FRAMEWORK FOR LOCALISATION OF RESIN SUPPLY CHAIN IN MALAYSIA AUTOMOTIVE INDUSTRY

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DEDICATION

This thesis work is dedicated to my wife, who has been a constant source of support and encouragement during the challenges of graduate school and life. I am also truly thankful for having my daughter in my life. This work is also dedicated to my late parents, who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve. Last but not least, to the Managing Director and Executive Director of my company for all their support and have made this research possible.

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ABSTRACT

In the current business environment, supply chain management plays an important role in business activities, manufacturing industries, and the service industries in increasing the effectiveness and efficiency of their customer service. It is crucial for most industries to focus on the key factors of supply chain framework which are quality, cost and delivery (QCD) to achieve their targeted profit. In Malaysia, car manufacturing organisations depend heavily on international suppliers for the provision of components and materials utilised in their finished products. The objective of this research is to find out whether the existing resin supply chain framework can be improved by realigning the local resin compounder supply chain framework in the automotive industry in Malaysia. This research uses a case study method with multiple organisations and Delphi method. The framework's development process involved case study method and Delphi method consisting of questionnaires and interviews. The validation process involved one Delphi round of questionnaire and interview. In Delphi round one, derivation of the proposed framework was obtained from the participant's feedback. In Delphi round two, conceptual framework was developed from the participant's feedback and consensus was achieved. In Delphi round three, refined and validated framework was obtained from the participant's feedback. Based on the experts' views obtained through the questionnaire and interview sessions, comparative comments were grouped. The consensus was obtained in order to achieve the key factors' (QCD) effectiveness to strengthen the automotive industry in Malaysia. The research significance and contribution to the body of knowledge is the proposed framework via the realignment and improvement of the existing resin supply chain framework in the automotive industry in Malaysia through local compounder. By having this framework, it is expected to produce a strong impact on resin supply chain in the local automotive sector especially in terms of quality, standard, technical expertise, flexibility, cost variation, customer focus and delivery variation.

ABSTRAK

Dalam persekitaran perniagaan masa kini, pengurusan rantaian bekalan memainkan peranan penting dalam kegiatan perniagaan, industri pembuatan, dan industri perkhidmatan untuk meningkatkan keberkesanan dan kecekapan layanan terhadap pelanggan mereka. Adalah penting bagi semua industri untuk menumpukan kepada faktor utama kerangka rantaian bekalan iaitu kualiti, kos dan penghantaran (QCD) untuk mencapai keuntungan yang disasarkan. Di Malaysia, organisasi pembuatan kenderaan sangat bergantung kepada pembekal antarabangsa dalam penyediaan komponen dan bahan yang digunakan dalam produk akhir. Objektif penyelidikan ini adalah untuk mengetahui sama ada kerangka rantaian bekalan resin sedia ada dapat ditingkatkan dengan melaraskan kerangka rantaian bekalan resin tempatan bagi industri automotif di Malaysia. Penyelidikan ini melibatkan kajian kes dengan pelbagai organisasi menggunakan kaedah Delphi. Proses pembangunan kerangka adalah melibatkan kaedah kajian kes dan kaedah Delphi yang terdiri daripada soal selidik dan temu ramah. Pengesahan kerangka melibatkan satu pusingan Delphi dengan soal selidik dan temu ramah. Dalam pusingan pertama Delphi, pembentukan kerangka cadangan diperolehi daripada maklum balas peserta. Dalam pusingan kedua Delphi, kerangka konsep diperolehi daripada maklum balas peserta dan persetujuan yang dicapai. Dalam pusingan ketiga Delphi, kerangka yang ditambahbaik dan telah disahkan telah diperolehi daripada maklum balas peserta. Berdasarkan pandangan pakar yang diperolehi melalui soal selidik dan sesi temu ramah, komen perbandingan dikumpulkan. Persetujuan diperolehi untuk mencapai keberkesanan faktor utama (QCD) untuk memperkasakan lagi industri automotif di Malaysia. Kepentingan dan sumbangan penyelidikan terhadap badan pengetahuan adalah kerangka yang dicadangkan melalui pelarasan dan penambahbaikan dalam kerangka rantaian bekalan resin sedia ada dalam industri automotif di Malaysia melalui pembekal resin tempatan. Dengan adanya kerangka ini, diharapkan dapat memberikan impak terhadap rantaian bekalan resin sektor automotif tempatan terutama dari segi kualiti, standard, kepakaran teknikal, fleksibel, variasi kos, fokus pelanggan dan variasi penghantaran.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AFTA	-	ASEAN Free Trade Area
AP	-	Approval Permit
APM	-	Automotive Parts Manufacturer
ASEAN	-	Association of Southeast Asian Nations
BMW	-	Bavarian Motor Works
CBU	-	Complete Built Up
CKD	-	Complete Knocked-Down
CSCMP		Council of Supply Chain Management Professionals
CSR	-	Corporate Social Responsibility
DRB	-	Diversified Resources Berhad
EEV	-	Energy Efficient Vehicle
EON	-	Edaran Otomobil Nasional
EV	-	Electric Vehicle
FDI	-	Foreign Direct Investment
FSP	-	Firm Supply Performance
HEV	-	Hybrid Vehicle
HICOM	-	Heavy Industry Corporation of Malaysia
INOKOM	-	Industri Otomotif Komersial (Malaysia) Sdn. Bhd.
ISI	-	Import Substitution Policy
IT	-	Information Technology
MAI	-	Malaysia Automotive Institute
MC	-	Mitsubishi Corporation
MIDA	-	Malaysia Investment Development Authority
MMC		Mitsubishi Motor Corporation
MODENAS	-	Motosikal dan Enjin Nasional Sdn. Bhd.
MTB	-	Malaysia Truck and Bus
NAP	-	National Automotive Policy
OEM	-	Original Equipment Manufacturer
OES	-	Original Equipment Supplier
PERODUA	-	Perusahaan Otomobil Malaysia Kedua

