sharing activities. This research has important implications for practitioners, particularly those who are involved in organizing inter-firm integration and information sharing, supply chain effort and activities, information security, and, in general, can be important to those with management responsibilities. As with any other studies, the present one has limitations but only some important limitations of this study are worth mentioning. Generalizability, cross-sectional, and companies' size are there main limitations of this study, which are explained further.

CHAPTER 1

INTRODUCTION

1.0 Introduction

Technology has fundamentally transformed the way businesses transact commerce. Based on the fame of Internet, applications, mobile devices, and cloud computing, companies and their suppliers would now be able to share a large amount of information at the touch of a button. Therefore, information plays a major role in organization's business operations and competitive advantages over others (Posthumus & Von Solms, 2004). Today, organizations share their information about everything from order volumes and production planning to inventory level and production capacity with their supply chain partners to enhance the organization's operational performance.

In the current business environment, competition is with supply chain partners and no longer between organizations (Wu, Chuang, & Hsu, 2014). Companies are progressively thinking that they should contend, as part of a supply chain, against other supply chains, to quickly replay to the market changes (Cigolini, Cozzi, & Perona, 2004). Therefore, effective supply chain management (SCM) is a source of potentially sustainable competitive advantage for companies (Mentzer et al., 2001). SCM tries to enhance the performance through productive utilization of resources and capabilities through the development of internal and external connectivity to make a integrative coordinated supply chain (Ketchen & Giunipero, 2004; Ketchen & Hult, 2007). Along these lines, the manufacturer may share its estimate and production planning information with its supplier, where its supplier may share inventory and production capacity information with the manufacturer (Huo, Zhao, & Zhou, 2014).

Information sharing with supply chain partners is the key establishment for close coordination and cooperation in the accomplishment of SCM execution and managing the information transmission in the supply chain process (Shore & Venkatachalam, 2003). Information sharing with supply chain partners can increase profit, improve efficiency and effectiveness, reduce uncertainty (Tan, Wong, & Chung, 2015; Z. Wang, Ye, & Tan, 2014), increase supply chain responsiveness to the customers' needs (Lau, Huang, & Mak, 2002; Roh, Hong, & Min, 2014), and enhance customer value and competitive advantage (Klein & Rai, 2009).

However, organizations will always be doubtful about sharing information with their supply chain partners due to its security risk and cost (Kembro & Näslund, 2014). Although information sharing is necessary for supply chain, many organizations are as yet not willing to share information with other partners in the supply chain (Ramayah & Omar, 2010; Ramayah, Tan Yen, Omar, & Dahlan, 2008). Therefore, the risk of sharing sensitive information across the supply chain is unclear and needs more investigation (Baker, Smith, & Watson, 2007; Du, Lai, Cheung, & Cui, 2012; Z. Wang et al., 2014). Effective information sharing significantly enhance supply chain performance (Hau Lee, So, & Tang, 2000; Hau L. Lee, Padmanabhan, & Whang, 1997; Zhou & Bentonjr, 2007), but it may have a adverse impact namely information leakage (Anand & Goyal, 2009; Hau Lee & Whang, 2000a). Subsequently, information sharing in supply chains is also a double-edged sword: it might have a harmful effect, which is information leakage.

The principal aim of this study is to examine the effect of information quality, information technology, and information security on information sharing. In addition, this study also investigates whether information sharing would lead to better supply chain performance. Moreover, this study examines three moderating effects including

information security technology, information security culture, and information leakage. This chapter is organized as follows: the background of the study followed by problem statement, research objectives, and questions. It then proceeds with the scope of the study and significance of the study.

1.1 Background of the Study

1.1.1 The Importance of Supply Chain Management (SCM)

Interest in the concept of SCM has steadily expanded since the 1980s when organizations understood the advantages of collaborative relationships within and beyond their organization. The term “supply chain management” was first used to depict connecting logistics with other functions in 1982 (Oliver & Webber, 1982) and also to describe the relationship between logistics and internal functions and external organizations (Houlihan, 1985, 1988) and extended to intra-organizational to describe upstream production chains and downstream distribution channels (Womack & Jones, 1996; Womack, Jones, Roos, & Technology, 1990).

