

CRANFIELD UNIVERSITY

NORDIN BIN YAHAYA

AN EXPLORATION OF CO-DEVELOPMENT WITHIN THE  
MALAYSIAN AUTOMOTIVE INDUSTRY

SCHOOL OF APPLIED SCIENCES  
CRANFIELD UNIVERSITY

PhD Thesis  
Academic Year: 2010

Supervisor: Professor Steve Evans  
June, 2010



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the degree of PhD

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## ABSTRACT

This is a study of Malaysian vehicle manufacturer-supplier relationships in the product development process. The collaboration, referred to as co-development, is highly important in order for vehicle manufacturers to remain competitive within this area of globalisation. So far, there have been no studies on the above subject area within Malaysia, which therefore makes this study both valuable and immensely important. The motivation comes from the uniqueness of the Malaysian automotive industry, which is newly established compared to other countries, and which has also been protected by the Government since the establishment of first National Car company in the 1980s.

The study has adopted a qualitative approach through exploratory study, and aims to explore in-depth the co-development practices within Malaysia. With the adoption of a case study research strategy, data is collected by means of interviews with consideration to both sides, i.e., local vehicle manufacturers and their suppliers.

It was found that, within Malaysia, two different approaches of co-development exist. First, the local suppliers mostly have low design capabilities, and the local vehicle manufacturer-supplier relationship exists only in terms of manufacturing components. Moreover, local suppliers have not become involved in the design process, but have received detailed drawings from vehicle manufacturers. However, they nevertheless have a freedom to manufacture the product without significant interference from the vehicle manufacturer. In this study, this type of supplier is labelled as a 'freedom to manufacture' supplier. In contrast, 'freedom to design, develop and manufacture' suppliers—which are mostly overseas suppliers—are involved in the design process at a very early stage. They are invited to participate at this point of the product development process in order to cater to the vehicle manufacturer's limited knowledge regarding the product.

The study provides insight into what has happened with regards to the Malaysian vehicle manufacturer-supplier relationship in the product

development process. It gives an indication of and new knowledge regarding the co-development of the newly established automotive industry in Malaysia.

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This has been a long journey, although it is full of memories. The journey has indeed been unforgettable. Importantly, not everything has gone as planned, and not everyone has understood the hardship. Nevertheless, many lessons have been learned; a lot of effort has been invested; and the result is my legacy at Cranfield University.

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To my family in Malaysia, all of whom tirelessly supported me from far away: I dedicate this thesis to all of you.

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# Chapter 1

Introduction

- Background of the research
- Introduction of research enquiry

Research objectives,  
thesis structure



# 1 Introduction

---

## 1.1 Introduction

This chapter explains the background of the research and the reason why this research is important, particularly to the Malaysian automotive industry. The discussion leads to the focus of the research and then details the objectives of this research. Moreover, in order to achieve the objective of the research, the research questions are developed. The researcher also explains how this study differs from other research. Importantly, an overview of the overall thesis structure is outlined at the end of this chapter.

## 1.2 Research Background

*Make no mistake about it; the motor industry is the empire of craftiness, the kingdom of the tinkerer and the paradise for the show-off (Gabriel Voisin, 1930, as cited by Nieuwenhuis & Wells, 2003)*

### **1.2.1 The Challenge of the Automotive Industry and Co-development**

The car industry has grown rapidly since its beginning. In 1885, Karl Benz invented the petrol engine and developed his and the world's first practical automobile ([http://en.wikipedia.org/wiki/History\\_of\\_the\\_automobile](http://en.wikipedia.org/wiki/History_of_the_automobile)). Henry Ford introduced the Ford Model T, the first mass-produced car using the Ford innovative assembly line, in 1908. Notably, the car market was predominantly dominated by both US and European manufacturers until Japanese cars

entered the industry in the late 1960s. Currently, there are more than 50 brands of cars from all over the world, and around 13 large vehicle manufacturers.

Today, the automotive industry is continuously expanding, and has been described as the single largest industrial sector in the world economy (Turnbull *et al.*, 1992). The International Organisation of Motor Manufacturers reports that over 70 million vehicles were produced in 2008 (<http://oica.net/>). With this in mind, it is true to state that the industry has had a significant impact on economic development, industrial organisations, technologies, managerial practices, and the standard of living in car-producing countries (Rosli, 2006).

The challenge of car companies is not simply assembling vehicles, but also orchestrating the complex set of processes involved in the manufacture of cars. The complexity is also owing to cars comprising approximately 10-15,000 individual parts, with a production run that includes approximately 500,000 units or more (Oliver *et al.*, 2008). Developing a new vehicle involves car companies and hundreds of suppliers, and requires numerous decisions to be made by many different people. Moreover, according to Thomas & Oliver (1991), European vehicle manufacturers typically outsource 50-60 per cent of their parts and assembly from outside suppliers. In contrast, Japanese car makers, such as Toyota and Nissan, outsource 70-75 per cent of their components from suppliers. This evidences the needs of vehicle manufacturers to work closely with component suppliers in developing a new car.

In many studies, working with suppliers to develop new products has been found to have a positive impact on three major challenges associated with manufacturing: reducing costs, improving quality, and shortening the lead time (Clark & Fujimoto, 1991; Wynstra *et al.*, 2001; Ragatz *et al.*, 2002; Vayvay & Cobanogulu, 2006). Notably, Nieuwenhuis and Wells (2003) detected the changing trend of vehicle manufacturers' sourcing strategies (Table 1). They

stated that vehicle manufacturers are moving towards innovative, global suppliers, with fundamental tools, such as research and development capabilities, enabling them to work with during this era of globalisation. Thus, as part of a maturing auto industry, car makers are feeling it necessary to move design work to Tier 1 suppliers; this is known as 'co-development'. Co-development is defined as being 'concerned with working together towards a common goal, with each party able to potentially gain more benefits from co-operating than from working independently' (Bevan, 1987).

Table 1: Transitions in vehicle manufacturers' sourcing strategies

(Nieuwenhuis &amp; Wells, 2003)

Item	Traditional	Lean	Extended Enterprise
No. of suppliers per model or plant	2000-3000	200-300	20-30
Geographic scope of supply base	Local	Regional	Global
R&D capacity of suppliers	Work to drawing	Design to fit	Innovative solutions
Contracts to suppliers	Short-term cost basis	Model term, cost quality and delivery basis	Model or platform term, 'shared destiny' basis
Management of supply base	Remote piece price focus	Interventionist, quality, price, delivery focus, supplier performance optimisation	Outsourced; value mapping; chain optimization; strategic focus
Structure of supply side	Fragmented, national focus	Tiered hierarchy, regional focus	Supply chain; global focus
Vertical integration in the vehicle manufacturers	High-captive suppliers for main sub-assembly	Reduced, captive suppliers seek external business	Selective integration in strategic technologies, reduces integration elsewhere

### **1.2.2 Malaysia and the Automotive Industry**

With independence having been granted in 1957, Malaysia had been struggling since the early 1960s as a poor country with an economy based on agriculture, rubber trees and palm oil. This continued until the 1980s when, under the new administration, the Government changed the country's direction towards



industrialisation, thereby promoting foreign companies' investment within Malaysia. The dream to become a modern and developing country subsequently drove the Government to introduce the big industrialisation project in 1983, referred to as the National Car Project (NCP). When the Government first announced the NCP, the amount of feedback, both positive and negative, and from Malaysians and industrialists was massive. Most industrialists at that time did not believe Malaysia could build a car; for middle- and lower-class people, it was like a 'dream come true'. However, under the leadership of the Prime Minister at that time—Dr Mahathir Mohammad—the Malaysians were proud; the first Malaysian car, the PROTON Saga, experienced its successful debut in 1985.

The criticism began with questions being posed as to whether or not Malaysia could cope with the complexity of the industry, as Malaysia had only a very short history in the automotive industry. Before the 1980s, there were only 15 factories assembling foreign cars, each of which had a limited number of components suppliers. Notably, the shortcut that the Malaysians took, that is, copying the Japanese Mitsubishi car and rebranding it to the PROTON, was also considered controversial at that time. However, in order to protect the NCP, the government introduced the protective tax tariff, resulting in higher taxes for foreign cars sold within Malaysia. As a result, the PROTON successfully dominated the Malaysian market until the early 2000s. Following the success of the PROTON, in 1994, the Government launched a second car project called the PERODUA with Daihatsu Japan. Fifteen years later, in 2009, both national car companies had a share of almost 60 per cent of the Malaysian car market. Currently, there are approximately 350 local automotive suppliers within Malaysia, with 4 companies (2 car makers; 2 commercial vehicle manufacturers) considered national vehicle manufacturers. As for the Malaysian automotive market, the industry has grown rapidly, recovering from the financial crisis in 1999. It was reported in 2008 that over half a million vehicles were sold within Malaysia, with almost 200,000 coming from the passenger car segment.

In comparison, the ASEAN (South East Asia) market recorded just below 2 million cars sold in 2009 (<http://www.just-auto.com/article.aspx?id=102890&d=1>).

As globalisation occurs, Malaysia is being affected along with the majority of countries. Under the ASEAN Free Trade Area (AFTA), the cars produced in neighbouring countries can enter the Malaysian market without any restrictions. As a result, most vehicle manufacturers and component suppliers from all over the world are establishing factories in most ASEAN countries, mainly in Thailand, focusing on the ASEAN and Chinese market. Ironically, the Malaysian automotive industry can no longer be protected: both national car makers have no choice but to compete with other manufacturers. Thus, Malaysian vehicle manufacturers and local suppliers have to become technologically more competitive than before, and ensure cost efficiency at all times.

The Malaysian automotive industry has many unique features, including 1) being a new entrant to the industry compared with other vehicle manufacturers, 2) having started by copying the Japanese, 3) having no history of suppliers, and 4) being protected by the Government throughout development. Furthermore, as discussed in 1.2.1, co-development offers great advantages to car companies in terms of decreasing lead times, improved quality, and reduced costs by using supplier knowledge about the product. Moreover, there is a great deal of additional evidence concerning the success of car companies that have moved towards the co-development approach. In the case of Malaysia, as there has so far been no study of co-development, there is an urgent need to understand current practices before any co-development improvement activities can be suggested or implemented. This study could also extend existing knowledge and thus may explore new knowledge of co-development within a unique automobile industry, such as that of Malaysia. Therefore, the focus of this thesis is on understanding the co-development relationship between Malaysian vehicle manufacturers and their suppliers.

### **1.3 Contribution to Knowledge**

In Chapter 2, the gap in existing knowledge will be explained through the literature review. The knowledge gap is not difficult to establish; most researchers of co-development practices have focused on either the Japanese or US automotive industry, whilst relatively small numbers have focused on developing countries. These findings are not necessarily applicable to developing countries, such as Malaysia; therefore, it is crucial that the gap in knowledge be reduced concerning how co-development practices might differ between developed and developing countries.

Currently, the car market in most developed countries is approaching a time of maturity, with most vehicle manufacturers and parts makers beginning to divert attention towards emerging markets, such as China, India and South East Asia (ASEAN). This research will help those automotive makers by providing them with various in-depth views of co-development practices within Malaysia, as an example of a developing country. Although this research focuses predominantly on Malaysia, the automotive industry throughout the region will have similarities in terms of supplier capability, technological complexity, and cost competitiveness.

With regards to academia, this research seeks to explore the new management practices within recently established vehicle manufacturers, such as the Malaysian PROTON or PERODUA companies. This research should also help practitioners to deal with their suppliers so as to remain competitive with other, more well-known and better established manufacturers.

## 1.4 Research Objectives

As previously explained, there is no known published research on co-development practices in the Malaysian automotive industry. Therefore, the objective of this research is:

***To explore and understand the co-development practices between Malaysian vehicle manufacturers and their suppliers.***

The study explores the characteristics of the current co-development practices within the Malaysian automotive industry, and accordingly seeks to establish the differences in terms of the practices between Malaysia and other countries' automotive industry.

## 1.5 Research Focus

In order to understand the current co-development practices within the Malaysian automotive industry, the researcher developed several criteria and situations that required further focus in this research. These criteria mainly stemmed from the literature review (Chapter 5).

In order to ensure a better understanding of Malaysian practices, this research compares such with the practices of other countries. Information regarding other countries' co-development practices was taken from the literature, and the choice of countries was determined by literature that emphasised the practices in the US and Japan, and further provided some European data.

The study focuses on the relationships between both vehicle manufacturers and their suppliers; this includes whether long-term focused relationships have any influence over co-development practices. The study also considers the types of

relationships, the types of information that might be exchanged, and the commitment between the two in relation to the product development process. However, the study does not go into detail concerning the type of contract, the knowledge-sharing technology, nor the cost information-sharing practices.

In order to understand the supplier's role in co-development practices, the study focuses on the supplier's involvement in the product development process. The supplier's influence over design and the timing of the supplier involvement are also studied. Furthermore, whether or not the supplier is able to influence the vehicle manufacturer in its decision-making process is also studied, and is considered to be an important factor in understanding the supplier's role in the process.

The supplier selection process is one of the focuses of this study; determining such helped the researcher to understand the criteria used when vehicle manufacturers select a supplier. Many criteria for selecting suppliers have been listed in the literature, such as supplier capability, quality, costs, and so on. In the case of the Malaysian automotive industry, these criteria might be contradictory or similar, as the setting of the industry differs from those of other countries. However, it was important for the researcher to investigate further the supplier selection process so as to reveal the factors, if any, that influence co-development practices in the Malaysian automotive industry. This also includes how supplier capability could potentially influence the selection process of suppliers by Malaysian vehicle manufacturers.

In addition, the researcher considers the nature of communication between the vehicle manufacturer and its suppliers throughout the co-development process. As communication is one of the important factors contributing to successful product development, it is important to pay attention to this area, giving consideration to how communication takes place in vehicle manufacturer-supplier relationships within Malaysia.

## 1.6 Research Questions

In order to achieve the objectives of the research, the researcher developed research questions that needed to have been answered by the end of the study. The first research question is:

***What are the characteristics of the current co-development processes between particular Malaysian vehicle manufacturers and their suppliers?***

In order to answer this question, several sub-questions were designed, all of which relate to the Malaysian context. These are:

- What types of relationship do vehicle manufacturers and their suppliers have?
- What are the critical criteria currently used by vehicle manufacturers when selecting those suppliers with product development involvement?
- At what stage of the product development process do the suppliers become involved?
- How do suppliers influence vehicle manufacturers in the product development and decision-making process?

The second question considered by this research is:

***How does the practice of co-development within Malaysian automotive companies differ from those in other countries?***

This question can be expanded into the following sub-questions:

- Where and how, if at all, do Malaysian automotive companies' co-development practices differ from those of Japanese or US companies?
- Under what circumstances do the practices of co-development in the Malaysian automotive industry differ from those other countries?

## **1.7 Thesis Structure**

Figure 1 below shows the structure of this thesis. Chapter 1 gives the background of the study, describing why and where this study took place. Chapter 2 presents the review of the literatures related to this study and explains the gap in existing knowledge. The methodology of this research is explained in Chapter 3, while Chapter 4 is concerned with the implementation of the selected research methodology. Chapter 5 reports the data collection process and Chapter 6 is concerned with analysing the data collected in the previous chapter. The list of findings from the study is listed at the end of Chapter 6. Chapter 7 presents the discussion of the findings, while Chapter 8 concludes the research journey, indicating the limitations of the study and suggesting possible future research areas.

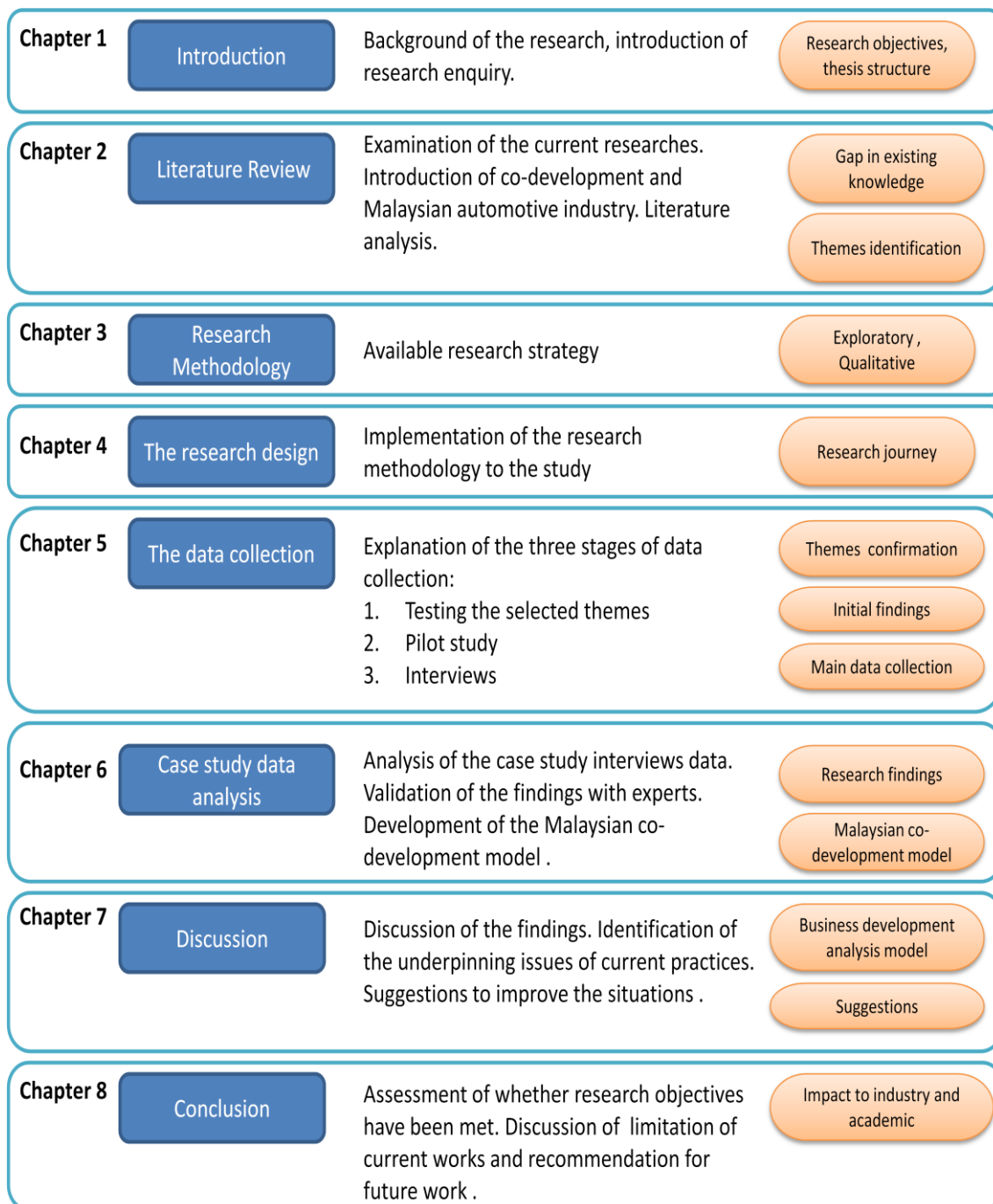


Figure 1: Thesis structure



## Chapter 2

### Literature Review

- Examination of the current researches
- Introduction of co-development
- Background of Malaysian automotive industry
- Literature analysis

Gap in existing  
knowledge

Themes identification



## **2 Literature Review**

---

### **2.1 Introduction**

The literature search strategy for this research was developed by first identifying the likely relevant databases, conferences and journals and using key words, such as Product Development, Buyer Supplier Relationship, Partnerships, Co-development and Automotive Industry. This generated many potential papers; the abstracts were analysed and promising papers read in detail. Snowballing using paper references, authors, conferences and journals generated a second long list. The researcher found many publications, including theses, journal articles, conference proceedings, newsletters, and books, and Government reports within Malaysia. Each new search brought more authors, journals, conferences and companies to the researcher's attention, as well as a growing set of potential keywords.

It is clear that the topics of co-development and the automotive industry have been described in many different ways over the past decades. Using the new keywords, new authors, new journals, and so on, the researcher was able to search further. Based on title and/or abstract, the researcher collated and read through all papers indicating the topics of co-development, product development and automotive industry, and added their references to the search. When new searches brought no new material, the researcher ended the initial search. Regular searches were used subsequently to update new material as it became available. The majority of the papers the researcher found did not relate directly to the topic of co-development and were discarded; the remainder formed a core set of some 100 papers that were used within this study.

## 2.2 New Product Development

The development of new and improved products is crucial in order for modern corporations to survive (Cooper, 2005). Poolton & Barclay (1998) claimed that *'[a] successful company can expect around two-thirds of all products they develop to be a commercial success, whereas one-third will fail'*. The 3M Company, for example, has generated a 25 per cent increase each year from new products (Gruenwald, 1992)

Numerous authors have agreed that product development is an important strategy that enables firms to remain competitive in a challenging business environment (Cooper, 1996; Cooper & Kleinschmidt, 1993). The ability to identify customers' needs and to respond to such needs quickly is one of the success factors in many manufacturing firms. Moreover, in order to achieve these goals, firms need to integrate the marketing, design, and manufacturing process to form one process known as product development (Ulrich & Eppinger, 2003).

The product development process is a major factor that affects the success of a new product. Cooper (1983) indicated that, in the product development process, multidisciplinary knowledge from marketing, engineering, research and development—right through all stages up until manufacturing—is essential. Notably, Clark & Fujitmoto (1991) defined the product development process as being information- and knowledge-intensive work. Therefore, the product development process has a major impact on the cost, quality and timing of the launch of a product (Fleischer & Liker, 1997).

One of the popular areas for product development process research is the focus on the reduction of development lead times and ideas for improving the process. Clark & Fujimoto (1991), for example, studied the development lead time of a new car in Japan and the US. They found that supplier involvement in the product development process was one of the key areas for reducing lead times and improving product performance.

Moreover, in their book *New Product Management*, Crawford & Benedetto (2006) summarised the definition of 'new product' from various resources. They categorised the new product in terms of how new it is in the world or to the firm. Table 2 below shows the categories and definitions of the term. Moreover, they also indicated that the new product process must respond to three unique inputs: the right quality product, the right time, and the right cost.

Table 2: What is a new product?

(Crawford &amp; Benedetto, 2006)

Category	Definition
New-to-the-world products, or really new products	These products are inventions that create a whole new market
New-to-the-firm products, or new product lines	Products that take a firm into a category new to it. Not new to the world, but new to the firm
Additions to existing product lines	Products that are line extensions in the firm's current markets
Improvement and revisions to existing product	Current products made better
Repositioning	Products that are retargeted for a new use or application
Cost reductions	New products that simply replace existing products in the line, providing customers with similar performance, but at lower cost

In his book *Innovation Management and New Product Development*, Trott (2002) classified the new product development activities across different industries. He divided the technological and marketing activities involved in the NPD process (Figure 2). Furthermore, industrial products have been indicated

as having more technological activities in the NPD process, whilst marketing activities play an important role in the NPD process of the food industry.

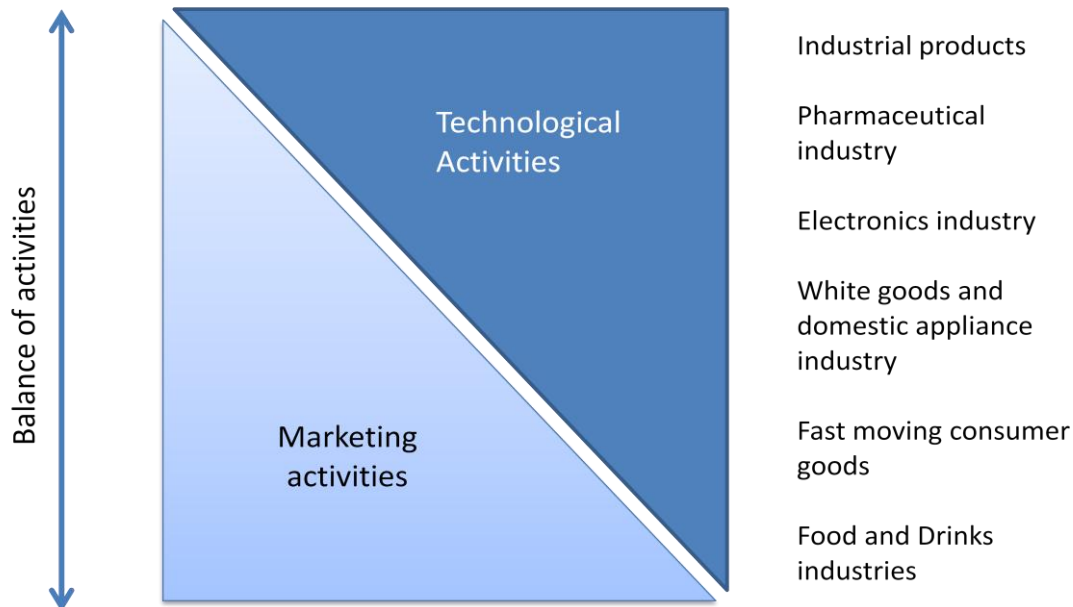


Figure 2: Classification of NPD activities across the industry

(Trott, 2002)

### **2.2.1 Product Development Stages and Process**

Ulrich and Eppinger (2003) divided the product development process into six phases: planning, concept development, system level design, detail design, testing and refinement, and production ramp-up (Figure 3).

The planning stage: this stage is referred to as 'phase zero'; it begins with corporate strategy and includes the assessment of technology developments and market objectives. The output of this phase is the project mission statement, which specifies the target market, business goals, key assumption and constraints.

Concept development stage: during this stage, the target market needs are identified, alternative product concepts are generated and evaluated, and one or more concepts are selected for further development and testing.

System-level design: this phase includes the definition of the product architecture and the decomposition of the product into subsystems and components. The output includes a geometric layout of the product, a functional specification of the product's subsystem, and a preliminary process flow diagram for final assembly.

Detail design: this stage includes the complete specification of the geometry, materials and tolerances of all the unique parts of the product, and the identification of the standard parts to be purchased from suppliers. The output is the control documentation for the product.

Testing and refinement: this part involves the construction and evaluation of multiple pre-production versions of the product.

Production ramp-up: this phase sees the product being made using the intended production system. In this stage, the work force will be trained, and any observed problems in the production processes will be eliminated.

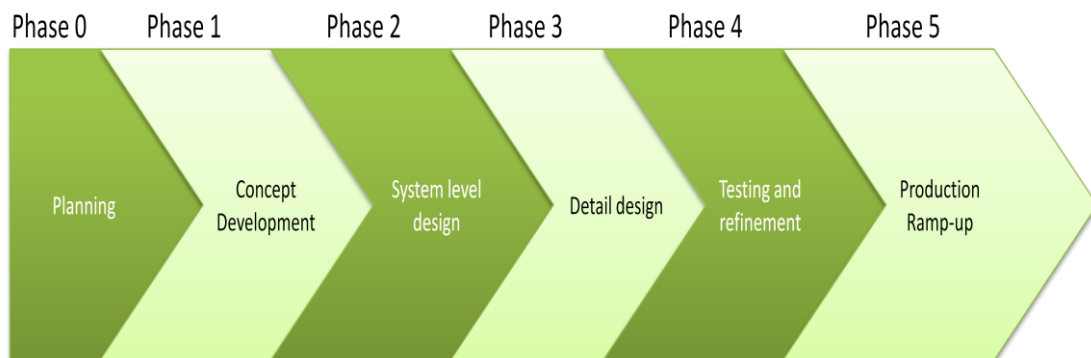


Figure 3: The product development process  
(Ulrich & Eppinger, 2003)

Meanwhile, Cooper (2005) developed a model that breaks the innovation process into various stages (Figure 4). The method developed by Cooper is known as the Stage-Gate Framework, and it accelerates new product projects from the initial idea through to a launch. Each stage comprises a set of concurrent, cross-functional and prescribed activities, undertaken by the cross-functional team. At each gate, the Go/No Go decision needs to be considered before continuing on to the next stage. Cooper refers to the term 'gate' as an evaluation task between stages.

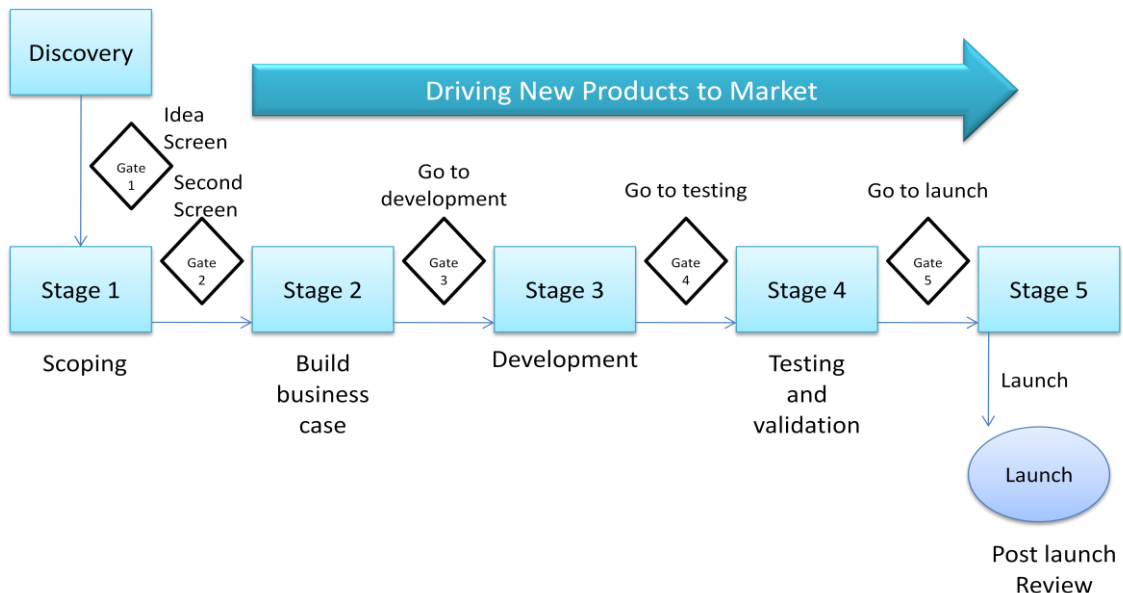


Figure 4: Stage-Gate: A five-stage, five-gate model

(Cooper, 2005)

Stage 1—Scoping: There is a quick investigation and sculpting of the project in order to determine the project's technical and marketplace merits.

Stage 2—Build the business case: Detailed homework and upfront investigation work is carried out. Detailed market analysis, competitive benchmarking,



concept testing, detailed technical assessment, source of supply assessment, and detailed financial and business analysis all form Stage 2.

Stage 3—Development: This stage involves the actual design and development of the new product. Stage 3 witnesses the implementation of the development plan and the physical development of the product. The deliverable of this stage is a prototype product.

Stage 4—Testing and validation: This involves the verification and validation of the proposed new product, its marketing and production. This stage tests and validates the entire viability of the project.

Stage 5—Launch: This stage deals with full commercialisation of the product, full production, the commercial launch, and sales. The post launch is for monitoring and fixing.

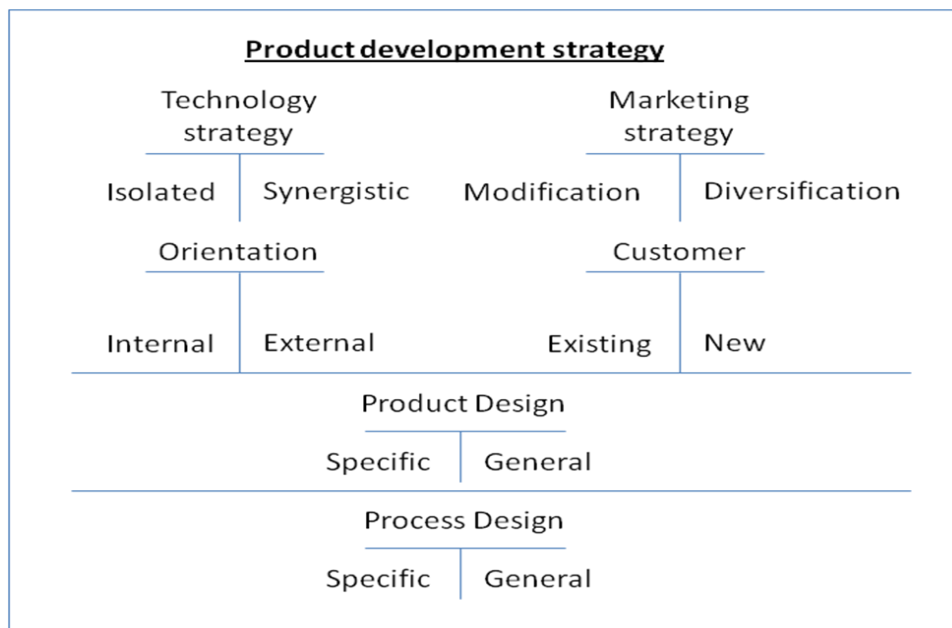
### **2.2.2 Product Development Strategy and Successful Product Development**

A formal NPD strategy helps to reduce cycle time for prioritising projects and allocating resources, thereby reducing conflict and the time required for decision-making (Parry *et al.*, 2009). Castellion (2005) proposed that it is possible to formulate the strategy of a new product by addressing the following questions:

1. Who are the target customers for the new product?
2. Which three or four critical benefits of the product create enough value for the target customers to buy the new product?
3. How can we produce these benefits cost-effectively, and correctly price the product?

Nystrom (1985) developed several strategies of new product development based on the technological and marketing side, and viewed the strategies as being either open or closed. Synergistic technology use and external technology orientation contribute to the open technology strategy, whilst product diversification and the emphasis on new customers are open marketing strategies. In contrast, internal technology orientation, product modification, and the emphasis of existing customers are aspects of the closed strategy. The summary of such strategies can be seen in Table 3.

Table 3: Product development strategy framework  
(Adopted from Nystrom, 1985)



Cooper (1984) listed the strategies of the top product development performers. The strategies were characterised by a technologically aggressive, innovative, venturesome, proactive, diverse and market-oriented stance. The strategies include:

- An aggressive technological orientation, strong R&D orientation, and proactive acquisition of new technology;
- A venturesome, offensive programme viewed as being the leading edge of corporate strategy;
- A market-oriented programme featuring strong efforts to identify customer needs, and a proactive search effort for new product ideas;
- The development of products with a differential advantage;
- The use of sophisticated technologies, but with a high degree of synergy with the firm's resources; and
- A relatively diverse new product programme.

A supportive and enabling environment is essential so as to ensure that the new product development process will be successful (Lettice *et al.*, 2005); this includes human resource management, technological infrastructure, organisational structures, and a competitive and financial context in which it can operate.

In order for the new product to succeed, the firm needs to manage the complexity of the process efficiently. Poolton & Barclay (1998) identified eight major variables associated with successful NPD (Table 4).

Table 4: Eight major variables with successful NPD  
(Poolton & Barclay, 1998)

Good internal and external communication	Person-to-person communication as the critical variable that makes the difference between success and failure
Innovation as a corporate-wide activity	Building solid foundation for innovation and sense of shared destiny for new products
High quality management and management style	Innovator firm is characterized by management of high quality, flair and ability
Key individuals	The role of one or two people who are prepared to maintain support for the new product and champion their development
Good planning and control	Both the intensity of development planning and the effective use of control procedures have positive impact to innovation
Efficient development work	Managing complexity and difficulty of development work accurately
Marketing and user needs	Identifying advantage according to users' needs rather than availability of new technologies
After-sales service and user education	Preparing users for new product could avoid costly mistakes and maintain company reputation

Furthermore, Ulrich & Eppinger (2003) listed the characteristics of successful product development, and defined the successful product development as products that can be produced and sold profitably. In their research, they added five more dimensions so as to assess the performance of product development efforts: product quality, product cost, development time, cost, and capability (Table 5).

Table 5: Successful product development: Dimensions of assessing product development effort  
(Ulrich & Eppinger, 2003)

Product quality	Product quality is ultimately reflected in market share and the price that customer is willing to pay
Product cost	Determines how much profit accrues to the firm for a particular sales volume and price
Development time	Determines how responsive the firm can be to competitive forces and to technological developments.
Development cost	Usually a significant fraction of the investment required to achieve the profits
Development capability	An asset the firm can use to develop products more effectively and economically

Of importance to this research is the view that NPD is strategically important to business success and that, without NPD capability, companies would be forced to compete primarily in terms of cost, and would have fewer opportunities to innovate and establish a competitive space away from their existing competitors.

### ***2.2.3 The Role of Collaboration in Product Development***

Collaboration processes provide an instrument that is used in several different industries in order to gain a competitive advantage and so reduce development costs. Collaboration can be both downstream with customers and upstream with suppliers and internal teams.

Moreover, collaboration with customers can help firms to understand customers and markets, and their needs and requirements; this has long been recognised

as being critical to the success of a new product development effort (Boike *et al.*, 2005). Copper (2001) indicated that one of the most essential components of new product success is establishing customer needs and wants. Griffin (2005) further indicated that the most successful new products match a set of fully understood consumer problems with a cost competitive solution to those problems. On the other hand, firms that ignore customers will risk wasting money developing solutions on problems that do not exist, or for which potential customers already have an adequate solution.

Alam (2005) listed several benefits of customer interaction in NPD: superior and differentiated new products, reduction of the time-to-market process, reduction of the time-to-acceptance process, and ensuring long-term relationships with customers. Alam further detailed the potential customer activities at the key stage of NPD (Table 6).

Table 6: Customer activities at the key stages of the NPD process

(Alam, 2005)

Development Stages	Activities Performed by Customers
Idea generation	Describe needs and wants
Idea screening and concept development	Rate the purchase intent of all by the product concept
Product development	May join NPD team to review and jointly develop the overall design and configurations
Product testing	Test the working prototypes by critiquing their functionality, reliability and performance
Test marketing	Provide feedback on various aspects of the marketing strategies
Product launch	Adopt the product as trial, provide feedback

Besides collaboration with customers, collaboration with suppliers is also considered to be one of the most important strategies in NPD: by involving suppliers in product development, buyers/customers can take advantage of their suppliers' resources, such as skilled workers, technological capabilities, and equipment, to maintain a competitive advantage by reducing costs and cycle times (Fliess *et al.*, 2006). Regarding this issue, Section 2.3 will discuss in detail the buyer-supplier collaboration in the case of product development.

### **2.3 Involving Suppliers in Developing the Product**

Outsourcing is one of the strategies involved in procuring products or services from sources that are external to the organisation. According to Lankford & Parsa (1999), firms should consider outsourcing provided by an outside organisation when it is believed that such an organisation will fulfil the brief faster, cheaper, or better than the firm itself can. Companies can buy technology from suppliers that would be too expensive for them to replicate internally. Moreover, by outsourcing, companies will have less manufacturing responsibility, as this is transferred to the selected suppliers. In the case of new product development, outsourcing is used to allow companies to cater for their lack of knowledge, technology and expertise on the developing component of their new product by using suppliers' resources. Notably, a study conducted by Roberts (2001) stated that North American and European companies spend 30 per cent of their research and development (R&D) budget outsourcing R&D-related activities.

Furthermore, Florida & Kenney (1991) indicated that, in the case of the Japanese automotive industry, suppliers' components dominate 70 per cent of the car compared to 30-50 per cent in the US. Clark & Fujimoto (1989) demonstrated that Japanese automakers have 12 months' lead time advantage compared to the US and European vehicle manufacturers; they explained further that the Japanese advantage in lead time appears to stem from a

combination of their internal organisation capability, strong supplier capability, and innovation strategy.

Supplier involvement in terms of product development may range from providing minor design suggestions to being responsible for the complete development, design and engineering of a specific part of the sub-assembly (Wynstra & Pierick, 2000). Microsoft, for example, has collaborated with Intel to provide microprocessor technology for Microsoft's software, whilst Dell and HP provide critical capabilities in the form of machines running the software. All of these organisations are working together to develop personal computers (Chesbrough & Schwartz, 2007).

In their study on suppliers' involvement and the success of radical NPD in new ventures, Song & Benedetto (2008) determined the positive impact of supplier involvement on new product performance. Supplier involvement and participation in new product development may help to reduce costs, reduce the time-to-market phase, improve quality and communication, and provide innovative technologies that ultimately can help to capture a market share and give a return on investment (Vayvay & Cobanogulu, 2006).

A strong relationship with the supplier in product development is essential in order for organisations to remain competitive in a global, rapidly changing, and demanding market (Womack *et al.*, 1990; Clark *et al.*, 1992; Nishiguchi, 1996). Supplier integration in the case of product development is one of the most important subject areas, as the purchased materials from suppliers are reported to account for at least 50 per cent of the costs of the final product (Handfield *et al.*, 1999). Stuart (1997) further reported that companies with a strong supplier network enjoy higher levels of productivity and quality than those with weak alliances.



None	'White Box'	'Grey Box'	'Black Box'
No supplier involvement. Supplier 'makes to print.'	Informal supplier integration. Buyer 'consults' with supplier on buyer's design.	Formalized supplier integration. Joint development activity between buyer and supplier.	Design is primarily supplier-driven. Based on buyer's performance specifications.



Figure 5: Spectrum of supplier integration

(Petersen *et al.*, 2005)

Petersen *et al.* (2005) outlined four types of supplier integration. Firstly, the black box type of supplier has almost complete responsibility for the product with customer performance specifications (Figure 5). On the other hand, the white box type of supplier will discuss product specifications and requirements with customers, but all designs and specification decisions are made by customers. With the grey type of supplier, customer and suppliers work together through different stages of the development process, sharing information and technology, and partaking in joint decision-making concerning design specifications; this involvement can range from very close discussions held early on in the development process to more distant relationships, which are mainly concerned with detail manufacturing. Koufteros *et al.* (2007) stated that selecting suppliers based on their capability will ultimately lead to a higher level of integration with both grey and black box types of suppliers.

Lamming (1993) suggested that co-operative buyer-supplier relationships are beneficial for both the buyer and the suppliers; as such a situation may lead to improved product quality, productivity and lead time, and cost reductions. Moreover, Bruce *et al.* (1995) pointed out that collaborative product

development with suppliers is one means of enabling organisations to achieve a competitive advantage in today's business environment.

Handfield *et al.* (1999) stated several reasons why companies choose to integrate suppliers into the product development process. The results clearly suggest that supplier integration would have a positive effect on products, especially on cost, quality, technology and time-to-market. The summary of the findings is listed in Table 7.

Table 7: Companies' objectives for supplier integration

(Handfield *et al.*, 1999)

Companies Objectives for Supplier Integration
1. Reduce design or development time
2. Reduce procured item cost
3. Improve procured item quality
4. Improve procured item reliability and durability
5. Reduce design and development cost
6. Access and improve product technology
7. Develop long-term supplier relationships
8. Improve product features
9. More effective use of internal human resources
10. Improve customer service
11. Reduce technological risk
12. Reduce financial risk
13. Access and improve process technology
14. Improve my business unit's position as a preferred customer to the supplier
15. Comply with environmental regulations
16. Comply with other Government regulations

Handfield *et al.* (1999) further defined the stages of supplier integration into the NPD processes (Figure 6). They indicated that early supplier involvement in NPD is crucial for complex products, the supplier of systems or sub-systems, critical items or technologies, strategic alliances and 'black box' suppliers. In contrast, early supplier involvement is not deemed to be as necessary in the case of less complicated products, single component suppliers, less complicated products or technology, non-allied suppliers and 'white-box' suppliers.

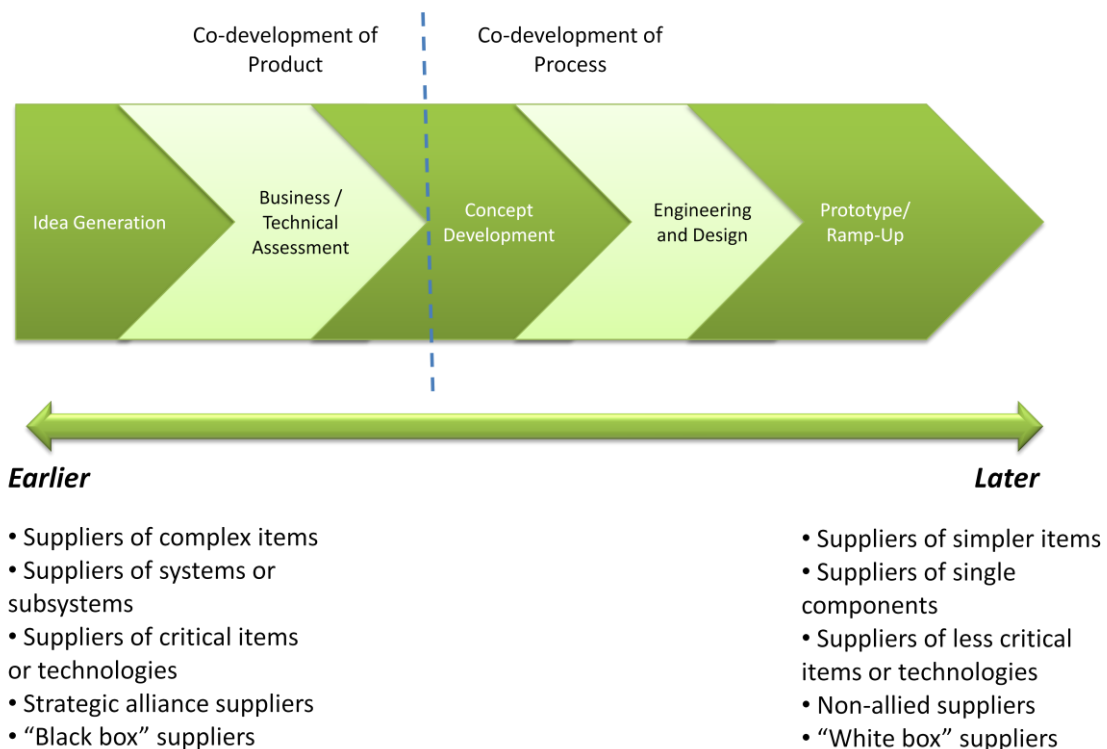


Figure 6: Integration of suppliers at different stages

(Handfield *et al.*, 1999)

Early involvement of suppliers on the development process could be joint working related to either process development or product development. Early involvement of suppliers in process development is defined as joint working that starts before the design is fixed, which on the figure above occurs after the Concept Development stage. Early involvement on product development in

some situations implies involving suppliers before the RFQ process starts. In Figure 6, it refers to before or during the Concept Development stage, where the design and engineering are not fixed.