PETRONAS	-	Petroliam Nasional Berhad
PROTON	-	Perusahaan Otomobil Nasional
PVD	-	Product and Vendor Development
QCD	-	Quality, Cost and Delivery
REM	-	Replacement Equipment Market
R&D	-	Research and Development
RSCI	-	Resin Supply Chain Improvement
SCM	-	Supply Chain Management
SCMP	-	Supply Chain Management Practices
SME	-	Small and Medium Enterprise
TCE	-	Transaction Cost Economics
TQMP	-	Total Quality Management Practices
TRW	-	Thompson Ramo Wooldridge
UPS	-	United Parcel Service
VDO	-	Vereinigte Deuta Ota

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1   Introduction

This chapter provides an overview of the Malaysia automotive industry background. It included the problem background and problem statement. The research questions, research objectives and scope of research are also discussed. The significance of study and the thesis structure are elaborated in the following sections.

1.2   Problem Background

A surplus of research has been witnessed in the recent decades focusing on the investigation of characteristics of suppliers at first tier level and the buyers-supplier relationships within the contexts of commercial and geographical numbers (Ford et al., 1998; Lamming and Cox, 1994; Sako, 1999; Hines, 1996; Langfield-Smith and Greenwood, 1998; Correa and Miranda, 1998; Spekman, Kamauff, and Myhr, 1998). Meanwhile the usual traditional perspective which has dominated the sector of automotive is that "first-tier" suppliers deliver discrete components to their customers which are the original equipment manufacturer (OEM) and by this process, able to manage part of the supply chain that offers services and spare parts for its product.

The Malaysia's automotive industry is rapidly growing locally and internationally, and it is regarded as an important sector in the economy. There is a huge economic contribution of this industry with impactful and positive contributions relating to employment, investment and the national income. Currently, the automotive sector is confronted with greater challenges, most importantly, the ever-increasing local and international competition and trade liberalisation. Based on this development, there are considerable amount of pressure on the manufacturers in

Malaysia to enhance performance as well as productivity so that they can be at par at the competitive global and local market.

The automotive industry has attained a state of maturity in Asia Pacific region. This is evident in the sectors' growth and competition, which means costs, speed, in moving to a certain growing region and segment and the industry's consolidation. At the same time, technical progress is advancing rapidly as there are new players entering this region. The new players seem to be coming from China, Malaysia and India.

The automotive industry has hundreds of suppliers and for the spare parts industry, which comprise thousands of suppliers (Babu, 2012). As a result of globalisation, the automotive supply chain has been going through drastic changes and in the meanwhile, the industry has also been developing innovative approaches to minimise cost, inventory and lead time to maintain their market growth. Going by the growth of sourcing partners, excellent forecasting, reorganisation enquiries of customers, management of inventory, cooperation and coordination of supply chain across board, better suppliers' relations, good visibility and process control, as well as lead time reduction to be attained by the organisations (Babu, 2012). For example, in India, in spite of the higher cost of raw materials, energy and infrastructure, multinational OEMs that entered into India, endeavour to produce cars with high local content and sold at very competitive retail prices as a result of effective and efficient supply chain. In the last few years, the Indian automotive industry witnessed higher level of integration with its global counterparts. The most obvious confrontations of Indian automotive players are integrating of the whole supply chain and management as a single incorporated entity or unit (Chinniah, Sundram, and Bhatti (2013); Babu, 2012). The management of inbound logistics stands out as main challenges for OEMs and players of auto components. This is driven more by data reliability, lead time, as well as lack of quality logistics players on the upstream side (Babu, 2012). Hence, this research intends to investigate the existing supply chain framework, localisation strategies of local resin maker in Malaysia and proposed a more effective supply chain framework for localisation of resin in automotive industry of Malaysia. The main challenges involved in the integration and implementation of supply chain framework

and then providing suggestions or solutions focused on a few strategies to overcome the challenges to leverage at the optimal level.