Supply chain becomes a major issue in the 1990s since companies recognized three reasons. Firstly, they searched for low cost and quality materials, and they understood that sharing resources with other partners could bring benefits to both of them. Second reason came from an increase in national and international competition. Third reason is because of a perception by most organizations that expanding performance of one segment in the organization may prompt not as much as maximum performance for the entire organization (Lummus & Vokurka, 1999).

SCM refers to managing the correlative flows including information, material, and finance between the focal organization and its partners (Wu et al., 2014).

Today competitive business environment put organization in uncertainty. One of the approaches to address these challenges is to implement SCM (A. Y. L. Chong, Chan, Ooi, & Sim, 2011). Many researchers concentrate on the importance of supply chain such as the achievement of competitive advantage (Archer & Du, 2007), improvement in firm performance (Cao & Zhang, 2011; S. W. Kim, 2009), financial performance (Huo, Qi, Wang, & Zhao, 2014), business and operational performances (Flynn, Huo, & Zhao, 2010), elimination of the bullwhip effect (Lee et al., 1997a), sustainability (Govindan, Azevedo, Carvalho, & Cruz-Machado, 2014), and reduction in transaction costs (Zhao, Huo, Flynn, & Yeung, 2008). SCM is the efficient and vital coordination of customary business capacities.

In addition, SCM demonstrate the flow of materials, products, information, and money inside an organization, as well as across businesses from suppliers to manufacturers to customers in the supply chain to enhance the long-term performance of the organizations and the supply chain in general (Mentzer et al., 2001). The Malaysian Government has concentrated extensive consideration on enhancing the SCM of Malaysian industries to guarantee that Malaysian organizations are attractive to foreign investors (Chong & Ooi, 2008). Economic development or delivering any non-digital (physical product/tangible product) product requires successfully managing a complex supply chain. Centralizing supply chain management into a hub is popular and a necessity for technology and industrial businesses.

Reducing supply chain barriers (i.e. border administration and transport and communications infrastructure and related services) could increase the global gross domestic product (GDP) up to six times more than removing all import tariffs (WEF, 2013). Global GDP would increase by nearly 5%, and global exports would increase by nearly 15%. For example, if we eliminate all import tariffs, then global GDP would

grow by around 0.7% (WEF, 2013). Malaysia was ranked 25th on the forum's Enabling Trade Index, which measure the ease of cross-border trade for 138 countries (Hanouz, Geiger, & Doherty, 2014). However, supply chain management influences manufacturing companies by the reliability of inputs (i.e. raw materials arrived at production section on time), lower distribution costs and increases profitability of manufacturing items, and organization infrastructure (i.e. distributing system and interacting with suppliers and customers).

1.1.2 The Importance of Information Sharing in Supply Chain Management

Information sharing is one of the vital element for enhancing collaboration and cooperation in the supply chain (M. Kim & Chai, 2017). Today globalized business requires supply chain information sharing for a responsive managerial decision such as forecasting and inventory replenishment to cope with rapidly changing requirements of the market. The term information sharing in the supply chain has been defined by Kembro & Näslund (2014, p.4) as the “inter-organizational sharing of data, information, and knowledge in supply chains.” Many researchers have reported the extensive value of information sharing in supply chain (Inderfurth, Sadrieh, & Voigt, 2013; Jeong & Jorge Leon, 2012; Özer & Zheng, 2017; Riley et al., 2016; Sabitha, Rajendran, Kalpakam, & Ziegler, 2016; Wong, Lai, & Bernroider, 2015). Information sharing can cut down lead time, decrease the risk brought by asymmetric and inadequate information, diminish total cost and increase aggregate supply chain profit, and relieve bullwhip effect (Hau Lee et al., 1997). Information sharing forms better collaboration and advance integration amongst suppliers and manufacturers in the supply chain, prompting better performance (Du et al., 2012; Khan, Hussain, & Saber, 2016).