Co-development is most often discussed in terms of product co-development, which this study also uses; hence the researcher concentrates on supplier collaboration on the product development process rather than the process development. Where insights into co-development of the manufacturing process occur, they are presented, but use of that term makes clear that they refer to process co-development.

Wynstra & Pierick (2000) developed the Suppliers Involvement Portfolio to provide support for setting priorities with regards to supplier involvement in a new product development project (Figure 7). This portfolio identifies four different types of supplier involvement on the basis of two variables: the supplier's degree of responsibility in the project, and the development risk. The four types of supplier involvement are categorised as follows: Strategic Development, where suppliers have a high responsibility concerning the development project together with a high development risk; Critical Development, which is characterised by a high development risk by the supplier with low supplier development responsibility; Arm's Length Development, which is when the major part of development is contracted to suppliers, and there is a very low development risk; and Routine Development, which belongs to a supplier with little responsibility and a low development risk.

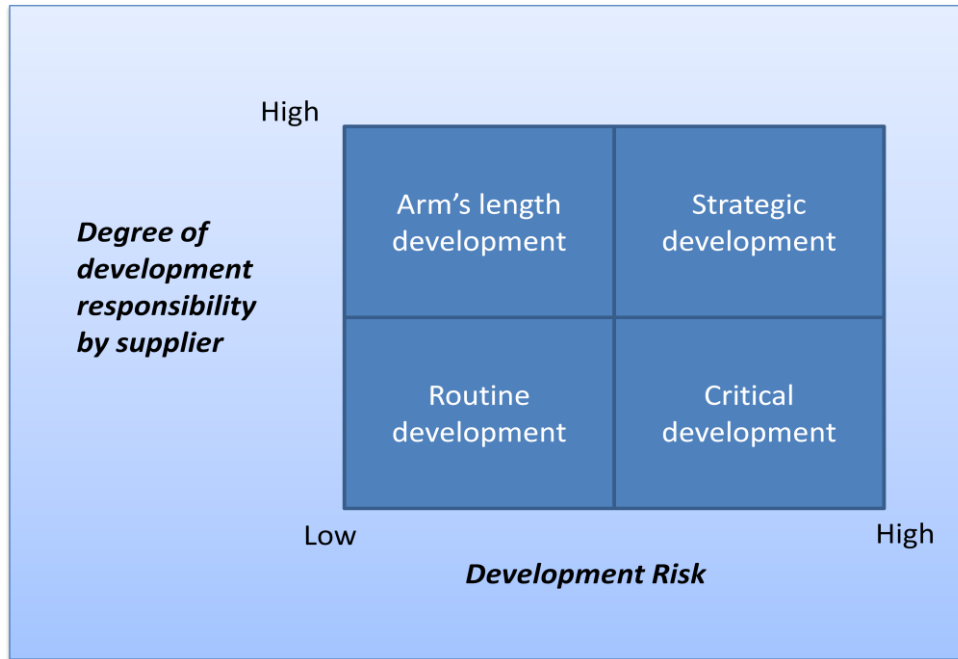


Figure 7: The supplier involvement portfolio

(Wynstra &amp; Pierick, 2000)

Much of the literatures had focused on the effectiveness and efficiency of involving suppliers in the product development collaboration. The majority of authors in this case believe that involving suppliers in the early stages can lead to better product performance and quality, can reduce the product and development costs, and may also shorten the development time (Clark, 1989; Ragatz *et al.*, 1997; Handfield *et al.*, 1999; Wynstra *et al.*, 2001; Ragatz *et al.*, 2002). Moreover, extensive communication between the buyer and supplier, and a frequent sharing of knowledge relating to product and customer requirements can also have a positive effect on the product development process (Clark *et al.*, 1989; Dyer *et al.*, 1993). In addition, early supplier involvement has also been found to be an effective strategy in terms of reducing overall development time, especially for a highly innovative product (Swink & Mabert, 2000). With this in mind, Wasti & Liker (1997) have previously suggested that one of the main reasons for supplier involvement is the

supplier's technical capability, especially when the buying company does not have enough internal expertise.

As previously discussed, all authors agree that supplier involvement will have a positive impact upon the overall product development process. However, some authors have commented that supplier involvement can also have disadvantages for participating companies; in most cases, these disadvantages are associated with the way in which the supplier involvement is managed (see 2.3.2). Moreover, the timing of supplier involvement seems to be a key area of research in terms of supplier integration in the product development process.

Several authors have studied the customer-supplier relationship in product development, and agree that the Japanese style of collaboration pioneered in the automotive industry has proven to be the successful model of supplier involvement in the case of new product development (Womack *et al.*, 1990; Sako, 1992; Nishiguchi, 1994; Liker *et al.*, 1995; Nishiguchi & Brookfield, 1997). Womack *et al.* (1990), for example, noted that the Japanese advantage of product development stems mainly from their style of leadership, multi-functional team-working, frequent communication, and simultaneous development within many Japanese organisations. Furthermore, due to the exclusive ties, and support from the *keiretsu* system (Lincoln *et al.*, 1992), the cooperative customer-supplier relationship in Japan has been found to be more successful than its US automotive competitor in terms of developing relation-specific knowledge, inventing relation-specific assets, and minimising transaction costs (Nishiguchi, 1994; Dyer, 1996).

Table 8 summarises the differences between the Western and Japanese customer-supplier relationships, based on the research conducted by various authors.

Table 8: The differences of the Western and Japanese buyer-supplier relationships

(Source: various)

Japanese	Traditional Western Approach
<ul style="list-style-type: none"> <li>• Long-term relationships</li> <li>• Small number of suppliers</li> <li>• Based on quality, cost and delivery</li> <li>• Contracts given to last the entire lifetime of the product</li> <li>• Partnership approach</li> <li>• Investment in equipment, plant and personnel</li> <li>• Intensive and regular sharing of technical and cost information</li> <li>• Extensive supplier involvement throughout the process</li> <li>• High level of face-to-face communication, especially for highly uncertain products</li> <li>• Broader perspective for measurement</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term relationships</li> <li>• Large number of suppliers</li> <li>• Based on competitive bidding</li> <li>• Contracts based on the lowest price</li> <li>• Adversarial relationships</li> <li>• Avoid tying asset or investment to the supplier</li> <li>• Information is proprietary</li> <li>• Customer designs the product, supplier follow customer's requirement</li> <li>• Relatively low level of communication</li> <li>• Measurement based on cost and delivery</li> </ul>

### 2.3.1 Success Factors of Collaboration

Several researchers have investigated the success factors of collaboration. Littler *et al.* (1995), for example, outlined those factors that influence the level of success of product development collaborations. The failure of collaborating

partners in terms of contributing to the product development process as expected is believed to be the most important reason for a less successful collaboration. This view is further supported by Lettice *et al.* (2009), who stated that, in order for the partnerships to succeed, clear and on-going expectations need to be formed and communicated.

The lack of communication and consultation between the buyer and supplier is the second factor leading to a less successful product development. Littler *et al.* (1995) suggested that there is the need for consultation with all those involved in developing a product, and this is crucial. The study also states that the role of trust in collaborative product development is clearly important. Their other findings are listed in Table 9.

Table 9: Factors discriminating between successful and unsuccessful product development collaborations

(Littler *et al.*, 1995)

Factors Discriminating Between Successful and Unsuccessful Product Development Collaborations
<ul style="list-style-type: none"> <li>▪ The collaborating partners failed to contribute as expected</li> </ul>
<ul style="list-style-type: none"> <li>▪ There was a lack of frequent consultation between the collaborating partners</li> </ul>
<ul style="list-style-type: none"> <li>▪ Benefits between the collaborators were perceived as 'evenly' distributed</li> </ul>
<ul style="list-style-type: none"> <li>▪ The relationship was perceived as being very important to the collaborators</li> </ul>
<ul style="list-style-type: none"> <li>▪ There was a champion for the collaboration</li> </ul>
<ul style="list-style-type: none"> <li>▪ There was little 'trust' between the collaborating partners</li> </ul>



Littler *et al.* (1995) further investigated the factors believed to affect collaborative product development, and accordingly outlined six major factors that are believed to influence the collaborations. Establishing the ground rules with clearly defined objectives and the responsibilities of all involved parties is likely to give rise to significant factors that can affect project outcomes; this is subsequently followed by people factors, such as the commitment of buyers and suppliers, and requires high levels of involvement from all levels, including top management. The right choice of partners for collaboration will also affect the outcomes of the collaboration. The results of the study conducted by Littler *et al.* are summarised in Table 10.

Table 10: Factors affecting outcomes of collaborative product development

(Littler *et al.*, 1995)

Factors Affecting Outcomes of Collaborative Product Development	More Experienced Respondents (% Mentioning Factor)	Less Experienced Respondents (% Mentioning Factor)
CHOICE OF PARTNER	43	21
Culture/mode of operation	15	14
Mutual understanding	15	14
Complimentary expertise/strengths	20	4
Past collaboration experience	3	-
ESTABLISHING THE GROUND RULES	63	64
Clearly defined objectives agreed by all parties	43	54
Clearly defined responsibilities agreed by	20	29

all parties		
Realistic aims	15	11
Defined project milestones	18	7
<b>PROCESS FACTORS</b>	<b>33</b>	<b>61</b>
Frequent communication/consultation	23	29
Mutual trust/openness/honesty	23	25
Regular progress reviews	15	18
Ensuring collaborators deliver as promised	-	29
Flexibility	5	4
<b>ENSURING QUALITY</b>	<b>53</b>	<b>32</b>
Mutual benefit	35	21
Equality in power/dependency	18	14
Equality of contribution	-	21
<b>PEOPLE FACTORS</b>	<b>50</b>	<b>50</b>
Commitment at all levels	25	25
Collaboration champion	8	11
Top management commitment	13	21
Personal relationships	10	18
Staffing levels	5	4
<b>ENVIRONMENTAL FACTORS</b>	<b>30</b>	<b>11</b>
Market need for product	25	11
Economic factors/recession	5	4

Ragatz *et al.* (1997) identified the success factors of supplier integration based on used management practices and project environment factors. Twelve

management practices were found to be statistically significant differentiators between the most and least successful supplier integration efforts. The study identified supplier membership of the NPD project team as being the greatest differentiator between the most and least successful integration efforts. Their findings are summarised in Table 11.

Table 11: Management practices for supplier integration into NPD

(Ragatz *et al.*, 1997)

Management Practices For Supplier Integration Into New Product Development
▪ Supplier membership/participation of buying company's project team
▪ Direct cross-functional and intercompany communication
▪ Shared education and training
▪ Common and linked information system (EDI, CAD/CAM, email)
▪ Co-location of buyer/seller personnel
▪ Technology sharing
▪ Formal trust development processes/practices
▪ Customer requirements information sharing
▪ Technology information sharing
▪ Shared physical assets (plans and equipment)
▪ Formalized risk/reward sharing agreements
▪ Joint agreement on performance measurements

As mentioned above, the supplier membership/participation in the buying company's project team is believed to be the single largest differentiator between the most and least successful supplier integration efforts. Many companies indicate that the extent of supplier participation fundamentally

depends on various project characteristics, such as technical complexity, strategic importance, and financial or volume projections. Furthermore, direct cross-functional, inter-company communication is the most extensively used technique when ensuring successful supplier integration into the product development process. Open and direct communication is a critical success factor in the early identification and rapid resolution of problems. Moreover, customer requirement information-sharing is the second most extensively used management practice in both the most and least successful integration cases. Importantly, customer information-sharing aligns suppliers with the customers' final requirements, and thereby strengthens the trust between the supplier and buyer.

Successful product collaboration ultimately depends on striking the right balance between the supplier's technological capabilities, a customer's willingness to share information, and both companies' strategic requirements (Kamath & Liker, 1994). These findings are supported by Petersen *et al.* (2003). In their study, they further explored the successful integration of suppliers within Japanese and US firms. Their study results suggest that (1) increased knowledge of a supplier will ultimately result in greater information-sharing and the involvement of the supplier in the product development process; (2) sharing of technology information will positively affect levels of supplier involvement and accordingly improve product outcomes; (3) supplier involvement in teams generally results in the higher achievement of NPD team goals; (4) suppliers and buyers are more likely to share information on NPD teams, especially in cases when technology is uncertain; and (5) the problems associated with technological uncertainty can be mitigated by a greater use of technology sharing and direct supplier participation in the case of new product development teams. They subsequently concluded that the higher level of benefits could be achieved by greater supplier participation as a true member of a new product development team.

Parker *et al.* (2008) concluded that the most significant factors contributing to the success of NPD projects and ensuring overall competitive advantage in the market place include the timing of supplier integration, the prior relationship established between the buyer and supplier, and the strategic importance of the supplied item.

Moreover, in their study on improving co-development in the automotive industry, Evans & Jukes (2000) suggested that synchronicity is an important element in successful co-development. They identified the process of standardisation, knowledge-sharing, alignment of existing practices, and the continuous elimination of waste as the four key steps of synchronisation.

Van Echtelt *et al.* (2008) further indicated that the success of involving suppliers in product development is reflected by the firm's ability to capture both short- and long-term benefits. Furthermore, if companies spend most of their time on operational management in development projects, they will fail to use the leverage effect of planning and preparing such involvement through strategic management activities. Strategic management activities contain processes that together provide long-term strategic direction and operational support for project teams adopting supplier involvement. In contrast, the operational management arena contains processes that are directly aimed towards planning, managing and evaluating the actual collaborations in a specific development project.

Olsen & Harmsen (2008) conducted a study on product development alliances within the food industry, and subsequently concluded that product development formation and success generally follow the literature on alliances, and further added that, in the case of the food industry, the motivation has to be stronger, as there is no external pressure on the industry.

Furthermore, Johnsen (2009), in his study of three decades' worth of literature related to supplier involvement, found overwhelming evidence to support the notion that early and extensive supplier involvement is a key explanatory factor of superior new product performance in terms of cost, quality and time-to-

market benefits. He subsequently listed the major management challenges in new product development, including internal coordination, the advanced supplier selection process, and long-term relationship adaptation to create supplier relationships with high levels of trust and commitment. Johnsen (2009) concluded his study by developing a model of factors that might affect the overall success of supplier involvement in NPD (Figure 8).

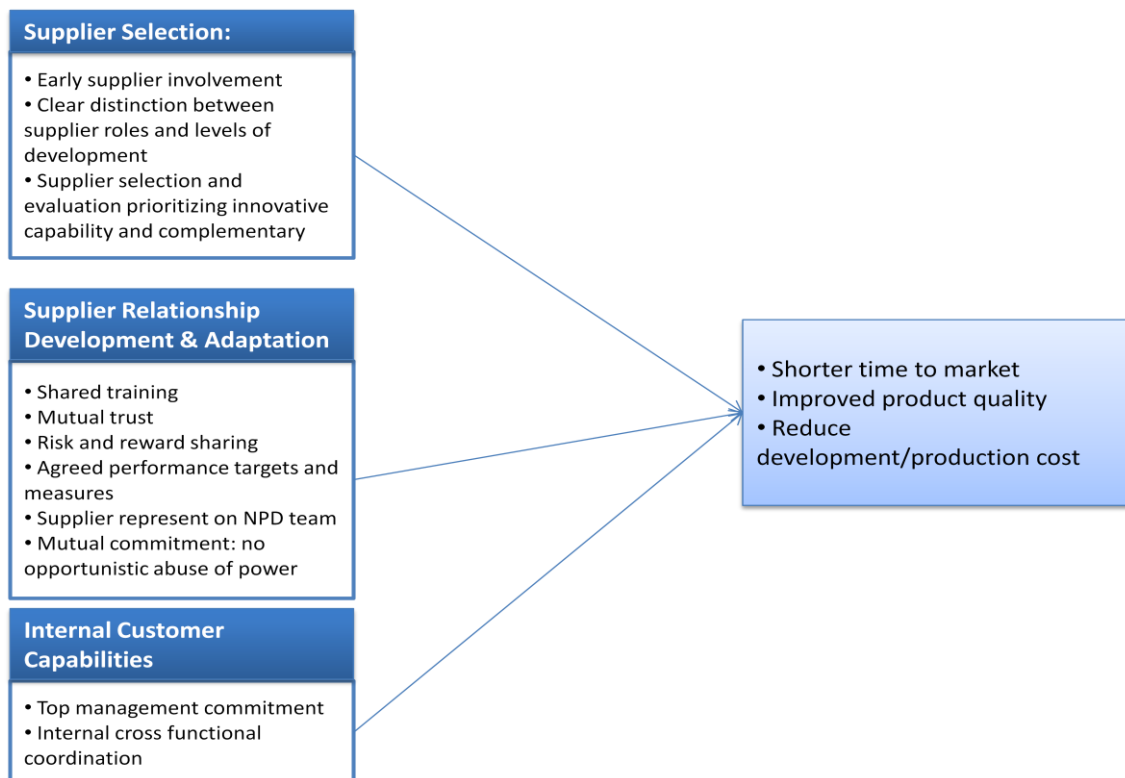


Figure 8: Factors affecting supplier involvement success

(Johnsen, 2009)

### **2.3.2 Advantages and Disadvantages of Involving Suppliers in Product Development**

As previously noted, many authors agree that involving suppliers in the product development process has significant advantages for both the customer and the

suppliers. Mikola & Larsen (2003), for example, identified the advantages of supplier participation in product development, and cited shorter product development lead times (Gupta & Souder, 1998; Clark, 1989), improved perceived product quality (Ragatz *et al.*, 1997) and improved manufacturability (Wasti & Liker, 1997); it also reduces the technological risks and makes the buyer-supplier relationship closer by the frequent sharing of knowledge and learning.

Importantly, although most of the authors suggest that collaborative product development could be beneficial for both parties, Mohr & Spekman (1994) indicated that unsuccessful product development has the potential to be significantly costly for both the buyer and the supplier. Collaborative product development can also increase the costs, complexity, and difficulties in developing the new product (Bruce *et al.*, 1995). Zirger & Hartley (1996) and Eisenhardt & Tarbizi (1995) suggested that supplier involvement will decrease the speed of developing the new product. Bensaou (2000), on the other hand, noted that products that are developed in conjunction with the supplier are difficult to maintain or nurture. Notably, supplier involvement may also increase the complexity of managing the product development process (Wynstra & Pierick, 2000).

Little *et al.* (1995) studied UK manufacturers of information and communication technology products, and further expanded the risk of collaborative product development. Table 12 summarises their findings.

Table 12: Major risks of collaborating product development

(Littler *et al.*, 1995)

Major Risks of Collaborative Product Development
1. Leakage of information
2. Loss of control and ownership
3. Longer development time
4. Differing aims and objectives, which could lead to conflict
5. Other party pulls out or becomes less committed
6. Collaborators can become competitors
7. Increased cost of development

In addition, Littler *et al.* (1995) also stated that 51 per cent of the respondents in their study agreed that collaborative product development makes product development costly; moreover, 41 per cent of them agreed that collaboration makes the product development process more complicated, whilst 41 per cent expressed the view that the product development process can be more difficult to control and manage if the buyer is collaborating with suppliers.

Handfield *et al.* (1999) listed the perceived positive and negative impacts of supplier involvement in NPD in relation to technology risk and uncertainty. The findings are listed below.

Positive:

- The supplier may have greater experience or expertise with technology.
- The supplier may take on technological risks.
- The buying company may have some ability to influence the direction of the supplier's R&D efforts in order to match them with developing technologies.



- The supplier may be more willing to share information with their partner concerning new/emerging technologies.

Negative:

- Involvement with suppliers may have a tendency to lock the buying company to the supplier and its technology.
- A supplier with an inside track may not have as much incentive to innovate, thereby slowing the pace of technological advancement.

Critically, Hamel *et al.* (1989) indicated that collaborating partners can leak information about a firm's skills, experience and general tacit knowledge, which might affect the firm's competitiveness. They also stated that firms fear the possibility of their partners having access to knowledge and skills that they use in other areas of their business. Koufteros *et al.* (2005) further indicated that assigning more product developing responsibilities to suppliers may have a negative effect on the ability of the organisation to offer new products and features, which may lead to the consequent deterioration in product innovation capabilities.

## **2.4 Co-development**

The term 'co-development' has become common usage for describing very close relationships between a customer company and a supplier company when developing a new product. There are several definitions of co-development. Bevan (1987) defined co-development in accordance with a broad view of cross-company collaboration, stating that co-development is concerned with working together towards a common goal, with each party potentially able to gain more benefits from co-operating than from working independently.

Littler *et al.* (1995) narrowed down the definition of co-development to a relationship that exists between two or more independent organisations and is specifically aimed at developing a product or series of products. Chesbrough & Schwartz (2007) further defined co-development as a partnership that embodies a mutual working relationship between two or more parties and is aimed at creating and delivering a new product, technology or service. According to EPSRC (1996), co-development can be defined as '*the ability of customers to design competitive products in collaboration with their first tier suppliers*'.

The aforementioned definitions show that co-development is a term used to describe customers and suppliers who come together to research and develop new products, thereby allowing each to take advantage of the strengths of its partners.

Co-development, however, does not differ much among sectors. For example, highly technological industries, such as the electronics and the automotive industries, are encouraged to involve suppliers earlier than in the food and drinks industry. The nature of high technological industries needs more supplier knowledge compared to less complicated products. Therefore, there has been much research studying the involvement of suppliers, focusing on the supplier involvement practices rather than on the industry itself. Mikkola and Larsen (2003), in their study of three companies from three different industries, concluded that suppliers can be involved during the planning, design or production stage of product development depending on the technological complexity of the product itself rather than industry.

## **2.5 The Automotive Industry**

The automotive industry is one of the largest industrial sectors in the world. According to Global Economic Research (2009), more than 52 million cars were sold in 2009 across the world. With more than 20,000 components included in

just one car, the industry has created a large number of companies that produce cars and their related parts. In some countries, the automotive industry plays a significant role in relation to the economy. In Japan, for example, 13 per cent of the country's total manufacturing output comes from the automotive industry, and 10 per cent of its corresponding employment (Hiraoka, 2000). With the customer demand focused on styling, safety, and efficiency, the ability of car companies to develop new cars, with low costs and high quality while satisfying customer demand is crucial.

The complexity of developing a new car is a challenge comprising integrating components, functions, and the process step with the efficiency of managing time, people, and the environment. Importantly, new car development involves many processes and parties, such as customers and suppliers, and high levels of investment and time. Moreover, in order for a new car project to become profitable, vehicle manufacturers need to sell as many cars as possible. In addition, as parts suppliers account for 70 per cent of the value added in the manufacture of cars (Klier & Rubenstein, 2008), supplier involvement becomes one of the key elements in any new car project (Kamath & Liker, 1994; Clark & Fujimoto, 1991).

### ***2.5.1 Focusing on Product Development in the Automotive Industry***

Product development in the automotive industry is one of the most popular research areas in the area of co-development. Several authors have focused on the product development processes in the Japanese and US automotive industry (Clark & Fujimoto, 1989; Kamath & Liker, 1994; Cusumano & Takeishi, 1991).

Beaume *et al.* (2009), for example, stated that, in the automotive industry, innovation management is not included in a linear process that starts with research and ends with development, but rather is found in the interplay

between product development projects and knowledge activities. This interplay contains a certain richness and complexity in the process.

As the automotive industry experiences a period of overcapacity, many vehicle manufacturers are moving towards mergers and acquisitions (Smart *et al.*, 2000). This leads to the rationalisation of product ranges and, therefore, product development activity is carried out under uncertain market conditions with high competition and new technologies. Customer demands become more varied and sophisticated, leading to high complexity in the product development process.

In their study on product development processes in an automotive industry, Clark & Fujimoto (1991) identified the four major stages of development: concept generation, product planning, product engineering and process engineering (Figure 9). At the concept generation stage, data relating to future market needs, technical possibilities and economic feasibility are gathered and translated into a corresponding product concept. Market information, strategic planning, and technology advancements are the three main resources utilised within this stage. The market input comes from market research, product clinics or feedback from car dealers and customers. Moreover, there is a long-term strategic plan for the entire product, which is created and periodically revised in order to ensure the coordination of the new vehicle launch timing. Furthermore, effective strategic planning requires a certain balance be maintained between the overall strategic direction, as well as flexibility in responding to the details of competition within a market segment. The availability of new or updated technology will also shape the concept generation stage. The development of technology may also drive the development of new vehicles.

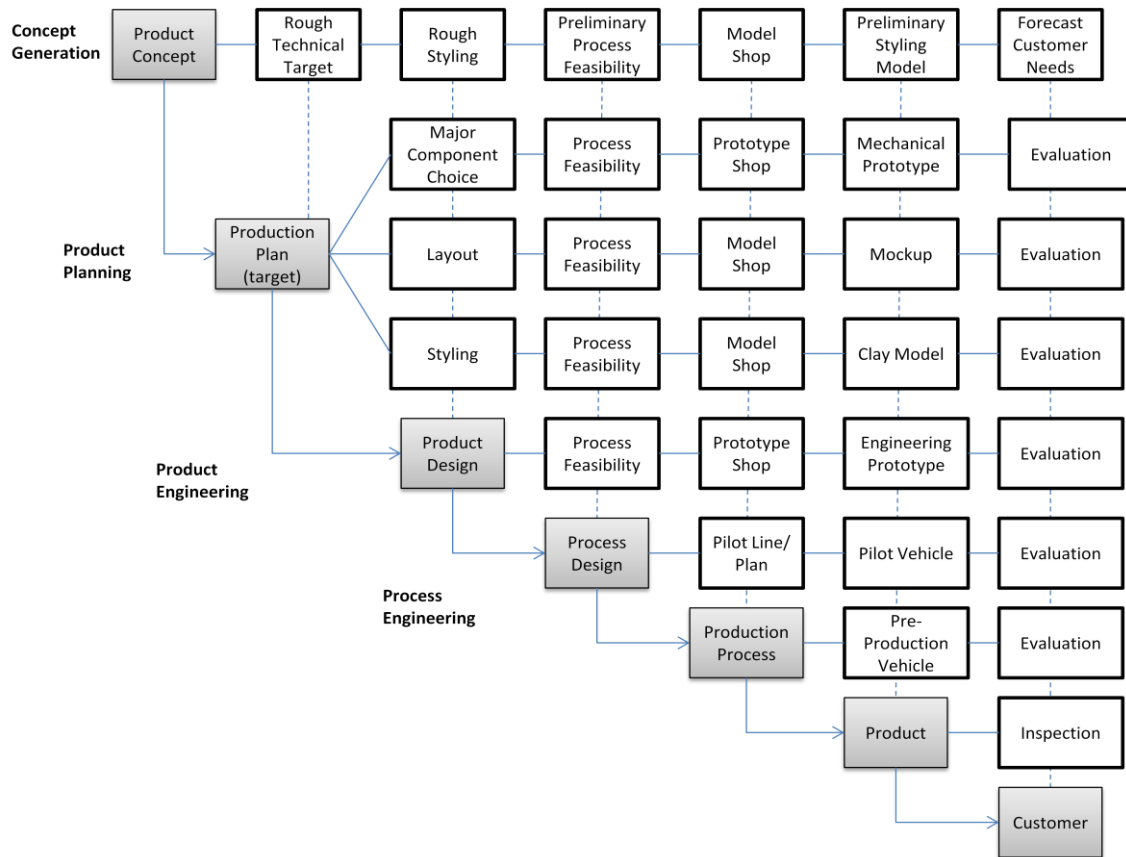


Figure 9: The product development process

(Clark &amp; Fujimoto, 1991)

At the product planning stage, the product concept is developed during the concept generation stage, which must be translated into concrete assumption details. The product concept must be broken down into a specification of costs and performance targets, component choice, styling, and layout for detailed product engineering; this involves many personnel within the car company, such as component engineers, designers, product managers, tester, controllers, die engineers, and so on. At this stage, difficult negotiations and organisational conflicts may emerge. In order to deal with these, effective communication and close coordination are essential to minimise the conflicts and subsequently to achieve the agreed target. Moreover, the planning stage establishes the overall direction and architecture of the vehicle development.

The product engineering stage is the implementation stage of the agreed plan. At this stage, the series of 'design-build-test' cycles of each component and system will be repeated until an acceptable performance is achieved. The study shows that the Japanese vehicle manufacturers took an average of 30 months to complete the product engineering stage, compared to 40-42 months taken by American and European companies. Moreover, after those cycles have been processed, the building and testing of the prototype vehicle takes place. Computer Aided Engineering (CAE) simulations help vehicle manufacturers to build and test the engineering prototypes; however, the physical models are important for customer evaluation. At this stage, concept sharing with marketability testers, who represent the customers, is important. Any engineering problems and required quality improvements need to be identified during this stage prior to any engineering changes (i.e., changes to parts or drawings that have already been released), as making such changes later in the process is expensive.

During the process engineering stage, design information is converted to tools, equipment, process control software, skilled workers and working procedures for the production process. Process engineering is normally separated from product engineering, despite the fact that its needs run parallel to and simultaneously with both processes; in other words, the design must be realistic and sensible in relation to the manufacturing process, although the design work is separated from the manufacturing work place. Multiple objectives, numerous constraints and uncertainty relating to market reactions in terms of process and product engineering will always be a source of conflict.

As discussed in 2.3.2, strategic partnerships with suppliers in the product development process have been found to have a positive impact on every industry. In the case of the automotive industry, supplier involvement is the key strategy for vehicle manufacturers to reduce lead time and product costs and accordingly to improve the quality of the new vehicle (Clark & Fujimoto, 1989; Kamath & Liker, 1994). In addition, cooperation with suppliers provides a

significant impact in terms of competitive advantage for Toyota and its suppliers (Dyer & Nobeoka, 2000), and is argued to be one of the key elements of Toyota's global success (Liker, 2004).

Wasti & Liker (1999) further investigated the degree of supplier involvement in relation to design and the factors leading to supplier involvement. They stated that a high degree of technical uncertainty and supplier technical capabilities provide two main factors that have the potential to lead to early supplier involvement in a product development collaboration. In other words, auto makers are more likely to select a supplier with high technical capability for design outsourcing, and to assign greater design responsibility to capable suppliers.

### ***2.5.2 Co-development in the Automotive Industry***

In their classic study on product development in the world auto industry, Clark & Fujimoto (1989) highlighted Japanese auto makers' ability to develop good quality cars with shorter lead times and fewer engineering resources in comparison to those of their US and European competitors. They highlighted that the suppliers' roles in product development in Japan might be a significant reason for the Japanese advantage; in addition, the study noted that US auto makers carried out 86 per cent of the product engineering compared to 50 per cent carried out by Japanese auto makers. Such a finding clearly indicates that a strong capability in engineering and good relationships with suppliers enable the Japanese auto makers to maintain a low level of project scope whilst simultaneously using a large proportion of unique parts. These findings are supported by Nishiguchi (1989), who explained that the competitiveness of the Japanese automotive industry stems from the distinctive collaborative relationships between auto makers and their suppliers.

Clark & Fujimoto (1991) further indicated that, in the traditional Western supplier management system, there are short-term contracts, a higher degree of vertical

integration, larger in-house component operations, and a flat hierarchy. These relations are described by Wasti *et al.* (2006) as showing a lack of trust, being highly dependent on detailed contracts, or otherwise protecting parties from any opportunistic behaviour. Moreover, having large numbers of suppliers competing fiercely, principally on the basis of price, is treated as a win-lose situation by the parties. In contrast, Japanese auto makers rely upon supplier engineering involvement to a high degree, which reflects the high engineering capability and effective relations that characterise the Japanese advantage (Clark & Fujimoto, 1991).

The study by Cusumano & Takeishi (1991) supported the findings of Clark & Fujimoto (1989). They stated that Japanese and US practices tend to differ in key areas, with Japanese suppliers performing better in terms of quality and price. The study also highlighted those US auto makers that seem to follow the Japanese model on supplier relations. These findings are also supported by many other researchers, such as Helper & Sako (1995), Bensaou (1999), and Fujimoto (2001).

Dyer & Ouchi (1993), in their study of different practices in Japan, Europe and America, suggested forming partnerships and alliances with suppliers as practised by Japanese auto makers, which is believed to be an increasingly important strategy enabling firms to develop and maintain a competitive advantage. The study also indicated that 25 per cent of parts are internally manufactured by Japanese auto makers compared with 48 per cent in the US. These figures clearly indicate that Japanese auto makers are more likely to depend upon their suppliers than are those in the US.

The Japanese style of manufacturer-supplier relationships is widely referred to as *keiretsu*. *Keiretsu* is defined as a group of companies or corporations that form a tight partnership to work with each other for mutual benefit (businessdictionary.com). Aoki (1988) reported that Japanese vehicle manufacturers repeatedly buy from a limited number of suppliers with long-term relationships, thus leading to the formation of *keiretsu* between the



manufacturer and the suppliers. Moreover, Dyer & Ouchi (1993) indicated that, in the case of the *keiretsu* system, Japanese vehicle manufactures own the partial shareholding of their suppliers and build close personal relations between manufacturers and suppliers. The Japanese *keiretsu* system has been developed through the long relationship, trust and close communication between both parties. The Korean *chaebol* concept is similar, but differs from the Japanese *keiretsu* system, as it is a group of large companies that operate in diverse, mostly unrelated industries, and that are owned and controlled by families (Shin & Kwon, 1999).

Kamath & Liker (1994), who have conducted studies on Japanese and US auto makers and their suppliers, outlined four supplier roles in the product development process; these include a series of roles from suppliers that are extremely close to buyers, and from the type of supplier that has a more distant relationship (Table 13). The partner type of supplier refers to those suppliers that understand the product and process, with technological capabilities and expertise of the product that are superior to the capabilities and expertise of their customers. Moreover, the mature type of supplier has capabilities similar to those of the partner type of supplier in the sense of the design and manufacture complex assemblies. However, a lack of technological capabilities in relation to the mature type of supplier makes them less influential in relation to the design process. In contrast, the child type of supplier has less influence in terms of design, but needs to work out details for design and testing, whilst the contractual type of supplier simply manufactures parts designed by the customer.

Table 13: Four supplier roles

(Kamath &amp; Liker, 1994)

Role	Description	Responsibilities during product development
Partner (full service provider)	Relationship between equals; supplier has technology, size, and global reach	Entire subsystem. Supplier act as an arm of the customer and participates from the pre-concept stage
Mature (Full system supplier)	Customer has superior position; supplier takes major responsibility with close customer guide	Customer assembly. Customer provides specifications. Supplier may suggest alternatives
Child	Customer calls the shots and supplier responds to meet the demands	Simple assembly. Customer specifies design requirements and supplier executes design
Contractual	Supplier is used as an extension of customer's manufacturing capability	Commodity or standard part. Customer gives detailed blueprints

Furthermore, Oh & Rhee (2008) classified the manufacturer-supplier collaboration within the automotive industry into five types: collaborative communication, collaboration in new car development, collaboration problems solving, strategic purchasing and supplier development (Table 14). The classifications are based on previous studies carried out by several researchers, which are classified according to four criteria: the purpose of, nature of, timing of and parties involved in the collaboration.

Table 14: Five types of manufacturer-suppliers collaboration

(Oh &amp; Rhee, 2008)

	Collaborative communication	Collaboration in new car development	Collaborative problem solving	Strategic purchasing	Supplier development
Definition and nature	Timely sharing & exchanging of information	Active supplier involvement from the early stage	Ways to solve routine problems	Evaluating & selecting suppliers	Assisting supplier development mid-to-long-term
Timing of collaboration	Entire lifecycle	New car development stage	Mass production stage	New car planning	After suppliers' selection
Parties involved	Purchasing (carmaker), marketing (supplier) R&D of both side	R&D of both parties	Purchasing (carmaker), marketing (supplier), production of both side	Purchasing (carmaker), marketing (supplier) R&D of both side	Purchasing (carmaker), marketing (supplier) R&D of both side
Purpose	Mutual understanding & prevention of problems	Quality assurance at an early stage	Immediate solution to problems	Finding prominent suppliers	Long-term improvement of suppliers' performance

In order for the partnership to be a success, both the vehicle manufacturer and the suppliers need to invest and work together. According to Lettice *et al.* (2009), on the part of the vehicle manufacturer, the investment would be predominantly resourced and timed in order to help the supplier, as well as aligning the supplier culture and process with that of the vehicle manufacturer. In contrast, the supplier might need to invest in new equipment, processes and techniques, as required by the customer.

Whilst most researchers have focused on the practices of product collaboration in the automotive industry in both Japan and the US, others have begun to focus on the industry in developing countries, such as Korea and Turkey.

Yun (1999) studied the buyer-supplier relationship in the Korean automotive industry, specifically the technological capability and risk-sharing performance. As expected, the levels of risk-sharing for many Korean automotive companies were considerably lower than for Japanese companies. Moreover, the suppliers in Korea were found to have little incentive to take the initiative in terms of technological learning, simply because of their permanent dependence on their prime customers. Chung *et al.* (2003) further indicated a higher level of supplier involvement, especially in the form of involvement in the design stage, which is shown to lead to a significant increase in Korean suppliers' innovation.

Wasti *et al.* (2006) identified three relationship types in the Turkish automotive industry: captive supplier, market exchange, and strategic partnership. Notably, Turkish buyers have been found to classify their suppliers strategically based on product and supplier characteristics.

As previously mentioned, most researchers have focused on co-development practices in developed countries compared with those in developing countries. Japan and the US are favourite countries for research in this area; both are now facing the mature period within their car markets. The competitive advantages of auto makers and suppliers in developed countries are not necessarily the same as those in developing countries; therefore, the research into those developing countries with a newly emerging market is highly important.

As this is important for this research, the researcher did not need to select a specific set of partnership types to study or search, nor to select specific dimensions to test, as the literature is complex and rich, although not yet mature. Moreover, this research aims to discover what is happening in the real world, as informed by this literature.

## **2.6 The Malaysian Automotive Industry**

The Malaysian automotive industry began in the early 1960s. The first policy within the automotive industry was announced in 1964 with the aim of encouraging overseas vehicles and automotive parts manufacturers to set-up assembly plants within Malaysia. The aims were to provide employment and to substitute the import of automobiles. By 1967, the Government had approved six assembly plants for operation within Malaysia. The assembly plants were all joint venture projects between Malaysian companies and European vehicle manufacturers. Furthermore, to develop further the industry scale within Malaysia, the Government introduced the 'local content programme'—the minimum requirement for local car assemblers to use Malaysian-produced parts. According to the report produced by UNESCAP (2000), the growth in the Malaysian automotive industry, especially with regards to components manufacturing was not very successful at that time.

Up until the early 1980s, there was only overseas transplant car assembly within Malaysia, with only very small local automotive product suppliers (Abdulsomad, 2000). Furthermore, according to the report of UNESCAP prepared by the Malaysian Industrial and Development Authority (2000), up until the early 1980s, there were approximately only 15 assemblers producing 38 overseas brand vehicles for European and Japanese manufacturers. At that time, there were too many makes and models causing the demand for a particular component to be low. As a result, the level of technology transfer was limited, and the development of skilled workers was also slow (Malaysia Industrial Development Authority, 2000, unpublished). Tyndall (1999) found that, in the 1970s, the proliferation of assemblers made it difficult to achieve economies of scale in production. As a result, the locally produced parts were expensive, and the Government policies towards the industry were not very successful.

Currently, Malaysia has the largest market for passenger cars amongst ASEAN countries. In 2008, over half a million vehicles were sold within Malaysia

(Malaysia Automobile Association, 2008). Furthermore, as previously mentioned, passenger vehicles dominated the sales with just under half a million, whilst commercial vehicles sales numbered just over 50,000 units. Moreover, as the largest market was the passenger vehicle segment, Malaysia has become one of the favourite emerging markets for vehicle manufacturers.

According to Malaysia Automobile Association (2008), there are currently 13 car assemblers and more than 350 parts makers within Malaysia. The national cars, PROTON and PERODUA, have dominated the passenger car segment within Malaysia, with a more than 55 per cent market share in 2008 (Malaysian Motor Trader News, 2008). The competition from the overseas brands, especially from Korea after 2004, has had a significant influence on the reduction of market share for both national car makers.

### **2.6.1 The National Car Project**

In order to promote the large economic scale of the industry, in 1983, the Government launched the National Car Project (NCP), called PROTON. The NCP aimed to develop the automotive industry, and accordingly promote the Malaysian people's participation in the industry. Moreover, it also aimed to shift the focus in the Malaysian automotive industry from assembling foreign cars to manufacturing cars and automotive parts (Abdulsomad, 1999). Initially, the first national car company, PROTON, assembled Mitsubishi cars before it started to develop its own passenger cars. Prior to this, in an attempt to gain knowledge concerning the relevant technology, PROTON sent its staff for training in Japan, with the aim of bringing back the technology to Malaysia and helping local suppliers or people interested in manufacturing the automotive parts (Yahaya, 2004).

Since 1983, PROTON has produced cars based on the Japanese Mitsubishi models. With help from the Government protection policy, PROTON has dominated the passenger car segment within the Malaysia automobile market.

Up until 2002, PROTON was reported to have had more than 60 per cent of the market share within Malaysia, the highest since its establishment. The success of PROTON in dominating the Malaysian market has subsequently enhanced the company's financial ability. As a result, in 1996, PROTON made a big move by buying 64 per cent shares of the UK sports car maker Lotus. The acquisition of Lotus helped PROTON to enhance its technological capability, and enabled it to stop relying upon the Japanese. In the year 2000, with Lotus's help, PROTON successfully designed its first car, Waja (Impiana in UK), which has since been successfully launched. Up until 2008, PROTON recorded production of more than 3 million cars since its establishment. However, despite PROTON's overall success in the domestic market, PROTON is struggling in terms of overseas sales. Since its establishment, PROTON has entered the UK, Australia and several Middle Eastern markets. In 2008, PROTON managed to sell only slightly more than 15,000 cars worldwide compared to just over 100,000 in the domestic market (PROTON Annual Report, 2008).

Following the success of PROTON, in 1993, the Government launched a second car project called PERODUA. PERODUA has a similar aim to PROTON: to accelerate the development of the Malaysian automotive industry. The Government mandated PERODUA to produce a car of less than 1000 cc in order to cater to the needs of the lower middle-income group (Tyndall, 1999). However, following the economic crisis in 1998, Daihatsu Japan acquired 20 per cent of PERODUA shares, making the car company a subsidiary of Daihatsu within Malaysia. PERODUA is currently producing cars based on the Daihatsu and Toyota models. Moreover, it is reported that PERODUA produced more than 200,000 cars in 2008.

The drastic changes in the Malaysian automotive industry since 1983 have created the opportunity for Malaysian citizens to become more involved in the industry. The Government has been promoting the participation of Malaysian people in the industry by providing tax exemptions and incentives and so on for local companies to establish local automotive parts makers.

### **2.6.2 Government Policy towards the Automotive Industry**

In order to protect and nurture the newly established industry, the Malaysian Government introduced several policies aimed to protect the automotive industry. The policies have been adopted and revised year-by-year in order to help national car companies and local automotive parts makers survive in the industry. Wad (2008) described the objectives of Malaysia's national policies as including 'the establishment of domestic vehicle manufacturers as automobile supplier industries emphasising the importance of the localisation of parts production in order to create economic growth, investments, jobs and technological development'. Importantly, the policies include investment incentives, local content policy, and tariff and non-tariff barriers aimed at protecting and stimulating the development of the industry (Rosli & Kari, 2008). According to Wad (2009), the Government has manipulated the protection and subsidised policy for PROTON so that the company can easily dominate the market share.

To protect the NCPs, the Government has placed tax barriers to the complete build-up unit (CBU) of cars from overseas. The tax also affects the completely knocked-down (CKD) cars, that is, the overseas cars assembled within Malaysia. The summary of the tax tariff is summarised in Table 15. The huge tax tariff implemented by the Government with CBU and CKD cars in mind has led to there being a significant difference between the prices of overseas and national cars. Aside from this, the Government has also introduced the Approval Permit (AP) to CBU car dealers in order to restrict the number of overseas cars entering the Malaysian market. Furthermore, under the AP system, car dealers have to apply for a permit in order to import a certain quantity of cars from overseas. The protection policy has largely contributed to the success of national car projects, PROTON and PERODUA. The share of both national cars in the Malaysian market has increased on a year-by-year basis. Moreover, it was reported that both PROTON and PERODUA dominated 80 per cent of the



Malaysian passenger car market in 2001, the highest figure since the establishment of both national car makers.

Table 15: Tax tariffs for national and non-national car within Malaysia until 2005

(Source: MIDA)

Makers	Engine Capacity (cc)	CKD	CBU
National cars			
PROTON	all	13%	-
PERODUA	all	13%	-
Non- national cars			
	Less than 1800	42%	140%
	1800 to 2000	42%	170%
	2000 to 2500	60%	200%
	More than 3000	70%	300%

However, since 2006, following the ASEAN Free Trade Area (AFTA) agreement, the Malaysian Government has been forced to lower the import tariff for cars built and assembled within the region (Table 16). Under the AFTA agreement, the import duty of products manufactured in the region should be between 0 and 5 per cent. Furthermore, to compensate for the low import duty, the Government has introduced a new excise duty, which aims to protect local vehicle manufacturers. The realisation of AFTA provides the opportunity for overseas vehicle manufacturers to enter into the Malaysian market by having various plants within the ASEAN region. Moreover, as the ASEAN market is one of the newly emerging vehicle markets comprising a population of 530 billion and with low production costs, most overseas cars manufacturers have established their plants in the region. Although the new tariff seems to be higher than before 2006, the production costs are lower in order make the price of CBU cars from ASEAN affordable for local people. Importantly, Malaysian

people have started buying imported cars, even though the price is slightly more expensive than that of national cars. As a result, the share of national cars in the Malaysian market is shrinking to just below to 60 per cent, as of 2008.

Table 16: Tax tariff for non-national cars within Malaysia since 2006

(Source: MIDA)

Capacity cc	ASEAN CKD		ASEAN CBU	
	Import Duty	Excise Duty	Import Duty	Excise Duty
<1800	0%	75%	5%	75%
1800 to<2000	0%	80%	5%	80%
2000 to<2500	0%	90%	5%	90%
2500 to<3000	0%	105%	5%	105%
More than 3000	0%	125%	5%	125%

Aside from the policy in place to protect national cars, the Government also introduced several policies aimed at boosting the local automotive parts makers. In order to help the establishment of local automotive parts makers, the Government directly invested in setting up manufacturing facilities (Tyndall, 1999). The Government also helped local suppliers to source overseas expertise in order to tighten joint ventures and technical assistance. In 1985, the Government introduced the Mandatory Deletion Programme (MDP) in order to localise the manufacture of certain automotive parts within Malaysia. Under the MDP, both national and overseas car assemblers within Malaysia are required to use 30 components, short-listed by the Government, that are produced by local suppliers.