The ever-changing situation of business conditions in this 21st century has made many companies being confronted with economic uncertainty such as in responding to new technologies, globalisation and high demands rate from customers. In the automotive sector, many automotive manufacturers design and produced vehicles globally while their supply chains are increasingly ambiguous with confrontations that usually hinder profitability of the organisation. The impact of global economic meltdown has escalated the forces on the automotive executives to make decisions that is right about their supply chain for good output and performance.

1.3 Background of Study

The early 1980s heavy Industrial Policy flag off a positive change of industrialisation (Wad and Govindaraju, 2011) approach in Malaysia tailoring towards the setup of an automotive industry owned and controlled by the government of Malaysia. The establishment and inauguration of the first national automotive project, called PROTON, was commissioned in 1983. This is with the establishment of a joint partnership between Heavy Industries Corporation of Malaysia (HICOM), Mitsubishi Motors Corporation (MMC) and Mitsubishi Corporation (MC) of Japan, which was an attempt by the government of Malaysia to increase local content, standardised the industry to attain economies of scale and promote the assembly industry to a manufacturing industry with international reputation and competitiveness (Abdulsomad, 1999). The industry was protected with some measures and heavily subsidised in several ways. In 1985, the first PROTON cars were produced and sold to the public. Thereafter, the programme of the national automotive also established a small car manufacturer, that is, PERODUA, in 1993, a heavy duty vehicle organisation, that is Malaysian Bus and Truck (MTB) in 1994, a manufacturing company for motorcycle, MODENAS, in 1995, as well as a commercial manufacturer of light vehicle, that is INOKOM, in 1997 (Wad and Govindaraju, 2011).

In reference to the National Automotive Policy (NAP) in 2006, the Malaysia government later established the initial policy of developing the national automotive industry of original equipment manufacturer (OEMs) and supplier, as well as the industrial stakeholders as envisaged in the early 1980s (MIDA, 2009). This industrial nationalism is obvious in most other developed and developing countries, at least in the early phase of the automotive industries evolution. Many have suspended the sustaining of local automotive companies, while some have grown to the stage of attaining the ability to compete internationally. For example, Japan established its automotive industry from the World War II ashes and steadily grow its global market shares till the season, in 2008, when Toyota Motor Corporation became the global champion (Wad and Govindaraju, 2011). Likewise, South Korea followed the same path since 1970s and the outcome is an automotive industry rated among the top 10 leagues in the world in this 21st century (Wad and Govindaraju, 2011). However, Malaysia is still trying to follow this path of success from other Northeast Asia countries. Hence the needs for this research to encourage growth and development locally.

The Malaysia's automotive history dated back to 1980s with the development of its national automotive company. Despite this, the automotive history commenced in the early 1970s when the government established the Import Substitution Policy (ISI) to promote local automotive components and parts production in Malaysia as done by Thailand. In the early stage of PROTON development, high tariff was implemented on imported vehicles and incentive to produce locally assembled cars to protect its local industry.

Competition level in today's business world has changed dramatically from national to the global stage. This is the same scenario witnessed in Malaysia whereby the main manufacturers, as well as the automotive components manufacturers are required to be more competitive to assimilate pressure from multinational companies. As stipulated by Malaysian Automotive Institute (MAI), the automotive sector had to wake up to a several number of major growths, which includes the development of automotive technology, some restructuring trends, liberalisation and rationalisation among international automotive companies (Wad and Govindaraju, 2011). These

evolutions have a definite influence on the policies and strategies on regional and domestic markets. Hence, both automotive supplier companies must apprehend these developments and take adequate measures relative to technology, cost savings and quality enhancement of products. A major option on how to overcome the challenge is through the enhancement of the operational efficiency, as well as the competitive ability of the supply chain system as an entity. Hence, this study is designed to look critically at the existing supply chain framework and propose a more efficient supply chain framework for the localisation of resin in Malaysia automotive industry.

Located in central ASEAN region of a total population of more than 500 million populations, Malaysia is considered an ideal hub for the world automotive industry. Based on this advantage, the Malaysia automotive sector is recognised as a key contributor of the nations' economic growth (MIDA, 2010). Recently, it has come to the knowing, that factors like the full execution of the ASEAN Free Trade Area (AFTA) had severe influence on the local automotive industry performance (Rosli, 2006). This type of pressure is envisaged to be experienced by the local automotive parts, as well as components suppliers, who are mainly the small and medium organisations. This may be because of lack of sufficient research and development capabilities, as well as accelerating costs of manufacturing. In view of all these facts, it is crucial that automotive companies search for alternative options to enhance and maintain their competitive advantage. One of the ways, in order to tune this issue is a development of an effective and efficient supply chain management framework for the automotive industry, hence the needs for this research to propose a more effective supply chain framework for localisation of resin in automotive industry of Malaysia.

Currently, manufacturing organisations depend heavily on suppliers for the provision of components and materials utilised in their finished products. Some researchers established that almost 50% to around 70% of the cost of production are expended on purchased of materials and components (Lee and Drake, 2010). Therefore, the process of managing supplier's performance and supporting their increasing growth are major issues for supply chain management (SCM) (Prajogo, Chowdhury, Yeung, and Cheng, 2012; Schoenherr et al., 2012).