Previous studies demonstrated that information sharing among supply chain partners and inside the organization have significant effect on the viability of supply chains (Ali, Babai, Boylan, & Syntetos, 2017; Cheng, 2011a; Engel, Brugger, Goswami, Bohm, & Krcmar, 2014; Li, Sikora, Shaw, & Woo Tan, 2006; Suhong Li & Lin, 2006; Madlberger, 2009). Information sharing with respect to the demand amongst manufacturers and retailers dependably benefits the manufacturers, who can respond to changes in demand (Hasan Cavusoglu, Cavusoglu, & Raghunathan, 2012). Information sharing enables the organizations to make better decisions on ordering, production and material planning, capacity allocations (Cheng, 2011a; Yu, Ting, & Chen, 2010), through expanded visibility of demand, inventory, and supply (Ding, Guo, & Liu, 2011). As information sharing enhances between the supply chain partners, activities such as cooperation and collaboration, over time, leading to joint decision-making, design teams also can be improved. These activities that is facilitated by strategic supplier relationship can increase the capacity of supply chain partners to improve the overall responsiveness in supplier-interface activities (Tarafdar & Qunfleh, 2017).

To compete in the present worldwide economy, manufacturers need to reexamine their approach to deal with cooperation and subsequently should give approaches to share updated information within the organizations (Nunes, Annansingh, Eaglestone, & Wakefield, 2006) and improve their competitive advantages by information sharing (Zha & Ding, 2005). Information sharing can improve the supply chain operation and enhance the supply chain performance (Cho & Lee, 2013). The out of stock issue in North America costs approximately \$93 billion annually. However, information sharing can connect the downstream retailing and upstream production to minimize the occurrence of stocking out (Li & Zhang, 2015).

Min et al. (2005) characterized information sharing as the core of supply chain collaboration. It implies that more consideration should be given to information sharing. In addition, information sharing encourages supply chain members in overcoming the fear of information disclosure and the loss of power over competitors since there is expanded transparency and advantageous connections (Zhou & Bentonjr, 2007). In addition, the benefits of information sharing in supply chain include lower operating costs, improve production planning, and reduce inventory cost up to 40% (Bowersox, Closs, & Stank, 2000; Ireland & Crum, 2005; Klein & Rai, 2009; Patnayakuni, Rai, & Seth, 2006).

1.1.3 Malaysia in Context

Manufacturing became an important activity in many developing countries after World War II. Consequently, structure and the shape of manufacturing have changed essentially (Szirmai, 2012). Recent study affirms that manufacturing has been immensely critical to the prosperity of countries, with more than 70% of the income variations of 128 countries clarified by differences in manufactured product export data alone (WEF, 2012). Strong manufacturing base is vital to the nations because advanced manufacturing gives an essential institutional establishment to learning and process skills as well as capabilities. This is because the development of learning, skills, and capacities may expand and entwined with core R&D in businesses and in particular in the country's economic future (Shih, 2012). Manufacturing in Malaysia is a vital sector proved by its GDP, job creation, and external trade. Malaysian manufacturing sector registered a growth of 4.2% in 3Q 2016, an increase of 1% compared to 2Q 2016 (4.1%). Investments in manufacturing grew year on year in Malaysia. The sale value of Malaysian manufacturing sector in November 2015

increased by 2.2% (RM 1.2 billion) to record RM 55.5 billion as compared to 54.3 billion reported in 2014 (DOSM, 2015a).

Malaysian manufacturing sector has stayed appealing to investors, with affirmed investments in the industry surging by 38% to RM71.9 billion in 2014 compared with RM52.1 billion in 2013 (MIDA, 2015). Malaysia is an ideal location for new investments in the manufacturing sector which 82.7% of the total projects are new projects and also manufacturing leads the economic sectors with an investment of RM 33.6 billion in the first quarter of 2015 (MIDA, 2015). According to manufacturing index 2014, Malaysia was ranked the world's top manufacturing location (Cushman & Wakefield, 2014).

Manufacturing sector is a significant portion of total Malaysian exports. Malaysian manufacturing exports in November 2016 reached RM 58 billion from RM 50 billion in January of the same year (MATRADE, 2016) (see Figure 1.1). Manufacturing performance increased in April 2015. Total manufacturing sector employees were 1,029,255 persons, an increase of 0.2% or 2154 persons as compared to 1,027,101 persons in April 2014. Salaries and wages paid in April 2015 rose by 3.6% (RM103.3 million) as compared with the same month in 2014. GDP in the manufacturing sector rose to 5.6 % in the first quarter of 2015 from 5.4 % in the previous quarter. The average salaries and wages paid per employee increased by 3.4% in April 2015 as compared with the corresponding month in 2014. Exports of Manufacturing products rose 0.1 % (RM 142.8 billion). Moreover, imports of manufacturing also increased by 2.1%. Therefore, there is no trade deficit when exports are more than imports. Sales value of the manufacturing sector rose by 1.1 % during January - April 2015. Moreover, manufacturing productivity increased by 0.9% (RM 214,348) (DOSM, 2015b).