Through the first national car company, PROTON, the Government initiated the Vendor Development Programme (VDP) in 1988. Coordinated by the Ministry of International Trade and Industry (MITI), the VDP aimed to help local suppliers—especially Malay people—to become involved in the industry. Under this programme, PROTON has to guarantee the market of local suppliers whilst the financial institutions provide loans to vendors (Tyndall, 1999). The Government helps local suppliers with financial support whilst PROTON helps on the technical side. The VDP has boosted the number of automotive product suppliers within Malaysia, which increased from 78 suppliers in 1988 to 188 in 1998, and currently stands at approximately 350 automotive product suppliers established within Malaysia. As VDP guarantees the market for local suppliers, the local suppliers have a lack of global competitiveness compared to overseas suppliers, as most of them have single-sourcing arrangement with local vehicle manufacturers (Rasiah, 1996).

Following MDP and VDP, the Government introduced a new policy in 1992 with the aim of speeding up the development of the local suppliers. The Local Material Content Policy (LMCP) required all national cars to have more than 55 per cent of local materials in their cars by 1995. In 1998, PROTON successfully reported 80 per cent of local content material in its cars. There was some doubt concerning LMCP, as not all products manufactured within Malaysia used local materials, with some raw materials being imported. The LMCP was however, abolished by the Government in 2002.

The National Automotive Policy (NAP) was announced by the Government in 2006 with the purpose of improving the current situation and increasing competitiveness within the industry. Under the new policy, the Government aimed to abolish the import quota of overseas cars under the AP system in 2010, and instead will comply with the AFTA import duty tariff of 0-5%. Under this new policy, the Government will provide financial support and incentives to the automotive players, will increase the scale of operations via rationalisation, and will promote strategic linkages with international partners. The Government

also aims to position Malaysia as a regional manufacturing and assembly hub by encouraging existing participants to deepen their commitment within Malaysia (Malaysian Ministry of International Trade and Industry, 2006).

### **2.6.3 Research on the Malaysian Automotive Industry**

The search for research relevant to the Malaysia automotive industry did not produce much on the topic of co-development. To date, some studies have focused on the economic scale impacts by the national car company (Rosli, 2006; Mahidin & Kanageswary, 2004; Wad, 2001, 2004; Rajah, 1996) whilst some have been related to production improvement, such as the just-in-time (Simpson *et al.*, 1998) and benchmarking (Deros *et al.*, (2006) approaches.

The study carried out by Rosli & Kari (2008) compared the performance of PROTON's foreign and local vendors. They used the statistical method of evaluating suppliers based on their financial and economic variables, such as turnover, profit attributes, and so on. The results show that local suppliers fall short of foreign suppliers in economic and financial variables. At the end of the study, they concluded that the research confirmed the general belief that local suppliers are lacking in terms of capabilities to compete with foreign suppliers. This study, however, did not indicate the problem underpinning this situation in the real world context.

Wad is an active researcher focusing on the automotive industry in Southeast Asia, in particular, Korea, Thailand and Malaysia. In his study of the automotive industry in Southeast Asia, Wad (2009) stated that both Malaysian national car projects have supported the development of local vendors, but there has not been a very successful process of technology transfer and learning due to the lack of high technology capabilities in relation to both local vehicle manufacturers. Wad also found that the Government's policy has successfully secured 90 per cent of the local market share, but has otherwise failed in terms of the export markets.

So far, no research has been conducted on the area of co-development within the Malaysian automotive industry. The only study on the buyer-supplier relationship within Malaysia was carried out by Abdullah *et al.* (2008), which focused on suppliers' improvement efforts by vehicle manufacturers. Furthermore, in their study on supplier development at PROTON, Abdullah *et al.* found that PROTON has played a significant role in developing and extending comprehensive supports to its suppliers in addition to nurturing its long-term relationships. The study focused on the production relationships rather than the design and development capabilities of suppliers; this formed the centre of the research. In his study, Abdullah *et al.* also outlined the formal suppliers' selection process by PROTON for new suppliers. Their findings will be further discussed in Chapters 6 (Data Analysis) and Chapter 7 (Discussion).

## **2.7 Identifying Themes from the literature**

In order to understand the current co-development practices within Malaysia, themes particularly related to this research needed to be selected for the purpose of further exploration. As has been indicated in many studies, there are many themes or factors that have been identified as being associated with co-development practices; however, the themes identified are not necessarily useful for exploring the current situation of co-development within Malaysia, as it might have a different industry background or from other countries. Therefore, the researcher needed to be careful when selecting the themes whilst also bearing in mind the Malaysian automotive industry background.

The critical review of the literature gave the researcher in-depth knowledge and further understanding of the topic of co-development. The literature review also provided the researcher with various themes that needed to be explored in order to understand fully the co-development process in the automotive industry setting. Reading the literature helped the researcher understand the basic reasons why a company would opt for co-development, what are the important

components to make co-development work, when a supplier becomes involved in co-development, who is involved in the process, and how suppliers are selected. The why, what, when, who, and how questions and their corresponding answers found in the literature were used as a guideline to identify themes in order to understand co-development within the Malaysian automotive industry, which has so far not been explored by any other researcher (Table 17). As there was a time limitation, the researcher did not explore specific themes, such as knowledge sharing, investment relationships, and process alignment between local vehicle manufacturers and their suppliers.

In conclusion, in order to understand co-development practices within the Malaysian automotive industry, the researcher expected that those questions posed below would be answered at the end of this research.

Table 17: Guidelines for identifying the themes

Co-development	Related topic in literature
Why co-development?	Resources, quality, cost, lead time
What are the components in co-development?	Relationship, communication, trust
When do suppliers get involved & how?	Timing of involvement, supplier influence in design
Who is involved in the process?	Purchasing, engineering, R&D department
How to select a supplier.	Technological capability, design and development capability, manufacturing capability, R&D, price, delivery, quality, past relationship

On the other hand, the literature review concerning the automotive industry gives a better understanding of the current situation of the automotive industry within Malaysia. The unique features of the Malaysian automotive industry

compared to other developed countries are that the Malaysian automotive industry is relatively young, it began by copying from the Japanese, it was protected by the government, and it had a small number of automotive components suppliers. Throughout the research, the unique identity of the Malaysian automotive industry is taken into consideration, as well as whether or not it has much influence on co-development in the industry.

### **2.7.1 The Customer-Supplier Relationship**

The relationship between the supplier and the vehicle manufacturer is one of the more important factors for successful co-development, and so needs to be considered in this research. Many studies agree that, the longer the relationship, the more likely the customers and suppliers are to build the relationship-specific assets, understand core competencies across the businesses, and to learn more about each other's products (Hines, 1994; Macbeth & Ferguson, 1994; Sako, 1992). These will lower the barriers of both parties to enable them to work together and focus on improving the lead times, costs and quality of the product itself. Stigler & Becker (1977) stated that, as two companies sustain their business relationships over time, both parties will ultimately develop a joint understanding that is highly idiosyncratic, but that allows for uniquely efficient communication. The buyer and supplier could also learn about each other from each transaction, which could lead to the establishment of reputation and trust, familiarity with the nature of the technology and the product involved, and about the necessary resources and capabilities (Imai & Itami, 1984). Long-term relationships could also help to build learning routines and to ensure that the capability sets of both parties are aligned and remain useful (Van Echtelt *et al.*, 2008).

Many researchers have studied the comparison between Japanese and Western styles of collaboration; studies have indicated the large differences between Japanese and US approaches to customer-supplier relationships. For

example, Helper (1991), Lamming (1993), and Hines (1994) agreed that the Japanese vehicle manufacturers benefit from long-term relationships with their suppliers by giving them long-term contracts throughout the product's lifetime, with the contract being given based on product quality, cost, and delivery. In contrast, in the traditional Western style of collaboration, vehicle manufacturers are more content with short-term relationships with suppliers, and giving the business to the lowest-cost producer. The Japanese manufacturers also prefer to tighten their relationship with their suppliers by sharing the assets, and call the suppliers earlier on in the product development process. However, car manufacturers in the Western world try to avoid investment in suppliers, and maintain the adversarial relationships between them. Dyer (1993) also indicated that the trust-building practices in the case of the relationships between Japanese vehicle manufacturers and suppliers create a high degree of goal congruence and mutual trust for both parties. Looking at the Japanese automotive industry competitive advantage in the 1990s, many studies (Womack *et al.*, 1990; Sako, 1992; Nishiguchi, 1994; Liker *et al.*, 1995; Nishiguchi & Brookfield, 1997) agree that the Japanese style of collaboration has proved to be the successful model of customer-supplier relationships in the product development process.

As discussed previously, the large difference in terms of customer-supplier relationships styles between the Western world and Japan could lead to the competitiveness of the industry itself. Most of the literature agrees that long-term relationships between customers and suppliers will have a positive impact for both parties in relation to the product development process.

Understanding customer-supplier relationships helped the researcher to explore the current practice of co-development within Malaysia. As the Malaysian automotive industry is young compared to those of other developed countries, it was possible that the customer-supplier relationships within Malaysia would be different compared to those mentioned above. Therefore, in this research, the



customer-supplier relationships were identified as one of the areas that needed to be explored further.

### **2.7.2 The Supplier Capability**

The supplier capability factor always arises when the customer considers the involvement of a supplier in their product development process. Liker & Wasti (1999) indicated that the ability to gain unique expertise from outside suppliers has always been an important reason for outsourcing. A buyer prefers to select its most capable suppliers for a component with high technological uncertainty. Notably, the issue is whether or not a firm or its suppliers are more efficient in producing the output (Kogut & Zender, 1992). The supplier's ability and funding to conduct R&D, skill, competitiveness in relevant design work, the number of patents, the hardware, and other facilities become the relevant factors. The specific supplier technical capabilities will offset the transaction costs associated with a given exchange. The buyer is also more likely to utilise the already existing in-house abilities of a supplier (Liker & Wasti, 1999). Collaboration would ultimately allow the buyer to tap into the supplier's experience and abilities without having to risk further resources in conducting the development in-house. Leverick & Cooper (1998), however, stated the competitive advantage is more intense with a supplier only if they are operating close to forefront technology, especially if the supplier contributes a major component of the automotive product.

There are comparative studies in relation to US and Japanese styles of collaboration, which have found that the strong supplier capability in engineering and the quality of the relationship enables Japanese automakers to reap advantages in product lead times compared to the US (Clark & Fujimoto, 1989). In Japan, there is a greater amount of collaboration between the buyer and the supplier when dealing with a technologically uncertain component. The Japanese vehicle manufacturers seem to make use of their suppliers' expertise

in terms of developing greater levels of internal expertise for conducting the product development themselves (Liker & Wasti, 1999).

As discussed previously, there are many studies that agree that supplier capabilities have a positive influence on the product development process. However, although some researchers argue that there are various strong supplier capabilities with some advantages with high technological products, none mention that these would have negative impacts upon the collaboration process or product itself. Thus, supplier capabilities should be seen as one of the factors of successful co-development.

Although this study does not assess supplier capabilities within Malaysia, the fact that supplier capabilities would nevertheless influence the co-development process cannot be ignored. Therefore, supplier capabilities were chosen as one of the factors that needed further investigation in order to understand the co-development practices within Malaysia.

### **2.7.3 The Supplier Involvement in Product Development**

The timing of supplier involvement and the consideration of whether or not suppliers should be involved in product development is a crucial factor in the co-development process. Baldwin & Clark (1997) and Wingert (1997) agreed that partnerships and alliances with suppliers are an increasingly important strategy when striving to develop and maintain competitive advantage. Mabert *et al.* (1992) also indicated that supplier involvement is an important strategy, with five out of six firms attempting to shorten their product development lead times. Supplier involvement could also help firms to reduce product development times within the computer industry (Eisenhardt & Tarbizi, 1994). In addition, Parker *et al.* (2008) stated that the timing of supplier integration is one of the significant factors influencing the success of new product projects.

There are large differences between Japanese and US supplier integration practices. Clark & Fujimoto (1991) indicated that supplier involvement in product development is dramatically different among Japanese, European and US firms. Japanese suppliers, for example, do four times more engineering work for a typical project than do US suppliers, whilst the amount of work done by European suppliers lies somewhere in between. The Japanese automakers also rely upon a high degree of supplier engineering involvement in relation to developing parts compared to the US. Moreover, Dyer & Ouchi (1993) also stated that the partnerships and alliances with suppliers used by Japanese companies are increasingly important strategies for firms to develop and to maintain competitive advantage. In traditional US supplier integration practices, suppliers are not commonly included in the product development process until the technology development and product development stages have been finalised by the buying firm (Shapiro, 1985; Walker & Poppo, 1991). However, in their study, Kamath & Liker (1994) found that Japanese practices of supplier integration are being used increasingly in the US.

Several researches specifically explain the needs and timing of supplier involvement in the product development process. According to Leverick & Cooper (1997), there is clearly a significant competitive advantage in working closely with a supplier if they operate close to the forefront of technology. This finding is supported by Wasti & Liker (1999), as they indicated that the technological uncertainty of the component is one of the most dominant factors of supplier involvement. In addition, Petersen *et al.* (2003) also agreed that supplier involvement is important when the technology is complex or the buying company does not have enough internal expertise.

The timing of supplier involvement is also important in the product development process. Dowst & Raia (1986) argued that earlier supplier involvement in terms of the design and engineering process can keep costs in check, minimise problems during the manufacturing process of the new product, and keep design teams abreast of the latest technology. Clausing (1994) suggested that

earlier supplier involvement is important, stating that tasks should be started as early as possible. Handfield *et al.* (1999) further indicated that the timing of supplier integration depends on the kind of product that has to be developed and in relation to technology risks. McIvor & Humphreys (2004) stated there was increasing importance for suppliers to become involved in the earlier stages of product development for OEM products in the electronics industry. Petersen *et al.* (2005) further identified significant moderating effects of supplier involvement timing, and the level of supplier design responsibility in terms of translating early supplier involvement initiatives into improved designs and greater financial performance.

As discussed above, the involvement of suppliers in product development processes is one of the most important strategies for developing competitive advantage. The timing and product characteristics are also important in the process. Furthermore, as this study explores co-development practices within Malaysia, the involvement of suppliers in relation to the product development factor is extremely important.

#### **2.7.4 The Supplier Selection Process**

The supplier selection process is crucial when firms decide to involve suppliers in the product development process. The buying company has to choose the right partner for developing the products. Geringer (1998) stated that a partner's task-related criteria—such as partners' technical expertise, financial assets, managerial experience and access to markets, and the partner's national culture, past experience, size and structure—are all important criteria. Petersen *et al.* (2005) stated that supplier selection decisions are not only influenced by supplier's capability, but also are dependent on the culture of suppliers in buying firms interacting effectively with the supplier. Notably, in their comprehensive review of literature, Lin & Chen (2004) identified 183 decision attributes for evaluating candidate supply chain alliances for general industries.

These attributes can be further categorised into eight aspects: (1) finance; (2) human resource management; (3) industrial characteristics; (4) knowledge/technology acquiring and management; (5) marketing; (6) organisational competitiveness; (7) product development, production, and logistics management; and (8) relationship building and coordination. Emden *et al.* (2006) suggested three aspects of creating synergistic value through co-development alliances: 1) selecting a partner with the maximum potential for creating technological synergy, 2) selecting a partner with the maximum potential to collaborate, and 3) selecting partner with the maximum potential to sustain the relationship.

One of the methods of selecting a supplier is through the competitive bidding process. Globerman (1980) suggested that competitive bidding might be a viable procedure when the technology is at a stage considered capable of *ex ante* specification (which would be expected when a part is no longer high in technological uncertainty). Globerman added that when a number of suppliers possess the capacity to satisfy the specifications, competitive bidding would be a favoured mechanism.

According to Clark & Fujimoto (1991), the US and Japanese supplier systems stand in sharp contrast to each other. The traditional US system is characterised by a large number of suppliers, each of whom deals directly with auto companies on the basis of short-term contracts. Furthermore, suppliers are effectively treated as a source of manufacturing capacity; vehicle manufacturers establish requirements and play suppliers off against one another in a contest for one-year contracts, which are won through the process of competitive bidding. In contrast, the Japanese supplier system has a tiered structure and emphasises long-term relationships; it also has a smaller number of Tier-1 suppliers. The Japanese auto makers will then normally communicate with two or three potential suppliers, all of whom then compete for the job. This selection process is known as 'development competition', which takes from six to twelve months. Dyer & Ouchi (1993) and Dyer *et al.* (1998) characterised the

Japanese style of collaboration as 'mutual assistance and a focus on total cost and quality'.

### **2.7.5 The Supplier Influence in the Decision-Making Process**

The supplier influence in the decision-making process could describe how dominant the customer is towards their supplier. Petersen *et al.* (2003) noted that supplier involvement in relation to the decision-making process has an influence on project success. Johnsen (2009) stated that there is evidence to support the view that those powerful customers who abuse their power advantage and behave opportunistically may ruin the trust, which is considered to be a critical factor in collaboration. However, according to Johnston & Kristal (2007), involvement in decision-making positively affects shared planning activities for the suppliers, and shows relationship flexibility on the part of the buyer.

Bresnen (1996) suggested that, upon close examination, partnerships between buyers and suppliers can be deconstructed in order to reveal the reality of control and market power, which underpin the demand-supply relationship. He further added that suppliers themselves are still typically reactive rather than proactive in their orientation to customer demands. Wyatt (2001), citing a study conducted by Lamming (1996), identified the 'flaw' in supply chain literature as being the corollary stating that the customer is always right. Lamming further suggested that the concept of the vantage point is not always helpful in developing genuine shared benefits and, indeed, whilst some degree of leadership might be necessary in any given supply situation, the notion of customer infallibility may be leading purchasers to a fatal misconception. Hill (1996), however, argued that there cannot be a partnership of equals where one of the partners is the customer and the other is the supplier. Wyatt (2001) concluded that both vehicle manufacturers and suppliers acknowledge the

potential suppliers of their partners; however, vehicle manufacturers more clearly demonstrate behaviours associated with power.

The study by Wasti & Liker (1999) indicated that the Japanese suppliers of highly uncertain products have significantly more influence in relation to early design decisions, such as interior design and engine performance. Technically competent US suppliers are given more flexibility in defining specifications. In the US, for instance, high uncertainty products make customers want to give greater design responsibility to their most competent suppliers, who have the most control. These types of interaction, however, are not a feature of the Japanese practices.

The supplier influence in the decision-making process could be translated to the behaviours of customers toward their suppliers. The willingness of customers to listen to their suppliers demonstrates the openness and flexibility of customers toward their suppliers in relation to the product development process. The success of co-development ultimately requires a change in the mind-set, understanding, trust and commitment of both parties (Melvor & McHugh, 2000). Furthermore, by exploring the factor of supplier influence on the decision-making process, the researcher was better able to understand the current situation of co-development practices within Malaysia.

### **2.7.6 *The Nature of Communication***

Several authors have studied the role of communication in the product development process. According to Morley (1990), both formal and informal communications have their own role in relation to the successful product development process. Littler & Leverick (1995) further indicated that frequent communication is the second most important discriminating factor between successful and less successful collaboration. Furthermore, in the study on cross-functional communication, Dougherty (1992) stated that successful projects combine cross-functional personnel and collate their perspectives in a

highly interactive, iterative fashion. McDonough & Kahn (1996) stated that performance is positively associated with the greater frequency of use of a variety of information technologies, including company database, e-mail, face-to-face meetings, faxes, phone calls, mail, teleconferences and videoconferences. Daft & Lengel (1986) specifically suggested that, for highly uncertain tasks, rich communication media (e.g., face-to-face) are more effective than less rich media, such as written communication.

Filippini *et al.* (2004) stated that the clear definition and communication of new product goals have positive effects on new product time performance, help to reduce levels of uncertainty and, accordingly, enhance the influence of other drivers, such as supplier and customer involvement. According to Badir *et al.* (2009), in the collaborative new product development, product characteristics, such as complexity and technological uncertainty, have a significant influence on the intensity and media richness of communication.

Comparisons between the Japanese and the US show the different ways in which communication is implemented in both regions in the product development practice. Dyer (1994) reported that, in Japan, direct communication and relationships develop over a long period of time, and detailed and explicit written communication is largely unnecessary, further stating that the shared language allows the parties to communicate effectively. Bensou (1992), however, stated that US manufacturers have been making efforts over the last decade to spend more time with their suppliers in imitation of the Japanese model. Wasti & Liker (1999) supported these findings, and proffered further evidence that, in the US, increasing levels of technological uncertainty in relation to the product are associated with greater frequency of communication with the buyers. They added that, in Japan, the lower the level of competition in the supplier market, the more frequently the two parties communicate.

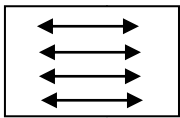
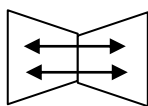
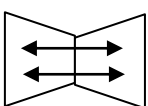
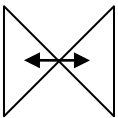
Wynstra & Pierick (2000) developed guidelines for the interfaces in the different collaboration relationships (Table 18). They divided four different types of



communication structures based on collaboration strategy: strategic development, critical development, arm's-length development, and routine development. Strategic development is a high-risk development with a high degree of supplier development responsibility. Furthermore, high-risk supplier involvement with low degrees of supplier development responsibility is categorised as being a critical development, whilst in the case of the arm's-length development, a large part of the development is contracted to the supplier owing to the low development risk. The supplier with low development risk—and little or no development responsibility—belongs to the routine development group.

Table 18: The guidelines for the interfaces in the different collaboration relationships

(Wynstra &amp; Pierick, 2000)

	Strategic Development	Critical Development	Arm's-length Development	Routine Development
Kind of collaboration	Close co-operation, joint development	Focus on obtaining information	Independent development by supplier	Informing each other about changes
Direction of communication	Two-way traffic	One-way traffic at manufacturer's initiative	One-way traffic at supplier's initiative	Two-way traffic
Communication medium	Rich media such as face-to-face group meetings	Lean media such as telephone and fax	Rich media such as face-to-face meetings	Lean media such as fax, mail and e-mail
Amount of communication	High	Medium	Medium	Low
Functional disciplines	Diverse	Purchasing/sales (and development)	Development (and purchasing/sales)	Purchasing/sales
Content of communication	Technical and commercial information	Market (and technical) information	Technical (and status) information	Status information
Communication structure				

As explained above, communication needs differ, and ultimately depend on product or technological uncertainty. Effective communication undoubtedly affects the product development process positively, especially with the suppliers. In an exploration of the co-development practices within Malaysia, the role of communication in the process cannot be ignored; therefore, communication has been identified as one of the key elements in relation to successful product development collaboration, and needs to be explored further in this research.

## **2.8 Chapter Summary**

The review of the literature began with the review of new product development (NPD) as a strategy for firms to remain competitive. All researchers in this field agree that NPD helps firms to survive in what is an overwhelmingly challenging business environment. The literature review further investigated the process and stages involved in NPD, as well as the strategy of developing new products. Involving suppliers in the NPD process is one of the key strategies of developing the product with minimal costs, shorter lead times, and better quality. The advantages and disadvantages of involving suppliers in the process have also been discussed. The close relationship between the buyer and supplier companies was discussed in terms of developing new products, which was subsequently defined as 'co-development'.

Furthermore, most researchers on NPD have different industrial backgrounds and come from different business environments. Unfortunately, they have not stressed the importance of or differences in the specific environment of the industry or situation that are the focus of their studies; therefore, given this apparent gap, a deeper understanding of the effects of these varying contexts (e.g., country, environment, sector, Government policy, etc.) would be valuable in achieving a better understanding of the product development collaboration.

On the other hand, the automotive industry seems to be one of the preferred areas of research in terms of co-development. As it is impossible for vehicle manufacturers to design and manufacture every single component used in the making of a car, collaboration with suppliers is subsequently crucial. The dissimilarity in supplier involvement in NPD between Japanese and US vehicle manufacturers shows that the suppliers' role is seen as important, but is a link that nevertheless varies between countries. The Japanese, for example, ensure long-term relationships, and have been shown to work closely with their suppliers compared to US companies. Thus, the research regarding co-development in different countries and through different backgrounds becomes interesting.

As has already been established, the Malaysian automotive industry is relatively young in comparison to those of other countries. The establishment of the industry is also unique, as it was started by copying and rebranding Japanese cars. The development of the industry has been predominantly protected by the government, ensuring less competition from overseas vehicle manufacturers and parts makers. The industry has experienced successful growth since the establishment of the NCP, which occurred in 1983; therefore, the context is significantly different to those previously studied.

Moreover, the research carried out on co-development in the Malaysian automotive industry can also be seen as highly important in relation to the next stages of the development of the national strategy. The literature review showed that there has so far been no study regarding the buyer-supplier relationship in the automotive industry within Malaysia. The review of the literature identified a gap in the co-development knowledge within the Malaysian automotive industry.

## Chapter 3

Research  
Methodology

- Consideration of available research strategies

Research strategy:  
Qualitative, exploratory



## 3 Research Methodology

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### 3.1 Introduction

This chapter explains how the research was conducted. The general perspective of the research that is available and was chosen by the researcher is explained in this chapter. The focus is on the decisions made by the researcher regarding the development of an appropriate and valid strategy to pursue this research. The section starts with basic information about research along with the philosophical study, and ends with the strategic methodology selected by the researcher.

### 3.2 Research Philosophy

According to Greenfield (2002), '*Research is an art aided by skills of inquiry, experimental design, data collection, measurement and analysis, by interpretation, and by presentation*'. Research in an academic context should be conducted within a system of knowledge or understanding, and should be tested or probed (Preece, 1994). Collin & Hussey (2009) further indicated that '*a) research is a process of inquiry and investigation; b) it is systematic and methodological and; c) research increases knowledge*'.

As this research is concerned with the exploration of co-development in the Malaysian automotive industry, the philosophy of social science research was adopted. Neuman (2006) defined social research as '*a collection of methods and methodologies that researchers apply systematically to produce scientifically based knowledge about the social world where a researcher needs to use their creativity, ideas along with theories in a systematic way*'. In the case of social inquiry research, the concept of epistemology and ontology must be covered. Furthermore, according to Blaikie (2008), epistemology involves ways of answering the question '*How can social reality be known?*' with consideration

given to the theory about how human beings come to have knowledge of the world around them, and the theory of method or grounds of knowledge. Ontology, on other hand, deals with the question: '*What is the nature of social reality?*' that is, the nature of what exists.

Bryman & Bell (2007) further indicated that the ontology assumptions in social research are concerned with the orientation of '*whether social entities can and should be considered objective entities that have a reality external to social actors or whether they can and should be social constructions built up from the perceptions and actions of social actors*'. An epistemology assumption is concerned with '*whether the social world can and should be studied according to the same principles, procedures as the natural sciences. In determining what is the research philosophy to select, the first thing to look at is the epistemological issue which concerns the question of what is regarded as acceptable knowledge in discipline*'.

In order to select the most appropriate methodology for the research, both epistemology and ontology assumptions need to be explored further. The research paradigms section below will consider the insight offered by both assumptions.

### **3.2.1 Research Paradigms**

Hussey & Hussey (1997) indicated that the term 'paradigm' refers to the progress of scientific practice based on people's philosophies and assumptions about the world, and the nature of knowledge, with the additional consideration of how research should be conducted. According to Blaikie (2007), the strategy of research is located within the broader frameworks of philosophical perspectives, which are referred to as paradigms. As this research focuses on the ontology and epistemology assumptions, other assumptions, such as axiological, rhetorical or methodological, will not be considered.



Ontological assumptions, according to Bryman & Bell (2007), can be divided into two main categories: objectivism and constructivism (Table 19).

Table 19: Objectivism and Constructivism  
(Bryman & Bell, 2007)

Objectivism
<p>An ontological position asserts that social phenomena and their meanings have an existence that is independent of social actors. It implies that social phenomena and the categories that we use in everyday discourse have an existence that is independent or separate from actors.</p>
Constructivism
<p>An ontological position asserts that social phenomena and their meanings are continually being accomplished by social actors. It implies that social phenomena and categories not only are produced through social interaction, but are in a constant state of revision.</p>

Positivism, realism and interpretivism are three different categories devised by Bryman & Bell (2007) under epistemology assumptions. The concept of those categories is summarised in Table 20. According to positivists, knowledge is valid only within observable and measurable phenomena. Interpretivist is the term given to contrast completely to positivism; it is concerned with the understanding of human behaviours from the participant's own frame of reference (Hussey & Hussey, 1997). Realism or critical social science stands between positivism and interpretivism: realism agrees with the positivism view that society is an unchanging order, and adds the social context, which is not considered in positivism.

Table 20: Positivism, realism and interpretivism  
(Bryman, 2008)

Positivism
An epistemological position advocates the application of the methods of the natural sciences to the study of social reality and beyond. It states that the only authentic knowledge is scientific knowledge and that such knowledge can come only from the positive affirmation of theories through strict scientific method.
Realism
Realism shares two features with positivism: a belief that the natural and social sciences can and should apply the same kinds of approach to the collection of data and to explanation, and a commitment to the view that there is an external reality to which scientists direct their attention.
Interpretivism
Interpretivism is taken to denote an alternative to the positivist orthodoxy that has held sway for decades. It is predicated upon the view that a strategy is required that respects the differences between people and the objects of the natural sciences and therefore requires the social scientist to grasp the subjective meaning of social action.

Neuman (2006) summarised the character of positivist, interpretivist and realist social science for easy comparison (Table 21). According to Neuman (2006), realism or critical social science is '*a critical process of inquiry that goes beyond surface illusions to uncover the real structures in the material world in order to help people change conditions and build a better world for themselves*'.

Table 21: The concept of positivism, realism and interpretivism  
(Neuman, 2006)

Positivism	Realism	Interpretivism
The purpose of social science is to discover laws	The purpose of social science is to reveal what is hidden to liberate and empower people	The purpose of social research is to understand social meaning in context
The essentialist view is that reality is empirical evidence	Social theory has multiple layers	A constructionist view is that reality is socially created
Humans are rational, thinking, individualistic mammals	People have unrealized potential and are misled by reification; social life is relational	Humans are interacting social beings who create and reinforce shared meaning
A deterministic stance is taken regarding human agency	A bounded autonomy stance is taken regarding human agency	A voluntaristic stance is taken regarding human agency
Scientific knowledge is different from and superior to all other knowledge	Scientific knowledge is imperfect, but can fight false consciousness	Scientific knowledge is different from but no better than other forms
Explanations are homothetic and advance via deductive reasoning	Abduction is used to create explanatory critiques	Explanations are idiographic and advance via inductive reasoning
Explanations are verified using replication by other researchers	Explanations are verified through praxis	Explanations are verified using a postulate of adequacy with people being studied
Social science evidence requires inter-subjectivity	All evidence is theory dependent and some theories reveal deeper kinds of evidence	Social scientific evidence is contingent, and context specific
Social science should be value free and objective	Social reality and the study of it necessarily contain moral-political positions that are unequal in advancing human freedom and empowerment	Social science should be relativistic regarding value positions

As this research is concerned with investigating the practices of co-development in the Malaysian automotive industry and gaining insight into what has happened in the real world, the constructivism approach of ontological assumption and realism on epistemology assumptions was selected (Figure 10). Notably, owing to the lack of understanding in relation to co-development practices within the Malaysian automotive industry, it was decided that it would not be sensible to attempt to devise hypotheses and to test them, as the positivism perspective suggests. The general research aim was to explore and gather information, understanding, and knowledge of this sparsely researched area via an investigation of the phenomenon in its real context. This research was fundamentally dependent on the two important entities: the vehicle manufacturer and suppliers. The interaction between actors on the topic of co-development became an important subject of research, and therefore, needed to be understood in social contexts.

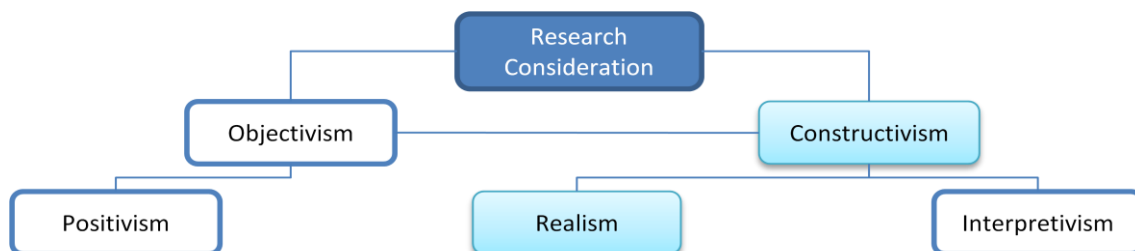


Figure 10: Research paradigms

### 3.3 Research Methodology

The methodology of a research refers to the way in which the research is carried out. According to Blaikie (2000), methodology refers to a discussion of how research is done, or should be done, and to the critical analysis of methods of research. This must include a critical evaluation of alternative research

strategies and methods. This section will explain the selected research methodology under the selected research paradigms discussed above.

### 3.3.1 Research Purpose

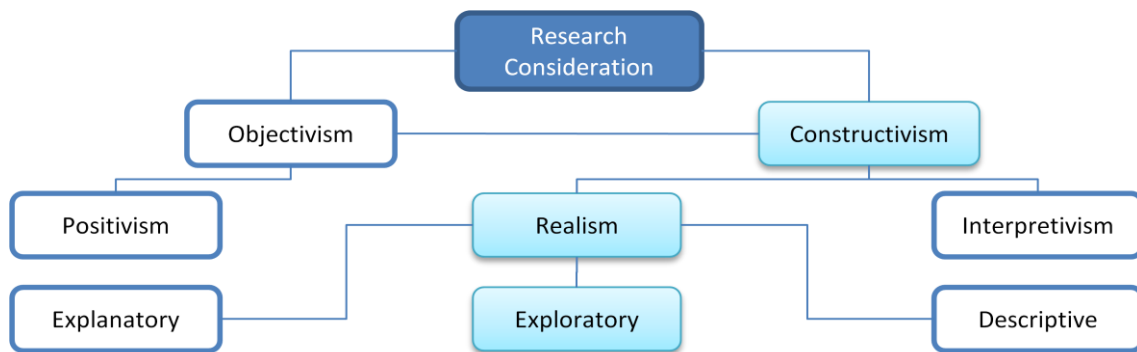


Figure 11: Research purpose

The purpose of this research project is to explore the co-development practices of the Malaysian vehicle manufacturers and their suppliers. Robson (2002) indicated that enquiries could be classified in terms of their purpose as well as by the research strategy adopted. Robson classified the purpose of enquiry into four categories: exploratory, descriptive, explanatory and emancipatory. The characteristics of these categories are summarised in Table 22. The purpose of this research project can be classified as exploratory due to the objective of determining the current practices of co-development in the Malaysian automotive industry (Figure 11).

Table 22: Classification of the purpose of enquiry  
(Robson, 2002)

<i>Research purpose</i>	<i>Characteristics</i>
Exploratory	<ul style="list-style-type: none"> <li>▪ To find out what is happening, particularly in little-understood situations.</li> <li>▪ To seek new insights.</li> <li>▪ To ask questions.</li> <li>▪ To assess phenomena in a new light.</li> <li>▪ To generate ideas and hypotheses for future research.</li> <li>▪ Almost exclusively of flexible design (qualitative).</li> </ul>
Descriptive	<ul style="list-style-type: none"> <li>▪ To portray an accurate profile of persons, events or situations.</li> <li>▪ Requires extensive previous knowledge of situations etc.</li> <li>▪ To be researched or described, so that the researcher knows the appropriate aspects on which to gather information.</li> <li>▪ May be of flexible and/or fixed design (qualitative or quantitative).</li> </ul>
Explanatory	<ul style="list-style-type: none"> <li>▪ Seeks an explanation of a situation or problem, traditionally, but not necessarily in the form of causal relationships.</li> <li>▪ To explain patterns relating to the phenomenon being researched.</li> <li>▪ To identify relationships between aspects of the phenomenon.</li> <li>▪ May be of flexible and/or fixed design (qualitative or quantitative).</li> </ul>
Emancipatory	<ul style="list-style-type: none"> <li>▪ To create opportunities and the will to engage in social action.</li> <li>▪ Almost exclusively of flexible design (qualitative).</li> </ul>

### 3.3.2 Research Type

A distinction is made between two types of data: qualitative and quantitative. Robson (2002) summarised the differences between qualitative and quantitative types of data (Table 23). Bryman & Bell (2007) indicated that qualitative data research deals with interpretivism under epistemological assumptions, and constructivism under ontological considerations. In contrast, quantitative data leans towards positivism and objectivism. According to Hussey & Hussey (1997), qualitative data is concerned with qualities and non-numerical characteristics. The sample of data is small compared to quantitative data, but requires in-depth data investigation.

Table 23: Qualitative and quantitative  
(Robson, 2002)

Qualitative	Quantitative
<ul style="list-style-type: none"> <li>• Deals mainly with the exploration of issues and the generation of theories within new and emerging subject areas.</li> <li>• Is used to develop insight and understanding of a subject.</li> <li>• Seeks to create gestalt and holistic interpretations.</li> </ul>	<ul style="list-style-type: none"> <li>• Is used in research that requires facts and figures in order to answer the research question (through verification of hypothesis).</li> <li>• Seeks to measure, test, and quantify elements in order to explain or describe something.</li> </ul>

A qualitative data/research approach was adopted in this research, since the purpose of this research was to understand the co-development practices of Malaysian vehicle manufacturers and their suppliers. Due to the lack of literature on the surrounding topic within Malaysia, building pre-existing

hypotheses such as those used in many quantitative researches was considered impossible, as the establishment of the industry within Malaysia is unique. A quantitative approach also requires large samples of data, which would have been difficult to achieve in the limited period of time available and with limited access to companies. Therefore, quantitative methods would not have been applicable for the purpose of this research.

### **3.3.3 Research Strategy**

Several strategies highlight the associations between the positivism and interpretivism paradigms. Hussey & Hussey (1997) summarised methodologies associated with both paradigms (Table 24). Collis & Hussey (2009) added the features of the paradigms based on the methodologies.



Table 24: Methodological assumptions of the main paradigms and it features  
 (Adopted from Hussey & Hussey, 1997; Collis & Hussey, 2009)

<b>Positivism</b>	Approach to social sciences	<b>Interpretivism</b>
←-----→		
<p><i>Associated Methodologies</i></p> <ul style="list-style-type: none"> <li>• Cross-sectional studies</li> <li>• Experimental studies</li> <li>• Longitudinal studies</li> <li>• Surveys</li> </ul>		<p><i>Associated Methodologies</i></p> <ul style="list-style-type: none"> <li>• Action research</li> <li>• Case studies</li> <li>• Ethnography</li> <li>• Grounded theory</li> <li>• Hermeneutics</li> <li>• Participative enquiry</li> </ul>
<p><i>Features</i></p> <ul style="list-style-type: none"> <li>• Large samples</li> <li>• Artificial location</li> <li>• Hypotheses testing</li> <li>• Precise, objective quantitative data</li> <li>• High reliability but low validity on result</li> <li>• Allow the result to be generalized from the sample to population</li> </ul>		<p><i>Features</i></p> <ul style="list-style-type: none"> <li>• Small samples</li> <li>• Natural location</li> <li>• Generating theories</li> <li>• Reach, subjective qualitative data</li> <li>• Low reliability but high validity on findings</li> <li>• Allow findings to be generalized from one setting to another similar setting</li> </ul>

As this research is concerned with the exploration of real-world contents of the co-development in the Malaysian automotive industry, the methodologies associated with the positivism approach were not adopted; this left the option of interpretivism-associated methodologies, which are near to the realism approach for this research. A description of the available research methodologies is given in Table 25.

Table 25: Available research methods

(Source: various)

Research Method	Description	Reference
Action Research	The main aim is to enter into a situation, attempt to bring about change and monitor the results. Improvement and involvement are central of this research.	Hussey & Hussey (1997); Robson (2002)
Case Studies	Empirical inquiry investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.	Yin (2009)
Ethnography	Seeks to capture, interpret and explain how a group, organisation or community live, experience, and makes sense of their lives and their world.	Robson (2002)
Grounded theory	The central aim of grounded theory study is to generate a theory from data collected during the study, which is particularly useful in new, applied areas where there is a lack of theory and concepts to describe and explain what is going on.	Robson (2002)
Hermeneutics	Refers to an approach that was originally devised in relation to the understanding or interpretation of texts, and of theological texts in particular.	Bryman & Bell (2007)
Participative enquiry	Involves the participants in the research as possible in the study that conducted within their own group or organisations	Hussey & Hussey (1997)

As described above, ethnography, hermeneutics and participative enquiry research methodologies were not applicable to this research. Furthermore, action research was not suited to this research, as the aim was to explore and understand co-development within the Malaysian automotive industry, not to improve or change the situation. Moreover, access would have been impossible. The study also does not aim to develop a theory from the data, as the theories and concepts of co-development have been much discussed in Japan, the US and European countries. Thus, the grounded theory approaches were not considered appropriate research methods in this research.

The case study research methodology fits the aims of the research. In order to understand the current practices of co-development within the Malaysian automotive industry from real-world perspectives, the researcher needed to conduct an in-depth investigation into the phenomenon. A case is widely defined as a location, an individual, a group of people, an organisation, and so on. Under the case study research methodology, the researcher had access to entities being studied, that is, the vehicle manufacturers and suppliers. The case study could involve single or multiple cases. Multiple case studies are used when the researcher needs to conduct comparisons of the cases being researched; this allows the researcher to compare and contrast the findings deriving from each of the cases (Bryman, 2008). This research was conducted in relation to multiple case study research methodologies in order to ensure the findings were accurate and had high validity (Figure 12).

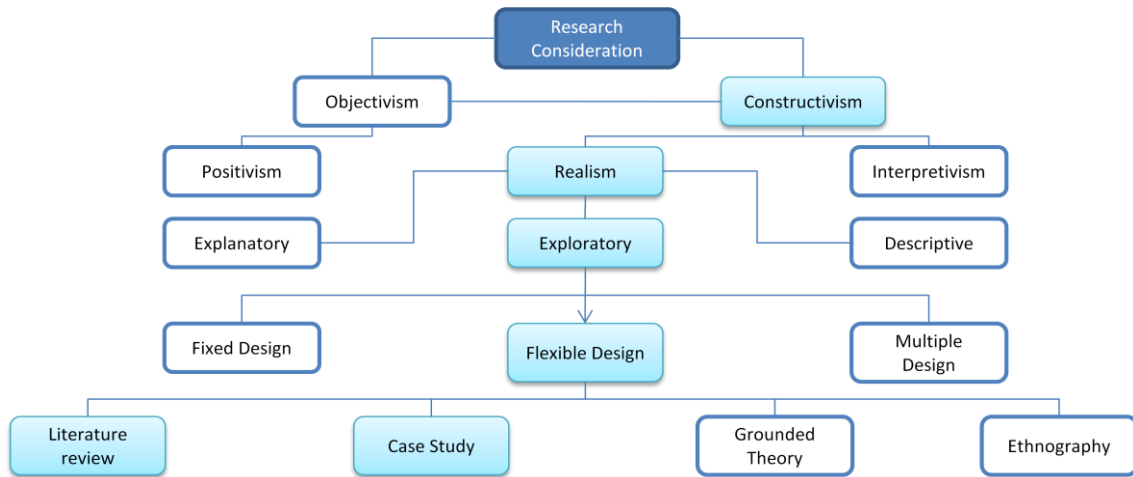


Figure 12: Research strategy

### 3.4 Data Collection

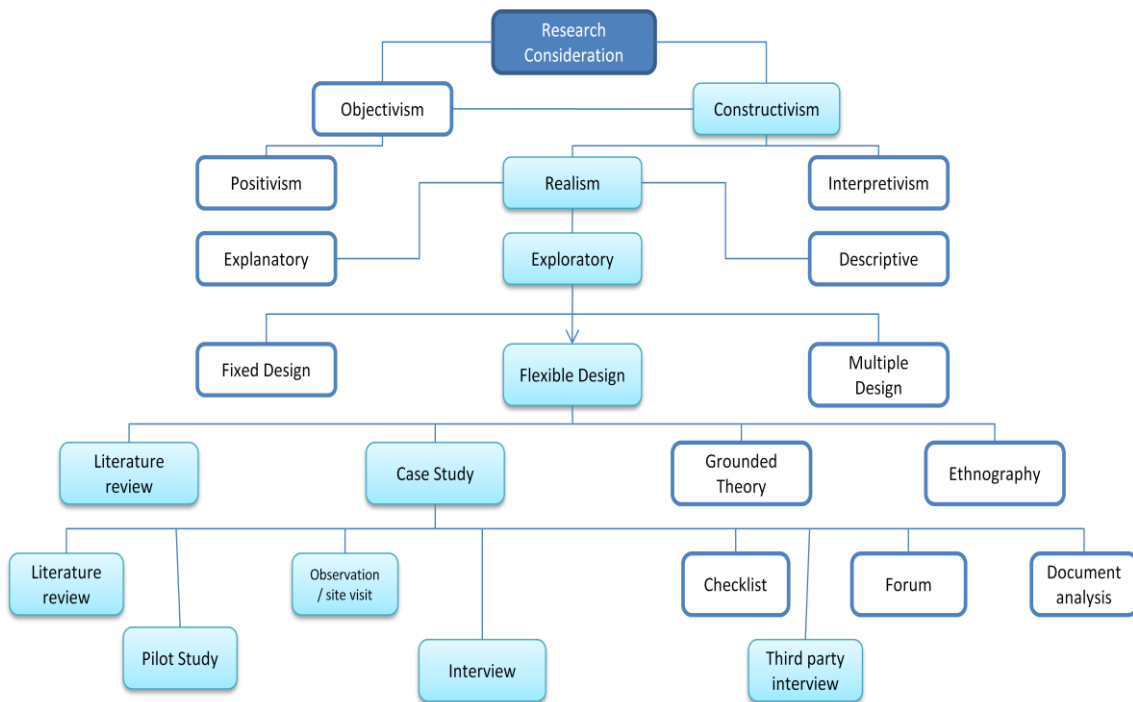


Figure 13: Data collection methods

The three main stages of data collection in this research were the literature review, pilot study and interviews (Figure 13). The information from the literature review was used to design the pilot study. Further, the findings from the pilot study were used to design the main data collection, that is, semi-structured interviews. Apart from the three stages of data collection above, observation or site visits also contributed some of the data in this research. The data came from companies' websites, notes and charts from the companies' notice boards, the Government and third party reports.