SCM includes certain approaches and practices so as to adequately incorporate suppliers, distributors, manufacturers and customers to enhance the sustained performance of individual organisation and supply chain combined in a unified business model (Chopra and Meindl, 2001). However, SCM basically focused inefficiencies in line with supply chain. It includes effective customer demand expectation, ultimate position of resources relating to this demand and its efficient fulfilment by means of healthier materials, financial and information management.

Some research which were conducted and published recently were mainly focused on supply chain issues in Small Medium Enterprises, such as Arend and Winser (2004); Halley and Guilhon (1997); Mahadevan (1997); Shah and Sundar (2001); Hvolby and Trienekens (2002); Quayle (2003), Gunasekaran and Ngai (2003); Singh, Garg, and Deshmukh (2004); Hong and Jeong (2006); Morrissey and Pittaway (2006); Williams (2006); Harland, Lamming, and Zheng (2006); Lenny Koh and Simpson (2007); Vaaland and Heide (2007); Faisal, Banwet, and Shankar (2006); Thakkar, Kanda, and Deshmukh (2008, 2009); and Singh, Garg, and Deshmukh (2010).

Physically, resourceful supply chains are those in which the basic objective is to reduce the cost connected with the goods production and delivery with comparatively predictable patterns of demand (Qi, Zhou, and Sheu, 2011). Contrary to this, market supply chain response seeks to limit the market costs of mediation links with imbalances between the demand and supply for products that are cited as unpredictable in demand (Roh, Hong, and Min, 2014).

The emergent economies of China and India are presently playing a pivotal role in the sourcing, production and distribution decisions, their huge continuously growing markets are representing the main demand centres for several products and services (Christopher and Juttner, 2000; Humphrey, 2003). The increasing development of OEMs suppliers and the expanding interdependence among the major stakeholders in many organisations certainly reveal a paradigm shift in process of value creation. In the word of Choi and Hong (2002), the ambiguous products with huge materials bills seem to depend heavily on consolidated supply network.

6

Customisation, at high level and market pressure with high quality standards offer a confrontation for the whole supply chain. Based on this development, product life cycle has swiftly shortened in the past years. Hence, organisations novelty potentials continue to be the main success factor in several industries. Moreover, the increasing efficiency and costs pressure is driving both OEMs and suppliers in a market environment full of large-scale competition. In order to accomplish the demands relative to novelty, quality, cost effectiveness, organisations centre their attention on their capabilities differences and strengthen their brands. The ever increasing necessary and complex brand management forces OEMs to hand over a huge portion of the production, as well as development procedure to their suppliers. Hence, wide-range exchange of information with specific and direct assistance are then important so that they can closely link suppliers to the buying company and as well incorporate their system.

In the case of Japanese manufacturers in the automotive sector such as Honda and Toyota, they have proved that maintaining close relationship with suppliers are a basis of strategic capacity in competitive environment (Langfield-Smith and Greenwood, 1998). Suppliers and OEMs are turning to new manner of inter-organisational collaboration in which the management of external supplier resources is a vital task for enhancing the general costs and the positioning of competitive advantage. There is substantial confirmation by researcher and practitioners establishing the demand and the growth of partnership-like alliance between OEMs and suppliers that go beyond the common and usual hierarchical relationships. This new partnership as stipulated is to be characterised by trust, mutual goal settings, inter-organisation cooperation and supplier integration.

During product development, organisation focus on limited number of suppliers, advanced intimate relationships with them and commit high level attention on the performance of the suppliers relative to cost, quality and delivery. In connection with this type of development of mutual relationships, the issue of supply networks is usually mentioned as a way of maintaining and remain competitive in the global manufacturing sector. The perception of network covers the celestial incorporation of all suppliers to integrate both resources and increase the flexibility with value creation

adaptability procedure. Based on the protective features of these policies, the suppliers have no technological abilities and can be categorised by non-competitive productivity and level of quality (Okada, 2004). In the view of the localisation requirement and necessity coupled with high import tariffs that hinder a deeper embracing utilisation of global imports, many manufacturers have called the attention of their global suppliers to the establishment of manufacturing facilities in Malaysia while many of them have commenced a local supplier base. Apart from this, the issues of quality, local content, supplier's innovative competency as well as emerging countries create unique challenges on the operation of supply chain relative to logistics, reliability, and cost. Hence, the need of supplier's base management practices by the large corporations to be adapted to features of emerging markets.

Several numbers of researchers have studied the features and scope of international organisations' localisation strategies (Seyf, 2001; Ramarapu, Timmerman, and Ramarapu, 1999; Bartlett and Ghoshal, 1990). Many of them have argued that organisations need to stress the localisation strategies since the process of adaptation to the local norms is germane for the success of a new subsidiary (Lee and Chen, 2003). So many advantages have been attached to localisation in all diversity (Bartlett and Ghoshal, 1990; Brikinshaw, 1996; Negandhi, Yuen, and Eshghi, 1987).