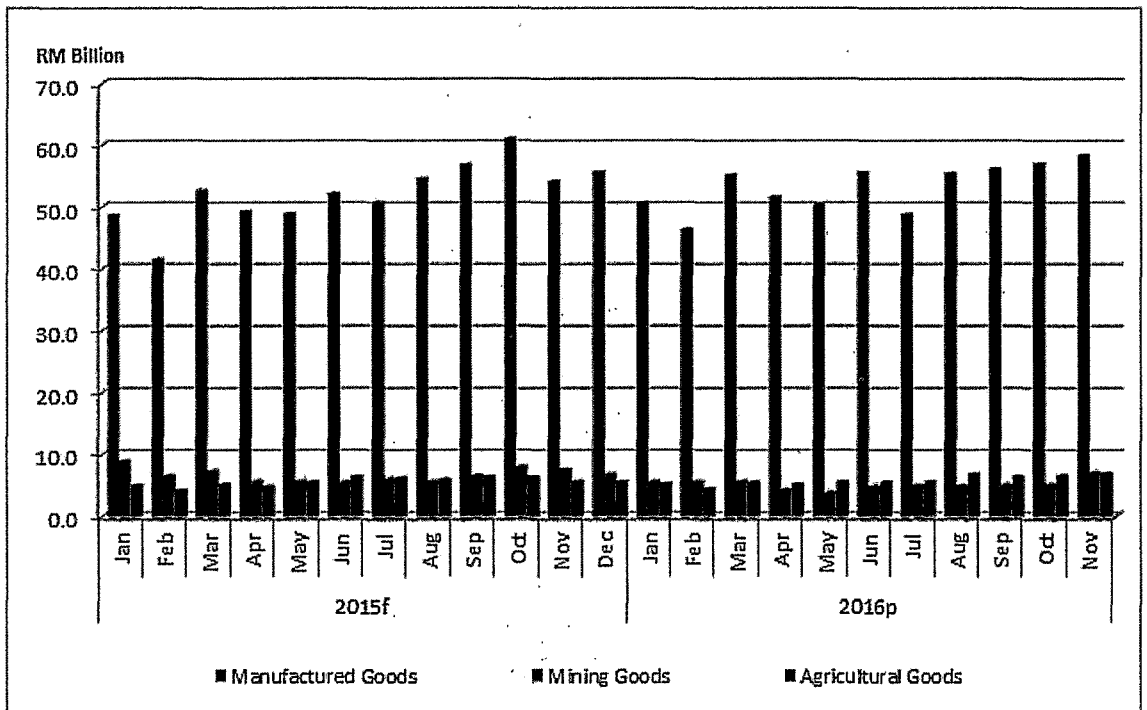


Figure 1.1 Malaysia's Exports by Main Sectors, 2016

Source: Malaysian External Trade Development Corporation (MATRADE)

Based on the World Bank ease of doing business ranking in 2017, the Malaysian economy was ranked 23 amongst 190 countries (The World Bank, 2017). Malaysia has a strong economy. Malaysia's economy expanded by 6.0% in 2014, rose to 7.3% in the fourth quarter of 2014 because of increasing domestic demand and exports. Exports of goods and services grew by 5.1% in 2014 due to higher export volumes of electrical and electronics sector as well as crude petroleum (The World Bank, 2015). Moreover, a gross national saving of Malaysia is estimated at 31.10 % of GDP in 2014 which this number indicates that the economy as a whole is spending less income than it produces, hence strengthening national wealth (CIA, 2014). Therefore, this can be vital to expanding the amount of capital available, lending to sustainable future economic development. Malaysia's economy added 333,100 net new jobs, an increase of 2.5 % in the year to March 2015. Overall jobs growth kept

the unemployment low and stable and this increase and high employment support consumption growth (The World Bank, 2015). Moreover, Malaysian GDP growth projected around 4.2% in 2016 and 4.3% in 2017 (The World Bank, 2016).