The intensive literature review in Chapter 2 not only gave the researcher an understanding of the related topic, but also was useful in the pilot study and interviews. As cited by Hussey & Hussey (1997), Gill & Johnson (1991) claimed that a literature review '*should provide the reader with a statement of the state of the art and major questions and issues in the field under consideration*'. In this research, the themes that were considerably important to the co-development were identified through the review of the literature and were used when designing the pilot study and interviews during the first stage of data collection.

The second stage of data collection, the pilot study, was carried out via questionnaires. The aim of a questionnaire is to find out what respondents think, do or feel (Hussey & Hussey, 1997). Both closed and open-ended questions were used in this research. Closed question are used to obtain factual answers, which can be selected from a number of predetermined alternatives and which are easy to analyse. On the other hand, open-ended questions can provide respondents with the opportunity to voice personal opinions in relation to the topic, using their own words (Hussey & Hussey, 1997). The aim of the pilot study in this research was to ensure the researcher had an overview of co-development, as well as of the Malaysian automotive industry, as there is very limited research on the topic of co-development within Malaysia.

The main data collection in this research used the interview approach. Interviews as a form of data collection are widely used in social research, and

can be used as the primary or only approach of the research (Robson, 2002). There are three types of interview: structured, semi-structured and unstructured. Semi-structured and unstructured interviews are used mainly in the collection of qualitative data; both types of interviews produce rich data and detailed answers (Bryman & Bell, 2007). Unstructured interviews provide a general overview of interest and concern relating to the topics, which was not suited to this research. Semi-structured interviews, on the other hand, provide flexibility and control in the interview process.

A list of the topics covered during the interviews will guide the researcher, and respondents will be able to answer freely the questions within the topics. In-depth interviews, as suggested by Yin (2009), are a type of case study, and were the option chosen in this research. In-depth interviews could seek facts, as well as respondents' opinions about an issue. Furthermore, the interviewer is able to ask respondents to pursue their own insights into certain occurrences (Yin, 2009).

### **3.5 Data Analysis**

There are three stages of data collection, which lead to three types of data analysis, namely, literature analysis, questionnaire data analysis, and thematic analysis for the main data collection (Figure 14). The first two data analyses shaped the interview questions for the third data collection.

The literature analysis aimed to identify the themes deemed important and relevant to co-development. There are many themes associated with the topic area; however, the researcher needed to identify the most relevant topics. In order to achieve this, the researcher first needed to understand the factors that are able to influence co-development. The literature analysis identified those factors from previous and related researches.

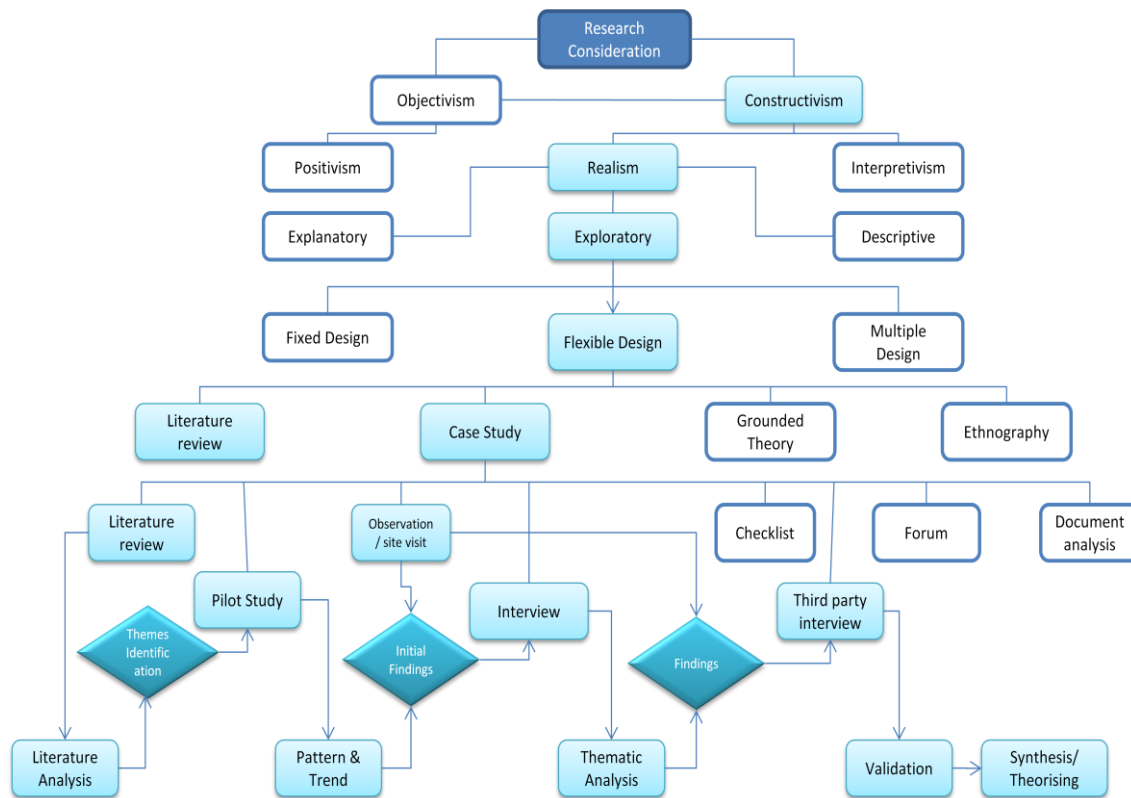


Figure 14: Data analysis methods

For the pilot study questionnaires, data analysis was more commonly used to identify the pattern of co-development within Malaysia. For example, the analysis in this stage indicated how many companies selected the ‘request for a quotation’ stage, and whether or not they were involved in the design process.

The challenge of data analysis was huge given the amount of qualitative data gathered from the interviews. According to Yin (2009), ‘*Data analysis consists of examining, categorising, tabulating, testing, or otherwise recombining evidence, to draw empirically based conclusions*’. Yin added that case study evidence data analysis is difficult, as the techniques are still not well-defined. Moreover, Miles & Huberman (1994) indicated that qualitative data analysis is concerned with describing what things mean, and noting regularities, patterns, explanations, possible configurations, causal flows and propositions.

Thematic analysis is a method of analysing qualitative data by encoding qualitative information (Boyatzis, 1998). According to Gomm, '*Thematic analysis looks for themes which are present in the whole set of interviews and creates a framework of these for making comparisons and contrasts between the different respondents*' (Gomm, 2004). Boyatzis stated, '*Thematic analysis enables scholars, observers, or practitioners to use a wide variety of types of information in a systematic manner that increases their accuracy or sensitivity in understanding and interpreting observations about people, events, situations, and organisations*' (Boyatzis, 1998).

According to Boyatzis (1998), a theme is a pattern found in the information that, as a minimum, describes and organises possible observations, and at maximum, interprets various aspects of a phenomenon. Themes may initially be generated inductively from the raw information, or may otherwise be generated deductively from theory or prior research. In this research, themes were identified using the latter technique, that is, information from prior research.

The interviews were transcribed, and statements placed under the themes identified in the literature analysis. There could be several layers of themes, with some themes contained within other themes. Gomm further suggested the step of thematic analysis:

- Deciding what themes there will be;
- Deciding what will count as evidence of a theme;
- Coding a transcript in order to indicate that one passage is an example of this theme, and that another passage is an example of another theme; and
- Analysis in terms of who said what, what relates to a particular theme, how saying something can relate to one theme, and how saying something with regards to one theme relates to saying something with regards to another theme.



At this stage, the researcher used MindManager software to analyse the interview data. The details concerning how the data were analysed are discussed in Chapter 6.

### **3.6 Chapter Summary**

In this chapter, the strategic and methodological considerations of the research were discussed in detail. The appropriate methodology and strategy chosen were explained thoroughly. The summary of the selected approach is summarised in Figure 15 below. The research adopted the constructivism approach under the ontological assumption and realism paradigm under the epistemological assumption. The exploratory research purpose was selected, as this study aimed to offer an in-depth insight into co-development practices within Malaysia.

The case study research method was selected as a research strategy with a flexible research design. The data were collected through three different stages: literature study, pilot study and semi-structured interviews. Analysis also comprised three stages: literature analysis, noting patterns and trends, and thematic analysis. In order to maintain the high validity of the data and the overall credibility of the research, triangulation with industry experts and the researcher's supervisor was conducted.

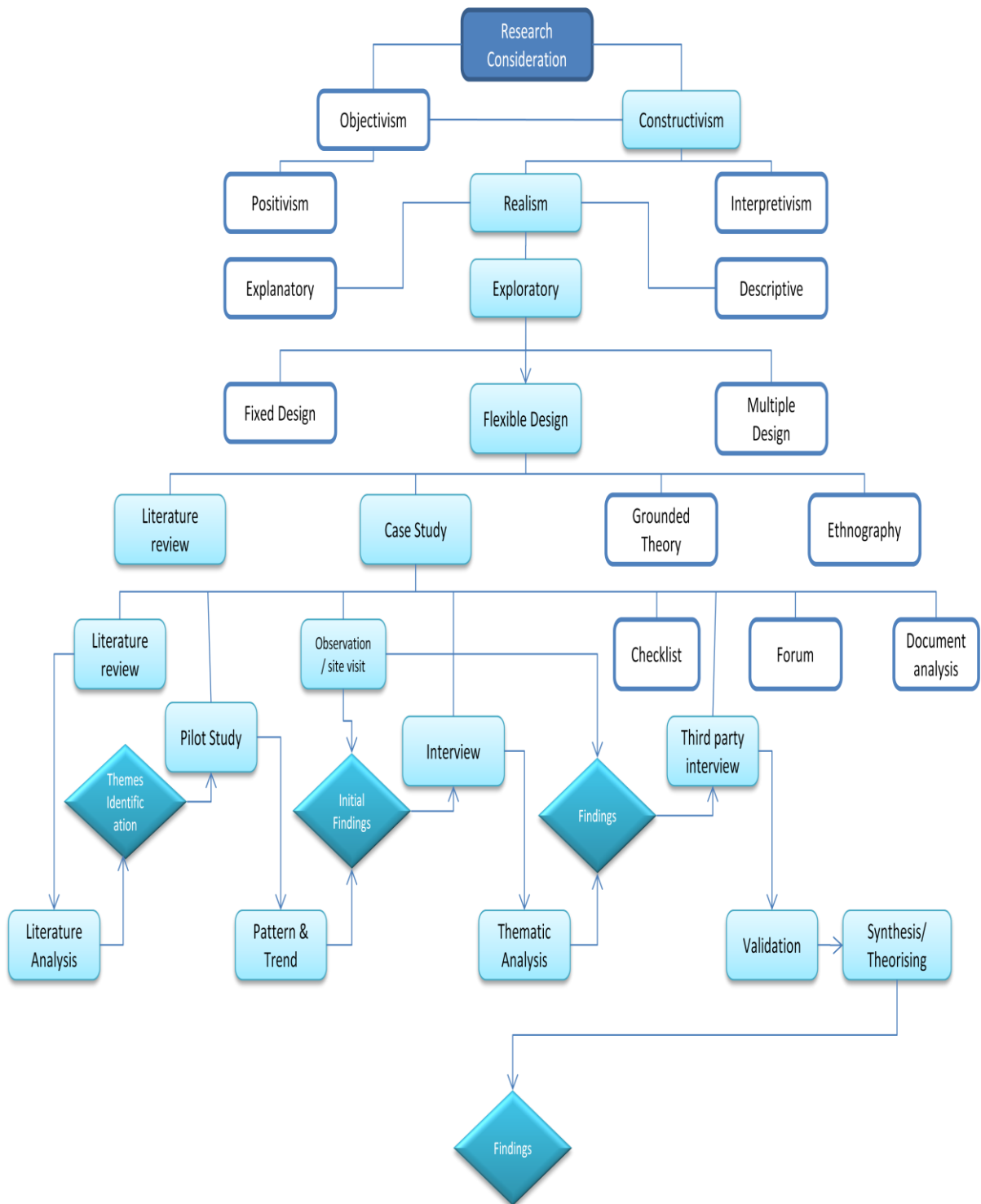


Figure 15: The research methodology summary

## Chapter 4

Research  
Design

- Implementation of the research methodology to the study

Research journey



## **4 Research Design**

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### **4.1 Introduction**

In this chapter, the implementation of the research methodologies chosen in Chapter 3 is discussed. Chapter 3 was concerned with the philosophical choice, whilst Chapter 4 is concerned with how the research was conducted in a real world context. The research journey from the beginning of the research process is briefly described in this chapter.

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### **4.2 The Data Collection Process**

The first section of data collection explored writings concerned with co-development in general, and accordingly sought to develop a list of factors that other authors considered important in terms of the success of co-development. The lists of identified themes were presented in section 2.7. As mentioned in Chapter 2, from the late 1980s, many researchers have focused on the co-development process in two major automotive markets, namely, the US and Japan; however, the trend changed during the late 1990s, when researchers began to explore the specific factors in co-development practices. In order to confirm whether the identified themes are still relevant or not, interviews were designed for experts from vehicle manufacturing and automotive product suppliers in the UK. At this stage, the experts confirmed, rejected or added a new dimension to the identified themes.

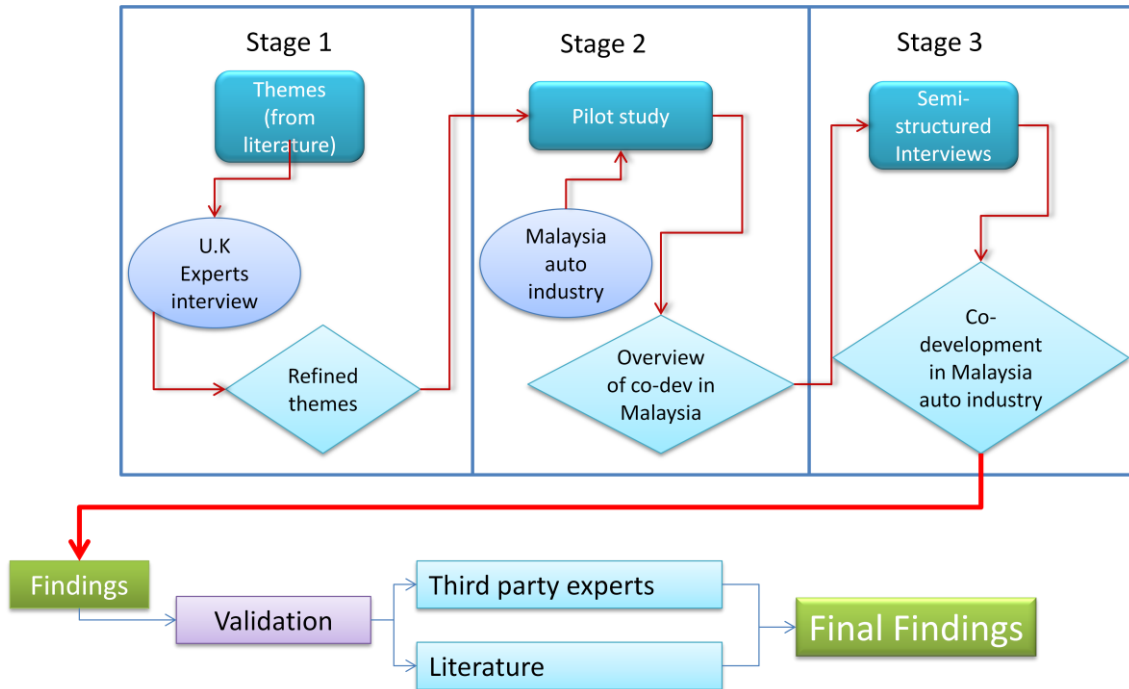


Figure 16: Three stage of data collection

The second section considers the factors identified as being concerned with the characteristics of the Malaysian industry, focusing on the automotive sector and describing the key differences in industry norms. In this section, the themes identified and tested in Section 1 are reconsidered in order to fit with the current characteristics of the Malaysian automotive industry. The results from the interviews with the experts in the first section were used to design the pilot study for the vehicle manufacturers and suppliers within Malaysia. The aim of the pilot study was to give the researcher an overview of buyer-supplier relationships in the Malaysian automotive industry before entering the main data collection stage 3. As there is neither research nor information about co-development, either in the automotive or any other industry in Malaysia, stage 2 was designed to allow the researcher to have initial thoughts about the researched area. The initial findings from the pilot study, together with the result from the interviews within the UK, were then used to design the interviews for

the main data collection, that is, the case study interviews. Figure 16 above summarises the data collection stage of this research.

#### **4.2.1 Case Study**

The case study was designed for the main data collection using a semi-structured interview approach. The interview questions were based on the findings of the pilot study and UK experts' knowledge. The case studies were conducted involving Malaysian vehicle manufacturers, Malaysian automotive Tier-1 suppliers, and overseas Tier-1 suppliers within Malaysia. The individuals selected for the interviews came from different backgrounds or departments involved in the product development process with suppliers, including purchasing, engineering, business development, and research and development. This provided the researcher with a variety of data from different perspectives with respondents that had different backgrounds.

The challenge of the case study interview is to make sure that the respondent answers the questions based on their experience and knowledge, and not only according to what they might view as the rules/standard process/best practice as described by the company. In order to help with this, the researcher asked the respondents to indicate their preference for the location of the interview before it took place, in order to increase the comfort of the respondent. Interestingly, the majority of the respondents chose to be interviewed at an independent place, such as a restaurant or café; this encouraged respondents to be more open and honest when answering the interview questions.

The aim of using semi-structured in-depth interviews was for the respondents to give information on as well as their knowledge of the buyer-supplier relationships surrounding the themes identified previously. The semi-structured interview questions were designed to allow the respondents to give their answers based on their experience and knowledge, without using too many technical terms. Moreover, there was no time limit to answer the questions, and

there was no right or wrong answer. The respondents were given the freedom to answer the questions in their own words. During the interviews, the researcher was able to change the question or ask further questions relating to the conversation in order to gain rich and valid data. The interview setting was face-to-face rather than via the telephone or another medium of interview. The face-to-face approach of the interview helped the researcher collect data with high validity. As there are limited resources and research in co-development within the Malaysian automotive industry, the semi-structured interview was the best instrument for examining the research topic in depth.

#### ***4.2.2 Strengths and Weaknesses of the Case Study and Interview***

The strengths of the case study methodology have been discussed in many different ways. It indeed helps to understand the research on phenomenology, discovering the facts in a real-world context. Case studies also help the researcher to gain insight into the process, and to look at what happens concerning the phenomena being studied.

However, using the case study method also has several weaknesses. The case study is time-consuming, as access to companies is not always easy (Hussey & Hussey, 1994). Convincing companies to participate in this research was one of the most difficult tasks. Apart from that, the case study investigator has a tendency of not following the systematic procedures and potentially introducing bias into the findings (Yin, 2009). To minimise this weakness, the researcher in this study used a triangulation process to ensure the findings were not affected by bias, and presented all the data in a systematic way.

Using semi-structured interviews in the data collection strategy had several advantages in this research. Yin (2009) suggested that interviews are an essential source of case study evidence because most case studies are concerned with human affairs or behavioural events. The interviewees can provide important insights into such events or affairs. Moreover, interview data



collection undoubtedly provides rich data and is effective in illuminating the material.

Again, the weaknesses associated with doing interview data collection include being subject to the common problems of bias, poor recall and poor or inaccurate articulation (Yin, 2009). Semi-structured interviews are also time-consuming and expensive; there can be difficulties in controlling the range of topics, and problems in analysing the data (Hussey & Hussey, 1994). The researcher needs to corroborate interview data with other information in order to minimise those issues. In this research, the interview data findings were compared with the information derived from the literature review and were triangulated with the views of experts in this field. It is also important for the researcher to conduct all the interviews in the same way in order to maintain the high validity of the findings.

### **4.3 Access to Companies**

Recruiting companies to participate in the research is one of the more difficult tasks of case studies. The formal way of recruiting, for example, formal invitation letters, emails or phone calls, was unlikely to work in this research. The researcher had to use several connections, such as friends, relatives, the university, and Government agencies, as well as the supervisor's contacts to establish contact with the companies. Another way to encourage companies to participate was to persuade respondents from the vehicle manufacturers to ask their suppliers to take part in the interview. The researcher also attended the Malaysian automotive exhibition in Kuala Lumpur to recruit companies. Although only one company was recruited from the exhibition, the researcher had the opportunity to converse with engineers and managers from various automotive product manufacturers, and therefore to ask about their technical capability and their opinions concerning the Malaysian automotive industry.

The guideline for the case study sample given by Eisenhardt (1989) is between 4 and 10 cases; 4 is too few for generating a theory, whilst more than 10 cases is too complex and too much data for a researcher to handle. In this research, each company represents one case study. Therefore, six case studies came from suppliers and three case studies were from the vehicle manufacturers' side.

#### **4.3.1 Choosing the Companies**

Choosing the right companies to participate in this research was not a difficult task because of the limited number of national vehicle manufacturers and local suppliers within Malaysia. Both national vehicle manufacturers, PROTON and PERODUA, participated in the interviews. In addition, one overseas vehicle manufacturer transplant assistant manager agreed to participate. Tier-1 local suppliers were selected based on the PROTON Vendor Association book, the association of PROTON Tier-1 suppliers. There were 130 Tier-1 suppliers listed on PROTON Vendor Association. Out of these 130 suppliers, only 57 suppliers are Malaysian-owned without any joint ventures with overseas companies. Of the 57 Malaysian-owned suppliers, 13 of them produce standard parts, such as bolts, paints, lubricants; carpets mats and so on; these were removed as having no co-development interest due to their non-technical nature. Often Tier-1 suppliers to PROTON are also Tier-1 suppliers to PERODUA but not necessarily Tier-1 to overseas vehicle manufacturers who have established their operations within Malaysia. During stage 2 of data collection, these 40 local suppliers without any joint venture with overseas companies and producing non-standard parts were approached regarding participation in the pilot study. Furthermore, the majority of Tier-1 suppliers listed in the PROTON Vendor Association book were approached regarding participation in the main data collection (stage 3); however, only six suppliers agreed to be interviewed.

#### 4.4 Processing the Data from the Case Study

Miles & Huberman (1994) saw qualitative data analysis as consisting of three concurrent flows of activity: data reduction, data display, and conclusion drawing/verification (Figure 17). Data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions. Data reduction is a form of analysis that sharpens, sorts, focuses, discards, and organises data in such a way that 'final' conclusions can be drawn and verified.

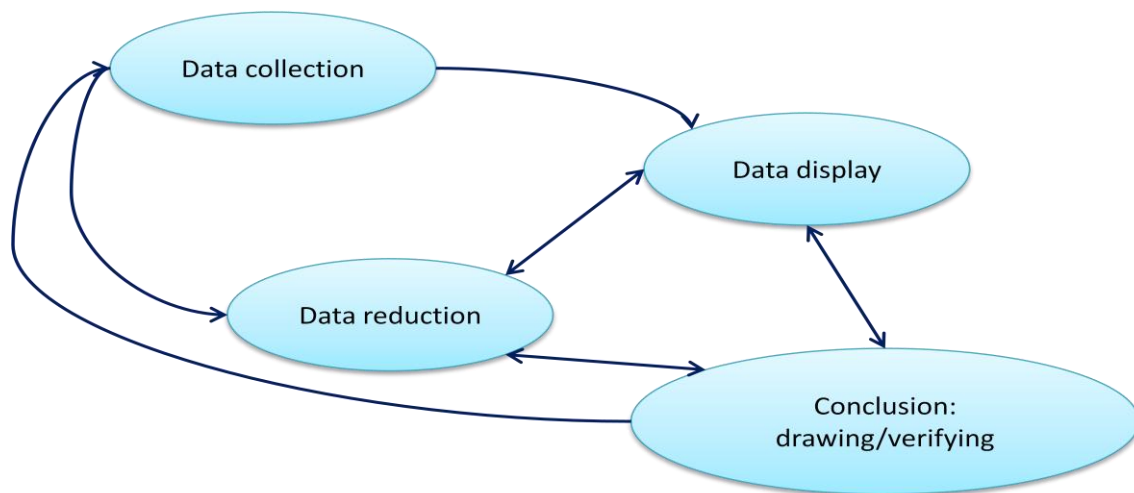


Figure 17: Components of data analysis

(Miles & Huberman, 1994)

Data display is an organised, compressed assembly of information that permits conclusion drawing and action. Tools, such as charts, graphs, matrices, networks and so on, are designed to assemble organised information into an immediately accessible, compact form. This allows the researcher to see what is happening and to either draw conclusions or move to the next step of analysis.

Drawing conclusions and verification are the third components in data analysis as described by Miles & Huberman (1994). They indicate that a good qualitative data analyst should start to decide what things mean from the start of data collection. The way to do this is by noting regularities, patterns, explanations, possible configurations, causal flows, and propositions.

Following the three streams of data analysis described by Miles & Huberman, the researcher started processing the data by transcribing the recorded semi-structured interviews. From the transcriptions, the researcher sought to identify statements relevant to the themes identified from the literature. The unrelated and unnecessary statements were eliminated at this stage. The statements were put under related themes using the mind manager technique (Figure 18). MindManager software was used to make the process easier.

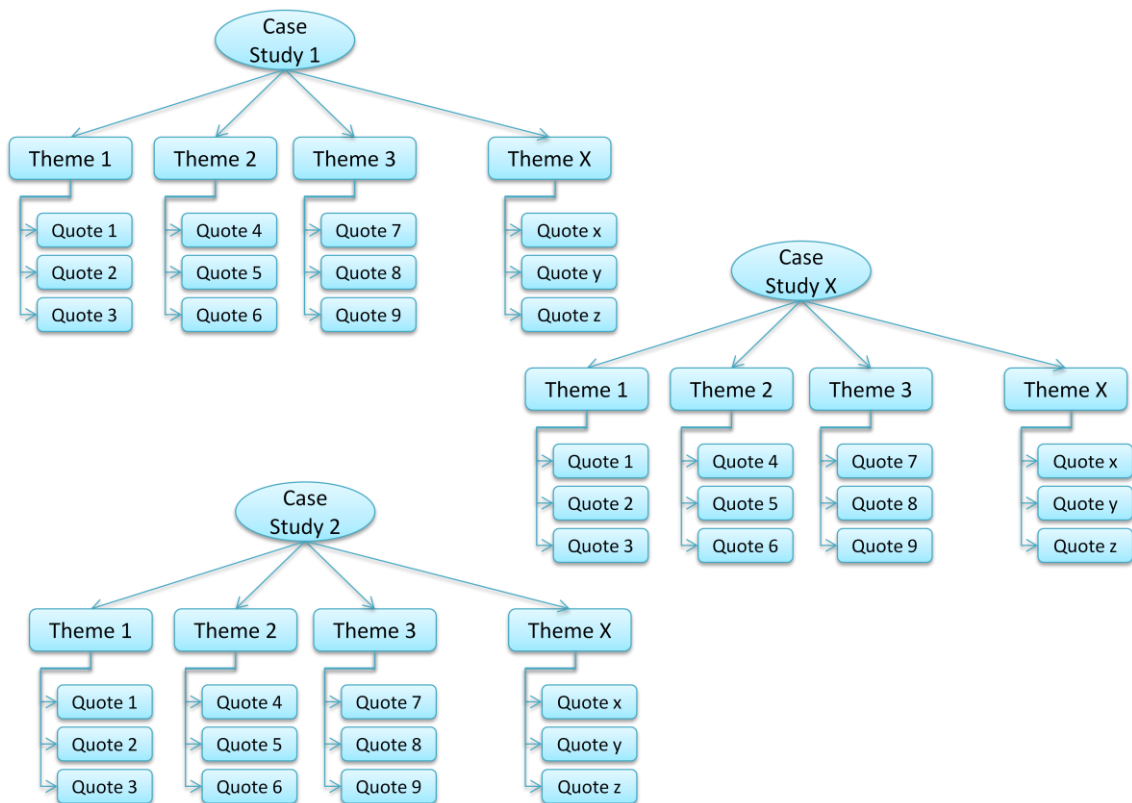


Figure 18: Data reduction

The data are displayed in the systematic mind mapping by case study. Each mind mapping represents one case study. The same themes are used in all mind mapping. The statements from each theme from each case study were put together on one mind map that represents vehicle manufacturer, local supplier and overseas supplier groups. This was the stage of organising data prior to drawing conclusions (Figure 19).

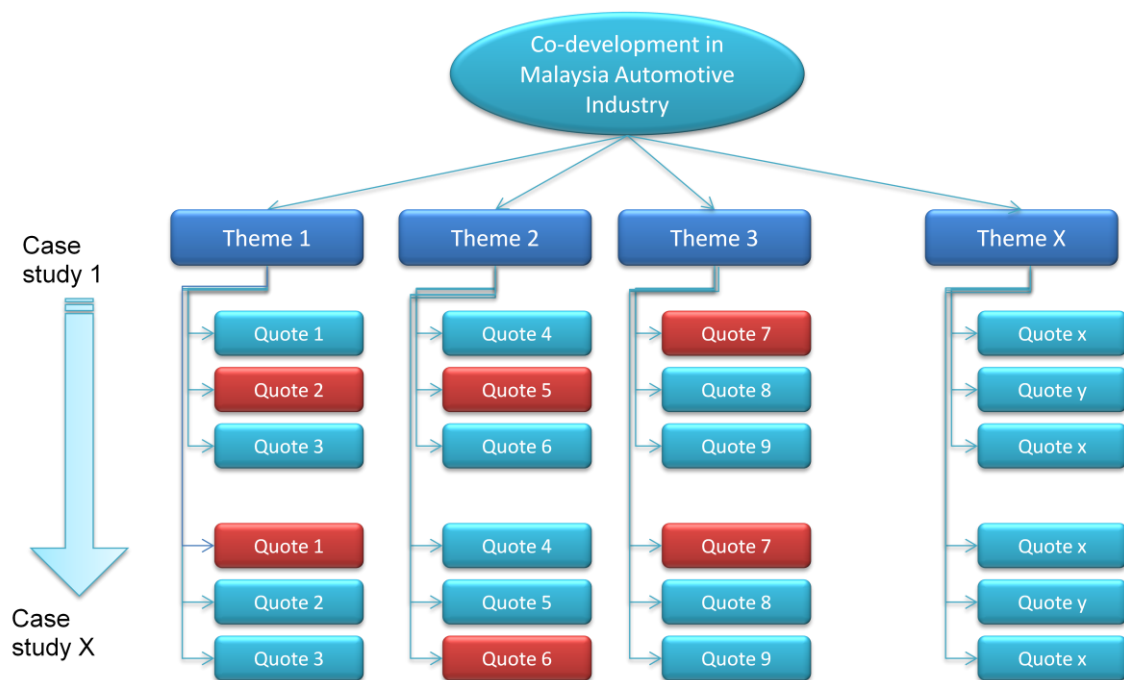


Figure 19: Data display

At the conclusion stage, the researcher looked for patterns across the statements. The statements were differentiated by colour. Similar meanings of statements are coloured in blue, whilst statements that differ from or are contradictory to the majority of statements are coloured in red (Figure 19). The yellow colour shows the interesting statements that need further investigation. The conclusions were drawn based on a particular theme before it could be

related to other themes (Figure 20). The analysis of the data is discussed in more detail in Chapter 6.

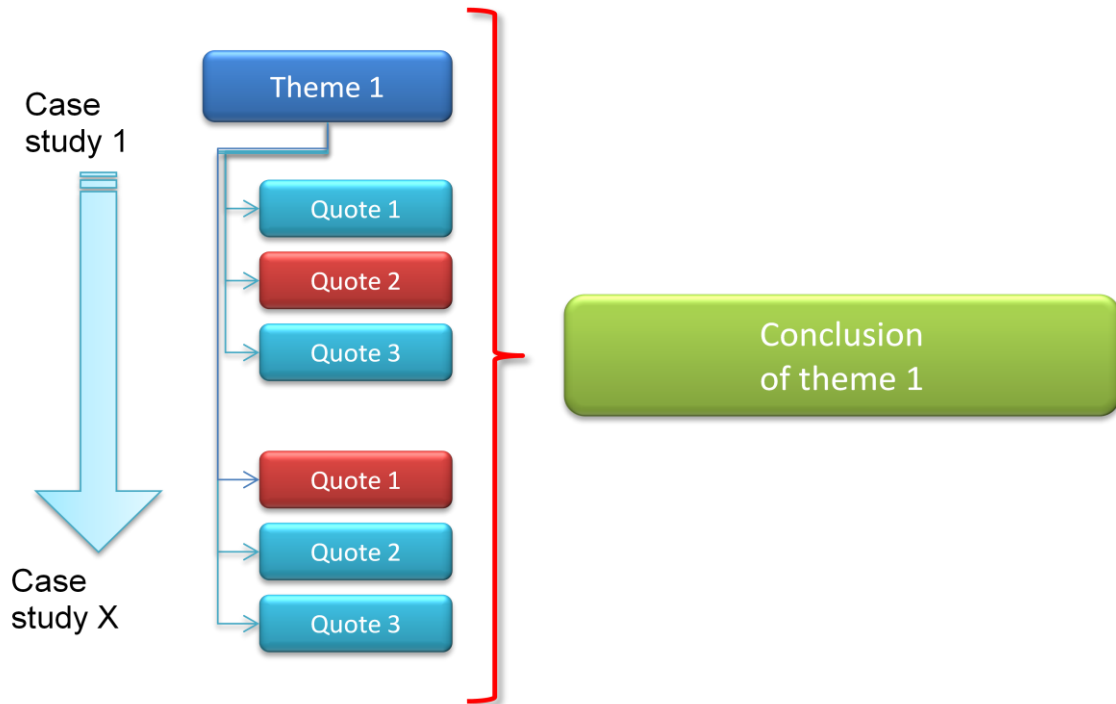


Figure 20: Conclusion drawing and verification

#### 4.5 Tackling the issue of Credibility, Validity, Reliability and Generalisation

In order to maintain the high quality of the research, the researcher had to understand the concepts of credibility, validity, reliability and generalisation. In this section, those concepts will be discussed from the philosophical and real research work perspective. Several tactics to tackle those issues dealt with by the researcher in this research are also explained.

### **4.5.1 Credibility**

The trustworthiness or credibility of research is a reliable way to check the quality of qualitative research (Robson, 2002). Bryman & Bell (2007) suggested that *'the credibility of findings entails both ensuring that research is carried out according to the canons of good practice and submitting research findings to the members of the social world who were studied for confirmation that the investigator has correctly understood that social world'*. Padgett (1998) listed several strategies to reduce the threats to research credibility. The appropriate strategies used in this research were peer debriefing and support, member checking, and audit trails. Peer debriefing and support, and member checking were done with the researcher's supervisor throughout the research process. The research considerations and decisions were discussed in detail with the researcher's supervisor before any decision was made. Audit trails were performed by keeping records of all the research activities including transcripts of interviews, field notes, a research journal, and details of data coding and analysis.

### **4.5.2 Validity**

Hussey & Hussey (1997) defined validity as *'the extent to which the research findings accurately represent what is really happening in the situation'*. They anticipated that validity would be low with positivism compared to interpretivism, as the researchers aim to have full access to the knowledge and full involvement in the study. Robson (2002) indicated that validity is about whether the findings are shown in the correct way. Hussey & Hussey (1997) suggested that triangulation could increase the validity and reliability of research.

Triangulation refers to the use of different methods or techniques in the same research to overcome the potential bias of a single method approach (Hussey & Hussey, 1997). Neuman (2005), however, defined triangulation as *'the idea that*

*looking at something from multiple points of view improves accuracy*'. In this study, triangulation is used to validate the findings. The triangulation process in this research was performed in several ways: the literature, the researcher's supervisor, and third party experts.

The first process of triangulation in this research was with the literature related to co-development. The findings were also presented to third party experts on the Malaysian automotive industry so they could confirm or reject the findings as well as enabling the researcher to collect their views on the researched topics. Besides that, triangulation was also performed with the researcher's supervisor throughout the research process as he had extensive knowledge and experience of the co-development subject area and real world research. Details of the triangulation process are discussed in Chapter 6.

### **4.5.3 Reliability**

According to Kirk & Miller (1986), reliability refers to the degree to which the findings of the study are independent of the accidental circumstances of their production. Silverman (2006) added that reliability deals with the concept of replicability, the question of whether or not some future researchers would be able to repeat the research and achieve the same results. Bryman & Bell (2007) however, argued against the concept of reliability in qualitative research, as it is impossible to freeze a social setting. One way to satisfy the reliability criteria of qualitative work is by making the research process transparent (Silverman, 2006). This can be done by describing the research strategy and data analysis methods in a sufficiently detailed manner in the research report. Robson (2002) suggested having a log book, whilst records and transcriptions will also increase reliability.

In this research, the researcher explains the research works in as much detail as possible to improve the transparency of the study. Starting from the beginning of this research, a log book was used to make sure all considerations



of the research were being documented properly. The interviews were also recorded, and interview transcriptions were done very carefully, by listening to the recorded voice repeatedly and concurrently with the transcript.

#### **4.5.4 Generalisation**

Generalisation, or transferability, on the other hand, refers to the extent to which the findings are applicable outside the studied phenomenon (Robson, 2002). It is related to the concept of reliability (Robson, 2002), that is, whether the study can be replicated (Bryman & Bell, 2007) and the findings can be repeated (Hussey & Hussey, 1997). Bryman & Bell (2007), however, argued that in the case study setting, it is impossible to know how the findings can be generalised to other settings. As cited by Denzin & Lincoln, (2005), Guba & Lincoln (1985) suggested that describing the data and process accurately will allow people to judge the extent to which the results can be applied to a different phenomenon, if at all.

In this research, generalisation was attempted by replication of the same questions during the case study. Each case study used the same questions of the same group, whether the vehicle manufacturers or the suppliers group. The research data and process are also presented in detail in this thesis, allowing the reader to assess and make their own decision regarding generalisation.

## **4.6 Chapter Summary**

This chapter explained the implementation of research consideration from Chapter 3, the methodology of the research. The literature review was used to develop the guidelines to identify the themes related to this research. Three stages of data collection took place in this research: identifying themes from the literatures, pilot study and case study interviews. The overview of data

collection and analysis process were also explained. Thematic analysis was used to analyse the data with mind-mapping techniques. The strengths and weaknesses of chosen method were also discussed.

In order to maintain the high quality of the research, the researcher examined in detail the issues of credibility, validity, reliability and generalisation. The tactics and techniques of tackling those issues were also discussed.

## Chapter 5

### The data collection

Three stages of data collection:

- Testing the selected themes
- Pilot Study
- Interviews

Themes confirmation

Initial findings

Main data collection



## **5 Data Collection**

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### **5.1 Introduction**

This chapter provides an explanation of the data collection process. The process is divided into three different stages: testing the selected themes from Chapter 2, designing the questionnaires for the pilot study and interviews based on those themes. As the automotive industry within Malaysia is unique, the process is not necessarily the same as that followed by many researchers in the US or Japan. Therefore, the data collection process design in this research had to be appropriate to the Malaysian automotive industry in terms of both its background and the current situation.

The first section explores writings concerned with co-development in general, and accordingly seeks to develop a list of factors that other authors have considered important in relation to the success of co-development. As mentioned in Chapter 2, since the late 1980s, many researchers have focused on the co-development process in two major automotive markets, namely, the US and Japan. However, the trend has changed since the late 1990s, when researchers began to explore specific factors in consideration of co-development practices. This section demonstrates how the researcher used the themes identified in Chapter 2 and validated them with experts. Based on the identified themes, the interview questions were designed and then subsequently tested among vehicle manufacturers and automotive product suppliers in the UK.

The second section considers those factors that have been identified and that concern the characteristics of the Malaysian industry, focusing on the automotive sector and subsequently describing the key differences in industry norms. This section shows how the themes identified and tested in Section 1 were re-considered in order to fit with the current characteristics of the Malaysian automotive industry. The results from the interviews within the first section were then used to design the questionnaires for the pilot study for

vehicle manufacturers and their suppliers within Malaysia. The initial findings from the pilot study together with the results from the interviews within the UK were then used to design the interviews so as to explore further the current practices of Malaysian vehicle manufacturers and automotive product suppliers.

## **5.2 Testing the Themes**

In order to achieve a better understanding of the current practices of co-development, the themes selected were tested among the UK's automotive industry players. The interviews were designed to obtain expert knowledge on each theme. As most of the literature is based on the academic review of co-development, it was important to gather fresh opinions from experts directly involved in the co-development process. This also helped the researcher gain a better understanding of the co-development process from a real-world perspective. The views of experts gained from the interviews were used to confirm, reject or otherwise re-define the themes identified in the previous section.

### **5.2.1 Selecting the Experts**

In order to derive the maximum benefit from the expert knowledge, the researcher needed to identify the right person for the interview process. Through the network of Cranfield University, five experts from both vehicle manufacturers and automotive component suppliers were identified for participation in the interview. Two of these experts were from UKVM-A (a global vehicle manufacturer with design activities on all five continents), and one from UKVM-B; they represented the vehicle manufacturers. In contrast, each expert from the suppliers UKAS-A and UKAS-B represented the automotive component supplier group. The selected experts were involved in the co-development process from either the vehicle manufacturers' or suppliers' side.

All of them worked directly with the vehicle manufacturers or suppliers in developing new products.

UKVM-A is a transplant company in the UK. UKVM-A is one of the leading vehicle manufacturers in Europe and responsible for local policy and decision-making for manufacturing plants across Europe, whilst design and R&D have a pan-European focus. UKVM-A is highly regarded within the automotive industry across the region. This is due to UKVM-A's active supplier development process since its establishment in the UK. As a multinational vehicle manufacturer with a mixture of styles of management and an acknowledged achievement in the vehicle manufacturer-supplier relationship, two UKVM-A experts in co-development were invited to participate in this research. Two experts were chosen from UKVM-A for this purpose; they were directly involved with the suppliers in the product development process.

Similarly, UKVM-B is based in the UK. Unlike UKVM-A, UKVM-B concentrates on the different side of the market segment in the automotive industry. They produce a low volume of cars per year compared to UKVM-A and most of the world's vehicle manufacturers, targeting a different group of people. Because of its reputation, UKVM-B has to be more precise in building its cars, and the suppliers involved have to understand the company's philosophy in terms of producing cars. By choosing UKVM-B, the researcher hoped to explore the different types of supplier-vehicle manufacturer relationships, with different views compared to those of UKVM-A and those found in the literature. The expert selected in this interview worked with UKVM-B suppliers in developing new products for various different projects.

UKAS-A and UKAS-B are well-known suppliers in the automotive industry, supplying entertainment systems and vehicle interior designs for seats, cockpits and so on. Both have experience in working with large vehicle manufacturers, such as Ford, Nissan, and General Motors. They all have their own experts, resources, finance and knowledge in their respective areas of expertise. Due to the technological complexity and the expertise of UKAS-A and UKAS-B, vehicle

manufacturers involve both of them early on in the product development process. Involving UKAS-A and UKAS-B in this research helped the researcher to ensure a promising view from the supplier perspective. Both UKAS-A and UKAS-B experts were invited to the interviews, and had experience working with the vehicle manufacturer in terms of developing new products. The excerpt from the experts' interview is attached in Appendix 5.

### **5.2.2 Experts' Knowledge versus Identified Themes**

#### ***The Customer-Supplier Relations***

In contrast to the findings in the literature, all comments in the interviews showed that customer-supplier relations are not the major factor for companies when considering product development with their counterparts. However, they did agree that understanding each other might ultimately have a positive impact in terms of achieving the same target in the product development process. UKVM-A, for example, choose their suppliers based on the accreditation system they created in order to categorise their suppliers. They had recently changed the system in order to make the supplier selection process more efficient and based on capability rather than on their previous projects or relationships. Furthermore, both UKAS-A and UKAS-B agreed that their previous relationships with vehicle manufacturers had not influenced their customers in terms of choosing them as a supplier.

*UKVM-A: 'As long as they can deliver the product, a previous relationship is not important. We always look for competent suppliers to work with us'.*

There is clear evidence from both vehicle manufacturers and supplier groups to confirm that customer-supplier relations are not a crucial factor of involving suppliers in the product development process. Most vehicle manufacturers have moved from the traditional customer-supplier relations mentioned in the



literature to a new approach due to global outsourcing activities and the more recent information technology innovations.

### ***The Supplier Capability***

As previously mentioned in the literature, supplier capability seems to be the main contributing factor in terms of involving suppliers in the product development process. Both UKVM-A and UKVM-B clearly indicated that there is no point in involving suppliers with low technological capability. They further agreed that the main reason for involving suppliers in the process is owing to the lack of expertise and resources on their side. Manufacturing capability is also the main issue in involving suppliers in product development. On the other hand, both vehicle manufacturers agreed that suppliers with low technological capabilities but high manufacturing capabilities are often considered for less complex products. The capability of producing the volume requested is also one of the factors considered by vehicle manufacturers when choosing a supplier. UKAS-A and UKAS-B also realised that the reason that vehicle manufacturers involve themselves in the product development process is their expertise and technological capability on the product.

*UKAS-B: 'We have the knowledge and technology. We're a well-known company'.*

Both will normally receive the specifications from their customers before starting to develop the product. Most of the design work will take part on the supplier side rather than the customer side; this clearly indicates that vehicle manufacturers want to use the supplier's resources in order to develop the product, which contrasts with the traditional Western practice whereby suppliers only receive the specification after being selected by the vehicle manufacturer.

There is no doubt that supplier capability is crucial for vehicle manufacturers considering whether or not to involve suppliers in the product development

process. Besides technological capability, manufacturing capability also seems important for vehicle manufacturers when considering whether or not to involve the supplier in the process. In conclusion, the interviews confirmed the findings from the literature on supplier capability factors in the product development process.