Nevertheless, localisation has being addressed from different point of view and perspectives whereby different type of definitions have been developed ranging from tailoring operations to local needs (Bartlett and Ghoshal, 1990) to observing the norms and practices of local business (Lee and Chen, 2003). The localisation definitions, its relationship to globalisation, its benefits and weaknesses are so numerous. In the context of what is lacking in Malaysia automotive industry, it is an incorporated analysis that acknowledge and identify the nature, rationale, scope and advantages of true resin localisation strategies to be adopted and implemented by Malaysia's car maker vendors. There is a need to investigate the existing supply chain framework and propose a more effective supply chain framework for localisation of resin in Malaysia automotive industry.

In summary, despite the advancement of the automotive industry, there are still some notable lapses in their mode of operations and procedure of activities. Noticeable among all these is the supplying framework and procedure of the raw materials especially the resin supply chain framework in the automotive industry in Malaysia, which if this problem is address adequately, it will bring more profit and less work flow to the sector.

1.4   Problem Statement

In the era of globalisation, the automotive supply chain has gone through remarkable changes and the industry has been trying to develop innovative systems to minimise cost of operation, lead time, and as well as inventory to maintain their market growth. Considering the sourcing partners' expansion, customer requirement streamlining, inventory management, precise forecasting, improved suppliers' relation, cooperation and coordination across the border line of supply chain, adequate and accurate visibility and control over the procedure and minimisation of lead time is being attained by the organisations (Babu, 2012). Relative to this is the most significant problem identified by Malaysia automotive players which is the integration of the entire supply chain and controlling as an integrated single unit. This also includes managing inbound logistics which is another major concern for OEMs and auto component stakeholders, and manoeuvre more challenges linked to data reliability, lead time and scarcity of quality logistics players on the downstream and upstream side.

The parts and components of the automotive industry in Malaysia was observed to be in trade deficit by importing of all automotive parts at 4 billion ringgits in values when compared to exports parts which was only put at 2 billion ringgits. Many past researchers such as Petison and Johri (2008), Petison and Johri (2008a; 2008b) had suggested and compared that to what is obtainable in Thailand and attributes the success of their automotive policy strategy on dependent strategy on foreign investment. Meanwhile, lack of performance in the manufacturing and components sector of automotive industry in Malaysia which has been seen as

attraction to invest in Malaysia, needs to be put in rightful perspective (Ariffin and Sahid, 2018). Hence, the need for this study.

The observation in the supply chain management of resin, which is one of the components of automotive in Malaysia call for concern based on the trade deficit observed. The challenges have links with logistics, quality and competitive pricing and lead time. Hence, this research aims at investigating the numerous issues relating to resin supply chain in his daily work which encourage for further research in this area.

1.5 Research Questions

Based on the aforementioned research problems, the following research questions are generated:

(a)   What is the existing resin supply chain framework in Malaysia automotive industry?

(b)   What is the localisation strategies of Malaysia resin maker?

(c)   How to develop a more effective supply chain framework for localisation of resin in automotive industry of Malaysia?

(d)   How to validate the newly introduced model of Resin Supply Chain Framework for automotive industry in Malaysia?

1.6 Research Objectives

In answering the research questions above, the following objectives are highlighted:

(a)   To investigate the existing resin supply chain framework in Malaysia automotive industry

(b)   To investigate the localisation strategies of Malaysia resin maker

(c)   To develop a new model of an improved resin supply chain framework that fits into the context of Malaysia automotive industry

(d)   To validate the new framework to support resin supply chain improvement for automotive industry in Malaysia

1.7   Scope of Research

The research mainly focuses on investigating of the existing resin supply chain framework for local and foreign car makers and proposed development of a more effective supply chain framework for resin localisation in Malaysia automotive industry. The qualified experts were selected from Procurement Department who specifically deals with the resin sourcing for their company. A qualitative research approach is used by obtaining and analysing experts' opinion and judgement collectively. The boundaries of the research are: industry type is automotive domain, focusing on resin sourcing product; and expert panel possess specialised industrial experience in handling resin sourcing.

1.8   Significance of Study

This study aims to contribute to the body of knowledge on the resin supply chain management   and the implementation of the newly introduced resin supply chain framework for the usage of the fast-growing local car makers as well as foreign car makers in Malaysia. Hopefully, the existing resin supply chain framework will be assessed, review and analysed for further enhancement which will contribute to the Quality, Cost and Delivery (QCD) success factor. The new improved resin supply chain framework will be utilised to safe guide the local and foreign car makers in Malaysia, to diagnose, determine and improve the recently use resin supply chain

scenario. This study will hopefully offer more opportunity for continuous enhancement in compounded resin supply chain management as well as the operations for the local and foreign car makers in Malaysia.