Malaysian's inflation rate was 3.1 % in 2014 which is reduced to 2.1 % in 2015 (The World Bank, 2015). Inflation rate of more than 17.2% is considered critical value and too high in developing countries. In contrast, developed countries inflation frontier is about 2.5% (Kremer, Bick, & Nautz, 2012). Hence, an inflation rate of 2.1 % in 2015 for Malaysia is same as the industrialized countries inflation rate.

To bring rigor to companies' decision about where to locate offshore operations, A.T. Kearney Global Services Location Index (GSLI) provides information including offshoring, outsourcing, and automation. Malaysia ranked 3rd in this index with a politically stable, multilingual environment at reasonable rates of doing business. Therefore, it is a good place for companies with mid-size demand and lower risk appetite (A.T.Kearney, 2015). Education has been the key to Malaysia's rapid development with 70% increase in total higher education enrollment (2004 to 2014) to 1.2 million students (MOE, 2015). Spending on education in Malaysia is two times more than other ASEAN countries (The World Bank, 2013). Consequently, all above statements clearly explained the criticality of Malaysian manufacturing. Therefore, based on the above reasons, this study was conducted in Malaysian manufacturing sector.

1.2 Research Problem

A new generation of the supply chain is enhanced by information technology (IT) to set up an effective value chain (Poirier, 2002). In the internet based supply chain, a significant amount of sensitive information move in an integrated system from

supplier to manufacturer to wholesaler to retailer to the consumer. Hence, even a small security incident in the supply chain could be harmful to the principal players. Unbalanced information sharing within supply chains might have negative outcomes. Loss of productivity and incomes (Anderson & Schwager, 2002), corporate liability, loss of validity, and money related harm (Huseyin Cavusoglu, Mishra, & Raghunathan, 2004), loss of trust of partners, and diminished competitiveness are created by security breaches in the supply chain (Kros, Foltz, & Metcalf, 2004). The importance of information security is increasingly recognizing in business. However, supply chain information security still widely neglected (Ashford, 2015c). In the recent years, several high-profile breaches occurred because of information security weaknesses at suppliers. These include malicious emails sent to air-conditioning supplier to US retailers target in 2013 and contractor PA Consulting lost the details of 84,000 prisoners on an unencrypted memory stick in 2008 (Ashford, 2015a). Information security weaknesses at suppliers have been responsible for several high-profile breaches in recent years. These include malware-laced phishing emails sent to an air-conditioning supplier to US retailer Target in 2013 and contractor PA Consulting losing the details of 84,000 prisoners on an unencrypted memory stick in 2008.

If shared information between retailer and manufacturer were disclosed to other parties, then retailers might be discouraged from sharing sensitive information with the manufacturers (Li et al. 2005). Therefore, information sharing benefits may be limited due to information leakage. Around 40 % of information security incidents in the organizations are from suppliers channel (SCB, 2013). Suppliers may approach an extensive variety of information from the supported organization. Once information shared with a supply chain partner, direct control of this information is lost. Only a

few organizations have a regular and ongoing supply chain information management (Ashford, 2015b). Hence, lack of awareness of sensitive information in contracts, numerous suppliers have access to the confidential information, and lack of control when information is shared within supply chains are three critical supply chain security challenges.

The willingness and ability of an organization to share information rely on its trust in the security of its supply chain system. A supply chain management (SCM) system can confront numerous possible security attacks like unauthorized access by hackers to erase or change information related to orders, pricing, or product description (Zhang & Li, 2006). Gordon et al. (2003) argued that when an organization share its information, each organization has diminished inducement to invest in information security. However, a study by Gal-Or & Ghose (2005) showed that security technology investments and security information sharing act as strategic complements.

Based on a survey conducted by Pricewaterhouse Coopers (PWC), information security incidents in 2015 was 38% more than incidents detected in 2014 (PWC, 2016). Moreover, information security incidents detected in 2014 were 42.8 million, an increase of 48% from 2013 (PWC, 2016). That is equivalent to 117,399 information attacks per day, every day. In addition, information security budget decreased to \$4.1 million, down 4 % from 2013 and only 3.8 % of total information technology (IT) budget used in information security in 2014, the lack of budget is one of the most challenging problems. Consequently, information security spending is not aligned with the frequency and cost of a security incident and the percentage of the amount allocated to information security from the total IT budget was kept very low. Another challenge in information security is a lack of cyber security skills. EY's Global Information Security Survey in 2014 showed that although the need for cybersecurity specialists

deepens, every year the lack of specialists remains as a current and future issue (EY, 2014). The lack of qualified security talent leads to ripple effects throughout the industry and economy.