### ***The Supplier Involvement in Product Development***

The evidence from the interviews shows that both vehicle manufacturers and suppliers agreed that early involvement in the product development process is important for highly technological products. Compared to UKVM-B, UKVM-A calls the supplier earlier, prior to the process of request for quotation (RFQ) starting. UKVM-A invites several suppliers for discussion before selecting one of them, thereby indicating that they need to know supplier capability before they select a supplier. The suppliers must show that they are capable in terms of developing the product by presenting their capability, resources, time plans, and so on to UKVM-A. Unlike UKVM-A, UKVM-B only calls the supplier for involvement in the project after RFQ. Both UKAS-A and UKAS-B also become involved with their customer's project after the RFQ process. All correspondents agreed that earlier supplier involvement in the product development process helps them to become more familiar with each other and to clarify the common process before starting the main product development process.

*UKAS-B: 'If we involve them earlier, we can work on the common process together before the development start; this helps us reduce the time for and complexity of the project'.*

As indicated above, all correspondents agreed that the early involvement of suppliers in co-development is important for both parties—the vehicle manufacturer and the supplier groups. This supports the findings from most of the literature, and confirms the importance of exploring further supplier involvement in product development within the Malaysian automotive industry.

### ***The Supplier Selection Process***

According to UKVM-A, in order for a company to be considered a potential supplier for their product, the supplier must first pass their accreditation stage. The supplier must apply to participate in the 'supplier consortium' in order to be eligible to take part in competition with other suppliers. A 'supplier consortium' is a group of suppliers that have passed the accreditation system developed by UKVM-A based on technological capability, quality, finance, resources, and so on. Before the selection of the suppliers starts, UKVM-A invites the accredited suppliers to submit a proposal based on the requirements and specifications given by UKVM-A. Moreover, selected suppliers then discuss with UKVM-A the product development process and the total costs. This type of selection process is similar to that of the Japanese model of collaboration, although not identical. UKVM-A is also associated with several factors indicated in the literature within their accreditation system.

*UKVM-A: 'We need their knowledge. Although we do not necessarily select them as our supplier, some suppliers have to convince us before the selection process. They have to pass our accreditation'.*

In contrast, UKVM-B is still using the competitive bidding process when selecting their suppliers, which is similar to the traditional approach of the US. UKVM-B issue the request for quotation (RFQ) with information that they think is adequate for suppliers to calculate a quotation. The selection is based on price, as the process is controlled by the purchasing department.

On the other hand, both UKAS-A and UKAS-B agreed that the selection process within most European and the US vehicle manufacturers is started with the request for quotation (RFQ). However, although not all of them are based on competitive bidding, price seems to be the major concern of European and US vehicle manufacturers compared to the Japanese. Both of them also agreed that the reason they are selected is because of their expertise and resources, which vehicle manufacturers do not have. They have to convince the vehicle

manufacturers during the presentation of a quotation in order to win the contract.

The findings from the interviews support the literature discussed in 5.2.4. The selection process of the supplier is still divided into two approaches, according to whether it is similar to the Japanese or the US approach. As there is no research yet concerning supplier integration within Malaysian automotive industry (see Chapter 2), it was considered essential to explore this factor further in order to gain a deeper understanding of the co-development practices within Malaysia.

### ***The Supplier Influence in the Decision-Making Process***

It is clear from the interviews with both vehicle manufacturers and suppliers that they have different views on supplier influence in the decision-making process. On the vehicle manufacturers' side, UKVM-A and UKVM-B stated that suppliers have the power to influence them in the decision-making process. They give freedom to suppliers to suggest and discuss the product at every stage; the only difference between UKVM-A and UKVM-B is that UKVM-B claimed that they have to listen to suppliers who have a superior position in the industry, as UKVM-B do not have much volume production and commercial power compared to other vehicle manufacturers. In fact, UKVM-B sometimes has to agree with what suppliers suggest, simply because they know that suppliers will not be interested in working with UKVM-B if the request is something radical.

*UKVM-B: '...our production volume is low compare to other vehicle manufacturers. Some suppliers are bigger than us. We have limited power to negotiate'.*

In contrast, UKAS-A and UKAS-B agreed that, whilst their customers give them the freedom to make propositions concerning the product, both of them feel that they could actually influence the customer if the customer did not have the expertise needed for the product. They both stated that it is difficult to influence

customers in relation to product price. Moreover, UKAS-B claimed that the process involved in influencing the customer is not easy, as a high level of management staff is needed for both parties to sit together and discuss the request. UKAS-A, however, stated that the process is easy if it is a fixed contract, which will not change much regarding the price.

The findings from the interviews support the literature concerning the power differences in buyer-supplier relationships. The dominant party will take charge of the process and often provoke feelings of dissatisfaction in the other party. This can slow down the process, and is not helpful in trust-building in relation to co-development practices. The results show that power differences still exist, even though they are not as critical as in the traditional buyer-supplier relationship. There is, however, the need to explore this within the Malaysian co-development practices, as this will indicate how power differences have an impact on buyer-supplier relationships within the Malaysian automotive industry.

### ***The Nature of Communication***

All correspondents in the interviews agreed that both formal and informal communications are important in relation to the product development process. The only difference that could be highlighted is the timing of the period of most intensive communication, where both parties agree to work together. UKVM-A, for example, claimed that the intensive communication happens before the supplier selection process. They call the suppliers to discuss the project several times before the selection process starts. The supplier, on the other hand, has to invest their time with UKVM-A, despite the fact that they know there is no guarantee from UKVM-A that they will be selected as the supplier. However, this type of communication happens in a formal way, which includes meetings, presentations, and so on. The informal communication happens in a very rich way; the companies use information technology tools to communicate. Face-to-face communication becomes common after the selection has been made.

On the other hand, UKVM-B, UKAS-A and UKAS-B agreed that intensive communication starts after the supplier selection process. UKAS-A and UKAS-B, however, mentioned that this depends on the vehicle manufacturers with whom they work. Furthermore, UKAS-A also agreed that having their engineer working with suppliers is very important for both parties. Apart from that, email and telephone are the tools implemented to communicate intensively. UKVM-B, on the other hand, claimed that informal communication takes place every day at the engineer level following the selection process. Formal communication happens only between UKVM-B purchasing departments with the supplier financial controller team, for example.

*UKAS-A: 'Sometimes we have to send our engineer to the customer plant.... just to show to our customer that we're there'.*

The nature of communication practices matches well with the findings in the literature; the obvious exception to this is related to the timing of the periods of intensive communication, and when that starts to take place in the process. The media of communication might vary, but the companies understand how important communication is in relation to co-development. Most of them use every medium in the case of information technology to communicate whether communication is formal or informal.

### ***Several Issues Highlighted by Interviews***

The correspondents highlighted several issues that they considered to be important to improve the co-development process. UKVM-B, for example, claimed that co-development is concerned with buying the service—for example, expertise and resources—and not the product from the supplier. The supplier has to be considered capable enough to serve the vehicle manufacturer throughout the process. Flexibility and reduction of the complexity of the system is the ideal type of co-development highlighted by UKVM-B.

Similarly, UKVM-B also likes to see more suppliers in the market, and prefers not to be restricted to only three or four available suppliers for one product.

On the other hand, UKAS-B highlighted the management of multiple relationships as one of the factors needing consideration in the co-development process. It always happens that UKAS-B needs to balance the politics between departments on the customer side: for example, not upsetting some departments and keeping good relations with other departments at the same time (e.g., testing vs. design department). Furthermore, investing more effort on the definition of the processes as part of the cost negotiation is the ideal type of co-development suggested by UKAS-B. Agreeing the terms of the common process, managing the way in which human resources are to be deployed and managed, and managing cultural differences were also mentioned by UKAS-B as elements of their ideal type of co-development.

### **5.3 The Pilot Study**

As explained in section 4.2, the aim of the pilot study was to allow the researcher to have an initial idea of co-development practices in Malaysia before the main data collection stage. Based on the themes identified and tested, the questionnaires for the pilot study were designed both for Malaysian vehicle manufacturers and automotive suppliers. The purpose of the questionnaires was to gain an overview of the co-development process within Malaysia (Appendices 2 and 3). The initial findings from this pilot study were used to design the interviews for both vehicle manufacturers and suppliers within Malaysia. The findings also confirmed or rejected the themes identified in Section 5.3.

### **5.3.1 Questionnaire Structure**

The questionnaires started by providing the company background, which included the company profiles (year of establishment, annual turnover, market share, etc.). To explore further on history of the company, the question concerning the Malaysian Government and foreign companies prior to the establishment have been asked to the respondent. This is important in order to understand the influence of Government policy and of foreign companies within the Malaysian automotive industry.

Secondly, the closed questions were designed to gather firm answers from the respondents. The answer option for each question was based on the themes identified in the literature. The 'yes' or 'no' answer options were used to confirm or reject the process or themes being investigated. Apart from that, open-ended-questions were used in some parts of the questionnaires to give the respondents the freedom to answer the questions in their own words. The summary of the type of question asked is shown in Table 26 below.



Table 26: Summary of questionnaires themes and type of questions asked

Themes	Question Aims	Question Type
Customer supplier relations	i) Year of relationship ii) Investment from vehicle manufacturer iii) Reason vehicle manufacturer chooses the particular company	Quantity Yes/No  Why
Supplier capability	i) Reason vehicle manufacturer chooses the particular company ii) R&D iii) Level of technology used in production line	Why  Does yes/no What/defining
Supplier involvement in product development	i) Stage of involvement ii) Invitation before selection process iii) Involvement in the design process	When Does yes/no  Does
Supplier selection process	i) Formal request of quotation process ii) Number of competitors within Malaysia iii) Negotiation	When  How many  Does
Supplier influence in decision-making process	i) Influence in decision-making ii) What parameter	Does What
Nature of communication	i) Richness of information media ii) Frequency of information transmission iii) Direction of communication	Rate (1 to 5) Rate (1 to 50)  Rate (1 to 5)

### **5.3.2 The Data Collection Process**

The researcher started the data collection process for the pilot study by recruiting companies via mail, email and telephone enquiry. Moreover, the recruitment process took a long time, as the companies did not reply to postal questionnaires during the first stage. The researcher then had to follow-up the questionnaires with emails and phone calls to ensure the companies had both received and replied to the questionnaires. Negotiating with companies in relation to their participation in the research was a very difficult and time-consuming process: companies simply did not see the benefits of participating in the research; therefore, the researcher had to create a flyer explaining the benefits and detailing the reasons why companies should participate in the research (Appendix 1).

Due to the long distance between Malaysia and the UK, and owing to the time difference, the researcher decided to journey to Malaysia, and spent almost three months in the country in order to recruit companies to answer the questionnaires. During those three months in Malaysia, the researcher went to vehicle manufacturers and automotive suppliers, actively distributing questionnaires by hand and trying to book as many appointments as possible. The researcher recognised that it is very difficult to recruit companies using formal channels. The researcher also found that respondents were not happy to answer the questionnaires without the consent of their top management. They were also not comfortable with meeting at their factory, as they could have been seen by their manager or anybody in a superior position.

In order to persuade the companies to answer the questionnaires within the limited time period stipulated, through friends, the researcher decided to meet the respondents in an informal way by inviting them to lunch or dinner. The informal meeting seemed to be more comfortable for the respondents. They were happy to provide answers to the questionnaires, and to talk about their experiences working with their counterparts, even though this issue was not mentioned in the questionnaires.

Due to all the difficulties associated with recruiting companies, the researcher managed to meet only 4 respondents to answer the questionnaires out of the 40 targeted companies. Those companies were Malaysian-owned without any joint-ventures with overseas companies; they produced non-standard parts such as die casting, automotive chassis, bumpers, and so on. Some of them however had had technical collaboration with overseas companies mainly concerned with tooling and dies development. Furthermore, one respondent from the supplier side and one from the vehicle manufacturer side agreed to be interviewed during this stage. They also discussed several important points that were thought worth exploring regarding the co-development process within Malaysia.

### ***5.3.3 Initial Findings from the Pilot Study and Interviews***

Although there were replies to only 5 (12.5 per cent) of the questionnaires by the automotive supplier companies, the answers from each company showed the same pattern of co-development process within Malaysia. Four of them were Tier-1 suppliers, while one was a local vehicle manufacturer. The summary and background of the findings are shown in Table 27 below.

Table 27: Summary of the findings from pilot study (suppliers' answers)

	Company 1	Company 2	Company 3	Company 4
Product	Die casting, cylinder head	Automotive chassis and body parts	Plate locking, clamp, bumpers	Body parts, Chassis parts, brakes
Number of competitors within Malaysia	4-5	2	3-4	2-3
Collaboration with foreign company	No	Yes	Yes	No
R&D	No	Yes (overseas)	No	No
Level of technology used in production line	Half automation	Full automation	Half automation	Half automation
Reason for having been chosen for collaboration	Price, long relationship	Price, long relationship, technology	Price, long relationship, technology	Price, long relationship
How the development project starts	RFQ	RFQ	RFQ	RFQ
Directly involved in product development process	Yes	Yes	Yes	Yes
Stage of involvement	Detail engineering stage	Initial stage	Detail engineering stage	Detail engineering stage
Discussion before selection	No	No	No	No
Involvement in design process	No	Yes	No	No
Influence on product price	No	No	No	No
Influence on product parameter	No	Yes (minor change)	No	No
Designs and develops own tools	No	No	No	No
Tool makers' location	Taiwan, Korea, Japan	Japan	Korea, Japan	Korea, Japan, Taiwan
Communication				
• Richness of information media	3	3	3	3
• Frequency of information	4	5	4	4
• Direction of communication	4	3	4	4
• Timing of information flows	4	3	3	3

### ***The Customer Supplier Relations***

All four respondents from the supplier side agreed that the length of the relationship as well as the price might influence the contract. However, the answers from the vehicle manufacturers' side show that they choose suppliers based on three factors: the price, technology and Government policy. The suppliers seemed to have a good relationship with vehicle manufacturers, simply because they had worked together since the year of the establishment of the Malaysian vehicle manufacturer. This could be explained by the history of the Malaysian automotive industry itself, whereby suppliers have been developed mainly by Government policy parallel with the establishment of the national auto makers.

The findings from the questionnaires are significant, because they reflect the Malaysian automotive industry history itself. The question regarding the extent to which Government policy influences the relationship was answered by the vehicle manufacturers in the questionnaires and needed to be further explored. The findings also contradicted the expert opinion in Section 5.3.2, which stated that long relationships are not important; instead it confirmed most of the suggestions in the literature review outlined in Section 5.2.1, which stated that long relationships could have an impact on co-development.

### ***The Supplier Capability***

Supplier capability seems to be the main concern of vehicle manufacturers when selecting the appropriate supplier. The answer from the vehicle manufacturer questionnaires confirmed this factor; however, only two respondents from suppliers agreed that vehicle manufacturers select them because of the technology they have; these suppliers also confirmed that they have collaborated with foreign companies, and use half or fully automated facilities in their production lines. However, only one of the suppliers has an

R&D department within Malaysia; therefore, the technology helped them to win contracts from outside of Malaysia or the company.

The findings show that supplier capability, whether design or manufacturing capability, is one of the factors for collaboration. The findings confirmed the findings from the literature review and the expert opinions stated above.

### ***The Supplier Involvement in Product Development***

All respondents from both the vehicle manufacturer and supplier sides agreed that the involvement in product development starts following the request for quotation (RFQ) stage. They confirmed that there is no discussion prior to the RFQ stage. Three suppliers answered that they are not involved in the design process stage, whilst one said they are involved in the design process. Three respondents from suppliers claimed that they had been invited by the customer to be involved in the product development process at the detailed engineering stage, and only one of them was invited at the initial stage of product development. Furthermore, all respondents agreed that the vehicle manufacturer provides them with the product drawing and specifications.

The findings confirmed that suppliers are not necessarily invited at the initial stage before the RFQ process. This finding agreed with the expert opinion that the involvement of suppliers is mostly initiated following the RFQ process. Given the background of the companies that answered the questionnaires, it can be assumed that the vehicle manufacturer invites the suppliers early on in the process if the suppliers have the relevant expertise and capability in relation to product design. This confirmed the finding from the literature review, which stated that early involvement in product development is associated with high technological or complex products.

### ***The Supplier Selection Process***

According to the answers from the questionnaires, all respondents agreed that the supplier selection process begins following the RFQ. The price negotiation process takes place prior to the vehicle manufacturer selecting a supplier. It can be assumed that competitive bidding takes place before the selection, as there are a small number of competitors within Malaysia, as was indicated in the questionnaires. According to the respondent from the vehicle manufacturer, the price negotiation process is led by the purchasing department on behalf of the vehicle manufacturer, and the engineering side does not have any power to influence the product price.

There are no significant findings in the supplier selection process compared to the literature or expert views. Both vehicle manufacturers and suppliers seemed to agree that price is the main criterion when considering supplier selection. The process needed further exploration in relation to the second stage of the data collection.

### ***The Supplier Influence in the Decision-Making Process***

The answers from suppliers in terms of the questionnaires indicated that three of the suppliers are not able to influence customers on any parameters of the product. Only one supplier agreed that they are able to influence customers in relation to small or minor changes of the product, but not in relation to the price.

The finding suggested that the power differences between vehicle manufacturers and suppliers still exists; this confirmed the findings from the literature reviews and the experts' opinions. Although the power differences seem to exist, the degree of difference and the need for further investigation required further research in order to understand what and who could influence the customer.

### ***The Nature of Communication***

In relation to the questionnaires, all respondents were asked to rate (1 to 5) the degree of communication between their counterparts. All respondents gave a rating of 3 for the richness of information, which indicates that they were neither more in favour of face-to-face communication nor of communication via documents, computers or network; it seems that they use both types of media for communication. On the supplier's side, however, it was agreed that the customers transmitted the information piece-by-piece rather than in a one-shot transmission. Three suppliers found that the direction of communication is bilateral during the product development process, and further stated that the vehicle manufacturer has fairly good timing in terms of releasing complete information on the product development process.

The findings highlight the way in which vehicle manufacturers and their suppliers communicate during the product development process. This suggests that both parties use several types of media to communicate. The vehicle manufacturer also needs to be careful when releasing information to the suppliers. Essentially, the findings could not demonstrate when the intensive communication takes place; thus, there was a need to explore further the nature of communication regarding the second stage of data collection.

### ***5.3.4 Summary***

The findings from the first data collection process confirmed there was a need to explore further the identified themes. The findings also indicated to the researcher new dimensions of the co-development process that therefore needed to be investigated; for example, the influence of the history of industry, the tool makers that are located mainly overseas and the effect of Government policy on the industry. The influence of foreign companies within the Malaysian automotive industry, especially concerning the supplier groups also needed further investigation. The researcher also realised that some automotive



suppliers have been established as a result of the collaboration with foreign companies. The influence of their parent companies in relation to overseas companies cannot be ignored.

From the pilot study, the researcher had revealed several questions concerning the co-development practices within Malaysia, all of which needed to be answered. One of these questions was how the vehicle manufacturers design every single element of their car parts if the supplier is not completely involved in the design process.

There was no doubt that the results from the pilot study needed further investigation. Aside from providing an overview of co-development practices within Malaysia, the questionnaires helped the researcher to find new parameters that had not previously been mentioned and that accordingly required further exploration (e.g., Government policy and joint venture type of supplier).

## **5.4 Interview Design**

Based on the findings from the literature, experts' interviews, and surveys, the semi-structured interview questions were designed for the main data collection. Two interview formats were designed, one each for vehicle manufacturer and supplier groups. The interview questions were designed to facilitate two-way communication; thus giving the researcher flexibility to explore in greater depth any interesting topic or point highlighted by respondents (Appendix 4).

### **5.4.1 Interview Structure**

The interview session started with an explanation of the research, its importance, and how the respondents and Malaysian automotive industry could benefit from it. The explanation about Cranfield University was also important in

order to make the respondents feel that they were talking to the right person or organisation. Before the interview questions were posed, the researcher explained the background of co-development in Japan and the Western world as a warm-up conversation.

The interview questions began by investigating background information of the company in general, the products, and the nationality of the company for suppliers. This also included the history of the establishment, and whether or not the company received incentives from Government; this indicated the Government policy towards the local suppliers and whether or not the suppliers had been established before the national car company was established.

In order to investigate further the influence of foreign companies on Malaysian vehicle manufacturers and suppliers, interview questions concerning collaboration with foreign companies were designed. The questions included product quality, design of the product (local or parent company), who influences decision-making, and the difficulties in working with a foreign company.

The main interview questions were structured based on the themes and findings from the previous section. For each theme, the questions started with the confirmation of the findings accumulated from the questionnaires, and further questions to explore the practices. Table 28 below highlights the themes and the findings prior to the interview questions being designed, and the content of the interview questions.

Near the end of the interview, the respondents were asked if they felt there were any issues important to co-development that had not been highlighted by the researcher; this gave respondents the freedom to talk about what they thought needs to be improved or what underpins the co-development practices within Malaysia. The researcher also asked respondents whether or not they would like to see any changes to co-development within the Malaysian automotive industry, and about their ideal type of co-development.

Table 28: Themes, findings and interview questions

Themes	Literature Review	Expert Opinions	Questionnaires	Interview Questions
Customer-supplier relations	Japanese, long-term, US short-term	Not very much influence	Long relationship might influence collaboration	Confirm findings from questionnaires. Role of supplier/customer in PD.
Supplier capability	Positive influence in PD	Crucial on selecting partner	No R&D facilities. Not involved in design process.	R&D facilities; where? Type of drawing from customer. Who does product design?
Supplier involvement in PD	Early involvement is better. Japanese involve suppliers in design	After RFQ. Design and develop with partner	After RFQ. No involvement in design activities.	How involvement in PD starts. When it starts.  Does customer share vehicle concept or call supplier before launching new car project?
Selection process	Criteria of selection	Expertise, resources. Different approaches to selection	Price, technology, long relationship. Competitive bidding	Discussion before selection process. Information exchanged before selection. Price-setting process; departments involved. Influence in product price.
Influence in decision-making process	Indicates power deference of both parties	Power deference still exist nowadays	Cannot influence customer	Confirm findings from questionnaires. Who could influence customer? Why would customer want to listen?
Communication	Japanese: intensive. All communication media are important	The timing of intensive communication take place	Not clearly indicative of the changes of communication	Describe degree of communication. Changes throughout the process. Face-to-face communication

### **5.4.2 The Interview Process**

The third stage of the data collection process started immediately after the interview design had been completed. The researcher spent three months completing the data collection process in Malaysia.

Again, recruiting companies to participate in the interviews was a time-consuming and difficult task. Several connections were used to approach companies, including friends, relatives, and university contacts. Notably, the majority of emails, telephones and faxes were not answered. On several occasions, the potential respondents cancelled the interviews at the very last minute due to other commitments. Furthermore, the researcher learned that using the formal channel of recruiting companies through the human resources department rarely worked.

After three months, the researcher had completed 12 interviews—6 from the vehicle manufacturers group, and 6 from the Malaysia-based automotive suppliers. Of the six vehicle manufacturers, two were from a Malaysian company and one from a Japanese transplant company within Malaysia. Three of the suppliers were owned by Malaysia, none of which had any collaboration with foreign companies. One of the suppliers was part of a joint-venture company between Malaysia and Japan, whilst another was an overseas company that had a factory in Malaysia. The selected automotive suppliers came from various backgrounds, and the Tier-1 company from Malaysian vehicle manufacturers. The respondents came from different designations, ranging from managers to engineers. The companies' backgrounds are summarised in Table 29 below (MVM stands for Malaysian vehicle manufacturer and MSP for Malaysian supplier). Only one supplier from the pilot study stage agreed to participate in the interviews.

Table 29: Companies participate on the interview process

Company Name	Respondent's designation	Background
MVM-1	Senior Engineer, New Project Group	Malaysian vehicle manufacturer
MVM-1	Senior Executive, Group Procurement, Purchasing	Malaysian vehicle manufacturer
MVM-1	Senior Engineer, Research and Development (Power Train)	Malaysian vehicle manufacturer
MVM-1	Engineer, Research and Development, (Mirror System)	Malaysian vehicle manufacturer
MVM-2	Senior Engineer, Engine Department	Malaysian vehicle manufacturer
MVM-3	Assistant Manager, Supplier development group, Purchasing	Japanese transplant vehicle manufacturer
OSP-1	Executive, Sales Department	Joint venture company (Malaysia-Japan). Tier-1 to MVM-1
OSP-2	Manager, Business development	Europe based company within Malaysia. Tier-1 to MVM-1, MVM-3
MSP-3	Manager, Business development	Malaysian owned company. Tier-1 to MVM-1 and MVM-2
MSP-4	Executive, Business development	Malaysian owned company. Tier-1 to MVM-1
MSP-5	Head of Department, Business Development	Malaysian owned company. Tier-1 to MVM-1, MVM-3
MSP-6	Manager, Business development	Malaysian owned company. Tier-1 to MVM-1

The interview sessions lasted approximately one to one-and-a-half hours. The interviews were recorded with permission from the respondents. Following the researcher's experience during the first stage of data collection, 90 per cent of the interviews took place in an independent area, that is, restaurant, coffee house, and so on. The researcher learned that buying dinner or drinks were an important strategy when inviting respondents to participate in the interview. This ensured that the respondents felt comfortable, and avoided the non-standardised answer. It was also considered important to keep in touch with the respondents after the interviews to ensure that they would respond to emails or phone calls if the researcher needed further explanation.

In total, approximately 22 hours of interviews were successfully recorded for this purpose. The interviews were transcribed before being entered into the analysis process (Appendix 6).

## **5.5 Chapter Summary**

This chapter addressed how the data were collected in this research. The chapter demonstrated the lessons learned by the researcher throughout the process. The identification of themes helped the researcher design the pilot study and interview questions. First, the data collection provided the researcher with an overview of co-development within Malaysia, and refined the findings from the literature review and from the interviews with experts. The second stage of the data collection process gave the researcher further opportunities to explore the co-development within the Malaysian automotive industry. The set of data gained in Chapter 5 are analysed in Chapter 6.

## Chapter 6

Case study  
data  
analysis

- Analysis of the case study interviews data
- Validation of findings with the experts
- Development of the Malaysian co-development model

Research findings

Malaysian co-  
development model





## **6 Case Study Data Analysis**

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### **6.1 Introduction**

This chapter shows how the data collected in Chapter 5 were analysed and synthesised. Three different stages of analysing/synthesising the data were used in this research. The first stage involved grouping the data under the themes identified. The statements were grouped according to the themes prior to conclusions being drawn. The conclusions subsequently led to the findings of the research based on the interviews discussed in Chapter 5. The second stage was the triangulation process with experts in the field. The aim of the process was to confirm the findings in Section 1, and to discuss any issues relating to co-development within Malaysia. The experts contributing to the triangulation process were from a third party—an independent company that works closely with Malaysian vehicle manufacturers and suppliers. The findings were then validated by the literature, which either supported or contradicted the findings.

### **6.2 Method of Analysis**

The researcher began the analysis by grouping the data collected under the master themes identified from the literature review, as discussed in Chapter 5. At the initial stage, the themes identified in Chapter 5 were used as labels or themes for the statements. The statements were grouped according to the most relevant to the themes. The process also considered the similarity, contrast or level of interest of statements; there are sub-themes that emerged during the grouping process. Sub-themes were derived from interesting statements, or the topic that the respondent of the interview felt to be important. Some of them also emerged with the repetition of statements by different respondents from different companies.

At the end of the grouping process, the statements were placed in the list by themes identified. The sub-themes were then be added to the list under the main themes, and the conclusions were drawn from the statements grouped in each of the themes. In order to group the data in a systematic way, the researcher selected MindManager software to use in this research.

### **6.2.1 Analysis Tool: MindManager**

Mind mapping involves representing words, tasks, or other items linked to and arranged around a central key word or idea. According to Litemind (<http://litemind.com/what-is-mind-mapping/>), a mind map is a graphical way of representing ideas and concepts. It is a visual thinking tool that helps to structure information, helping the user to analyse better, comprehend, synthesise, recall and generate new ideas. The use of mind maps is wide-ranging, and includes problem-solving, outlining/designing frameworks, researching and consolidating information from multiple sources, presenting information, gaining insights into complex subjects, anonymous collaboration, the individual expression of creativity, condensing material into a concise and memorable format, team-building or synergy-creating activity, enhancing work morale, and so on.

There are several advantages and disadvantages of using the mind-mapping process. The advantages of mind-mapping include the links between key concepts, which will be immediately recognised, recalled and reviewed so as to be more effective and more rapid. Furthermore, it is easier to add information to the mind-mapping process. In contrast, mind mapping could lead to misunderstandings or misinterpretation by other parties who are not involved in the process, and so, ultimately, it is not considered suitable for recording more chaotic forms of ideas and information.

The MindManager software was developed to use the mind mapping system on computers. MindManager can be effectively used to organise large amounts of information, combining spatial organisations, dynamic hierarchical structuring and node folding. Software packages can extend the concept of mind-mapping by allowing individuals to map more than thoughts and ideas with information on their computers and the internet, such as spread sheets, documents, Internet sites and images.

Often qualitative data analysis uses the NVivo software tool instead of MindManager as an analysis tool. Although both of them offer similar functionality for analysing qualitative data, MindManager was selected in this research because of its superior graphical representation, which helps when making connections between themes that are still emerging (see figure 21 for an example). Nvivo does have more powerful functions in tracing back statements, but it was anticipated that the quantity of data generated in this study would be handled adequately by nomenclature during the analysis; hence, NVivo was not a preferred option for this research. It is also easier to connect between statements in MindManager compared to NVivo. Besides presenting data, MindManager also helps the researcher to structure the data gathered and look at the statements more deeply with the themes identified by keeping them on one piece of paper or computer screen, which is less easy with NVivo software. MindManager can also show links between the data under different themes, which makes it easier for the researcher to draw conclusions at the end of the process. Similarly (blue), contrasting (red) or interesting (yellow) statements can be easily identified with MindManager.

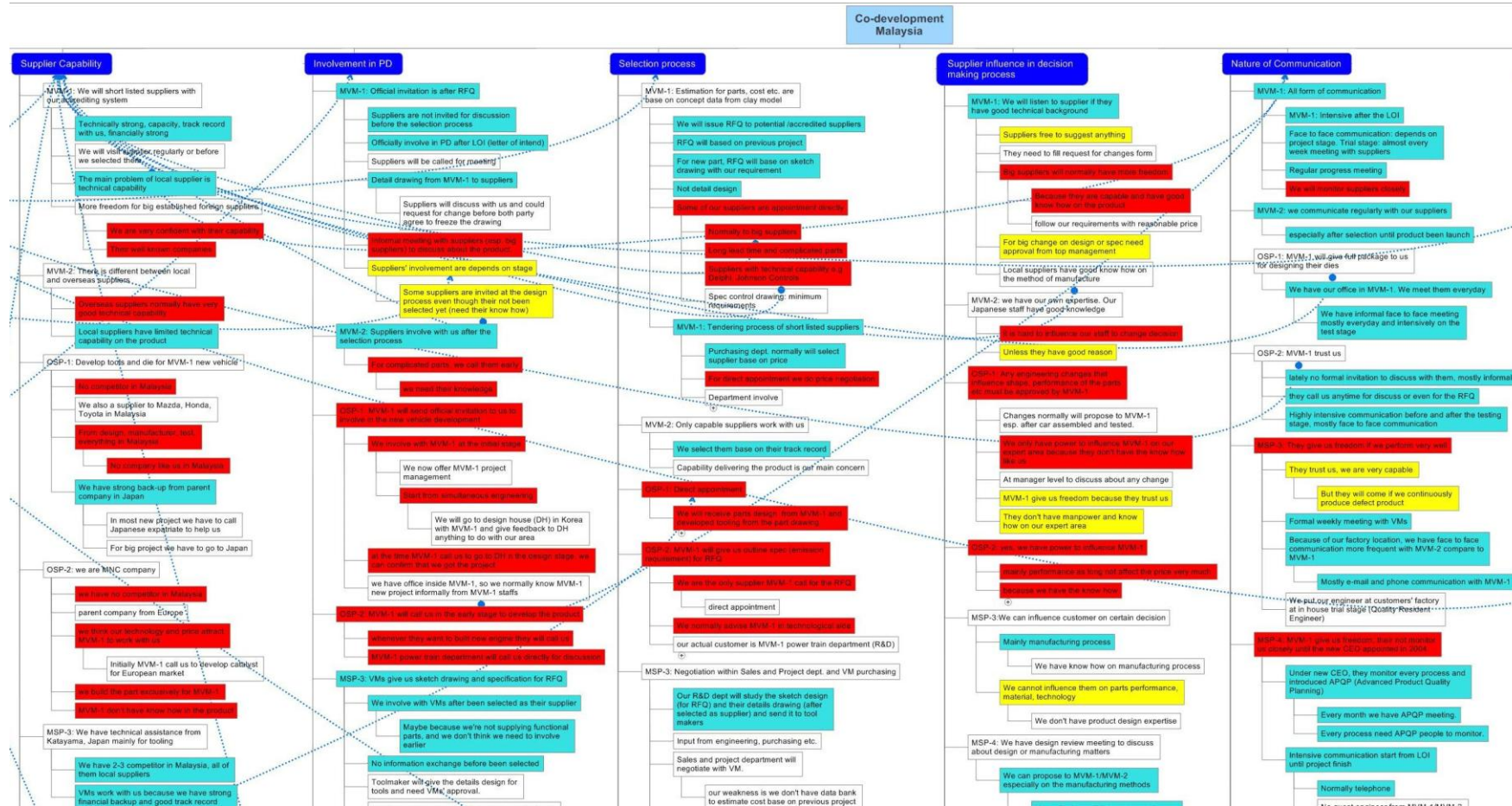


Figure 21 Excerpt from the MindManager

### **6.2.2 Grouping the Data**

As previously explained, the data gathered were grouped according to the themes identified in Chapter 5. As the statements were not necessarily placed on just one theme, several statements were used in other themes as well. Each interview represents one case study, before the statements were divided into three main groups; vehicle manufacturers, local suppliers and overseas suppliers.

One criterion for grouping the data was that they were technically relevant to co-development, in particular to the themes identified. The interesting statements were placed as floating topics on the mind map, and the statements were used again in relation to the discussion and conclusion process. There were also statements of respondents concerning the elements that interviewees believed to be important, and the suggestions from respondents concerning current co-development practices within Malaysia. These statements were grouped separately from the master themes.

#### ***Theme: The Customer-Supplier Relations***

The statements regarding the relationship between the suppliers and the vehicle manufacturers were grouped under this theme. The statements show two different types of vehicle manufacturer and supplier relationship. Vehicle manufacturer MVM-1 admitted that most local suppliers had worked with them since the vehicle manufacturer was first established. Furthermore, although MVM-1 claimed that they worked only with suppliers with good track records, they also could not deny their obligations as national car manufacturers in helping local suppliers. MVM-1 also claimed that, prior to the establishment of most local suppliers, with Government help, it was MVM-1's obligation to develop local suppliers until they were established; therefore, MVM-1 still had in-house expertise regarding the product.

*MVM-1: 'Most of local suppliers have worked with us since we were established'; 'We must help local suppliers to become more competitive'.*

The local suppliers seemed to support MVM-1's views. From four local suppliers' interviews, three of them had worked with the Malaysian vehicle manufacturers since the establishment of the Malaysian car companies. Two of them, however, were part of MVM-1 and MVM-2, and had been before they were established, and there were still 30 per cent of shares from MVM-1 and MVM-2 for each company. The local suppliers also agreed that there was no investment from vehicle manufacturers for new projects.

*MSP-5: 'We're part of MVM-1 previously. MVM-1 never invests in us for a new project'.*

*MSP-6: 'We have worked with MVM-1 since our establishment'; 'They choose us because we have a very good relationship'.*

On the other hand, the interviews with overseas suppliers, such as OSP-1 and OSP-2, gave rise to no clear evidence to support the view that Malaysian vehicle manufacturers want to work with them purely because of their previous history or relationships. Both of them were confident that it was their technology and expertise that made vehicle manufacturers chooses to work with them.

*OSP-2: 'We think our technology and price attract MVM-1 to work with us'.*

### **Sub-theme: Trust**

'Trust' was a theme commonly highlighted by the local supplier group during the interviews. Three of the four local suppliers participating in the interviews mentioned trust as one of the main criteria as to why vehicle manufacturers worked with them. They also highlighted that trust was important for them when

striving to secure business. Therefore, trust seems to be one of key points for companies working with each other, as indicated by local supplier groups. Moreover, trust develops over long-term relationships with good track records.

*MSP-6: 'They trust us; we think trust is important to get the business'; 'Of course, our track record is the reason they trust us'.*

***Theme: The Supplier Capability***

The statements from the vehicle manufacturer group clearly indicated two different approaches towards suppliers. Suppliers with high technological capability have more freedom, and are frequently invited to participate early on in the development process. Some of them are directly appointed by vehicle manufacturers without having to compete with other companies; in contrast, local suppliers have to compete and are normally selected through the formal process; these two attitudes towards suppliers are based on supplier capability. Moreover, interviews with MVM-1 respondents clearly indicated that they give more freedom to overseas suppliers because they are well-known companies, and MVM-1 has confidence in their capability. MVM-1 also stated that the main problem with local suppliers is their technical capability.

*MVM-1: 'We give more freedom for big established foreign suppliers'; 'The main problem of local supplier is technical capability'.*

There is evidence from local supplier group's statements that they support MVM-1's views. The local suppliers clearly indicated that they do not have the capability to design products. Most local suppliers participating in the interviews said they receive the drawing from vehicle manufacturers without having been invited to participate in the design process and following the selection process. Although some of the local suppliers admitted that they have received technical assistance from an overseas company, this has been mostly for supplying tools and dies and not for developing the product.

*MSP-4: 'We not do design; we only manufacture what our customer wants'.*

*MSP-6: 'We totally are not involved in parts design by vehicle manufacturers'.*

From the interview with the overseas supplier groups, it can be stated that there is clear evidence to support the view that overseas suppliers have more freedom compared with local suppliers, as mentioned by the vehicle manufacturers. Both overseas suppliers participating in the interview agreed that they do not have any competitors within Malaysia, and that their technology and expertise fundamentally attracts vehicle manufacturers. Moreover, with the exception of strong support from their mother company overseas, both suppliers also have their own capability in designing and developing products within Malaysia.

*OSP-1: 'We have no competitor within Malaysia. We design, develop and test the product within Malaysia'.*

*OSP-2: 'We think our technology and price attract MVM-1 to work with us'.*

### ***Sub-theme: Manufacturing Capability***

The manufacturing capability emerged as a sub-theme during the analysis process. There is a clear indication from the interviews with the vehicle manufacturer and local supplier groups regarding the importance of technical—or, in particular, design—capability. In the interviews, the local supplier group indicated that one of the reasons that vehicle manufacturers want to work with them is owing to their good track record. MSP-6, for example, agreed that their capability in manufacturing products is one of the reasons why the vehicle



manufacturer selected them as a supplier, despite the fact that they do not have any design capability. On the other hand, MVM-1, for example, stated that one of the criteria for selecting suppliers is their track record, especially whether the supplier can fulfil their requirements. The local suppliers—none of whom have any design capability—would be considered a partner if they could manufacture the product accordingly.

*MSP-6: 'Our capability and track record are the main consideration by vehicle manufacturer'; 'vehicle manufacturers feel safe and think we can do what they request'.*

*MSP-3: 'They trust us; we're very capable of manufacturing what they want'.*

*MSP-5: 'We normally advise vehicle manufacturers in the manufacturing process'.*

### ***Theme: The Involvement in Product Development***

There was no clear statement from the vehicle manufacturer group interviews regarding supplier involvement in the product development process. MVM-1, for example, mentioned that the involvement of suppliers in product development depends on the stage; some suppliers are involved in the early stages, whilst some become involved after the selection process has ended. In the interview, MVM-1 agreed that they call overseas suppliers for informal meetings to discuss the product before the selection process. An interesting point made in the interview is that MVM-1 also mentioned that no supplier is called before the request for quotation process, and no discussion is held before the selection process. This statement clearly contradicts the first one; this suggests that MVM-1 has two different approaches towards suppliers.

*MVM-1: 'Suppliers are not invited for discussion before the selection process; the official invitation is the request for quotation'; 'Informal meetings [are held] with suppliers especially big suppliers to discuss the product before selection'; 'Some suppliers are invited to the design process even though they've not been selected yet because we need their know-how'.*

In contrast with the interviews with the local supplier group, there are very clear statements concerning suppliers' involvement with vehicle manufacturers during the product development process. All of them agreed that they are involved with their customers only following the selection process. They also agreed that vehicle manufacturers provide them with detailed drawings after the selection process, and that they are not involved in the entire design process. According to one of the suppliers, vehicle manufacturers also do not share their vehicle concept before selection, and they know about new car projects only on an informal basis.

*MSP-4: 'In a letter of intent after selection, the vehicle manufacturer will give detailed drawings with CAD data after we have been selected as their supplier'; 'They do not call us at the initial stage; we are involved with the customer after the selection process'.*

*MSP-3: 'We are involved with the vehicle manufacturer after the selection process; no information is exchanged before we have been selected'.*

On the other hand, the interview data from the overseas supplier group show that they are invited to participate in the product development process by the vehicle manufacturer at an early stage. According to OSP-1, the Malaysian vehicle manufacturer sends an official invitation for OSP-1 to become involved in the process at an early stage.

*OSP-1: 'MVM-1 sends an official invitation to us to be involved in the new vehicle development; we become involved with MVM-1 at the early stage'.*

*OSP-2: 'MVM-1 will call us in the early stage to develop the product; whenever they want to build new engine they will call us'.*

**Theme: The Selection Process**

The statements from the vehicle manufacturer group interviews show that there are two different approaches for selecting the suppliers. The suppliers with high technical capability, for long lead times and complicated parts will be awarded the contract through 'direct appointment', which means that they been selected by the vehicle manufacturer without having to undergo the tendering process. The negotiation happens only in relation to price. Another approach of vehicle manufacturers in terms of the selection of suppliers is based on the tendering process. The process starts with vehicle manufacturers issuing a request for quotation (RFQ) to their accredited supplier. MVM-1 claimed that they will have accredited the supplier with technical capability, a track record, strong financial support, and with the capacity to manufacture their product.

*MVM-1: 'We shortlisted suppliers with our accreditation system; we issue RFQ to accredited or potential suppliers'; 'Direct appointment is normally for big suppliers; for a long lead time or a complicated product'.*

The statements from the local supplier group seem to match those of the vehicle manufacturer group. All local suppliers had to go through a tendering process before they were selected; however, the interesting statements from one of the respondent shows that tendering or price does not necessarily influence vehicle manufacturers when selecting the supplier. The respondent mentioned that they are always confident that they will get the project as they

have good relationships with the vehicle manufacturer. At least two local suppliers agreed that they were selected because of their good relationship with the vehicle manufacturer management staff. Two of the local suppliers also mentioned that a good track record with the vehicle manufacturer could influence the selection process. Furthermore, financial background was also mentioned as one of the criteria that could help vehicle manufacturers to select them as suppliers.

*MSP-4: 'Even though we have competitors, we are quite confident of getting the project from the car manufacturer'; 'They choose us because we have a very good relationship with their management staff'.*

*MSP-3: 'Vehicle manufacturers work with us because we have strong financial backup and a good track record'.*

*MSP-6: 'Our capability and track record are the main considerations for vehicle manufacturers'.*

In contrast, both overseas suppliers participating in the interview agreed that they are normally appointed by vehicle manufacturers without having to undergo the tendering process. This confirmed the statements provided by vehicle manufacturer interview. OSP-1 mentioned that the negotiation of price took place between them and the vehicle manufacturer purchasing department, whilst in the case of OSP-2, the vehicle manufacturer power train department suggests the price to their purchasing department. This clearly indicated that approaches by the vehicle manufacturer to both suppliers are different to those to the local supplier. The interesting statement by OSP-1 is that vehicle manufacturers do not know about the process. OSP-1 also claimed that the vehicle manufacturer does not have another supplier to compare the price with, and therefore always negotiates the lowest possible price.

*OSP-1: 'Direct appointment by vehicle manufacturer'; 'The vehicle manufacturer doesn't know the process and the price. They always negotiate to lower the price but they don't have another quotation for comparison'.*

***Theme: The Supplier Influence in the Decision-Making Process***

The influence of suppliers in the decision-making process shows the different types of data between vehicle manufacturer, local supplier, and overseas supplier groups. The vehicle manufacturer group data shows that they are open to any suggestions from the supplier; however, one of the respondents admitted in the interview that they will listen to a supplier with good technical capability. Furthermore, the respondent stated that overseas suppliers will normally have more freedom to make suggestions, provided it is within their requirements and with a reasonable price. The supplier has to fill the 'request for change' form before the change is approved by vehicle manufacturer.

*MVM-1: 'We will listen to the supplier if they have a good technical background'; 'Overseas suppliers will normally have more freedom to make suggestions'.*

In contrast, the data from the local supplier group show that they can influence vehicle manufacturers mainly in terms of the methods of manufacturing. One of the respondents mentioned that they cannot influence vehicle manufacturers in terms of product performance, technology and materials. Furthermore, all suppliers' respondents agreed with the vehicle manufacturer data, stating that they have to fill in the 'request for change' form to suggest any changes to vehicle manufacturers.

*MSP-4: 'We can propose anything to the vehicle manufacturer especially about the manufacturing method; normally, they will listen to us on how to manufacture the product'.*

*MSP-3: 'We can influence customers on certain decisions; we cannot influence them on parts performance, material, or technology'.*

The data from the overseas supplier group, however, show that they have more freedom in suggesting changes to vehicle manufacturers. OSP-2, for example, clearly mentioned that they could influence the customer mainly in terms of product performance, as the vehicle manufacturer does not have any expertise relating to the product; OSP-1 further agreed that they could influence their customers in the area of their expertise. OSP-1, however, stated that it is not easy to influence vehicle manufacturers, as some elements of the design will have been frozen before the design is sent to OSP-1.

*OSP-2: 'Yes, we have the power to influence local vehicle manufacturers, mainly on performance as long as it does not affect the price much'; 'unlike overseas vehicle manufacturers, local vehicle manufacturers depend 100 per cent on our expertise'.*

***Theme: The Nature of Communication***

The data from the vehicle manufacturer group show that the intensive communication between vehicle manufacturers and suppliers starts following the selection process, that is, after the vehicle manufacturer issues the 'letter of intent' to a selected supplier. MVM-1 mentioned that they use all forms of media to communicate, and the amount of face-to-face communication depends on the project stage, for instance, there is a weekly meeting at the trial stage. They also have regular progress meetings with suppliers. MVM-1 also monitors suppliers closely.