The proposed resin supply chain framework in this study will avail other local and foreign car makers or assemblers, as well as local car spare part maker will hopefully be able to implement the same concept of resin supply chain framework. Automotive companies such as, PROTON, Toyota Motors, Nissan Tan Chong, Cycle and Carriage, just to name a few, will find it useful in their operational procedures. The proposed of resin supply chain framework with local car maker will be implemented not only to all local manufacturers, but suppliers or vendors too as its benefits for resin supply chain strategies. The proposed framework will provide routing of resin supply chain and expected to reduce production cost, improve deliveries and to maintain competitive advantage in Malaysia market.

1.9   Chapter Summary

This thesis consists of five chapters. Chapter One provides the introduction where discussions on the automotive industry in Malaysia and the background of the study and review of the supply chain management of automotive parts and components, including resin, in Malaysia are explained. This is followed by the problem statement of the research, the objectives, and the scope of the research and the benefits of the study.

Chapter Two deals with the literature review on all variables and the related topics and concepts in this research. It begins with a review of on automotive industry in ASEAN countries, as well as in Malaysia in particular. This is followed by reviewing the supply chain management in the automotive industry. It then reviews the literature on supply chain framework in automotive and in Malaysia automotive industry in general. At the end of review, a proposed indicators and Conceptual Framework was developed.

Chapter Three gives details of the research methodology adopted in this research. Review on qualitative method of research was given and specific details about interview perspective of qualitative with focus on Delphi methodology used in this research. The analysis of the collected and collated data is also explained in detail.

Chapter Four of this study gives the findings of the data collected, specific details of results interpretation were done descriptively and in a form of thematic analysis and description that follows the pattern of Delphi methodology. Overall discussion of all the results and findings. Lastly, Chapter Five of the thesis shows adequate conclusion as well as recommendations. Research contribution, limitation of the research and future research are also discussed in this chapter.

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LIST OF APPENDICES

Appendix A   Letter of Consent to Conduct Research Work

1 September 2018

Mr. XYZ
Procurement and Vendor Management (PVM)
Car Maker A

REF : REQUEST FOR AN APPOINTMENT DISCUSSING ON RESIN SOURCING   FRAMEWORK FOR MALAYSIAN AUTOMOTIVE INDUSTRY

First of all, I would like to thank you for receiving my call recently. I'm currently working with ██████████ Sdn. Bhd. and attached to Universiti Teknologi Malaysia for my PhD research on an improve resin supply chain framework for Malaysian automotive industry.

In relation to this, I would like to request for an appointment with you at your convenience to discuss several issues based on your expertise in resin sourcing.

I understand that you are having tight work schedule, and I just would like to request a little of your time for the purpose of this research.

It would be best if you could suggest suitable date and time within the month of October 2018. Appointment outside office hour also would be possible if your daily schedule is fully occupied.

Look forward to hear from you soon.

Thank you,

ROSDAN

Yours sincerely,

Rosdan

Appendix B   Questionnaire – Round 1 (Development Phase)

In Round One – Section A, the questions listed below are designed to seek your personal opinion on resin supply chain framework. Please provide a narrative or short-answer response to all questions and do not feel limited in the length or style of your answers. Feel free to give your own opinion.

1.   In your opinion, what is the current issue in the resin supply chain?

2.   If you can, kindly describe the current supply chain framework used for resin in Malaysia automotive   industry.

3.   In your opinion, what are the benefits of resin localisation activities?

.

4. In your point of view, what are the factors that contributed for resin localisation activities in Malaysian automotive industry?

5. If you can, kindly describe the current localisation framework used for your current resin?

Please write any other comments (optional).

Appendix C   Questionnaire – Round 2 (Development Phase)

Dear Respondent,

The following questionnaire is to analyse your view on how to facilitate the resin supply chain process in Malaysia. We are seeking your recommendations for further improvement.

Please circle the response that most closely represents your opinion toward the current resin supply chain of your suppliers/vendors with their compounder.

(1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree)

A. Quality & Standard (QS)

QS1: Ability of compounder to produce low defect rate of product.

1   2   3   4

QS2: The compounder is able to meet global certification and standard required.

1   2   3   4

QS3: The compounder produces environmentally friendly product.

1   2   3   4

QS4: The performance of the product of the compounder is high.

1   2   3   4

QS5: The compounder is reliable to meet product quality specification.

1   2   3   4

B. Customer Focus (CF)

CF1: The compounder is able to customise their product as per customer's requirement.

1   2   3   4

CF2: The skill of compounder for satisfying their customer's need.

1   2   3   4

CF3: The compounder support for any product issue during mass production activity.

1   2   3   4

CF4: The compounder has the required knowledge, skills and ability to support during product development stage.

1   2   3   4

C. Flexibility (FX)

FX1: The compounder has ability to respond to and accommodate demand variations, such as seasonality.

            1   2   3   4

FX2: The compounder has ability to respond to and accommodate the periods of poor manufacturing performance such as machine breakdown.

            1   2   3   4

FX3: The compounder has ability to respond to and accommodate the periods of poor supplier performance such as resin shortage.