In conclusion, the information sharing domain in the supply chain is still awaiting further investigation (Baker et al., 2007; Du et al., 2012; Huong Tran et al., 2016; Z. Wang et al., 2014). Many firms are still reluctant to share information with other supply chain partners (Fawcett, Osterhaus, Magnan, Brau, & McCarter, 2007; Lei, Liu, Deng, Huang, & Leong, 2014; Marinagi, Trivellas, & Reklitis, 2015; Ramayah & Omar, 2010; Ramayah et al., 2008; L. Wang, Pfohl, Berbner, & Keck, 2016; M. Zhou, Dan, Ma, & Zhang, 2017). Ramayah et al. (2008) indicate that many manufacturing companies are not willing to share information with their suppliers. Therefore, seller have to guess buyer demand when buyers do not share forecast information. Consequently, seller overall efficiently in operations will be negatively affected. Ramayah and Omar 2010 argued that, although information sharing in vital in supply chain management, many firms are still hesitate to share information with their supply chain partners.

Moreover, many supply chain issues are related to lack of information sharing across supply chain (Lotfi, Mukhtar, Sahran, & Zadeh, 2013). Moreover, world-class information sharing has not yet been established (Fawcett et al., 2007). On the other hand, there are also many supply chains where information may not be shared properly due to lack of information quality and information security (Ali et al., 2017). When the information sharing system designed with flaws and vague boundaries, there is a high possibility that sensitive information will be leaked to external parties (Tan et al., 2015).

Hence, based on literature, this study formulates a research model to examine the effect of information quality, information technology, and information security on information sharing across the supply chain. Furthermore, this study hypothesized three moderators to investigate the issue of information security. Therefore, Information security technology is moderating the relationship between information technology and information sharing. Information security culture is moderating the relationship between information security and information sharing. Information leakage is moderating the relationship between information sharing and supply chain performance.

1.3 Research Objectives

This study attempts to meet the following objectives:

- 1- To examine the relationship between information quality and information sharing.
- 2- To examine the relationship between information technology and information sharing.
- 3- To assess the relationship between information security and information sharing.
- 4- To investigate the relationship between information sharing and supply chain performance.
- 5- To study the moderating effect of information security culture in the relationship between information security and information sharing.
- 6- To examine the moderating effect of information security technology in the relationship between information technology and information sharing.

- 7- To examine the moderating effect of information leakage in the relationship between information sharing and supply chain performance.

1.4 Research Questions

Based on the problems situation and the research objectives, this study attempts to answer the following questions:

- 1- What is the relationship between information quality and information sharing?
- 2- What is the relationship between information technology and information sharing?
- 3- What is the relationship between information security and information sharing?
- 4- What is the relationship between information sharing and supply chain performance?
- 5- Does the information security culture moderate the relationship between the information security and information sharing?
- 6- Does the information security technology moderate the relationship between the information technology and information sharing?
- 7- Does the information leakage moderate the relationship between the information sharing and supply chain performance?

1.5 Scope of the Study

The study scope was confined to the manufacturing sectors in Malaysia. This research examines the relationship between information quality, information technology, and information security with information sharing. This research also focuses on the relationship between information sharing and supply chain performance. In addition, this study looks into the moderating effect of information

security culture in the relationship between information security and information sharing. Moreover, this research examines the moderating role of information leakage in the relationship between information sharing and supply chain performance. This study also investigates the moderating role of information security technology in the relationship between information technology and information sharing.

Data was collected through sending online survey questionnaire to the manufacturing companies according to Federation of Malaysian Manufacturing (FMM) directory 2015 and the unit of analysis was organization. Responses were collected from supply chain managers or those who are involved with decision making in the supply chain.