*MVM-1: '[There is] intensive communication after letter of intent; we use all forms of communication'.*

The local supplier group data match the data from the vehicle manufacture above; the intensive communication starts after the supplier has been selected. However, there are very significant and different data regarding the vehicle manufacturer monitoring process. Two of the suppliers—MSP-3 and MSP-6—stated that vehicle manufacturers do not monitor them closely, as long as they can comply with the vehicle manufacturer's requests and requirements. In contrast, MSP-4 and MSP-5 claimed that the close monitoring process by the vehicle manufacturer starts from the moment the supplier has been selected. Three of the local suppliers also confirmed that there was no guest engineer from the vehicle manufacturer at their factory.

*MSP-5: 'The vehicle manufacturer will monitor us starting from the tools conceptual stage; they monitor us at every stage (to witness what is happening)'.*

*MSP-3: 'They give us freedom if we perform very well; but they will come to us if we continuously produce defective products'.*

The data from the overseas supplier group show that informal communication takes place more frequently compared to formal communication. OSP-1, for example, meets with MVM-1 every day, as they have offices inside the MVM-1 factory. Furthermore, OSP-2 claimed that there is no formal discussion with MVM-1, and MVM-1 can call OSP-2 at anytime to discuss issues. OSP-1 also mentioned that intensive communication occurs most frequently before and after the testing stage, with face-to-face meetings.

*OSP-1: 'We have our office in MVM-1; we have informal face-to-face meetings nearly every day and intensively on the test stage'.*

**Sub-theme: Freedom to Manufacture**

The Freedom to Manufacture sub-theme emerged from the statements of two local suppliers: MSP-3 and MSP-6. Both claimed that vehicle manufacturers do not monitor them closely if they perform very well. MSP-3, for example, used the word 'freedom' when describing the monitoring process by vehicle manufacturers, and MSP-3 agreed that vehicle manufacturers give them freedom as long as they do not have problems delivering the product. MSP-6 also claimed that the vehicle manufacturer will not bother with them as long they can deliver the product. An interesting point mentioned by both MSP-3 and MSP-6 is that the vehicle manufacturer will come to them if they cannot deliver the product on time or if there is another problem with the product they have manufactured.

*MSP-3: 'They give us freedom if we perform very well; but they will come if we continuously produce defective products'.*

*MSP-6: 'As long we can deliver what they want, they don't care; but they will come to our factory if we cannot deliver on time and if there is any problem with the product'.*

**Theme: Important to Interviewee**

The vehicle manufacturer data show that they are not very satisfied with the technical capability of local suppliers. They highlighted that the technical capability of the Malaysian supplier is far behind that of the suppliers in developed countries. One of the reasons MVM-1 thought underpins this problem is local suppliers' production volume, which is low, and the fact that they do not want to invest in research and development. MVM-1 also mentioned that they need strong suppliers in order to compete with foreign vehicle manufacturers within Malaysia. Other interesting points mentioned by MVM-1 include that they outsource the design process to design consultants, who do the design for the new car project, which subsequently helps them reduce the lead time of the new car.



*MVM-1: 'Malaysian suppliers' technical capability is far behind automotive suppliers in developed countries; because of the low volume production, the suppliers don't want to invest in R&D'.*

On the other hand, the local suppliers participating in the interviews said they were satisfied with the current situation. They also stated that they would not invest in research and development. All of them mentioned that they prefer the vehicle manufacturer to provide detailed drawings for them; however, they highlighted the fact that there is a problem with not having tool makers within Malaysia; accordingly, most of them have to go overseas to buy the tools and dies, which does not help them to shorten the lead time.

*MSP-4: 'We're happy with our relationship now; we have no problem dealing with vehicle manufacturers'.*

*MSP-3: 'Because we only produce body in white parts, we don't think we need R&D or a design department; we're happy having detailed designs from the customer'.*

The data from the overseas supplier group, however, show the difference with the local supplier group. OSP-1, for example, urged vehicle manufacturers to give more freedom to the supplier. In contrast, OSP-2 mentioned that the win-win situation for both parties—supplier and vehicle manufacturer—is important to keep a good and long business relationship. Furthermore, one of OSP-2's approaches to maintaining good relationships is by regularly updating their new technology to vehicle manufacturers.

*OSP-2: 'A win-win situation is the best way to keep the business and long-term relationship; we will update our new technology to MVM-1 to maintain our relationship'.*

**Theme: Interviewee Suggestions**

Local vehicle manufacturers indicated clearly that they need local suppliers to become more competitive. MVM-1 wanted local suppliers to compete with overseas suppliers and so start to expand their market to overseas and foreign vehicle manufacturers. MVM-1 also mentioned that local suppliers need to undergo aggressive change in order to survive in the automotive industry. MVM-1 has no problems with helping local suppliers, as long they want to change.

*MVM-1: 'We would like to see local suppliers competing with big suppliers; they need aggressive change in order to become more competitive in the automotive world'.*

In contrast, two local suppliers—MSP-4 and MSP-6—stated that they are satisfied with the current situation; they did not have anything to suggest. MSP-3 and MSP-5, however, suggested that one of the problems with the Malaysian automotive industry is the lack of skilled workers in the industry; some of their engineers are not loyal to the company, and therefore keep changing their jobs in favour of a better salary. MSP-3 suggested the Government should develop a national research and development centre to deal with this problem. MSP-5 further stated that they would like to design the product themselves, but they lack the capability to do so.

*MSP-3: 'The problem within Malaysia is we don't have enough skilled workers in the automotive industry; most of our engineers are not loyal to the company, they are always looking for a higher salary'.*

The overseas suppliers suggested that the local suppliers should start developing their own capabilities in order to compete with overseas suppliers. Apart from this, OSP-2 also urged local vehicle manufacturers to make more resources available for the product, especially manpower. OSP-1, on other hand, suggested MVM-1 shortens the price negotiation process, as the vehicle

manufacturer does not really know the price. OSP-1 also mentioned that Tier-1 suppliers should invest in tools and dies, which could help suppliers to develop the required level of expertise about the product.

*OSP-2: 'Local vehicle manufacturers should have more resources available for the product, especially manpower'.*

### **6.2.3 Conclusion**

#### **Vehicle Manufacturer Group**

The data suggested that vehicle manufacturers demonstrate two different approaches to suppliers according to whether they are local or overseas suppliers. The local vehicle manufacturers seem to divide both types of supplier by technical capability.

In terms of the supplier-vehicle manufacturer relationship, the vehicle manufacturers select the local supplier based on their previous relationship with the supplier; the supplier is normally selected based on their good track record. The long-term relationship, price and capacity also influence vehicle manufacturers in terms of choosing their supplier. In contrast, for overseas suppliers, the previous relationship seems unimportant to vehicle manufacturers as long as the supplier has the required technical capability. Apart from that, the obligation of Malaysian vehicle manufacturers towards local suppliers also has an influence on the long-term relationships developed between vehicle manufacturers and local suppliers.

The level of overall technical capability was a significant difference between local suppliers and overseas suppliers. Vehicle manufacturers select local suppliers based on the criteria mentioned above, whilst overseas suppliers are selected based on technical capability. Overseas suppliers enjoy more freedom

compared with local suppliers, and are directly appointed by the vehicle manufacturer.

The involvement in relation to the product development of both local and overseas suppliers clearly does not occur at the same stage; whilst overseas suppliers are invited at the early stage; local suppliers become involved with the vehicle manufacturers only after the selection process.

The selection process of suppliers by vehicle manufacturers shows two different approaches between local and overseas suppliers. Local suppliers have to compete with other suppliers, and the process starts with a request for quotation by the vehicle manufacturer. In contrast, overseas suppliers are normally directly appointed by the vehicle manufacturer without undergoing the tendering process.

In relation to the supplier influence on the decision-making process, the vehicle manufacturers stated that they are open to any suggestions, despite the fact that they also admitted that they will listen only to suppliers with a good technical background. The overseas suppliers are also given more freedom to make suggestions to the vehicle manufacturer.

Intensive communication between the vehicle manufacturer and the supplier starts after the selection process. They use all types of media to communicate, whilst the level of face-to-face communication depends on the project stage.

The vehicle manufacturers expressed dissatisfaction with local suppliers' technical capability, as they need strong suppliers to compete with foreign vehicle manufacturers. They suggested local suppliers expand the market and compete with overseas suppliers, which would require aggressive change. The vehicle manufacturers also commented on the outsourcing of designs for their new car projects in order to shorten the lead time.

### **Local Supplier Group**

The data suggested that reputation is an important factor in relation to supplier selection for the local supplier group. Trust and track records are a significant part of the reputation mentioned by the local suppliers. Furthermore, good relationships with the vehicle manufacturer also form an important part of the criteria regarding the selection of a local supplier. Moreover, although the tendering process was mentioned as a formal process of selection, some local suppliers were nevertheless confident that they could win contracts due to their good relationship with vehicle manufacturer management staff. This indicates that the formal tendering process and the price are not necessarily key points considered by vehicle manufacturers when choosing the supplier.

As local suppliers lack capability in terms of designing products, vehicle manufacturers do not call them in on the design process. The vehicle manufacturers provide detailed drawings to the selected suppliers; accordingly, local suppliers' involvement in the product development process starts after the selection process.

The capability of local suppliers to manufacture the product is an important factor that was highlighted in the interviews. As local suppliers have low technical capability with no design capability, the manufacturing capability then becomes important to local suppliers when striving to obtain business. Therefore, rather than investing in research and development, some suppliers would rather invest in machinery.

Concerning the expertise in terms of the method of manufacture on the supplier side, the local suppliers again claimed that they could influence customers in the manufacturing process. This supports the fact that local suppliers have a very good manufacturing capability. Furthermore, some local suppliers stated they have the freedom to manufacture the product as long as they follow the vehicle manufacturer's requirements.

The monitoring of local suppliers is by two different methods. Local suppliers with a good track record and good reputation with vehicle manufacturers seem to have no formal monitoring by their customers; on the other hand, whilst some local suppliers have been closely monitored by vehicle manufacturers, there is no clear evidence regarding how or why vehicle manufacturers choose the suppliers they wanted to monitor. The only assumption that can be made is related to the product itself: for example, MSP-5—one of the largest local suppliers with a fully automated production line—said that the vehicle manufacturer monitored them closely starting from the tools conceptual stage; in contrast, MSP-6—a small local supplier with a partly-automated production line—said that the vehicle manufacturer was not monitoring them closely as there is shared confidence that they can deliver the product. From the scale of business and the production line, it can then be assumed that MSP-5 is manufacturing a more complex product than is MSP-6; this indicates that product complexity might influence vehicle manufacturers in terms of whether or not to monitor their supplier.

The data also suggested that local suppliers are satisfied with the current co-development practices within Malaysia. Furthermore, although one local supplier mentioned the lack of tool makers within Malaysia, overall, they did not see any disadvantages to the current practice. They also clearly indicated that they are happy to receive detailed drawings from customers, and are not going to invest or go further into the design or research and development process. Moreover, a lack of skilled workers was also mentioned as a reason why local suppliers cannot compete with overseas suppliers.

### ***Overseas Supplier Group***

The data from the overseas supplier group suggested that technological capability is the main reason why vehicle manufacturers choose to work with them. Due to their high technological capability and resources, vehicle manufacturers have a different attitude towards them compared to their attitude towards local suppliers.

There is clear evidence that their high technological capability attracts vehicle manufacturers; in fact, the overseas suppliers enjoy more freedom in terms of the design and manufacturing process compared to local suppliers. These suppliers become involved at the early stage of product development, as the vehicle manufacturers need their expertise and resources. The overseas suppliers often highlighted that the vehicle manufacturers do not know about the product, and therefore have to depend 100 per cent upon them. Accordingly, overseas suppliers seem to have more influence in regards to the decision-making process compared to local suppliers. Moreover, overseas suppliers could also influence vehicle manufacturers in terms of product performance.

One of the interesting statements made by overseas suppliers is about the price-negotiation process. The suppliers mentioned that the vehicle manufacturers have always negotiated, despite their lack of knowledge regarding the product or the price. The vehicle manufacturers always negotiate the lowest possible price—the typical attitude of price negotiation. The price negotiation here, however, occurs following the selection process, as overseas suppliers are often appointed without undergoing the tendering process.

It is also interesting to note that informal communication takes place more often between the vehicle manufacturer and overseas suppliers throughout the product development process; this shows that vehicle manufacturers prefer to work with overseas suppliers informally, rather than in a formal way. Moreover, overseas suppliers did not mention the vehicle manufacturer monitoring system during the interviews. This supports the claim that overseas suppliers have more freedom than have local suppliers, as mentioned above.

Furthermore, although there is clear evidence that overseas suppliers have more freedom compared with local suppliers, one of the overseas suppliers interestingly suggested that the vehicle manufacturer should give more freedom to the supplier. The supplier also urged the vehicle manufacturer to shorten the price negotiation process, as they do not have expertise in that area. Therefore,

OSP-2, for example, suggested that vehicle manufacturers should ensure more resources are made available in order to improve the current co-development practices; this indicates some dissatisfaction by overseas suppliers in relation to the current co-development practices, and further suggests that there is room of improvement in relation to both parties.

#### **6.2.4 List of Findings**

The result of the data analysis clearly indicated the following:

- Good relationships with vehicle manufacturers could influence the selection process;
- There are longer relationships with local suppliers compared to overseas suppliers as, since the establishment of national car manufacturers, they work together;
- Two different approaches of supplier selection co-exist: a tendering process for local suppliers and direct appointment for overseas suppliers;
- Criteria for selecting local suppliers emphasise good track records, good relationships, and trust;
- Overseas suppliers are invited to participate in the early stage of product development due to their technical capability;
- Local suppliers are not involved in the design process at all. Rather, they are invited to participate at the request for quotation stage;
- Local suppliers can influence vehicle manufacturers on the method of manufacturing the product;
- Overseas suppliers can influence vehicle manufacturers on product performance and shape (as well as on manufacturing method);
- Local suppliers have a good manufacturing capability;
- Local suppliers that produce less complicated parts have a reduced monitoring process by vehicle manufacturers, and freedom to manufacture;



- Communication intensively occurs after the supplier selection for local suppliers;
- Informal communication is more frequent than formal communication between vehicle manufacturer and overseas supplier throughout the product development process;
- Local suppliers are satisfied with the current co-development practices within Malaysia;
- Local vehicle manufacturers are not satisfied with local suppliers' technical capability; and
- Local vehicle manufacturers use design consultants to help them to design a new car.

### **6.3 Expert Triangulation**

In order to increase the validity of the findings, triangulation with subject experts was conducted. The triangulation process was used to validate the findings from the analysis stage above. The process of triangulation by experts was used to confirm, reject or modify the findings.

The triangulation process took approximately one-and-a-half hours of interviewing time for both respondents. During the process, the respondents were specifically asked about the local vehicle manufacturers and suppliers' capability and their experiences of working with local suppliers and vehicle manufacturers, and were finally shown the findings and asked about their knowledge regarding the findings. Although neither expert could answer all the questions about the findings directly, their experience within the Malaysian automotive industry ultimately helped the researcher to validate the findings. Keeping in mind this exception, EXP-1 in particular was asked for their opinion of the Malaysian automotive industry overall, as they work with Malaysian vehicle manufacturers on developing new vehicle and parts. At the end of the interview, the respondents were asked about the current situation of the

Malaysian automotive industry, their opinions about the local vehicle manufacturers and suppliers, and their suggestions concerning the improvement of the Malaysian automotive industry.

### **6.3.1 Expert Findings**

The first expert invited into the validation process, EXP-1, worked for an overseas vehicle manufacturer from Europe, and had been involved within Malaysian automotive industry since 1996. EXP-1 is involved in several activities in helping both Malaysian vehicle manufacturers and local suppliers in designing and developing new vehicles and products. As a well-known company especially for producing sport cars, EXP-1's technological capability in automotive industry is undeniable.

Since the establishment of Malaysia's office, EXP-1 has helped Malaysian automotive players by continuously providing training in automotive design and technology. EXP-1 also helps local vehicle manufacturers in designing new vehicles. The significant contribution of EXP-1 is the development of a new engine for a local vehicle manufacturer. The collaboration between EXP-1 and local engineers took just nine months to design and develop the engine. The engine has been in use since 2003, and has helped local car manufacturers financially, by their not needing to buy engines from overseas car companies. Apart from that, EXP-1 also collaborates with local vehicle manufacturers to design and develop new cars, and helps car manufacturers develop new chassis, handling systems, interior design and so on.

EXP-1 also works with several local suppliers on developing suppliers' competitive advantage by helping them with designing activities and the latest technology. Furthermore, EXP-1 helps vehicle manufacturers in accrediting local suppliers based on suppliers' capability. At the time of the interviews, EXP-

1 was working on promoting a local supplier to the overseas market, especially the European market.

The second expert for the triangulation process (EXP-2) also worked for an overseas vehicle manufacturer, with a high reputation for producing high quality cars in world automotive industry. As a Japanese transplant within Malaysia, EXP-2 expects parts for their cars to be of high quality. In order to provide this, with the Government requirement of local contents in cars produced within Malaysia, EXP-2 has helped some local suppliers to come up to their standard. However, compared to EXP-1, EXP-2 is not involved directly in developing (or selling consulting services to) local suppliers. In this process, EXP-2 was asked about their experience of working with local suppliers since their establishment within Malaysia in the early 1980s.

The long-term involvement of EXP-1 and EXP-2 within Malaysian automotive industry helped both of them to understand the current situation within Malaysia. As representatives of a third party in the industry, the opinions of EXP-1 and EXP-2 about the findings in this research were vital.

### ***6.3.2 Experts' Knowledge versus Findings/Data***

#### ***On vehicle manufacturer-supplier relationship***

EXP-1 confirmed the finding that a good relationship with vehicle manufacturers might have great influence on supplier selection. According to EXP-1, who had experience working with several local vehicle manufacturers on new car projects, some of the local suppliers selected to work on the project do not even have any expertise about the product, but interestingly, have good relationships with the vehicle manufacturers' management staff. EXP-1 concluded that those suppliers achieved the contract through politics rather than their capability.

*EXP-1: 'Some local suppliers selected by the vehicle manufacturer do not even have know-how about the product; the political background influences the decision on supplier selection'.*

In contrast, EXP-2 selects their suppliers on the basis of a good track record, which shows that the supplier can follow their requirements. As the requirements are very strict, only suppliers with a high commitment and proven reputation are considered.

### ***On Suppliers' Capability***

Both EXP-1 and EXP-2 agreed that local suppliers' capability is far behind that of overseas suppliers. According to EXP-1, most local suppliers have no design facilities in their offices or factories. EXP-1 also admitted that they have tried to promote design activities and provide training in computer-aided manufacturing to local suppliers in order for local suppliers to start designing products. However, they commented that, unfortunately, there is no corresponding effort from local suppliers to invest in design equipment, such as CATIA or CAD. They concluded that the training provided by EXP-1 has no effect. EXP-2 also agreed that local suppliers have no design capability; they have to provide detailed drawings to local suppliers, and appoint local suppliers only for 'non-functional parts', such as stamping or plastic parts. This supports the findings that local suppliers' technological capability is low, and no design activities occur at local suppliers' sites.

*EXP-1: 'Local suppliers do not invest in design facilities, CATIA or CAD; our training is useless. They don't want to go further than manufacturing the parts'.*

On the other hand, EXP-1 and EXP-2 supported the findings that local suppliers have good manufacturing capability. In fact, EXP-1 mentioned that local

suppliers also have competitive product prices compared even to the global leaders in low-cost-production from China or India. EXP-2 also agreed that most local suppliers with whom they work have good manufacturing facilities. With good manufacturing capability and competitive prices, EXP-1 always urge local suppliers to expand into the overseas market. Moreover, several activities promoting local suppliers overseas are organised by EXP-1; however, local suppliers seem to have little or no interest in expanding the market.

*EXP-1: 'Local suppliers have very good manufacturing facilities and in fact the product price is very competitive compared to China or India'.*

### ***On the Selection Process***

As discussed above, having a good relationship with the vehicle manufacturer has a great influence on local suppliers' selection process. Furthermore, EXP-1 admitted that local suppliers are very confident that they will get the business from local vehicle manufacturers. According to EXP-1, most local suppliers know that local vehicle manufacturers have obligations to help local suppliers; therefore, although there is competitive bidding on the selection process, local vehicle manufacturers will try to divide the project amongst several local suppliers in order to give them the business.

*EXP-1: 'Local suppliers are very confident that they will get the business from local car companies'.*

On the other hand, as EXP-2 does not do research or carry out development within Malaysia, the suppliers are more likely to be selected according to their capability of manufacturing the product under EXP-2's strict requirements. The selection process is ultimately based on competitive bidding, and only accredited suppliers are invited to participate in the request for quotation stage. Local suppliers are not involved in the design process at all. This approach is similar to the formal process of supplier selection described by local vehicle

manufacturers; however, good relationships seem to have less influence on EXP-2 in terms of selecting their suppliers.

*EXP-2: 'We're not doing R&D within Malaysia. There is no point involving supplier in the design process; we select suppliers' based on their manufacturing capability'.*

### ***On Supplier Involvement in the Product Development Process***

According to EXP-1, from their experience on working with local vehicle manufacturers on new car projects, overseas suppliers become involved in the early stages, as vehicle manufacturers believe they have expertise on the product. As local vehicle manufacturers have limited resources in terms of product technology—especially complex parts—they always call overseas suppliers directly in order to involve them in the project. This supports the findings that overseas suppliers become involved at early stages compared to local suppliers.

Furthermore, the main constraint in terms of developing new cars on the part of vehicle manufacturers is the shortage of skilled workers within the research and development department; therefore, local vehicle manufacturers have no choice other than to involve capable suppliers within the early stages in order to shorten the lead time. Aside from this, local vehicle manufacturers have to outsource large parts of their own design process to design consultants in Korea and Europe for their new car projects; this helps local vehicle manufacturers overcome the design constraint.

*EXP-1: 'We are involved with local vehicle manufacturers at the early stage, helping them design the product. So do other capable suppliers; vehicle manufacturers need their knowledge'.*

EXP-2 clearly indicated that they do not invite suppliers during the early stages, as all part design comes from EXP-2's parent company in Japan, and their research and development centre. Therefore, there is no need to involve suppliers at the early stage.

### ***On Supplier Influence in the Decision-making Process***

The interview with EXP-1 did not clearly indicate supplier influence in terms of the decision-making process. Nevertheless, they claimed that their experience of working with local vehicle manufacturers indicated that it is easier to influence them if suppliers have good knowledge of the product. As local suppliers are not involved in the early stages of the product development process, according to EXP-1, it is difficult to influence vehicle manufacturers, as the design becomes frozen before the supplier selection occurs. This supports the finding that overseas suppliers with high technological capability can fundamentally influence vehicle manufacturers in the decision-making process.

EXP-2, however, clearly indicated that it is not easy for suppliers to influence them, as they have their own expertise in the area. Any request for product-related change involves several formal processes before it can be approved by EXP-2.

### ***On the Nature of Communication***

Although there was no direct comment from EXP-1 concerning the nature of communication, EXP-1's experience and knowledge regarding monitoring local suppliers is interesting. According to EXP-1, local vehicle manufacturers are not very strict with their suppliers, and some local suppliers who break the contract or regularly produce defective products are not punished by local vehicle manufacturers. Strangely, some of these suppliers receive a contract from local vehicle manufacturers for the next project. This contrasts with local vehicle manufacturers' and suppliers' data, which suggested that a track record and reputation are the main criteria for selecting suppliers. EXP-1 concluded that

political decisions or a good relationship between both companies' management staff (e.g., CEO, MD) fundamentally underpins this situation. Meanwhile, their experience of working with local vehicle manufacturers indicates that informal communication takes place more frequently compared to formal communication. The local vehicle manufacturers use telephone, email and face-to-face communication throughout the process.

*EXP-1: '[There is] no punishment for suppliers who break the contract; in fact, some of these suppliers are selected again for the next project'.*

In contrast, EXP-2 indicated that they monitor all suppliers closely. All types of communication tools are used during the process. They also urge their suppliers to inform them if there are any problems during the product development process.

### ***The Malaysian Automotive Industry Overall***

At the end of the session, EXP-1 and EXP-2 were questioned about the Malaysian automotive industry overall; they were asked about the current situation, and asked for their suggestions to improve the current situation within Malaysia.

EXP-1 began by discussing the current local vehicle manufacturers' attitude towards local suppliers. Most of the local vehicle manufacturers have very good relationships with local suppliers, as the automotive industry within Malaysia is not large compared to that of overseas, such as Japan or Europe. EXP-1 believes that some local suppliers take advantage of the good relationships between them, as suppliers are always confident that they will get the contract. Contributing to this, local vehicle manufacturers are not very strict in terms of punishing problematic suppliers and, essentially, this type of supplier keeps producing defective products and delayed delivery and does not improve their capability. This type of local supplier still exists in an apparently competitive automotive industry due to the continuous support from local vehicle



manufacturers. This situation will not help the Malaysian automotive industry to become competitive, and does not help vehicle manufacturers to improve.

On the suppliers' side, EXP-1 thinks that most local suppliers are comfortable with the current situation, which EXP-1 believes is a key reason why they do not want to change. Some of the suppliers have very good manufacturing capability and further provide a competitive price; nonetheless, they do not want to expand their business into the overseas market. EXP-1 strongly suggested local suppliers' increase their production volume by expanding the business into the foreign market, as this would help local suppliers to increase their profit and invest in much-needed research and development.

In contrast, EXP-2 suggested that local suppliers need to ensure they receive more technical assistance from overseas companies in order to become competitive. EXP-2 also proposed that local suppliers supply foreign vehicle manufacturers and expose themselves to competition with overseas suppliers, as this would help local suppliers build up their capability.

EXP-1 also urged the Malaysian Government to reduce slowly the protection of local suppliers, and to let local suppliers compete with regional suppliers—especially those from Thailand or Indonesia; this would help local suppliers to understand how competitive the automotive industry is, and perhaps make local suppliers change. EXP-1 also suggested that the Government have clearer policies within the automotive industry. According to EXP-1, currently, the Government, national car manufacturers and EXP-1 are working separately to improve the current Malaysian automotive industry.

### **6.3.3 Findings after the Triangulation Process**

As discussed above, no findings were rejected, and all except two were directly supported by the experts. However, there are four main points that should be added to the findings:

- 1) The supplier selection process is greatly influenced by good relationships between management staff of both suppliers and vehicle manufacturers; this indicates that political background is a key criterion for the selection of suppliers—not just reputation, as suggested by the vehicle manufacturers themselves;
- 2) Malaysian local suppliers have good manufacturing capability with competitive prices compared to other low-cost countries, such as China and India;
- 3) Local vehicle manufacturers are felt not to be strict with problematic suppliers; therefore, suppliers feel very comfortable with the current situation;
- 4) Local suppliers do not want to change; they are thought to be very comfortable with current practices.

## **6.4 Comparing the Findings to the Literature**

In this section, the findings listed in 6.2.4 with the amended findings in 6.3.3 are compared to the literature. The key references used in this section will confirm, reject or add detail to the findings. Given that the original themes emerged from the literature, it is expected that the high-level themes will be confirmed; this comparison process is primarily used to enrich the findings by comparing and contrasting them with findings from other researchers.

**Theme: Vehicle Manufacturer-Supplier Relationships**

The findings suggested that local suppliers with good, long-term relationships, as well as good track records, are normally awarded the contracts. In addition, expert triangulation confirmed that political background could influence the vehicle manufacturers' decision when selecting suppliers.

The literature confirmed that suppliers with a proven track record should be approached to participate in the process (Petersen, 2003). Athaide & Klink (2009) suggested that product knowledge, prior relationship history, as well as product customisation and technological uncertainty, provide key starting points for collaboration. Furthermore, Ellram (1990) indicated that checking suppliers' performance records provides important indications of how well suppliers keep their word. Several authors relate the concept of trust and reputation to the vehicle manufacturer relationship. Thorelli (1986), for example, suggested trust towards one partner is based on the latter's reputation, and on its past performance. Trust is also one of the core elements of collaborative buyer-supplier relationships. Stuart (1997) also stated that long relationships or alliances can maximise the probability of success by continually tempering the perceived benefits that both parties will achieve through collaboration. This is further supported by Koufteros *et al.* (2007), who found that long-term relationships will develop the embeddedness with suppliers, and further have a positive impact upon the collaboration. Lettice *et al.* (2009) also suggested that long-term relationships are beneficial to both buyers and suppliers in partnerships.

According to Abdullah *et al.* (2008), the Malaysian vehicle manufacturer PROTON has long-term relationships with its suppliers in order to reduce transaction costs and the costs associated with controlling suppliers' quality and delivery, as well as flexibility in terms of trying to implement a complicated product.

The literature clearly supported the research findings whereby only trusted suppliers with a good track record and long-term relationships are considered in the collaboration process; however, it should nevertheless be noted that the later findings on the good relationships—especially selecting suppliers based on political background—could not be found in the co-development literature.

***Theme: The Supplier Capability***

The findings suggested that supplier capability is the main reason why local vehicle manufacturers' have different attitudes towards local and overseas suppliers. The first finding suggested that overseas suppliers are involved early as the vehicle manufacturers need their know-how; the second finding suggested that's overseas suppliers could influence vehicle manufacturers in product performance, shape and so on, but, on other hand, local suppliers have good manufacturing capability with competitive product prices, as suggested by experts and the data analysis.

The literature clearly indicated that the main reason for involving suppliers in product development is technological complexity. Wasti & Liker (1997) indicated that OEMs mainly outsource their designs in order to tap into suppliers' capability outside their organisation. Wasti & Liker (1999) further proposed that the in-house technical capabilities of the supplier and the technical uncertainty of the component are two dominant predictors of supplier involvement in product development. In addition, Petersen *et al.* (2003) stated that supplier involvement is important when technology is complex, and buying companies do not have a high level of internal expertise. Moreover, supplier product and process knowledge are considered to be the most important elements when selecting suppliers (Petersen *et al.*, 2005). Filippini *et al.* (2004) suggested that in-depth knowledge product technologies and market needs will help to overcome the difficulties associated with defining the products, and will help to improve lead times. They further added that, with the high level of capabilities, development will speed-up and ensure punctuality.

The model of local suppliers' manufacturing capability within Malaysia is similar to that which has occurred in the US, where suppliers were effectively treated as a source of manufacturing capacity (Clark & Fujimoto, 1991). As most of the local suppliers have no design capability, vehicle manufacturers seem to use them as manufacturing arms.

***Theme: The Selection Process***

The findings suggested that two different types of supplier selection process co-exist in Malaysian vehicle manufacturers. The first one is the competitive bidding process for local suppliers, which have low technological capability. The second one is the direct appointment for overseas suppliers, which have good technical capability. The criteria for selecting the suppliers described in the findings are based on track record, good relationships, and technological capability for overseas suppliers. The experts added that political decisions have a great influence on the selection of local suppliers. The criteria of selection have been discussed in the vehicle manufacturer-supplier relationship theme above.

The competitive bidding process, as described by Globerman (1980), is stated as being the most viable procedure when technology is at a stage of *ex ante* specification, meaning there is no element of high technological uncertainty. Furthermore, competitive bidding would be good way of selecting suppliers, especially when a number of suppliers possess the capacity to satisfy the specifications. This supported the finding on the formal process of supplier selection within Malaysia for local suppliers.

***Theme: Supplier Involvement in the Product Development Process***

The findings suggested two different stages of supplier involvement within the Malaysian automotive industry. For local suppliers, the involvement starts

following the selection process and the formal invitation made by request for quotation. In contrast, overseas suppliers are involved at the early stages of the product development process due to their technological capability.

The literature is also divided into two different approaches of supplier involvement. The current Malaysian practice of local supplier involvement is similar to that of the US model of the early 1980s. Shapiro (1985) indicated that, in the US, suppliers were usually not included in the product development process until the technology development and product design were finalised in-house. Furthermore, Wasti & Liker (1999) suggested that, in US practice, suppliers have less influence on the design decisions if there is a high level of supplier competition in the supplier market. In addition, Perks (2000) suggested that suppliers with limited expertise should be involved less and only later in the process.

The second approach in terms of supplier involvement is described in the literature as being mainly related to product or technological complexity. Clark & Fujimoto (1991), the leading researchers in this area, suggested that, in the case of complicated parts, supplier involvement at the early stage is crucial. Handfield *et al.* (1999) added that supplier identification criteria and the timing of supplier integration depend on the product and technology risks. Furthermore, Quesada *et al.* (2006) mentioned that, in order to improve performance and concurrent engineering practices, suppliers should be involved at the early stages of new product development. Parker *et al.* (2008) detected a significant relationship between the need for new technology and earlier supplier involvement in new product projects, but were unable to determine the significant relationship between prior experience and the timing of supplier integration. This supports the finding that overseas suppliers are invited to participate earlier on in the process even if they do not have long relationships with local vehicle manufacturers, as local vehicle manufacturers lack sufficient expertise on the product.

***Theme: Supplier Influence in the Decision-making Process***

The findings suggested that overseas suppliers could influence local vehicle manufacturers in the decision-making process, as they have good technological capability. Overseas suppliers could also influence vehicle manufacturers on product performance. In contrast, local suppliers could influence local vehicle manufacturers only on the method of manufacture the product.

There was no clear indication from the literature review that could confirm or reject the findings. However, Petersen *et al.* (2005) suggested that carefully selected suppliers have a positive influence on the decision-making process by the development project team. Furthermore, the Japanese model of co-development described by Wasti & Liker (1999) could be held to be similar to the overseas supplier role within Malaysia. Both of them indicated that the Japanese suppliers of highly uncertain products have significantly more influence in early design decisions. In comparison, technically competent US suppliers are given more flexibility in defining specifications. In the US, high uncertainty products make customers want to offer greater design responsibility to their most competent supplier over whom they have the most control.

***Theme: The Nature of Communication***

There are two findings relating to the nature of communication from the analysis. The first finding is that informal communication between overseas suppliers and local vehicle manufacturer is more frequent compared to formal communication. On the local suppliers' side, the intensive communication takes place after the selection process.

The first finding is supported by Daft & Lengel (1986), who specifically suggested that, for highly uncertain tasks, rich communication media (e.g., face-to-face) are more effective than less rich media (e.g., written communication). Furthermore, Wasti & Liker (1999) stated that, in the US, increasing levels of

technological uncertainty in the product are associated with greater frequency of communication with the buyers. However, there is no literature concerning intensive communication associated with suppliers' capability.

### 6.4.1 Conclusion

The validating process with the literature review confirmed all the findings. However, some of the literature did not directly support the findings, and the similarity of those studies could not be used to validate the findings.

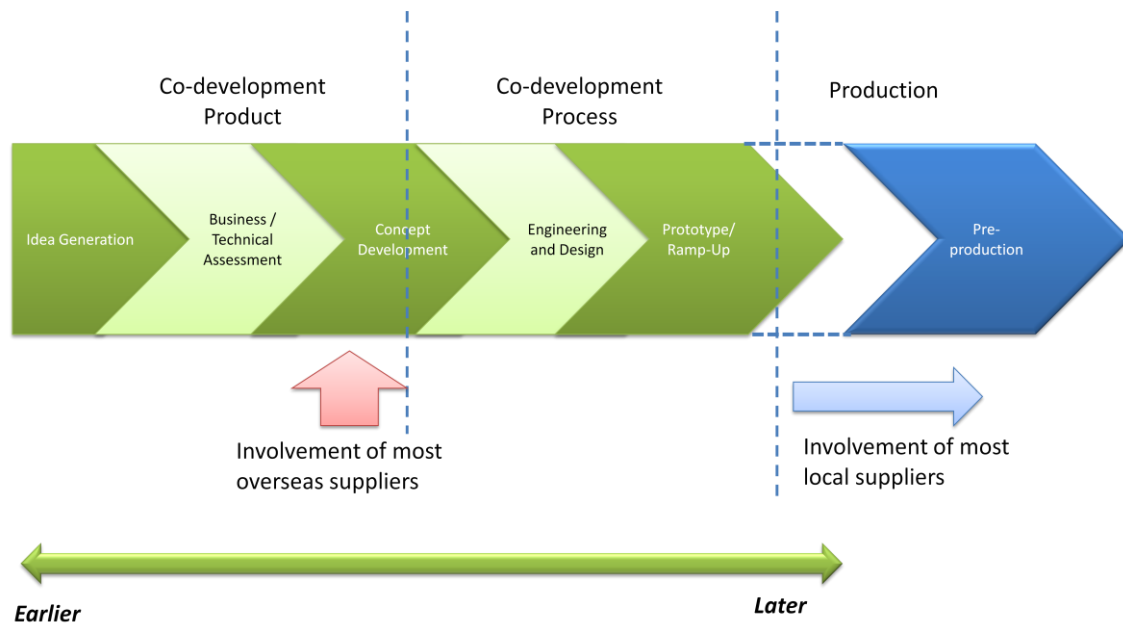


Figure 22: Malaysian suppliers' involvement in product development stages (Based on Handfield *et al.*, 1999)

Figure 6 from Handfield *et al.* can be used as a basis to explain the Malaysian situation (Figure 22). Most local Malaysian suppliers are involved after the engineering and design stage while most overseas suppliers are involved with local vehicle manufacturers at the early stages. This is clearly based on



suppliers' capability, as local vehicle manufacturers need overseas suppliers' expertise on the project. As explained above, most local suppliers act as manufacturing arms to local vehicle manufacturers and therefore they become involved after the design has been frozen. It is clear from the findings that local suppliers are not involved in the product development process or in the process co-development. In contrast, overseas suppliers seem to be involved in the product co-development process; but there is no evidence of overseas suppliers' involvement in process co-development as the manufacturing process usually occurs entirely within the supplier and is largely within its own control.

To understand further the current co-development practices in the Malaysian automotive industry, Kamath & Liker's (1994) model of supplier roles in product development can be used to describe the role of suppliers within Malaysia. Their model is summarised in Table 30 below.

Table 30: Four supplier roles, Kamath & Liker (1994)

Role	Description	Responsibilities during product development
Partner (full service provider)	Relationship between equals; supplier has technology, size, and global reach	Entire subsystem. Supplier act as an arm of the customer and participates from the pre-concept stage
Mature (full system supplier)	Customer has superior position; supplier takes major responsibility with close customer guide	Customer assembly. Customer provides specifications. Supplier may suggest alternatives
Child	Customer calls the shots and supplier responds to meet the demands	Simple assembly. Customer specifies design requirements and supplier executes it
Contractual	Supplier is used as an extension of customer's manufacturing capability	Commodity or standard part. Customer gives detailed blueprints

Overseas suppliers are categorised as a 'partner' type of supplier to vehicle manufacturers, as they have technological capability and expertise. According to Kamath & Liker (1994), this type of supplier is superior to the customer (in their specific technological area), and they can therefore suggest solutions regarding customer performance and activities. The suppliers in this group were involved at the early stage, and intensive communication occurred throughout the cycle. All the criteria mentioned in Kamath & Liker's (1994) partner supplier role match the situation with overseas suppliers within the Malaysian automotive industry.

In contrast, local suppliers within the Malaysian automotive industry play a role that falls between 'child' and 'contractual'. Suppliers under the child role have less influence on design, as the customer provides the detailed specifications, whilst they have to build and test the prototypes. Some local Malaysian suppliers are categorised as playing this role. Vehicle manufacturers monitor these suppliers closely, as the product complexity is often higher than for those suppliers who take a contractual role.

The contractual type of supplier simply manufactures parts designed by the customer. They may have unique manufacturing capabilities, such as large-scale flexible automation and communication, which is less extensive than for other supplier roles. Normally, contractual role suppliers have long-term relationships with their customers (Kamath & Liker, 1994). As the research suggests, local Malaysian suppliers have no design capability, have long relationships with vehicle manufacturer, and can offer good manufacturing capability, and so most of them fall into this role. In fact, local suppliers in this role enjoy much freedom to manufacture the product without close monitoring from vehicle manufacturers.

## **6.5 Chapter Summary**

In this chapter, the data gathered from interviews were analysed. The analysed results suggested 13 key findings concerning the co-development practices found within the Malaysian automotive industry. The findings were then confirmed and modified through expert triangulation. The experts added four main points, which had not been mentioned by respondents during the interviews. Finally, the findings were validated against the literature. The lists of findings are summarised in Table 31 below.



Findings	Expert Triangulation	Literature
Good relationships with vehicle manufacturer influence the selection process	Political background greatly influences selection process	Adds trust as a concept
Long-term relationship with local suppliers	The automotive industry within Malaysia is not as large as that of Japan or the US.; manufacturers and suppliers know each other quite well	Long relationship might be a factor in supplier selection
Tendering process for local suppliers and direct appointment for overseas suppliers	Formal process of selecting local suppliers not necessarily followed by vehicle manufacturers; political influence	Competitive bidding on less complicated products
Criteria of selecting local suppliers: good track records, good relationship, and trust	Political background greatly influences selection process	Suppliers with proven track record should be involved. Good product and process knowledge
Overseas suppliers involved at the early stage of product development due to their technical capability	Vehicle manufacturers need overseas suppliers' knowledge on the product	Early involvement for high technological product
Local suppliers not involved in design process at all, therefore, are invited at request for quotation stage.	Local suppliers have no design capability	Suppliers with limited expertise should be involved less and later in the process.
Local suppliers could influence vehicle manufacturers on the method of manufacture	Local suppliers are good at manufacturing the product	Suppliers are effectively treated as a source of manufacturing capacity
Overseas suppliers could influence vehicle manufacturer; on product performance and shape	Local vehicle manufacturers lack expertise on the product	Japanese suppliers of highly uncertain products have significantly more influence on early design decisions

Local suppliers have good manufacturing capability	Local suppliers have very competitive product prices	Contractual role suppliers
Local suppliers of less complicated parts have less monitoring by vehicle manufacturers; freedom to manufacture	Local vehicle manufacturers not strict with problematic local suppliers	
Informal communication is more frequent than formal communication between vehicle manufacturers and overseas suppliers	Informal communication takes place more frequently compared to formal communication	For highly uncertain tasks, rich communication media (e.g., face-to-face) are more effective
Local suppliers are satisfied with current co-development practices within Malaysia	Local suppliers are very comfortable with current practices, they do not want to change	
Local vehicle manufacturer use design consultants to help them design new car.	Local VM use design consultants to overcome the design constraints	

Table 31: List of findings versus expert triangulation versus literature

## Chapter 7

### Discussion

- Discussion of the findings from previous chapter
- Identification of the underpinning issues of current situations
- Suggestions for improvement

Analysis model

Suggestions





## 7 Discussion

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### 7.1 Introduction

The findings from Chapter 6 are discussed in this chapter. The first section in this chapter shows how the model of Malaysian co-development practices was built, based on the outcomes of Chapter 6. The model was built to describe the current co-development within Malaysia.

The second section provides a discussion about what underpins the current situation of co-development within Malaysia. This includes the historical background of the Malaysian automotive industry, the impact of Government policy, and the attitude of both vehicle manufacturers and suppliers towards the industry.

Based on the discussion from Section 2, the model, showing the strengths and weaknesses of Malaysian co-development, was built. The model provides a summary of the current situation of the automotive industry within Malaysia. The negative and positive factors in the model clearly show the factors that need to be improved.

The suggestions of how to overcome the weaknesses and the factors that need attention are discussed in the last section of this chapter. The recommendations for improvement are from the vehicle manufacturers' and suppliers' perspectives, and the perspectives of Government policy and academia.

### 7.2 Integrating the Findings into the Model

#### 7.2.1 Model Overview

The model was developed to describe the current co-development practices within Malaysia. There are four important elements included in the model:

vehicle manufacturer, local suppliers, overseas suppliers and suppliers' capability. Vehicle manufacturers in this model represent two Malaysian car manufacturers, whilst suppliers' groups are represented by the 'freedom to manufacture' and 'freedom to design and develop' types of supplier.

Two major factors needed to be considered when building the model. One was the vehicle manufacturers' criteria for supplier selection, that is, how suppliers are categorised by vehicle manufacturers. The local vehicle manufacturers clearly have different attitudes and approaches toward suppliers based on suppliers' capability. Thus, suppliers' technical capability is presented as one of the important elements in the model besides the vehicle manufacturers, and two types of suppliers. Figure 23 below shows the model overview.

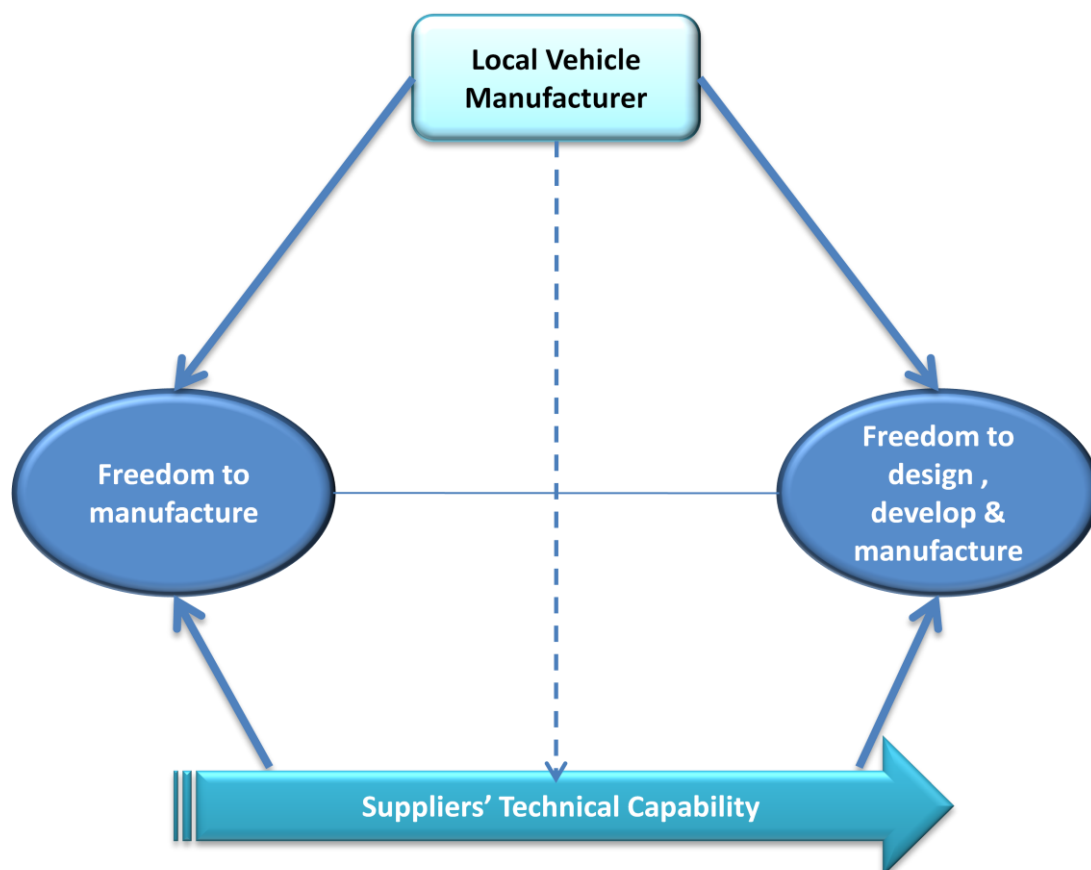


Figure 23: Overview of Malaysian co-development model

The findings clearly suggested that suppliers with high technological capability have more freedom in terms of the design and development process. In contrast, suppliers with good manufacturing capability enjoy the freedom to manufacture the product without much interference from their customers, as long they can deliver the product. However, there is a small group of local suppliers that do not have very good technical capability, and that produce complicated parts, but are not involved in the design and development process. This type of supplier is monitored closely by the vehicle manufacturers.