            1   2   3   4

FX4: The compounder has ability to respond to and accommodate the periods of poor delivery performance.

            1   2   3   4

FX5: The compounder has ability to respond to and accommodate new products, new markets or new competitors.

            1   2   3   4

D. Delivery Variables (DV)

DV1: The compounder has ability to deliver goods according to required quantity.

            1   2   3   4

DV2: The compounder has ability to deliver their goods accordingly despite ordering fluctuation.

            1   2   3   4

DV3: The compounder has ability to maintain product quality in every delivery.

            1   2   3   4

DV4: The compounder always delivers the right quantity for every delivery.

            1   2   3   4

DV5: The current supply chain system reduces your product field return.

            1   2   3   4

E. Technical Expertise (TE)

TE1:   The compounder has ability to develop the product tailoring to customer specification.

<div align="center">

1   2   3   4

</div>

TE2:   The compounder has ability to preserve their product knowledge even with high staff turnover.

<div align="center">

1   2   3   4

</div>

TE3:   The compounder has creativity for solving and troubleshooting problems.

<div align="center">

1   2   3   4

</div>

TE4:   The compounder has proper internal training to preserve their standard.

<div align="center">

1   2   3   4

</div>

TE5:   The compounder has ability to contain their knowledge within organisation.

<div align="center">

1   2   3   4

</div>

F. Cost Variables (CV)

CV1:   The compounder is able to provide competitive product costs.

<div align="center">

1   2   3   4

</div>

CV2:   The compounder conducts continuous improvement activity for cost reduction including kaizen activity.

<div align="center">

1   2   3   4

</div>

CV3:   The compounder continuously finds value added activities with their customer.

<div align="center">

1   2   3   4

</div>

CV4:   The compounder is able to keep minimal inventory cost.

<div align="center">

1   2   3   4

</div>

CV5:   The current supply chain system of the compounder is able to reduce overall vehicle resin cost.

<div align="center">

1   2   3   4

</div>

G. Demographics (Please tick)

1. Qualification:

   Diploma   ☐

   Degree   ☐

   Masters   ☐

   Others   ☐

2. Age category:

   21 – 25   ☐

   26 – 30   ☐

   31 – 35   ☐

   36 - above   ☐

3. Working experience:

   1 – 5 years   ☐

   6 – 10 years   ☐

   11 – 15 years   ☐

   16 - above   ☐

4. Approximate size of company:

   1 – 10, micro   ☐

   11 – 100, small   ☐

   101 - 500, medium ☐

   501 & above, large ☐

Thank you for your participation.

Appendix D Questionnaire – Delphi 3 (Validation Phase)

Dear Respondent,

The following questionnaire is to analyse your view on how to facilitate the resin supply chain process in Malaysian automotive industry. We are seeking your recommendations for further improvement.
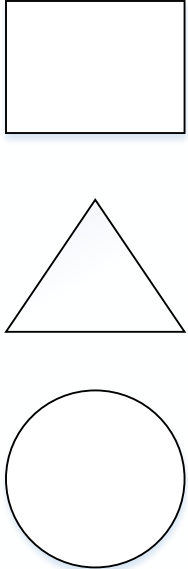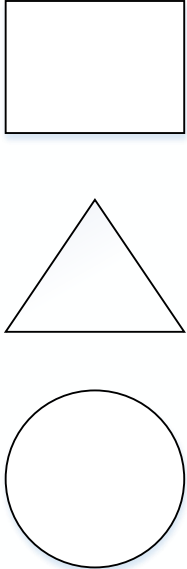
Please circle the response that most closely represents your opinion toward the current resin supply chain of your suppliers/vendors with their compounder.

(1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree)

No.	Items	4	3	2	1	Comments
1.0	**Resin Supply Chain Improvement (RSCI) Framework**					
1.1	RSCI framework has great impact in cost improvement, delivery improvement, quality improvement and inventory improvement.					
1.2	There is a limitation to fully implement on all parts due to low volume/quantity of the vehicle produced.					
1.3	RSCI framework leads to smoother pricing control for resin.					
1.4	In general, implementation of new RSCI framework will benefit car maker to reduce overall vehicle cost.					
2.0	**Success Criteria: Consistency**	4	3	2	1	Comments
2.1	RSCI framework enhance supplier adaptabilities for better resin delivery.					
2.2	RSCI framework enhance supplier adaptabilities for better resin inventory.					
2.3	RSCI framework enhance supplier adaptabilities for better resin quality.					
2.4	RSCI framework enhance supplier adaptabilities for better resin cost.					
2.5	RSCI framework enhance supplier adaptabilities for better resin development.					