1.6 Significance of the Study

This study plans to broaden the body of knowledge relating to information sharing across supply chains in Malaysian manufacturing segment. Sharing information externally exposes a firm to the danger of losing the core and strategic sensitive information. Regarding inter-organizational relationships, researchers have perceived the problem of information sharing and leakage (Creese, Erola, Goldsmith, & Nurse, 2015; Indjejikian, Lu, & Yang, 2014; Jain & Sohoni, 2015). Distinctively, when sharing information with external parties, there is always a risk of accidental information leakage. Moreover, the real possibility of information leaking might shackle the efforts to share the information in collaborations. Consequently, firms face a seriously difficult situation in information sharing in supply chain collaboration. A firm must share relevant information externally to be a potential receiver of another party's information; however, their data/information is their business, the firm must consider the conceivably harmful impacts of leaking business-information. Hence,

many organizations are often unwilling to share sensitive information even when they have sufficient capability to share.

Therefore, this study aims to investigate the factors influencing information sharing in the supply chain. Information quality has a vital role in information sharing. Although information sharing is essential, the significance of its effect on supply chain relies on what information is shared, how and when it is shared, and with whom. Another challenge that organizations face in their mission to use information as a viable enabler is information technology (IT). However, the reliance on the network empowered by the internet has made exceptional difficulties for organizations to set up more secure IT infrastructure. Thus, IT without security may have a negative effect on information sharing.

Moreover, this research will attempt to show that although organizations benefit from sharing information through supply chains regarding supply chain performance, unintentionally or deliberately leaking information may curb these endeavors (i.e. a negatively moderating effect). According to this logic, the best-performing firms are those that enable high-level information sharing while eliminating information leakage.

1.7 Theoretical Contributions

This study will contribute to the resource-based view (RBV) theory. While RBV posits that capability leads to performance, this study suggests that information leakage moderate the relationship between information sharing as a capability and supply chain performance negatively. It means the positive correlation between information sharing and supply chain performance is high when information leakage is low. Although prior studies have argued that information sharing influences supply chain performance positively. This study suggests that information sharing is not

effective in improving supply chain performance when information leakage is high. Therefore, information sharing is only useful for supply chain performance with low information leakage.

Although the issue of information sharing and supply chain performance have been recognized in the literature, the researcher believes that this is one of the first empirical researches that shows the moderating effect of information leakage on the relationship between information sharing and supply chain performance. Therefore, this research helps to fill the gaps by extending the body of knowledge relating to information sharing and the dark side, which is information leakage.

Another significant theoretical contribution of this study is that information quality, information technology, and information security are important factors that are influencing information sharing. Consistent with RBV theory, this study suggests that information, as an intangible resource of the firms, is essential for sharing capability of the company. However, information without quality, technology, and security are not helping information sharing. Therefore, this study suggests that information should be with quality, security, and technology to be useful for sharing.

Moreover, this study suggests the moderator effect of information security technology. Although information technology has a vital role in information sharing but without information technology security may have an adverse effect on information sharing. Therefore, this study suggests securing the information technology before initiating information sharing. In addition, this study suggests information security culture as a moderator on the relationship between information security and information sharing. Employees' security behavior may ensure information security against security threats posed by insiders (AlHogail, 2015).

Hence, this study posits that information security culture can moderate the relationship between information security and information sharing positively.

1.8 Practical Implications

This study has important implications for practitioners, particularly those who are involved in organizing inter-organization integration and information sharing, supply chain effort and activities, information security, and, in general, can be important to those with management responsibilities. Supply chain executives should be aware that sharing information with other suppliers may increase the risk of information leakage, and thus, they must manage this risk carefully. Therefore, the supply chain can benefit more from information sharing under low information leakage.

From a practical perspective, the findings of this research could give manufacturing firms a competitive edge over their competitors in supply chains. This study hopes to increase the awareness of the companies who share information with other partners across supply chains.

Information sharing across the supply chain is useful for a complex supply chain. When organizations collaborate with a large number of partners, information sharing is helpful to meet different market needs. The result of information sharing can be beneficial for supply chain through quicker response time, reduce delivery error and replenishment, and lower cost for administration, inventory, distribution, and order management. Information sharing is an advantage for the supply chain operations when the market is more complex.

1.9 Definitions of Key Terms

- *Information Sharing*

In this study, the term information sharing refers to “the extent to which critical and proprietary information is communicated to one's supply chain partner” (Monczka, Petersen, Handfield, & Ragatz, 1998).

- *Information Quality*

The definition of the term information quality includes such aspects as the accuracy, timeliness, adequacy, and credibility of information exchanged (Suhong Li & Lin, 2006).