The second factor that needed to be considered when building the model was the vehicle manufacturers' attitudes and approaches toward the suppliers. The model is divided by two different approaches, as described in the findings. The suppliers with good manufacturing capability and who enjoy the freedom to manufacture the product are labelled 'freedom to manufacture', whilst the suppliers with design, development and manufacturing capabilities are labelled 'freedom to design, develop and manufacture'. The small group of local suppliers that have good technical capability, but which are not involved in the design and development, fall between the two respective labels.

### ***7.2.2 Freedom to Manufacture versus Freedom to Design and Develop***

#### ***Freedom to Manufacture***

The 'freedom to manufacture' type of supplier refers to those suppliers that are good at manufacturing the products. 'Freedom to manufacture' defines the suppliers that have been given the right to manufacture the product with minimal interference from the vehicle manufacturers. As described in Chapter 6, the findings suggested that local suppliers have very good manufacturing facilities and capabilities. The experts in the triangulation process added that

local suppliers have very competitive product prices compared to other low-cost countries, such as China and India.

The findings also suggested that local suppliers with less complicated products are monitored less by the local vehicle manufacturers. The vehicle manufacturers do not monitor them regularly, as long they can deliver the products without major problems. PROTON, for example, monitors the new and problematic suppliers only (Abdullah *et al.*, 2008). The vehicle manufacturers also seem not to bother about how the suppliers manufacture the parts. As they are not closely monitored by the vehicle manufacturers and they enjoy freedom in the manufacture of the product, they are put under the 'freedom to manufacture' type of supplier.

### ***Manufacturing Capability***

In the model, manufacturing capability is defined for suppliers who have good facilities and expertise concerning manufacturing the product but lack any design and development capability. The vehicle manufacturers use them as manufacturing arms. Most of the local suppliers with good manufacturing capability have good manufacturing facilities with full- or semi-automated production lines.

### ***Freedom to Design, Develop and Manufacture***

The 'freedom to design, develop and manufacture' type of supplier is defined in the model as those suppliers with high technical capability. In the case of Malaysia, this type of supplier comes mainly from overseas, and has established the company by joint venture or factory transplant within Malaysia. The vehicle manufacturers normally have limited expertise about how the product is designed, developed and manufactured by this type of supplier;

therefore, this type of supplier is given the right to design, develop and manufacture the product in accordance with the vehicle manufacturers' requirements. The findings suggested that this type of supplier enjoys the freedom to design and develop the product without much interference from vehicle manufacturers. Thus, in this model, the suppliers with high technological capability are labelled 'freedom to design, develop and manufacture'.

### ***Design, Develop and Manufacturing Capability***

In contrast with the suppliers with good manufacturing capability, the suppliers under the 'freedom to design, develop and manufacture' label have a complete package of technical capability. They have design and development capability with research and development facilities within either Malaysia or their parent company. Most of them manufacture complicated or high technological parts and have no competitors within Malaysia.

### ***The Selection Criteria***

Based on the findings in Chapter 6, the criteria of the selection of the 'freedom to manufacturer' type of supplier are based on reputation, which includes previous track record, trust, good relationship, and production capacity. This is similar to the study carried out by Abdullah *et al.* (2008), which indicated that the criteria of selecting suppliers by PROTON were based on supplier performance in terms of management, financial and technical capability, quality, delivery and host. However, as the study by Abdullah *et al.* (2008) considers the formal process of selection, the informal relationship developed between both parties, which influence the selection process found in this study, is new. Therefore, in this research, the findings also suggested that good relationships with the management staff of both parties seem to have a great influence on the

selection process. This was also mentioned by one of the experts consulted during the triangulation process.

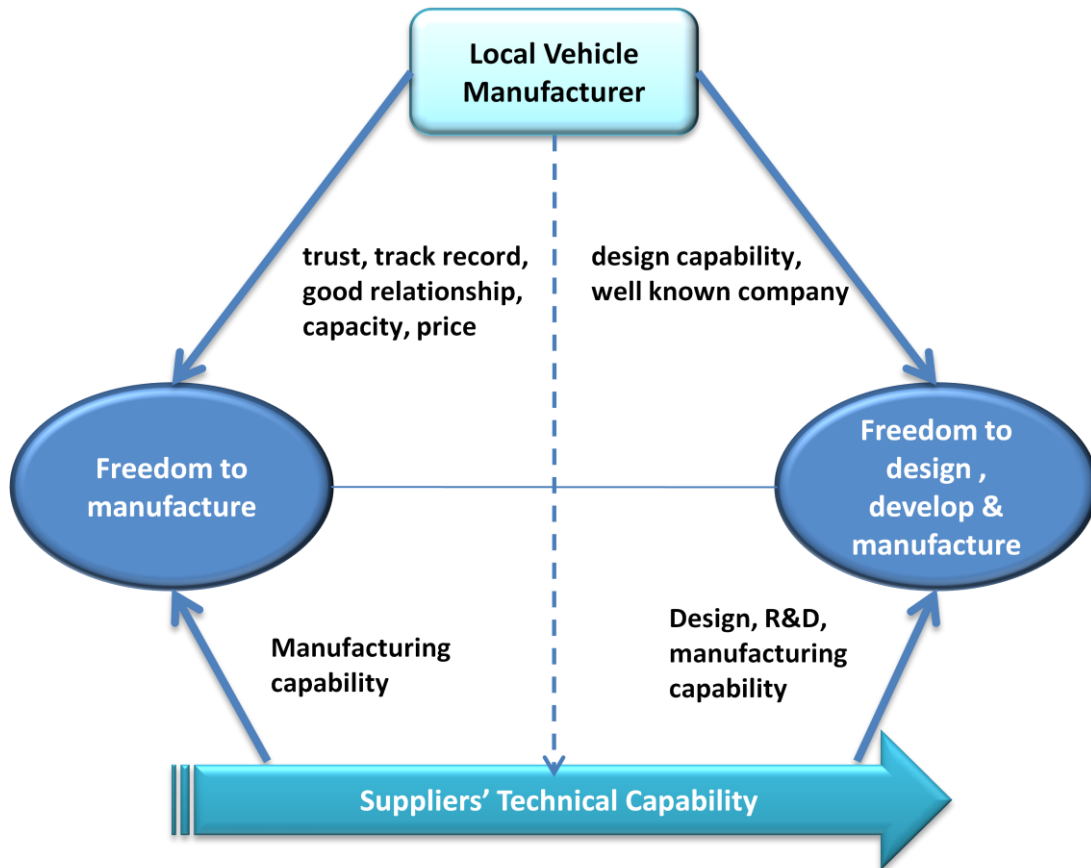


Figure 24: Selection criteria of both type of supplier

The criteria of selecting the suppliers under the freedom to design, develop and manufacture group are based on technical capability, as described in the findings. As most suppliers have no competitors within Malaysia, the vehicle manufacturers have no broad choice of suppliers. Therefore, most of the suppliers in this group are well-known suppliers who have factories within Malaysia.

The summary of the selection criteria for both freedom to manufacture and freedom to design, develop and manufacture groups is shown in Figure 24 above.

### ***Suppliers' Characteristics***

The findings suggested that suppliers that belong to the 'freedom to manufacture' group are mostly the make-to-print type of supplier. The local suppliers in this group are not involved in the design process at all; they receive detailed drawings and specifications from vehicle manufacturers, and manufacture the product according to the specification provided by vehicle manufacturers. Most of these suppliers have very good manufacturing facilities and capability; however, they have limited capability when designing the product. These types of local suppliers produce less complicated parts and some of them supply commodity parts to vehicle manufacturers. They also admitted that they do not go further than manufacturing the product, that is, they are not involved in design or development. Therefore, on the model, this type of supplier is positioned at the low side of the suppliers' technical capability.

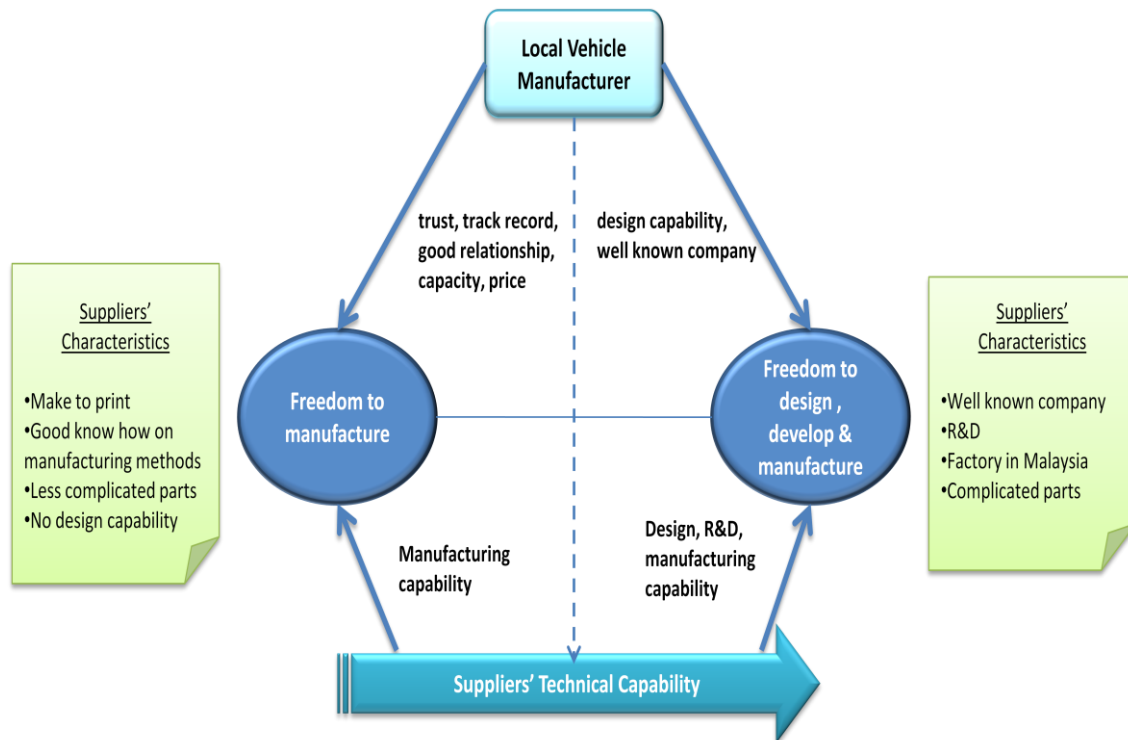


Figure 25: Suppliers' characteristics of both group of suppliers

From the findings, it can be seen that the suppliers belonging to the 'freedom to design, develop and manufacture' group have good technical capability; the vehicle manufacturers need only to outline the product specifications for the suppliers to design and develop the product. Most of the suppliers in this group are well-known globally, and have factories within Malaysia. Figure 25 above summarises the characteristics of both types of supplier.

### ***Vehicle Manufacturers' Attitudes toward Suppliers***

The vehicle manufacturers' attitudes toward the 'freedom to manufacture' type of supplier are also typical. As described in the findings, vehicle manufacturers use a formal process of selection—competitive bidding—to select suppliers. The local suppliers have to compete with each other in order to win the contract. However, the findings also suggested that this formal process of selection is not



necessarily consistent, as the selection process could be influenced by the political background and long relationship. Figure 26 below shows the summary.

As the suppliers in this group do not have design capability, they are invited by vehicle manufacturers to participate in the process after the request for quotation takes place. Therefore, they are not involved early on in the product development process.

The uniqueness of this type of supplier is that they could influence the vehicle manufacturers on the manufacturing methods, as they have good expertise in the manufacturing process, as suggested in the findings.

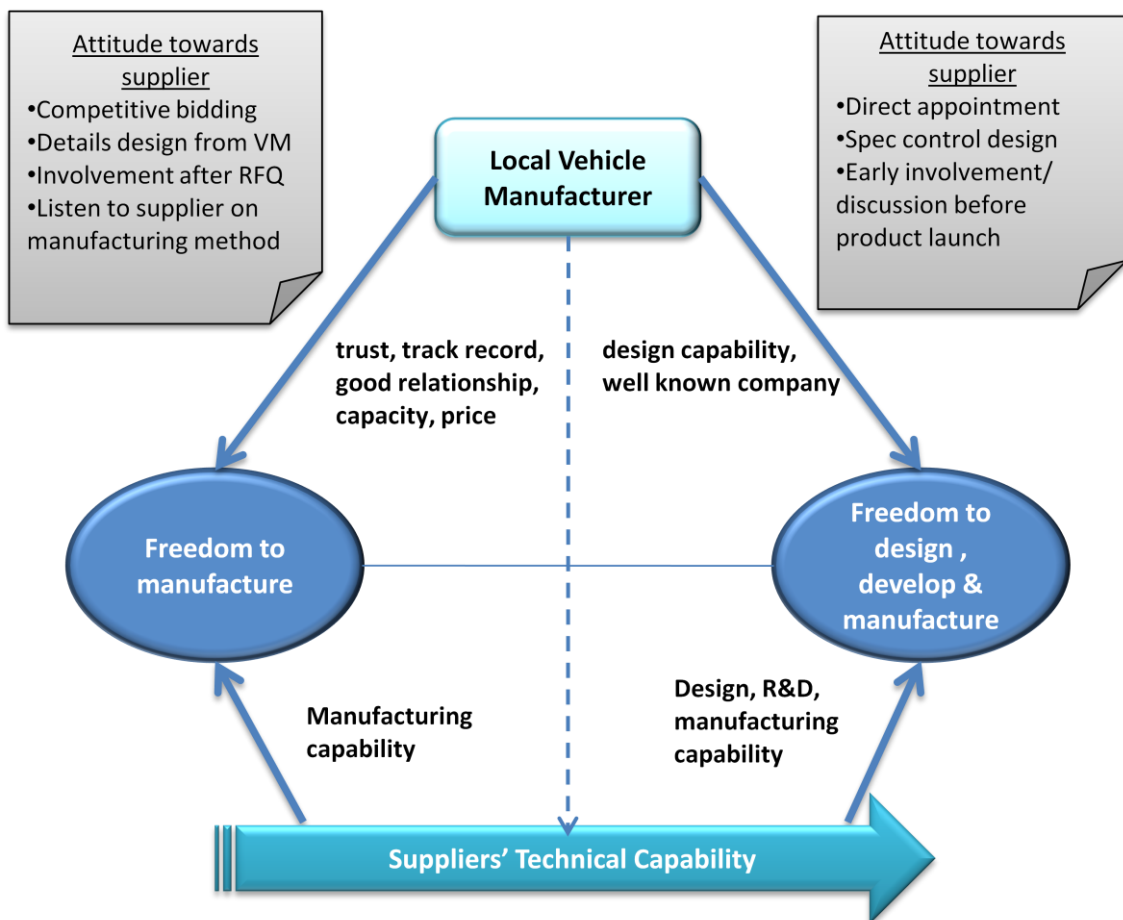


Figure 26: Local vehicle manufacturers' attitudes toward both types of suppliers

The vehicle manufacturers' attitudes toward the 'freedom to design, develop and manufacture' type of supplier is totally different when compared with their attitude towards the 'freedom to manufacturer' group of suppliers. The findings suggested that most suppliers within this group are directly appointed by vehicle manufacturers without having to undergo the tendering process. The negotiation is based on price, not technology. As the vehicle manufacturers need their expertise, the suppliers in this group are accordingly involved in the early stages of the product development process.

### ***7.2.3 Model of Co-development Practices within Malaysia***

Figure 27 shows the complete model of co-development within the Malaysian automotive industry. As indicated above, local suppliers have good manufacturing capability with less monitoring from the local vehicle manufacturers. Therefore, local suppliers are positioned with freedom to manufacture the product. In contrast, most overseas suppliers belong to freedom to design, develop and manufacture the product because of their technical capability. Based on the model, a gap between most local suppliers and some local suppliers with good technological capability arises, as some local suppliers within Malaysia (e.g., MSP-5) have very good fully automated manufacturing capability and produce complicated parts compared to most local suppliers. This type of supplier invests in manufacturing facilities and supplies other overseas vehicle manufacturers based within Malaysia and the corresponding region. They are optimistic about their business, and often update their manufacturing capability. The approach towards them by vehicle manufacturers is mixed between local suppliers and overseas suppliers. MSP-5, for example, on a recent project was directly appointed by local vehicle manufacturers without having to undergo a tendering process, which is a common practice for local suppliers. However, they do not go further than manufacturing the product, as they are satisfied with having the detailed design from vehicle manufacturers. Therefore, in terms of the model, they are

positioned between local suppliers with good manufacturing capability and overseas suppliers with good technological capability.

It is clear from the findings that political background plays a significant role in the selection of local suppliers. The good relationships between local vehicle manufacturers and suppliers influence the selection and involvement of suppliers in the co-development process. On the other hand, overseas suppliers are selected based on their technical capability rather than on there being a good relationship between their staffs. Design, develop and manufacturing capabilities are the main criteria for involving overseas suppliers in the product development process.

These findings are unique to the Malaysian automotive sector, as this is the only high technological industry protected by the government. Other industries, such as electronics, chemicals or the pharmaceutical sector, come from direct investment by overseas companies and the development of new products normally occurs at their parent firms. Therefore, the automotive industry was chosen as the focus of this research rather than any other industry.

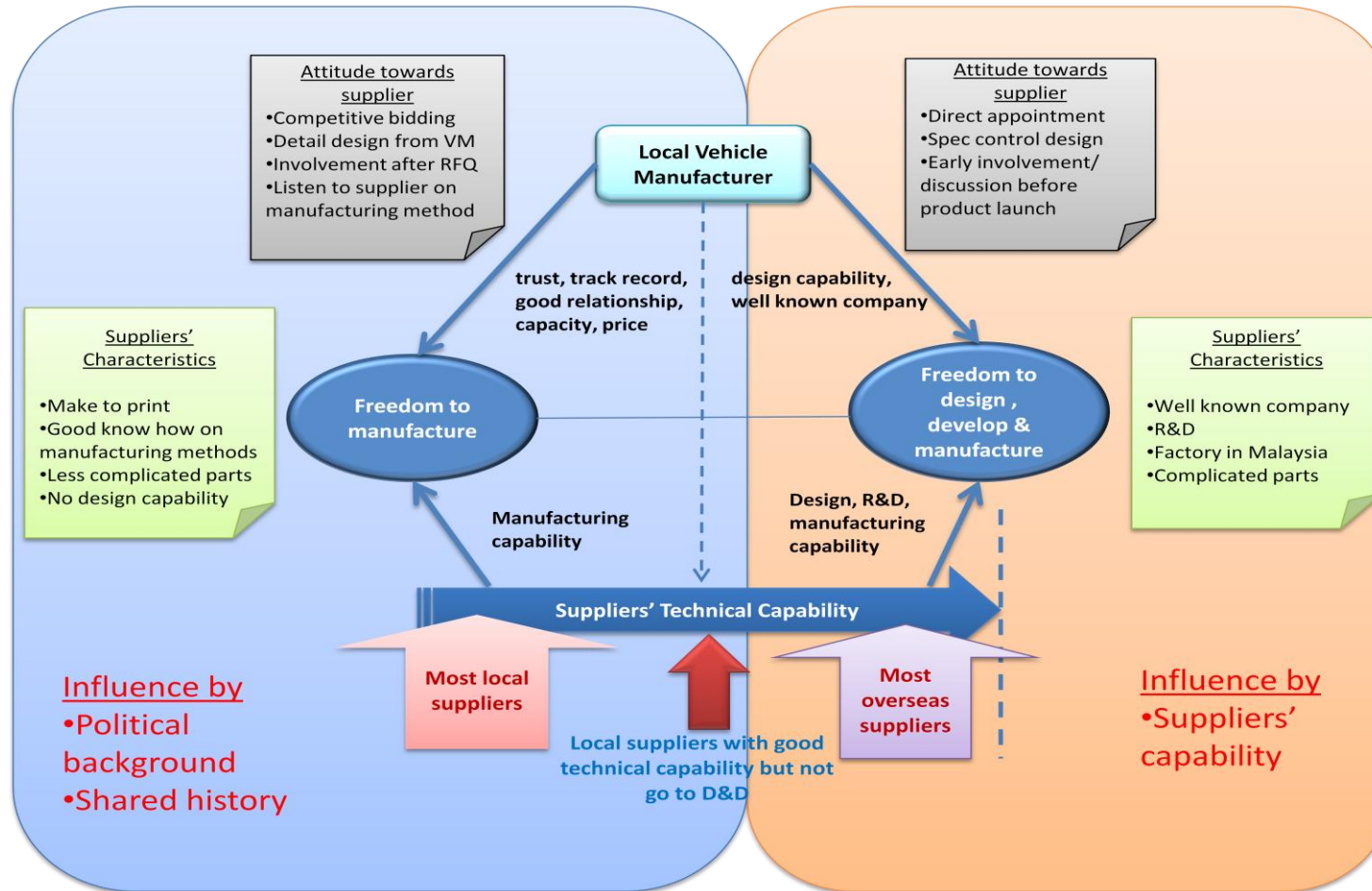


Figure 27: Malaysian co-development model

### **7.3 The Underpinning Issues of the Situation**

This section describes the background to this co-development research within the Malaysian auto sector. It identifies key Government policies, and considers the history of vehicle and manufacturing companies within Malaysia. The section explains the effects of history in terms of shaping the model described in section 7.2.

As discussed above, the co-development practices within the Malaysian automotive industry can be divided into three groups of suppliers: the local suppliers with low technical capability but good manufacturing capability; the local suppliers with good technical and manufacturing capability, but which are not involved in the design and development of the product; and overseas suppliers with high technical and manufacturing capability, which design and develop the product according to the vehicle manufacturers' requirements. There are several issues identified within the Malaysian automotive industry that contribute significantly to these situations.

The first factor is the history of the establishment of the Malaysian automotive industry itself. As the industry is very young compared to those in other developed countries, such as Japan or the US, there are some issues or gaps that need to be tackled so as to overcome this situation. The Malaysian Government's policy towards the industry is also identified as one of the factors underpinning current practices. Other factors include vehicle manufacturers' attitudes toward suppliers, and the current atmosphere of the automotive industry, which resulted in the 'comfort zone' of local suppliers worsening the situation.

#### ***7.3.1 History of the Malaysian Automotive Industry***

As discussed in Chapter 2, the Malaysian automotive industry started quite late compared to those of other countries. With the exception of approximately 15

assembly plants in the early 1980s, the number of local automotive product makers was also low. However, the industry changed drastically after 1983, when the Government launched the national car project. As well as the national vehicle manufacturer at that time, PROTON, local suppliers also started their own production by copying Japanese parts makers, mainly Mitsubishi suppliers. Most of the local suppliers at that time established their companies by joint venture or technical assistance from overseas counterparts, especially Japan. Moreover, the local suppliers also hoped their foreign counterparts would transfer their knowledge to Malaysian suppliers. MSP-5 and MSP-6, for instance, clearly indicated in the interviews that, prior to the establishment of the national car industry; they worked with Japanese suppliers in order to develop their own capability. However, the knowledge transfer process was not very successful, and they ended up manufacturing the product without having the expertise or capability in terms of product design, in contrast to the government's aim. Therefore, some local suppliers, such as MSP-5 and MSP-6, cut their relationships with their overseas counterparts, and asked for help only when it was needed; some local suppliers are still buying parts and machinery from their overseas counterparts.

The history of the automotive industry within Malaysia has contributed to the current situation within Malaysia. The local suppliers were too dependent on their overseas counterparts in terms of developing their own capabilities. As overseas suppliers do not easily share their expertise or are otherwise not 100 per cent committed to knowledge transfer, local suppliers have to struggle in order to gain as much knowledge as they can from their overseas counterparts. Furthermore, local suppliers are also dependent on foreign technology, and have not significantly upgraded their technical capability (Farrell & Findlay, 2001). As a result, local suppliers end up buying manufacturing facilities from overseas and producing parts according to the drawings and specifications given by their suppliers. This has been the case since the establishment of their company, and the local suppliers have become comfortable with this situation; therefore, they are reluctant to change or go further than designing the product.

The findings in Chapter 6 also suggested that a long relationship is one of the criteria local vehicle manufacturers have for selecting suppliers. As most of the local suppliers were established with the establishment of the national car projects, PROTON and PERODUA, the relationship between them is quite long-standing. At the time of establishment, there were small numbers of automotive part-makers within Malaysia. Apart from manufacturing the Malaysian own-brand car, the national car projects also aimed to develop the local automotive part-makers. The staffs involved in the national car project have also had to learn how to develop and help the Malaysian people to be more involved in the industry. Under the Vendor Development Programme, which was launched in 1988 to help newly establish local suppliers, PROTON and PERODUA have the obligation to buy from local suppliers. PROTON, PERODUA and local suppliers, with the help of the Government, support each other to enable the automotive industry within Malaysia to flourish. This special relationship has developed year by year, making both local suppliers and local vehicle manufacturers compatible and dependent upon each other. In conclusion, local suppliers concentrate only on local vehicle manufacturers as their market. This finding supported that of Abdullah *et al.* (2008), which stated that 90 per cent of their study respondents depend on about 90-100 per cent on the annual sales to PROTON.

### ***Effects of the Malaysian Automotive Industry History***

Drastic changes to the automotive industry in 1983 resulted from the announcement of the National Car Project; this has not helped local people cope with the technology in the industry. Most of the history in the automotive industry in the world starts from zero and gradually develops over time. This enables people to understand the basic principles or technology of the industry. As Oliver *et al.* (2008) argued, when companies grow organically, they gradually develop the capabilities necessary for managing projects of enormous scale and complexity.

The National Car Projects within Malaysia were a shortcut to building cars. Most local suppliers who involve themselves in the industry have no basic knowledge and depend totally on overseas expertise by joint-venture and technical assistance. The knowledge transfer process is as expected, and burdens the supplier's technical capability.

The effects of the way in which the Malaysian automotive industry was established have been a major influence on the current situation within Malaysia. In conclusion, the history of the Malaysian automotive industry has contributed significantly to various elements: 1) A lack of suppliers' technological capability as the knowledge transfer from overseas companies was not very successful. Most of the local suppliers have no experience or start from zero in the industry; 2) Long relationships developed between local vehicle manufacturers and suppliers bind them together, and it seems that local vehicle manufacturers have an obligation to select local suppliers. This makes local suppliers comfortable and reluctant to change; and 3) Local suppliers feel that they are in the safe zone, without having to worry about competition from overseas suppliers; this explains why local suppliers lack competitiveness compared with overseas parts makers. Essentially, the findings are similar to the study results of Rosli & Kari (2008), who found that local suppliers still lack design capability, manufacturing, engineering and skilled manpower. According to the independent audit in 2004/2005, as cited by Wad (2009), out of 185 local suppliers, only 4 were graded A by German standards, whilst the rest were graded A/B (13), B (134) and C (34), which is below global standards.

This reflects the research findings that suggest local suppliers have limited design capability but are good at manufacturing the product, and are therefore able to influence the local vehicle manufacturers in terms of the method of manufacturing the product. The long relationship between the local vehicle manufacturers and their suppliers since the establishment of both companies clearly influences the selection process, although there is a formal tendering process for selecting suppliers.



### **7.3.2 The Government Policy towards the Automotive Industry**

Not only is the history of the Malaysian automotive industry of significance to the current state of the industry; the Government policy towards the industry has also been found to be one of the factors underpinning the current situation. In order to protect and nurture the newly established industry, the Malaysian Government introduced several policies in order to protect the automotive industry. The policies have been adopted and revised year by year in order to help the national car companies and local automotive part-makers survive in the industry.

#### ***The Impact of the Government Policy***

There is no doubt that the protection policy introduced by the Government benefits local vehicle manufacturers in terms of growth in the industry. The protection policy also helps the Malaysian Government to nurture and control the industry without the interference from overseas competitors. The success of the national car projects has also accelerated the development of the local part suppliers. The high profit acquired in the industry helps national car manufactures and local suppliers to spend more in relation to high technology manufacturing facility, to enhance product quality, and to ensure that research and development take place. PROTON, for example, established their new modern high technology plant in Tanjung Malim, Perak, in order to cope with the demand and with the aim of producing better quality cars. MSP-5 and MSP-3 expanded their market to ASEAN by establishing a new plant in Thailand, which goes some way to explaining why local suppliers have very good manufacturing capability, as suggested in Chapter 6.

However, it can be argued that the protection policy also has a negative impact upon the industry itself. Restricting the players in the industry leads to a lack of competition; this will decrease the competitiveness of the industry. The national car projects also suffer from criticism regarding the quality of the cars they

produce. As the protection policy gives national cars huge advantages in terms of price, the Malaysian people have little choice but to buy the national cars. The domination of the car market within Malaysia by the national cars makes the manufacturers feel safe and comfortable. The quality levels, which are not internationally competitive, may be due to this lack of competitiveness in the industry.

Under the Government policy of the Vendor Development Programme (VDP), the local vehicle manufacturers have to guarantee to use local suppliers. As there are a limited number of local suppliers, most of the suppliers compete with each other for projects. In order to follow the requirements, local vehicle manufacturers sometimes have to divide the project between several suppliers. Therefore, the local suppliers have no fear of losing the contract. This was indicated in the interview with MSP-6, which was very confident that MVM-1 would give them the project despite their having to compete with other local suppliers. This situation makes local suppliers feel comfortable, and they are always confident that they will get the business.

The Malaysian Government has clearly helped to create economic success and jobs through the policies supporting a new local automotive industry. However, this strategy may not be best suited to the next stages of the development of the Malaysian automotive sector. It is clear that the policy goals have now changed so as to include an increased emphasis on bringing technology expertise to Malaysian vehicle manufacturers and suppliers, but the policy mechanisms appear to reflect older goals particularly.

The Government policy is felt to influence the findings discussed in Chapter 6 that suggest that local suppliers feel comfortable as 'local manufacturers', and accordingly do not fear losing the business. Such companies have access to support mechanisms, which help them to develop their technological capabilities; however, ultimately, they appear to be less interested in making this change.

## **7.4 Local Vehicle Manufacturers' Attitudes and how these Shape the Sector**

The local vehicle manufacturers' attitudes toward the industry and suppliers also contribute to the current situation of the Malaysian automotive industry. This was studied in detail during the research, and is discussed in the model above.

As indicated by the experts in Chapter 6, local vehicle manufacturers are not very strict in their relationship with their suppliers. According to EXP-1, local vehicle manufacturers do not penalize suppliers when they break the contracts or regularly produce defective products. In fact, some of these suppliers are selected again for different projects. This kind of attitude towards suppliers clearly does not encourage suppliers to improve their capabilities. In addition, the suppliers will feel very comfortable and have no fear of losing the business, as they are guaranteed to get the next contract. Local suppliers then feel that they do not need to invest to increase their capability, as they think the local vehicle manufacturers are satisfied with their current performance. In the end, local suppliers remain with their current status, with a lack of competitiveness and continuously producing defective or low-quality products. However, the interview with one of the local vehicle manufacturers—MVM-1—clearly indicated that they urge their suppliers to become more competitive and to improve technical capability. The local vehicle manufacturer attitudes toward suppliers are completely in contrast with what they would like local suppliers to be.

The use of design consultants to overcome the design constraints suffered by local vehicle manufacturers has had many impacts, with some suppliers accepting a passive role because they can rely on external experts rather than investing in their own. According to MVM-1, they have to use design consultants to design their new car projects in order to shorten the lead time. They successfully shortened the new car project lead time to 18 months compared to

36 months on the previous project using local design capabilities, including in-house research, the development team, and local suppliers. The use of design consultants has become important to the local vehicle manufacturers, which are striving to compete with other assemblers in ASEAN, especially after the realisation of AFTA. With limited resources in terms of local vehicle manufacturers and suppliers, the use of design consultants is crucial for local vehicle manufacturers. In the short-term, using a design consultant enables local vehicle manufacturers to produce various models of a vehicle, and allows them to compete with overseas brand cars. This also helps them to remain up-to-date with technology and accordingly to shorten the process to bring the technology back to their side. However, in the long run, the use of design consultants will not help local vehicle manufacturers and local suppliers to improve their capability; rather, they will remain with limited capability and expertise, and have to depend upon design consultants every time they want to build a new car. Furthermore, the use of design consultants seems to send the wrong signal to local suppliers: as the local suppliers are not involved in the design and are totally dependent on their customers to provide the detailed drawings and specifications, they feel that they do not need to go further than manufacturing the product. The interview with the local suppliers showed this misunderstanding. The statements from respondents of local suppliers in the interview, as analysed in Chapter 6, clearly indicated that they are happy to receive detailed drawings from their customers, and do not think they should make the effort to invest in design capability.

In addition, in his study on the development of automotive parts suppliers in Korea and Malaysia, Wad (2008) used the Global Value Chain perspective, and stated that PROTON does not have the capability to upgrade Malaysian suppliers, as it is struggling with its own problems. The Malaysian vehicle manufacturers also highlighted a lack of capability in terms of upgrading to export markets. As a result, local suppliers are left alone and marginalised from the global value chain.

## **7.5 Local Suppliers' Attitudes**

The suppliers' mind-set towards the automotive industry also underpins the current practices of co-development within Malaysia. The main problem with the Malaysian automotive parts suppliers at the moment is due to the lack of technical capability and competitiveness compared with overseas suppliers.

The findings in Chapter 6 suggested that local suppliers are very comfortable with the current situation, as they are happy to receive detailed drawings and manufacture the product according to the specifications provided by their customers. They also do not fear losing business to other suppliers, as most of them are confident that the local vehicle manufacturers will give them the contract. Those local suppliers feel comfortable and safe with the current situation is due to not feeling any threat from other suppliers, and the customers are not very strict with them, as explained in 7.3.3.

Moreover, local suppliers also do not fear the realisation of the free trade area, in particular AFTA. Under the AFTA agreement, for instance, products manufactured within the region could enter any ASEAN country without tax barriers; this will give overseas parts makers who have plants within the region the opportunity to compete with the local suppliers. From the interviews, when asked about whether or not local suppliers are ready in terms of AFTA, many of them seemed confident that they would survive, as they have good relationships with local vehicle manufacturers. It seems that they are confident that the Government will not easily allow overseas suppliers into the market. The Government, however, urges local suppliers to be ready for AFTA.

Local suppliers feel comfortable and safe, since the establishment of the company is becoming part of their culture and practices; they have no idea of the competition or why they would need to go further, as they feel the local vehicle manufacturers are happy with the current practices.

## **7.6 The Strengths and Weaknesses of the Malaysian Automotive Industry**

From the information gathered through the use of interviews, analyses, validation, the literature review and discussion, a model was developed that shows the strengths and weaknesses of the Malaysian automotive industry. There are three key elements within the model. The hexagon describes the internal capability of local vehicle manufacturers and suppliers, and the text outside the hexagon describes the information gathered from interviews, literature review and the experts' validation. The green hexagons represent the suppliers' strengths, the yellow hexagons show the opportunity to explore, and the red hexagon shows the weaknesses of both local suppliers and vehicle manufacturers. The model is adapted from the PRIMO-F model by RapidBI ([www.rapidbi.com](http://www.rapidbi.com)), the business improvement consultant. The PRIMO-F model provides a summary of P for people, R for resources, I for innovation, M for marketing, O for operation and F for finance. This model is used by RapidBI to assess the effectiveness with which a company is using its resources in order to achieve improved business and organisational success. An overview of the strength and weakness of Malaysian automotive industry is shown in Figure 28.



Figure 28: The strengths and weaknesses of the Malaysian automotive industry

### ***7.6.1 The Strengths of the Malaysian Automotive Industry***

The model shows two strengths of the Malaysian automotive industry, as represented by the green hexagons. The strong financial support from the Government and the good manufacturing capability are elements indicated as advantages for the Malaysian automotive players.

Since the start of the National Car Project, the Government has spent huge amounts of money on supporting the growth of the automotive industry. The Government provides grants and loans, and further promotes local suppliers and vehicle manufacturers to the global market. Under the National Automotive Policy (NAP), announced in 2006, the Government again announced the

financial support for the automotive players within Malaysia (Malaysian Ministry of International Trade and Industry, 2006). Besides the financial support, the Government also helps local suppliers and vehicle manufacturers to find technical assistance from global players. The Government also makes more funds available for research and development, and this is based on the viability and economic contribution of the research development project.

There is no doubt that local suppliers have good manufacturing capability. This issue was raised several times during the interview and the experts' validation process. In fact, the experts agreed that local suppliers offer very competitive prices compared to Chinese or Indian suppliers. Without competition from overseas suppliers and considering the Government protection policy, local suppliers enjoy good profits, as has been the case since the establishment of the company. As they do not invest in research and development or on expanding to the overseas market, most local suppliers use their money to improve the manufacturing facilities. Therefore, local suppliers have a good advantage on the operation side.

### ***7.6.2 The Weaknesses of the Malaysian Automotive Industry***

The weakness within the Malaysian automotive industry is the lack of innovation, represented in the red coloured hexagon. The lack of research, development facilities and skilled workers, combined with the local suppliers' attitudes of not investing in innovation underpins this situation. According to the expert, EXP-1, they have tried promoting design and development to the local suppliers by providing training programmes and advice; however, the training leads to no further action from suppliers.

On the vehicle manufacturers' side, the lack of skilled workers is the main constraint on their research and development activities. In the interview, MVM-1 respondents indicated that they have only around 300 research and development engineers in the company compared to the design consultants



they hire in Korea, who have around 200 automotive designers for one department, for example, the power train department. Therefore, they prefer to hire design consultants to shorten the lead-time and so overcome the design constraints.

### **7.6.3 The Opportunity to Improve**

The yellow hexagon shows the opportunity for local suppliers and vehicle manufacturers to explore further. Both of them could improve their capability by investing in people and resources and expanding into the overseas market.

The lack of skilled workers in the automotive industry within Malaysia comes from the culture of employment in the country itself. One supplier stated that local people are always looking for higher salaries, are not loyal to the company, and keep changing employers. Therefore, it is difficult for both local suppliers and vehicle manufacturers to train and educate local people. MSP-3, for example, stated that the company sometimes wastes money sending staff overseas, as they then leave the company looking for a higher salary. However, this problem could be minimised if local suppliers were to work with each other closely and exchange expatriates between companies. On the other hand, in the interview, EXP-1 said that they provide training for local people on automotive product design and other courses related to the industry.

### **7.6.4 The Advantages and Disadvantages of Local Suppliers**

In addition, the black text outside the hexagon in Figure 29 below shows the advantages in the industry; the blue text show the opinions voiced by local vehicle manufacturers regarding why local automotive players are not competitive enough; and the red text show the reasons why local suppliers are not considering design and development.



Figure 29: The constraints of local suppliers of not growing internationally

***The Black Text: advantage to both local vehicle manufacturers and suppliers***

The black text on the model shows that there is sufficient financial support within the Malaysian automotive industry from the Government. The Government also provides strong financial support, as explained above. Besides Government support, the long-term protection policy by the Government helps local suppliers and vehicle manufacturers to grow rapidly and without interference. As a result, they enjoy high profits in their businesses, and have built up a strong financial base.

***The Blue Text: Local vehicle manufacturers' thoughts about local suppliers' competitiveness***

According to the local vehicle manufacturers, the constraints to local suppliers' competitiveness include their not being involved in research and development, but waiting for everything from the vehicle manufacturers. The suppliers do not take serious action to invest in research and development; in fact, most local suppliers have no research and development facility, which is the main reason why innovation cannot be active at a supplier level.

Furthermore, local vehicle manufacturers stated that they always urge local suppliers to expand into the overseas market, and not to depend totally on them to develop local suppliers' competitiveness. The report by FOURIN in 2002 indicates that, although Malaysia is the largest passenger car market in ASEAN with the largest number of part-makers in the region, the export volume for automotive parts is nevertheless very low; this shows that local suppliers are concentrating on the local market and on local vehicle manufacturers in particular. According to EXP-1, there are many opportunities for local suppliers to expand into the overseas market; however, local suppliers are simply not interested in expanding their business. This research suggests that this is not due to a lack of capability (many are excellent manufacturing suppliers), but rather due to their high level of comfort with the current situation.

***The Red Text: The reasons given by local suppliers to explain why they are not involved in design and development***

On the suppliers' side, they cannot go further in terms of design and development due to political issues; resources, that is, a lack of skilled workers, tool makers, and training; and the limited capacity or volume of production.

The suppliers personally believe that, in order to get business within Malaysia, they have to have a good relationship with the management staff of the local vehicle manufacturers. They feel that business decisions can be influenced by political background, something that was also mentioned by the expert EXP-1. Some suppliers get the project simply because of their relationship with the top management staff, not their capability. As a result, some local suppliers have to spend more time and money building the relationship rather than investing in design and development. Therefore, at the end, suppliers feel that political contact and relationship are more important than their capability.

The problem of limited resources was also mentioned as a reason why local suppliers do not compete internationally. Apart from the lack of skilled workers and limited research and development facilities, as mentioned above, the location of tool makers prevents suppliers from going further in terms of design. Most local suppliers have to go overseas to design and develop tools and dies, as there are very limited numbers of tool makers within Malaysia. Therefore, after receiving the detailed drawings from vehicle manufacturers, local suppliers have to go overseas to find suitable makers of dies; this consumes both time and money. As the tools will decide the production processes, design engineers from local suppliers and tool makers need to interact closely. Most local suppliers' tool designers are based in Taiwan or South Korea; the knowledge sharing between local suppliers and tool makers seems to be difficult. There are also issues of time and cost when the tool makers are far from the local suppliers. Furthermore, overseas tool-makers do not help local suppliers to learn and understand the tool-making process closely, as they act as suppliers to Malaysian automotive parts makers, not technical partners, and it is in the

tool-makers interest to keep their customers expertise low, so that they keep the work. This is in direct contrast to other country's practice – such as South Korea or Japan – where tool makers are kept physically close to improve knowledge sharing as well as lead time. Without local tool-making competence in Malaysia it may be very difficult for local suppliers to take on co-development roles with VMs.

The capacity and volume of production is also mentioned as a barrier for local suppliers to become involved in the design and development. As most of them work only with local vehicle manufacturers, the production volume is considerably low. Furthermore, according to Wad (2006), the local supplier industry seems to have a lack of capability in terms of Malaysia's national vehicle manufacturers undertaking the market upgrading into exporting. Local suppliers do not see any benefit in investing large amounts of money in design and development, as they are not making good profit. However, according to EXP-1, local suppliers could expand their capacity by expanding the business overseas. With good financial support from the government, EXP-1 cannot see why local suppliers concentrate only on the local market.

## **7.7 Implications and Suggestions**

### ***7.7.1 Local Vehicle Manufacturers***

In the interviews, local vehicle manufacturers indicated several points that needed improvement. As discussed above, some local vehicle manufacturers' attitudes toward suppliers have a negative impact on local suppliers' development. Firstly, the local vehicle manufacturers should be stricter with problematic suppliers; the contract should clearly indicate the action or penalty for local suppliers who breach the agreement. Furthermore, the lack of escalation mechanisms forcing suppliers to improve their long-term performance means that some suppliers maintain a quality level below that

which is normally acceptable. Moreover, the author believes that problematic suppliers should not be invited to tender for a subsequent project; this will help develop local suppliers' awareness of quality, cost and delivery, and reduce the feel safe factor of getting the business.

The political influence in the selection process should also be discarded by local vehicle manufacturers. They should go back to the formal process of examining suppliers' selection: track record, price and capability. Without this political influence in the decision-making process, local suppliers will be aware that they can get the business only if they have a good track record and capability. In other words, only appropriate suppliers will get the contract.

Local vehicle manufacturers' actions are also critical to changing suppliers' capabilities. Local vehicle manufacturers should start slowly to reduce their dependency on design consultants. Of course, it is nearly impossible for local vehicle manufacturers to design and develop all the parts within the appropriate lead times without support from local suppliers: for a start, local vehicle manufacturers should delegate the design responsibility for less complicated or non-functioning parts to local suppliers (remembering that the supplier is responsible for creating the design, but the vehicle manufacturer remains responsible for approving the design). This should develop the local suppliers' design capability before they become involved in more complicated parts. On the other hand, local suppliers should start investing in design facilities so as to cater for the local vehicle manufactures' requests.

The reason local suppliers feel very comfortable with the current situation is that they are confident that the local vehicle manufacturers will give them the business. They also feel that local vehicle manufacturers are happy with the current practices; however, as mentioned in 6.2.3, local vehicle manufacturers clearly urge local suppliers to become more competitive and to improve their technical capability. They are also not satisfied with the current local suppliers' technical capability. It seems that local suppliers are not receiving this message of dissatisfaction from local vehicle manufacturers; this miscommunication

needs to be resolved urgently in order for both parties to have a better understanding of each other's expectations. Moreover, local vehicle manufacturers should also have clear objectives of what they want from local suppliers.

### **7.7.2 Local Automotive Parts makers**

As discussed in 7.5, the awareness of local suppliers in terms of the opportunities and threats in globalisation—or, in particular, the ASEAN Free Trade Area (AFTA)—is very low. One of the reasons for this situation is the safe factor, as local suppliers have little fear of losing the business. In order to reduce this feel-safe factor and comfort zone, local suppliers should start involving themselves in the global market. They could start by expanding their businesses into regional areas of ASEAN, and by taking advantage of the realisation of AFTA by offering themselves as manufacturing suppliers. This would help local suppliers to develop their competitiveness and to compete with global automotive players. Notably, in the interviews, EXP-1 mentioned that local suppliers have a lot of opportunity in the overseas market, as they have good manufacturing facilities and competitive prices.