3.0	**Success Criteria: Usability**	4	3	2	1	Comments
3.1	RSCI framework is beneficial for projects overall improvement.					
3.2	RSCI frameworks practices will enhance organisation profits.					
3.3	RSCI framework easily understandable by any related organisations.					
3.4	RSCI framework ease the selection of resin suppliers for the organisation.					
3.5	RSCI framework helps to minimise inventory stock for the organisation.					
3.6	RSCI frameworks able to standardise the resin quality for the organisation.					
4.0	**Success Criteria: Adaptability**	4	3	2	1	Comments
4.1	The comprehensive procedures of RSCI framework activities is common and generic, which expected to be applicable to most car maker.					
4.2	RSCI framework is organised, so that it can be customised to a specific project development requirement.					
4.3	RSCI framework is adaptable to the objectives of the organisation.					
4.4	RSCI framework is adaptable to the limitation of the organisation.					
4.5	RSCI framework requires minimal resources					
5.0	**Success Criteria: Verifiability**	4	3	2	1	Comments
5.1	The RSCI framework permits user to provide reasonable judgement in terms of its benefits.					
5.2	Array of findings will be produced if the RSCI framework is applied to distinctive projects for the organisation.					
5.3	RSCI framework meet the objectives of organisations ultimately for resin pricing control.					

Please sketch the current and your proposal of resin supply chain improvement framework applicable to your organisation. Add necessary arrow/flow to the diagram.

Current Supply Chain Framework	Proposed Supply Chain Framework

LEGEND: ☐ CAR MAKER

△ VENDOR

◯ RESIN SUPPLIER

Appendix E

Form: Delphi Round 3 (Validation Phase) – Final RSCI Framework Consensus

Dear Respondent,

The current resin supply chain framework and a newly derived improved resin supply chain framework are shown respectively in Figure 1.0 and 2.0.

Kindly evaluate and provide your recommendation or feedback on the newly derived RSCI framework.
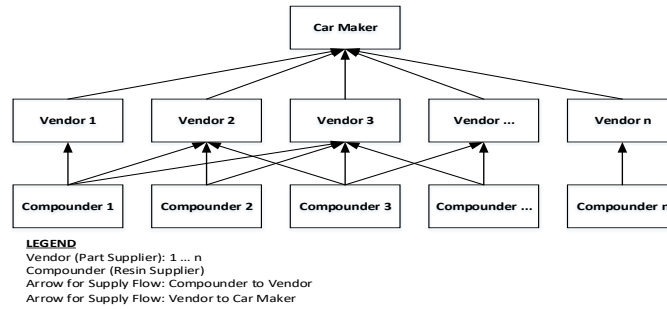

LEGEND
Vendor (Part Supplier): 1 ... n
Compounder (Resin Supplier)
Arrow for Supply Flow: Compounder to Vendor
Arrow for Supply Flow: Vendor to Car Maker

Figure 1.0 Current Resin Supply Chain Framework

LEGEND
Vendor (Part Supplier): 1 ... n
Compounder (Resin Supplier)
QCD: Quality, Cost and Delivery
Arrow for Supply Flow: Compounder to Vendor
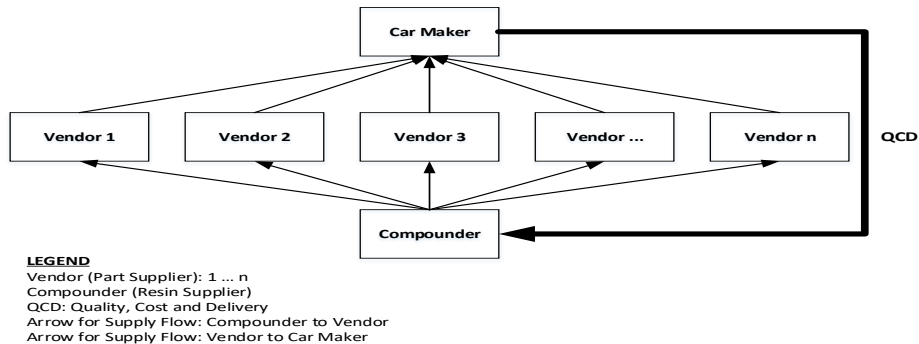Arrow for Supply Flow: Vendor to Car Maker

Figure 2.0 Improved Resin Supply Chain Framework

Instruction: Please tick (√) in either one of the empty fields.

Recommended	Not Recommended

Instruction: Please write any other comments.

Comments

Company Stamp and Date	Signature

151

LIST OF PUBLICATIONS

Indexed Conference Proceedings

Rosman, R., and Yusof, S. M. (2019). An improved resin supply chain framework for Malaysia automotive industry – Case study of foreign car maker. *In 2018 The 3rd International Research Conference on Economics, Business & Social Sciences (IRC 2018).* 9-10 November, 2018. *3*(1), (pp. 50). University of Malaya, Kuala Lumpur, Malaysia. **(Indexed by Scopus)**

Conference Proceedings

Rosman, R., and Yusof, S. M. (2018). An improved resin supply chain framework for Malaysia automotive industry – Case study of local car maker. *In 2018 The 19th Asia Pacific Industrial Engineering & Management Systems Conference (APIEMS 2018).* University of Hong Kong, Hong Kong. 5-8 December, 2018.