- *Supply Chain Management (SCM)*

In this study, the term supply chain management is used to mean “managing the correlative flows including information, material, and finance between the focal organization and its partners” (Wu et al., 2014).

- *Supply Chain Performance*

In this study, the term supply chain performance is used to mean “Supply chain performance refers to the operational performance of the whole supply chain, including the focal company and its major supplier chain partners” (Huo, Zhao, et al., 2014).

- *Information Technology*

In this study, the term information technology is used to mean “facilities that improve processing of complex information, provides real-time supply chain information, and better inter-firms coordination” (Prajogo & Olhager, 2012).

- *Information Security Culture*

In this study information security culture has been defined as “all socio-cultural measures that support technical security measures” (Chen, Ramamurthy, & Wen, 2015).

- *Information Leakage*

In this study the term information leakage has been defined as “the act of intentional or unintentional disclosure of information to an unauthorized party is considered as information leakage” (Tan et al., 2015).

- *Information Security*

The term information security has been defined as “the safe acquisition and transfer of information from its source in a standardized and structured process” (Qin & Fan, 2016).

- *Information Security Technology*

Information security technology defined as “the extent to which an organization possesses preventive and detective technical solutions to address vulnerabilities within information technology infrastructure in which critical information assets reside” (Cavusoglu et al., 2015).

1.10 Summary of the Chapter

This chapter provided an introduction and a general background to the thesis and mentioned importance of information sharing in the supply chain. The problem situation is described, which provides the justification as to why this is a significant research. The purpose and significance of the study were presented while the key research questions were highlighted.

This thesis is organized into five chapters. Chapter one presents the background of the study continue with problem statement, research objectives, and research questions. This chapter also covered the scope of the study, significance of the study and definition of key terms.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter presents relevant literature to the study. It begins with the theoretical background that underpins the framework of this study namely resource based view, knowledge-based view, and relational view. Next, the chapter proceeds with an in-depth discussion of definitions and previous researches on information quality, information technology, information security, information security culture, information security technology, information sharing, information leakage, and supply chain performance followed by the proposed framework to illustrate the linkage of the variables mentioned. Finally, the development of hypotheses that link the variables in the proposed framework is elaborated.

2.1 Theoretical Background

This study uses one main theory, which is Resource Based View (RBV), and two supporting theories such as relational view and Knowledge-Based View (KBV). RBV theory supports the entire research model. In a brief sentence RBV says, resources through capability will enable the firm to achieve competitive advantages. Therefore, in this study, information is a resource, information sharing is a capability and performance is a competitive advantage. Relational view explains the inter-organization relationship, which in this study is relationships with supply chain members. Finally, knowledge-based view explains information as an intangible resource of the organizations.

2.1.1 Resource Based View (RBV)

Edith Penrose (1959) was one of the first scholars who conduct resource-based view theory. He recognized the importance of resources to a firm's competitive advantages. Besides Penrose (1959) and Rubin (1973) conceptualize firms as resources bundles before the formal origins of the resource-based view. Subsequently, Wernerfelt (1984) developed RBV to serve as a tool to analyze an organization's resources position and apply it to examine the relationship between profitability and resources. He also argued that in a firm, resources and products are two sides of the same coin (Wernerfelt, 1984, p.171). Barney (1986) clarified that, while a company's performance is driven directly by its products, it is indirectly (and ultimately) driven by the resources that go into their production.

Barney (1991) and Peteraf (1993) have discussed, in more specific terms, the five specific characteristics of a resource that would allow firms to attain a sustainable competitive advantage. First, the resource must be valuable in that it improves firm efficiency and effectiveness. Second, the resource must be rare so that by exercising control over it, the firm can exploit it to the disadvantage of its competitors. Third, the resource must be imperfectly imitable to prevent competitors from being able to develop the resource in-house easily. Fourth, the resource must be imperfectly mobile to discourage the ex-post competition for the resource that would offset the advantages of maintaining control of the resource. Fifth and last, the resource must not be substitutable; otherwise, competitors would be able to identify differently, but strategically equivalent, resources to be used for the same purpose.

Resources are categorized as "all assets, capabilities, organizational processes, firm attributes, information, and knowledge controlled by the firm that enables the firm to conceive and implement strategies that improve its efficiency and effectiveness"