Besides developing competitiveness, expanding the business to overseas markets would help local suppliers to increase their production volume. As suggested by EXP-1, this could help local suppliers to raise their profit margin, and could have the secondary effect of increasing the availability of funds to invest in skilled workers, training, research and development, and related resources. Ultimately, local suppliers have very good manufacturing capability but, in order to compete globally, they should also start thinking about becoming intensively involved in design and research, and development processes.

Although not all local suppliers should be involved in product development activity, strengthening their technical capability would certainly help local vehicle manufacturers and the Malaysian automotive industry in general. In this

globalisation era, and especially after the realisation of Free Trade Area when government protection is no longer available, local suppliers must be able to compete with overseas suppliers. Local suppliers with less complicated product or standard parts who are currently not heavily involved in developing new products or in research and development activity should still seek to strengthen their technical capability by producing high quality product with competitive price in order to survive in this competitive industry. For a start, as suggested by one of the experts in the interview, local suppliers should expand their markets overseas and compete with overseas suppliers especially from low cost country such as South East Asia and China regions. In contrast, for local suppliers with high technological product, investment in research and development will certainly help them to develop technological capabilities and this enable local suppliers to work with vehicle manufacturers in developing new product.

As the natural rubber industry is one of Malaysia's leading sectors, and a key part of the vehicle supply chain, rubber-related-suppliers should take this opportunity to move up the value chain by investing in research and development. With 510 rubber-related manufacturers, Malaysia is the world's largest producer of natural rubber. Malaysia has unique knowledge with good manufacturing capability in this particular industry. In addition, the Tun Abdul Razak Research Centre (TARRC) in London provides a world class research facility to rubber-related research and development. In an interview, one of the TARRC technologists said that one of their jobs is to promote the Malaysian natural rubber industry to the world and they are willing to help local rubber suppliers to expand their business. However, the laid back attitude displayed by local suppliers, who feel very comfortable with the current situation in Malaysia, does not help TARRC to promote Malaysian companies to the overseas market. According to the Malaysian Industrial Development Authority (MIDA), the Malaysian government is currently emphasising high technology rubber products. Local rubber-related suppliers should take this opportunity to become involved more in research and development, and build their own competitive advantage to compete with overseas suppliers.



### **7.7.3 The Malaysian Government**

As discussed above, the feel-safe factor and lack of competitiveness of local suppliers are influenced by the Government's protection policy. For more than 25 years, this protection policy has helped local vehicle manufacturers and suppliers to grow without tight competition from overseas automotive players. As globalisation and the realisation of AFTA come about, the local suppliers will face greater competition, as the ASEAN market will expand and attract more foreign auto part-makers to the region. The Government should reduce the protection of the Malaysian automotive players slowly; it will be difficult for Malaysia to escape from the effects of globalisation and AFTA. If the Government continues with this protection policy, the risk for local automotive players in competing with overseas suppliers in this globalisation era and even within the region is high.

Apart from that, the Government should also have a clear policy and objectives for local automotive players, as urged by EXP-1 in the triangulation process. In their view, the Malaysian Government has not given a clear pathway to the automotive players within Malaysia. Apart from helping the Malaysian automotive makers, the responsibility of EXP-1 within Malaysia is also to encourage local automotive engineers to become involved in design and development. However, the Government seems to fail to recognise EXP-1 as one of the training providers within Malaysia; as a result, EXP-1's expertise is always ignored by the Government. In order to involve all local automotive players in the industry, the Government should set up one independent body, for example, a consortium, and invite all types of automotive players, vehicle manufacturers, suppliers and third parties who have expertise in the area to discuss the future of the Malaysian automotive industry; this would provide clear objectives regarding how the Malaysian automotive industry should be in the future, and how all players should work towards fulfilling those aims.

## **7.8 Chapter Summary**

In this chapter, the researcher developed the model of the Malaysian co-development model based on the findings in Chapter 6. The model clearly indicated two different approaches towards suppliers by local vehicle manufacturers. The strengths and weaknesses of the Malaysian automotive industry—all of which influence the co-development practices—were also discussed. The model shows the advantages of the industry, and the areas requiring improvement.

Based on both models, and on the findings from the interview and the literature review of the industry, the issues that potentially underpin the current situation of co-development practices were also discussed. At the end of this chapter, the researcher offered suggestions and implications of the local vehicle manufacturers, local auto part-makers, as well as the Malaysian Government.



## Chapter 8

### Conclusion

- Assessment whether research objectives have been met
- Discussion of the limitations of the current work
- Recommendations for future work

Research summary

Impact to industry and  
academia



## **8 Conclusion**

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### **8.1 Introduction**

This chapter briefly explains the whole research process, the outcomes, the strengths and the weaknesses of the research, and the recommendations for future studies. The research was based on the subject area of co-development practices within the Malaysian automotive industry. The research shows that the co-development practices within Malaysia differ from those of other countries.

### **8.2 Research Journey**

The research began with the intensive literature review to facilitate understanding the product development process in the automotive industry. From the broad view on product development, the review of literature then focused on the supplier involvement in the process. This led to the concept of co-development.

Co-development was defined in Chapter 2 as a concept where customers and suppliers come together to research and develop new products. The concept of co-development was then extended to the automotive industry, the field in which this research takes place. In the automotive industry, the collaboration between vehicle manufacturers and suppliers has been researched since the early 1980s. Most of the studies, however, have focused on Japan, the US and European countries. The lack of co-development research in the newly established Malaysian automotive industry inspired the researcher to explore co-development practices within Malaysia.

The objectives of the research came from a lack of knowledge about or studies on co-development within the Malaysian automotive industry. As this had not been covered in the literature, the aim of this research was simply to explore the co-development practices between local vehicle manufacturers and automotive

product suppliers in the country. In order to do this, the researcher needed to understand the co-development concept in the automotive industry, before focusing on the Malaysian automotive industry. Therefore, the literature review also covered related research on the automotive industry within Malaysia.

The exploratory approach using the qualitative research method was used in this research in order to achieve the research aims. The qualitative methodology suited the research, as the research aim was to explore the current situation of co-development in the automotive industry within Malaysia; the characteristics of this situation are that it involves a small number of vehicle manufacturers and a small number of Tier-1 suppliers, only some of which have a co-development relationship with the vehicle manufacturers. The small number of subjects precluded the use of quantitative research methods. Equally importantly was the need to build a deep understanding of the relationship between vehicle manufacturers and suppliers, which meant that semi-structured interviews were the best, and the most appropriate method for analysis would be the qualitative approach.

In order to gain the maximum output for this research, three stages of data collection were designed. As there was a limitation in terms of accessing companies, together with time restrictions on the research, the researcher could not explore all aspects of co-development across the industry. Therefore, several themes considered to be important to co-development were identified during the review of the literature, and these created a focus for the remainder of the study. The identified themes were tested with experts in the industry before the questionnaire design was finalised. The pilot study was used to enable the researcher to have an initial idea of the co-development practices within Malaysia, as there was no literature or information available. The findings from the pilot study were analysed, and the results used to design the interview for the main data collection. Twelve respondents, from both vehicle manufacturers and automotive part-makers, were involved in the interviews, thereby giving the researcher enough data to analyse.

The researcher learned that, in order to encourage respondents to speak about the informal or personal experience and deal with sensitive data, the interview process should take place at an independent area, such as a coffee house or restaurant. This certainly helped the researcher to explore and gain evidence on the informal processes occurring behind the formal process of co-development.

MindManager software was used as a tool for recording the data analysis in this research. MindManager is software for systematic mind-mapping; in this study, it allowed the researcher to identify similar statements and patterns, and to relate statements to each other. At the end of the analysis process, MindManager gave the researcher a broad view of co-development on a single sheet of paper and on the computer screen. Possible conclusions were drawn after the researcher had analysed the data. Two validation processes with the industry experts and key literature were used to validate the data. After these processes, the final findings were confirmed.

The findings show two different approaches have been taken by local vehicle manufacturers regarding their suppliers. The suppliers with technological capability are often involved in the early stages of the design process and are accordingly appointed directly by local vehicle manufacturers. Normally, this type of supplier comes from overseas. In contrast, the local suppliers typically have low technical capability but good manufacturing capability, and the selection process is based on competitive bidding. However, selection could be influenced by the political background and the relationship between management staff at both companies. Local suppliers are not involved in the design process; they were also found to be comfortable with the current practices within Malaysia. Some of the local suppliers with good technical capability seem comfortable with current relationships with their customers. The final findings are summarised by the co-development model in Chapter 7 (Figure 30).



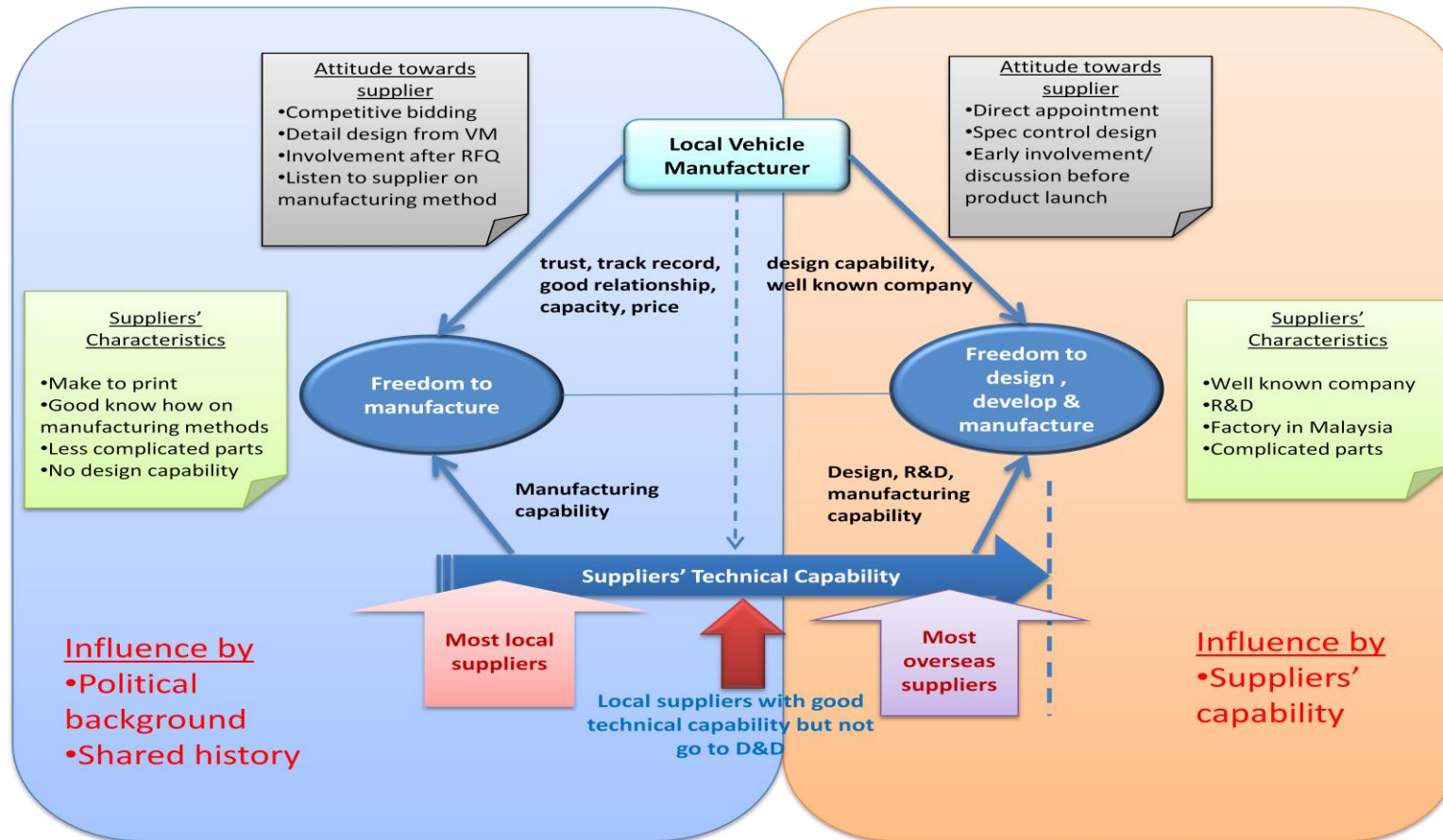


Figure 30: The Malaysian co-development model

The issues underpinning this situation were also identified. The Malaysian automotive industry history, and the way in which it has been developed and nurtured, has greatly influenced current practices within Malaysia. The protection policy introduced by the Government has succeeded in protecting the industry from overseas automotive players, and has successfully supported the creation of a competitive manufacturing-only base; however, these policies have failed to develop a design-led competitiveness in both local vehicle manufacturers and suppliers. The attitude of local vehicle manufacturers and suppliers also contributes to the current situation of co-development practices within Malaysia.

The strengths of the Malaysian automotive industry include the financial support provided by the Government. Although local suppliers are good at manufacturing products, they have little desire to expand their business to overseas. Concentrating on the local market does not help local suppliers as it reduces the growth in production volume; therefore, they are not investing in research and development. Moreover, a lack of innovation is shown to be one of the main problems within the Malaysia automotive industry, as most local suppliers have no research and development department. Local suppliers are totally dependent upon their customers to provide product drawings and specifications. This research, in addition to that of many authors, argues that such reliance upon manufacturing competence places these companies at risk in the long-term, as only design-competent suppliers will survive.

Several suggestions were made in Chapter 7 regarding the improvement of this situation. Local vehicle manufacturers need to be stricter with problematic suppliers and avoid the influence of political backgrounds in the decision-making process. Design responsibility should slowly be transferred to those local suppliers who are ready to accept it. The Government has a key role to play in supporting their readiness. Miscommunication between both parties also needs to be resolved. Local suppliers should start taking necessary steps to compete in the era of globalisation and, in particular, AFTA. Meanwhile, the

Government needs to have a clear policy on the future of the automotive industry. Moreover, the Malaysian Government should also reduce and change the protection policy slowly to develop the competitiveness of the local automotive players. With regards to academician, more research needs to be conducted, as the Malaysian automotive industry is different from those of other developed countries.

If the above suggestions are followed, the co-development capability of the Malaysian automotive suppliers will improve. Such an improvement could potentially lead to an expansion in business as local suppliers take on more tasks (designing & testing), which will help them win more international business (even if the first contracts are mainly manufacturing only). In turn, the extra business will generate funds to invest in research and development.

### **8.3 Contribution to Knowledge**

As mentioned in Chapter 2, currently, there is no literature concerning co-development within the Malaysian automotive industry. Whilst most of the studies in the field of co-development focus on developed countries, this research explores the co-development concept in developing countries, in particular, Malaysia. The concept of co-development that has been explored in this research is differentiated from those usually studied on the basis of the companies' size and the environment in which they operate.

This research has developed the understanding of co-development practices within Malaysia. The new knowledge of the co-development has been generated based on the background differing from those of the automotive industries studied by other researchers. The findings clearly indicate that co-development practices within Malaysia are different to those of other countries (Table 32), and are unique. Care, of course, should be taken with such broad categorisations; not all Western companies are the same, and many do adopt

the co-development practices that are normally associated with Japanese VMs. The research differs from similar researches on co-development, as it involves the influence of Government policy and historical background that shape the industry.

Two different approaches of co-development within Malaysia have appeared in the findings. First, for most local suppliers, their selection is based on competitive bidding and involves the product development process after the request for quotation process has been completed. There was also clear evidence that most local suppliers have limited design capability; therefore, the vehicle manufacturers provide drawings and detailed specifications. Local suppliers typically have good manufacturing capability in terms of making made-to-print products. Furthermore, as they have good manufacturing capability, the vehicle manufacturers give them the freedom to manufacture the product without much interference, provided the local suppliers are able to deliver the product within the specified time, and at an acceptable quality and price.

In contrast, for overseas suppliers, which mostly have good technical capability, the selection is based on their knowledge of the product with design and development competency. They are involved early on in the process, and given the freedom to design and develop the product according to the customer's specifications.

The research findings also provide a brief overview of the current practices within Malaysia; this will give interested parties who would like to involve themselves in the industry some background knowledge, and enable them to prepare themselves before becoming involved.

The research can also be used for local suppliers and vehicle manufacturers to improve the current practices. The research could help the Government to reconsider or restructure the automotive industry policy. As for academia, the research has explored the unique practices for recently established automotive manufacturers and suppliers within Malaysia.

Japanese	Traditional Western Approach	Malaysia
<ul style="list-style-type: none"> <li>• Long-term relationships</li> <li>• Based on quality, cost and delivery and continuous improvement ethic</li> <li>• Partnership approach</li> <li>• Extensive supplier involvement throughout the process</li> <li>• High level of face-to-face communication, especially for highly uncertain products</li> <li>• Broader perspective for measurement of performance</li> </ul>	<ul style="list-style-type: none"> <li>• Short-term relationships</li> <li>• Based on competitive bidding</li> <li>• Adversarial relationships</li> <li>• Customer designs the product, supplier follows customer's requirements</li> <li>• Relatively low level of communication</li> <li>• Measurement based on cost and delivery</li> <li>• Suppliers act as manufacturing arms of vehicle manufacturers</li> </ul>	<ul style="list-style-type: none"> <li>• Long term relationships with local suppliers</li> <li>• Based on competitive bidding for local suppliers, but direct appointment for overseas suppliers. Political background could influence the selection of suppliers</li> <li>• Adversarial to local suppliers, but partnership approach to overseas suppliers</li> <li>• Overseas suppliers involved at the early stage compared to local suppliers, which become involved after RFQ</li> <li>• Intensive communication throughout the process, but only with overseas suppliers</li> <li>• Good relationships with vehicle manufacturers seem to influence measurement process</li> <li>• Local suppliers have a very good manufacturing capability</li> </ul>

Table 32: Japanese versus traditional Western versus observed Malaysian co-development practices

## **8.4 Limitations**

The strengths of the research are based on the exploratory study, involving the researcher in the real world situation. The data collected are in-depth and based on the experience of the respondents from the real-world perspective. The openness and honesty of the respondents when sharing the experience have come from the agreement that the respondents will remain anonymous in the research. Notably, most of the respondents held senior positions in either development or in purchasing (vehicle manufacturer) or in customer-facing roles or Director/VP roles in the suppliers. Informal interviews at non-formal places also provided the key to obtaining non-standard answers from the respondents.

Due to the limited research on co-development within the Malaysian automotive industry, the research was totally dependent on the data collected. The literature validation was also limited by the industry scale. Furthermore, most current research emphasises giant vehicle manufacturers and technologically potent Tier-1 suppliers; as can be seen by the background of other studies, these are different from Malaysia. The findings do not cover the entire topic of co-development, as there was a time limitation. However, the findings come from the rich and powerful data with proper analysis methods.

The difficulties in gaining full and free access to the companies also affected this study by reducing the quantity of companies that were accessed. In order to strengthen the findings, there is a research need for a greater number of in-depth studies in the future.

## **8.5 Recommendations for Future Research**

As co-development research is new within the Malaysian automotive industry, there are many opportunities for research in this field. Due to time limitations, this research did not explore themes relating to co-development in detail.

Further research on themes relating to co-development, such as the selection process, knowledge sharing, investment, and so on, is recommended in order to understand in greater depth the impact of each factor upon the co-development of the Malaysia automotive industry. The themes need to be explored individually in order to provide a better understanding and so tackle the issues behind the themes.

As this study focused on the co-development practices between Malaysian vehicle manufacturers and their Tier-1 suppliers, it would also be interesting to explore the behaviours of local suppliers toward foreign vehicle manufacturers in Malaysia on the co-development process. Furthermore, it would be interesting to know foreign vehicle manufacturers' views on Malaysian suppliers, for example, whether co-development occurs between foreign vehicle manufacturers and local suppliers, and what foreign vehicle manufacturers' opinion is of local suppliers and their view on the Malaysian automotive industry. This could provide a richer and more balanced view of the challenges concerning co-development in Malaysia. It would also be interesting to involve in the study more people from local vehicle manufacturers and suppliers with different designations and roles who are involved directly in the co-development process. The internal triangulation would benefit from accessing finance, purchasing and design, for example, who may give a different view on the co-development process due to the perspective offered by each department.

Research on how to develop successful co-development within Malaysia could also be interesting. Besides helping local vehicle manufacturers and suppliers, the research could generate knowledge about the new management practices associated with newly established car makers or the automotive industry overall. Although the research is time-consuming and needs more participants from both parties, that is, local vehicle manufacturers and their suppliers, the research is valuable as there has been no such research about the newly established automotive industry so far.

In this study, the impact of industry scale, and the environment and culture of Malaysia were not taken into consideration. Further study is recommended to assess how each of these factors could potentially influence the process of manufacturers and suppliers working with each other in the product development process. The classic example of this type of study is the comparison of co-development in the Japanese and US automotive industry. The culture and working environment in Japan, for example, enables the Japanese vehicle manufacturers to work closely with their suppliers. Adding Malaysia, or any other newly established automotive industry to this type of comparison, would also be beneficial.

## **8.6 Chapter Summary**

In this chapter, the brief research journey from the beginning until the end of the study was demonstrated. The chapter showed how the research objectives have been successfully achieved, and that significant new knowledge has been generated. The strengths and weaknesses of the research process were also presented. The researcher finally recommended several areas for research relating to the co-development concept.





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## APPENDIX 1

Brochure for company recruitment



### CO-DEVELOPMENT

#### The Research

Co-development processes are used in several industries and to reduce development costs and to gain a competitive advantage. By integrating suppliers in product development, customers can take advantage of their suppliers' resources, such as skilled workers, technological capabilities and equipment, to remain competitive. Improvement in co-development is also known to lead to other benefits such as reduced product development time, reduced product cost and improved product quality.

This research is investigating the practice of co-development in the automotive industry. The research will also explore the practices in the European, Malaysia and Japanese companies. These practices will then be catalogued to identify issues that company may have with them, with a focus on how companies could improve their current practices.

Among the questions to be addressed through this research are:

- When are suppliers involved in the product development process?
  - How are suppliers selected (as developing partners)?
- What level of communication occurs between manufacturers and suppliers in the product development process?
- What is the suppliers influence in the decision making process during product development?

#### Who could help?

We are looking to interview automotive manufacturing companies with experience in co-development. Both vehicle manufacturers and tier 1 automotive component suppliers are welcome.

#### Benefits of Participation for Companies

Based on a strong record of similar research and having led vehicle manufacture supplier development initiatives, with Cranfield strong knowledge, we believe that we could help your company to improve your co-development relationships, reduce product lead time and design cost. And, of course if your company **have** unsatisfactory relationship within your current customers such like Toyota or Honda, we **are** willing to help. If requested, we will provide you a report or presentation comparing your company current situation with co-development best practices.

Cost and Risks

The only cost to your company is the time of your staff. We will use your company's data, such as notes from the interviews, in anonymous format, to inform this research. We will not use your company's data in any public presentation or document without your express permission. We recognise sensitivity in this and are very happy to discuss in detail.

Contact Details

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Thank You





## APPENDIX 2

Questionnaires to Malaysian automotive suppliers

*AN EXPLORATION OF CO-DEVELOPMENT WITHIN THE  
MALAYSIAN AUTOMOTIVE INDUSTRY*

*QUESTIONNAIRES FOR TIER-1 SUPPLIERS*

*Company Profile:*

Company Name: \_\_\_\_\_

Company Address: \_\_\_\_\_

*Respondent Profile:*

Name (Optional): \_\_\_\_\_

Position: \_\_\_\_\_

Department: \_\_\_\_\_

Email Address: \_\_\_\_\_

1. Your company *annual turnover*:

- i) Less than RM 200,000
- ii) RM 200,000 to RM 499,000
- iii) RM 500,000 to RM 999,000
- iv) RM 1,000,000 to RM 4,999,999
- v) More than RM 5,000,000

2. Year of establishment: \_\_\_\_\_

3. Approximate number of employees \_\_\_\_\_

4. Your *current* major products and year of first production

	Products	Start date of production (year)
i)	_____	_____
ii)	_____	_____
iii)	_____	_____
iv)	_____	_____

5. Is there any company that produces similar products in Malaysia?  
If yes, please indicate:

	Company name	Origin
i)	_____	_____
ii)	_____	_____
iii)	_____	_____

6. Your company *major market and percentage of sales*:

	Region/Countries	%
i)	Malaysia	_____
ii)	ASEAN	_____
iii)	Japan	_____
iv)	WORLDWIDE	_____

7. Your company *major customers and start date* (in year) of supply.

	Customers	Year
i)	_____	_____
ii)	_____	_____
iii)	_____	_____
iv)	_____	_____
v)	_____	_____

8. Does your company *receive any fund* from the government?

- i) Yes
- ii) No

If yes, please specify type of fund and when.

---

9. Does your company receive *any other incentives/supports* provided by the government?

- i) Yes
- ii) No

If yes, please indicate when and what type of incentives/supports that your company received from the government.

---

10. Please indicate *the level of technology* that your company use in production line.

- i) Fully automation (High tech)
- ii) Half automation (Medium tech)
- iii) Low automation (Low tech)

11. Does your company have *any collaboration with foreign companies*?

- i) Yes
- ii) No

If yes, please go to questions 12, 13 and 14.

12. Please indicate your partner's (company) country of origin.

\_\_\_\_\_

13. Does your company have *any foreign staffs* from your overseas counterpart?

- i) Yes
- ii) No

If *yes*, please indicate the *number or ratio* of your foreign counterpart staffs

General Manager \_\_\_\_\_

Manager \_\_\_\_\_

Engineer \_\_\_\_\_

Technical Advisor \_\_\_\_\_

14. Does your foreign counterpart have *share* in your company?

- i) Yes
- ii) No

If *yes*, please go to question 15.

15. How much share does your foreign counterpart has in your company?

- i) less than 30%
- ii) more than 30% but less than 50%
- iii) more than 50%
- iv)

16. In your opinion, why do the customers *choose* your company as their supplier?

(*You may circle more than one answer*)

- i) Price
- ii) Technology
- iii) Trust
- iv) Long relationships
- v) Government policy (e.g. Malaysian company)
- vi) Others; Please indicate \_\_\_\_\_

17. Is your company *normally aware* when your customers plan to develop a new product?

- i) Yes
- ii) No

**18.** Does your development project with the customers start with a *formal request for quotation* from customers?

- i) Yes
- ii) No

**19.** Does your company get *directly involved* in product development process with your customers?

- i) Yes
- ii) No

If yes, please go to question 20.

**20.** Please indicate in *which stage of product development process* that your company has been formally invited by the customers.

- i) Initial stage
- ii) Concept stage
- iii) Detail engineering stage
- iv) Process Engineering stage

**21.** Do your customers *invite* you or your colleagues for discussion before sending parts drawing or specification to your company?

- i) Yes
- ii) No

**22.** Does your company *receive* parts drawing specifications from your customers?

- i) Yes
- ii) No

**23.** Are you or your colleagues *involved* in the design process before the design specification had officially been '*frozen*'?

- i) Yes
- ii) No

If yes, please go to question 24.

**24.** *Approximate time* (in hours) of meeting with customers before design specification had officially been '*frozen*'.

\_\_\_\_\_ hrs

**25.** Do your customers *negotiate* the price before the design specification has officially been '*frozen*'?

i) Yes

ii) No

If *no*, please go to question 26.

**26.** Who has *more influence* on the product price?

i) Your company

ii) Customers

**27.** Do you think that you or your colleagues *could influence* your customers on product e.g. shape, performance and cost?

i) Yes

ii) No

If *yes*, on what parameters? \_\_\_\_\_

**28.** Does your company have an *R&D* department?

i) Yes

ii) No

If *yes*, please go to questions 29, 30 and 31.

**29.** Where is the R&D department located?

i) Malaysia

ii) Overseas, please specify \_\_\_\_\_

**30.** Approximate number of employees involve in *R&D*

\_\_\_\_\_

**31.** Approximate number of employees involve in *new product development* (e.g. product design, performance etc.)

\_\_\_\_\_

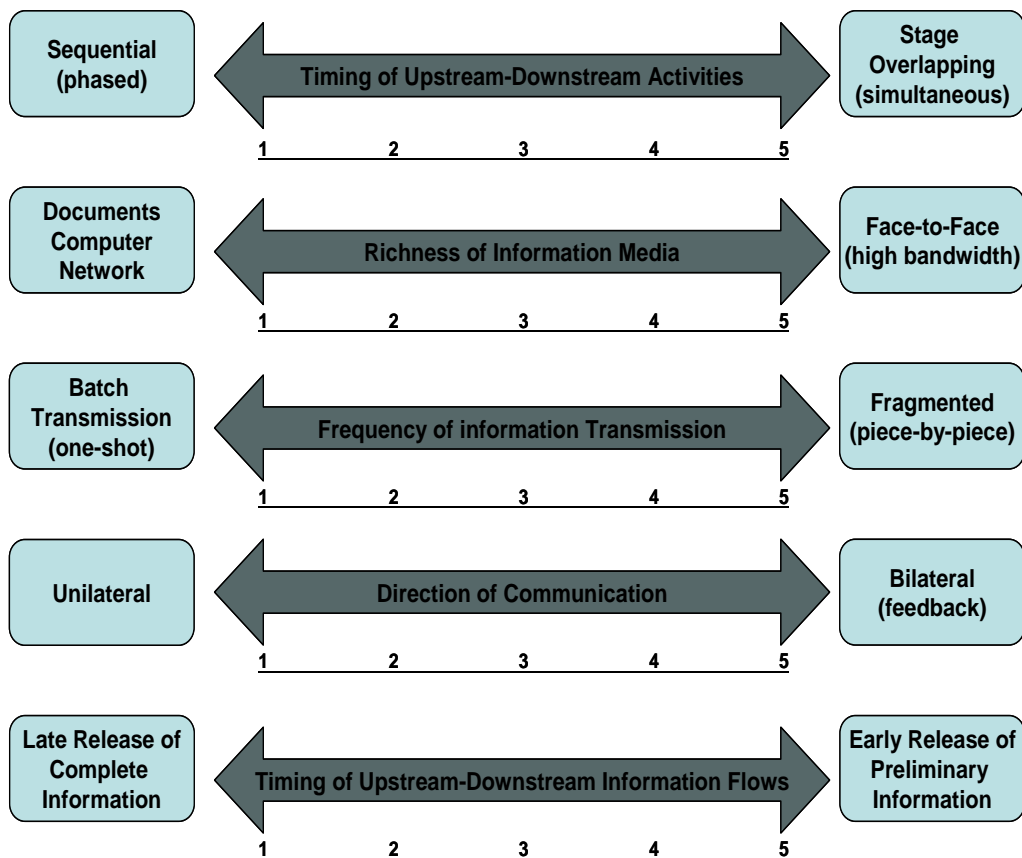
32. Approximate number of employees involve in *manufacturing process development* (e.g. tool design, production line setup etc) for the new product

---

33. Please indicate the *major facilities* in your R&D department.

---

34. Please rate the *degree of communication* between your company and your customers during the product development process:  
(Please circle the appropriate number)





**35.** Does your company *design and develop your own tools* e.g. die, mould etc.?

i) Yes

ii) No

If *yes*, please go to question 36.

If *no*, please go to question 37.

**36.** In the last major development, approximately how long the *lead times* (in weeks) for the development of the new tools?

---

**37.** Where are your *major tools makers* located?

---

*Congratulations, you have finished answering this questionnaire. Do remember to return this using the self-addressed envelope.*

*Thank you for your time and co-operation.*

## APPENDIX 3

### Questionnaires to vehicle manufacturers

#### *AN EXPLORATION OF CO-DEVELOPMENT WITHIN THE MALAYSIAN AUTOMOTIVE INDUSTRY*

#### *QUESTIONNAIRES FOR VEHICLE MANUFACTURERS*

*Company Profile:*

Company Name: \_\_\_\_\_

Company Address: \_\_\_\_\_

*Respondent Profile:*

Name (Optional): \_\_\_\_\_

Position: \_\_\_\_\_

Department: \_\_\_\_\_

Email Address: \_\_\_\_\_

1. Your company *annual turnover*:

- i) Less than RM 499,000
- ii) RM 500,000 to RM 999,000
- iii) RM 1,000,000 to RM 4,999,999
- iv) More than RM 5,000,000

2. Year of establishment: \_\_\_\_\_

3. Approximate number of employees \_\_\_\_\_

4. Your company major market and percentage of sales:

Region/Countries	%
i) Malaysia	_____
ii) ASEAN	_____
iii) EUROPEAN	_____
iv) OTHERS	_____

5. Your *current* major products and year of first production

Products	Start date of production (year)
i) _____	_____
ii) _____	_____
iii) _____	_____
iv) _____	_____

6. Does your company *receive any fund* from the government?

- i) Yes
- ii) No

If yes, please specify type of fund and when.

\_\_\_\_\_

7. Does your company receive *any other incentives/supports* provided by the government?

- i) Yes
- ii) No

If yes, please indicate when and what type of incentives/supports that your company received from the government.

---

8. Please indicate *the level of technology* that your company use in production line.

- i) Fully automation (High tech)
- ii) Half automation (Medium tech)
- iii) Low automation (Low tech)

9. Does your company have an *R&D* department?

- i) Yes
- ii) No

If yes, please go to question 16..

10. Where is the R&D department located?

- i) Malaysia
- ii) Overseas, please specify \_\_\_\_\_

11. If your company has *more than one R&D centres*, please indicate each centre responsibility (*e.g. R&D centre 1 for design process etc.*)

	R&D Centre (name)	Main responsibility
i)	_____	_____
ii)	_____	_____
iii)	_____	_____

12. Approximate *number of employees* involve in R&D

Malaysia \_\_\_\_\_

Overseas (*if any*) \_\_\_\_\_

**13.** Approximate number of employees involve in *new product development* (e.g. product design, performance etc.)

\_\_\_\_\_

**14.** Approximate number of employees involve in *manufacturing process development* (e.g. tool design, production line setup etc.) of the new product

\_\_\_\_\_

**15.** Please indicate the *major facilities* (and quantity) in your R&D department.

\_\_\_\_\_

**16.** Are your company *collaborating with foreign vehicle manufactures* in developing a new product/car?

i) Yes

ii) No

If yes, please indicate the foreign vehicle manufacturer's name.

\_\_\_\_\_

**17.** Does your company have *any foreign staff* from your overseas counterparts?

i) Yes

ii) No

If yes, please indicate the *number or ratio* of your foreign counterpart staffs

General Manager \_\_\_\_\_ (e.g. 7 or 50/50)

Manager \_\_\_\_\_

Engineer \_\_\_\_\_

Technical Advisor \_\_\_\_\_

**18.** Please indicate the *lead time* in your latest new car development project (from styling freeze to start of production)

\_\_\_\_\_ months

19. Total number of companies as your *tier-1 suppliers*

---

20. Number of *local (Malaysian)* companies as your *tier-1 suppliers*

---

21. Has your company made *any specific investments* in supplier?

- i) Yes
- ii) No

If yes, please indicate the type of major investment in supplier.

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22. Please indicate your company and *Tier-1 supplier* relationships

	<u>Type 1 (Black Box)</u>	<u>Type 2</u>	<u>Type 3 (Design for Manufacturing)</u>	<u>Type 4 (Make to print)</u>
Types of Tier-1 suppliers	Your company does briefing of product outline and specifications only; supplier does everything else.	Your company does outline design/ specification of product; supplier does design and details drawing.	Your company does product design; supplier does details drawing.	Your company does product design and details drawing; supplier as a manufacturer only.

<i>Number of suppliers or in ratio (%)</i>				
--	--	--	--	--

**23.** Does your development product with the suppliers start with your company creating a *formal request for quotation*?  
*(Please tick at the appropriate column)*

<i>Types of Suppliers</i>	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>	<i>Type 4</i>
<i>Yes</i>				
<i>No</i>				

If *no*, how does the process (of involving Tier-1 suppliers in product development) start?

**24.** For *type 1,2, and 3 suppliers* only  
 Please indicate in *which stage of product development process* that your company formally invite Tier-1 suppliers to respond?

*(Please tick at the appropriate column)*

<i>Stage / Types of Suppliers</i>	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>
<i>Initial stage</i>			
<i>Concept stage</i>			
<i>Detail engineering stage</i>			
<i>Process Engineering stage</i>			

**25. For type 1,2, and 3 suppliers only**

Are your Tier-1 suppliers *invited* to the *planning stage* of new product development?

*(Please tick at the appropriate column)*

<i>Types of Suppliers</i>	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>
<i>Yes</i>			
<i>No</i>			

**26. For type 1,2, and 3 suppliers only**

Are your Tier-1 suppliers *invited* for discussion in the *design process*?

*(Please tick at the appropriate column)*

<i>Types of Suppliers</i>	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>
<i>Yes</i>			
<i>No</i>			

For *yes* answer, please indicate in *which stage* that your Tier-1 suppliers get involve in design process. *(Please tick at the appropriate column)*

<i>Types of Suppliers</i>	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>
<i>Outline Design</i>			
<i>Details Design</i>			

**27. What are the *main criteria* for selecting your Tier-1 suppliers?**

*(You may circle more than one answer)*

- i) Price
- ii) Technology



- iii) Trust
- iv) Long relationships
- v) Government policy (e.g. Malaysian company)
- vi) Others; Please indicate\_\_\_\_\_

**28.** Is your company *assigned the task of new product development*?

- i) Yes
- ii) No

If *no*, please go to question 30.

**29.** Please indicate, from which department your product development team members come from.

*(Please tick at the appropriate column)*

<i>Department</i>	<i>Please tick</i>	<i>Approximate number of staffs assigned from each department</i>
Research and Development include Design		
Operation (Manufacturing & Engineering)		
Quality Control		
Information Technology		
Purchasing		
Finance		
Human Resource		
Supplier		
Others, please specify		

**30.** Does your product development team have *any influence* on the selection of suppliers?

- i) Yes
- ii) No

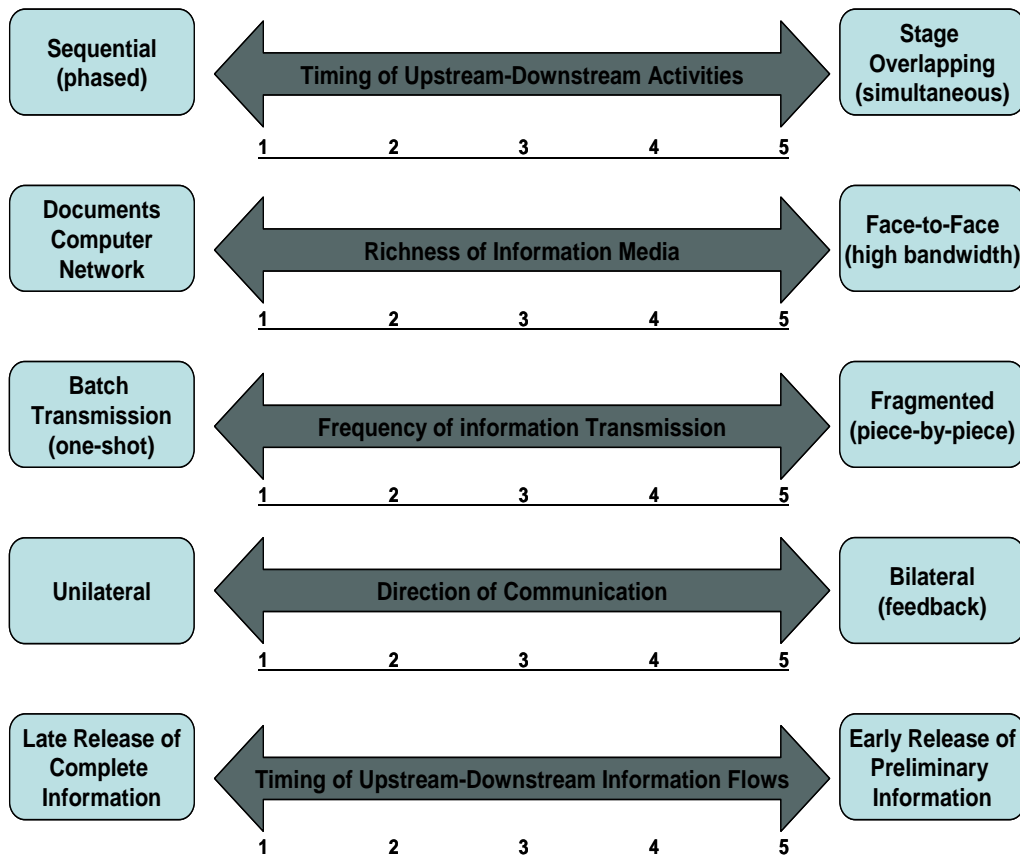
If *no*, please indicate which department selects your company suppliers.

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31. Please rate the *degree of communication* between your company and your typical Tier-1 suppliers during the project development process:  
 (Please circle the appropriate number)



(If you have groups of suppliers, please label them: e.g. Japanese; local & small; local & big; and position each grouping)



## APPENDIX 4

### Interview format for suppliers

The interview has 11 sections:

1. Warm up questions

What products do your company produce?

What is the nationality of your owners?

Where is the HQ located?

2. Establishment and Government support

Did your company exist before Malaysian VM/Proton had been established?

If yes, did your company exist because of government incentives?

If *no*, what made you work with Malaysian VM?

3. Collaboration with foreign company (*if any*)

How do you think your products compare to the products from your foreign counterpart/competitors? (In term of quality, technological capability etc.)

Who normally does the product design? You or your foreign counterpart?

Are there any difficulties in working with a foreign company, especially in developing a product with a technology that is new to you?

4. Customer-supplier relationships

What do you think attracted the customer to you?

How long have you been involved with Malaysian VMs?

How would you describe your company's roles/responsibilities in developing new product with customers? (e.g. built to print, black box etc.)

Please describe the role of your customers in product development?

Did your customers tell you what to do in details or they give you more freedom on designing/manufacturing the product?

While you have the long trusting relationship with Malaysian VM, how do you deal with foreign or new vehicle manufacturers?

5. The selection and price setting process

Do your customers discuss new product projects with your company prior to (officially) selecting you as their supplier?

What information is exchanged between you and your customers before your company is selected as their supplier? (e.g. contract details, drawing, technical meeting, presentation)

We believe with your long history with Malaysian VM, you always have discussion with them before you have been selected, is this true?

How is it difference or difficult with foreign or new vehicle manufacturers?

What are you allowed to do before everything become formal?

Please describe the price setting process between you and your customers. Is it pre-selection, short-list or open competition.

We believe that normally the process started with the RFQ, before the formal discussion; do you think this is good?

Which departments are involved with customers in price setting process?  
-Purchasing, engineering, sales, manufacturing etc

Which departments have more influence on the product price?

-Purchasing, engineering, sales, manufacturing etc

6. Involvement in product development process

How do you normally find out when your customers plan to develop a new car?

Is there an official invitation to become involved with the customer? If no, how does the involvement start?

Do your customers share their new vehicle concepts with you?

7. Influence in decision making process

Who do you think has more influence in the decision making process, your staff or your partners staff?

In what parameters do you think that you have the power to influence customers while developing new product? E.g. spec, performance, quality, method of manufacture, price etc.

We believe that nowadays most of the VMs are concentrating their knowledge in car assemblies and new car concept. As one of automotive components maker, do you think it is good for your company?

Do you think your expertise or knowledge on the product helping you in influences your customers?

If yes, who from your company could influence the customers? (e.g. CEO, Technical Manager or Engineer etc.)

8. Research and development

If you do not have an in-house R&D department, where does the R&D activity occur?

Is there any difficulty in not having in house R&D department?

9. Degree of communication

Do your customers regularly call for meeting or discussion?

Are you always discussing the project through email, telephone or face to face?

Are there any changes in communication routes before and after the new product development project has been launched?

Do you put your engineers at VMs office?

10. Tool makers

Where your tool makers are located?

How significant are the tooling suppliers during your product development?

What are the advantages and disadvantages of buying from foreign and local tool makers?

11. Respondents opinion, suggestions about current practice

Is there anything important to you that we have not talked about?

What you would like to see change?

What would be your ideal type of co-development in the future?

## APPENDIX 5

### Excerpt of company interview

Interview with Mr. XXX, tier-1 supplier to vehicle manufacturer YYY, expert from UK on testing the themes

-continues-

NY: How would you describe your company's roles or responsibilities in developing new product with your customer..especially YYY?

Mr XXX: Very (?) and very much riddle..service orientated. To extend that the actual product it self is not as important as the services which you provide during the development of that product... I mean they wanted the system at the end but they also want people with expertise to help them developing the system with their requirements. They also want people with expertise to help develop the test ..to develop the interpretation strategy for the system.. The physical bits are on the vehicles, but the resources are the expertise.

NY: You only supply to YYY or do you have other customers?

Mr XXX: We also supply to Daimler Chrysler, Direct Diesel Corporation whom make trucks in America and some others tier-1 companies

NY:What are the differences with different customers? For example; if you work with YYY, is the requirements or expectations are same like other customers for example ZZZ?

Mr XXX: I think the big different perhaps between YYY with some other companies is YYY is more bureaucratic compare to another companies. The have a lot of standard processes. A lot of people on the ground don't seem to follow..where is in my experience working with ZZZ they had more define processes and people actually follow them more..so you can say that bad or good....



NY: We go to the supplier selection process. Do your customers discuss new product projects with your company prior to officially selecting you as their supplier?

Mr XXX: Yes...what normally happens is OEM will issue the RFQ which defines the services that they want the supplier to supports and the RFQ is technically detail..I mean requirements...to enable you to put together the project plan to support the RFQ. So you have to know quite a lot about the end product and that implicit the RFQ itself. And then you have to do the presentation to the organisation to win the business

NY: What information is exchanged between you and your customers before your company is selected as their supplier?

Mr XXX: It certainly not a detail design..in some circumstances you actually show them something that you done to someone else. They are all the OEM but particularly YYY is quite risky to us. So you have to prove that the things work before actually starting the project..so as much information you can provide to them to give them a warm feeling that the thing is not high risk is the best.

NY: How do you know when your customers plan to develop the new cars?

Mr XXX: Its not really formal identification prior to RFQ, but you generally get information from someone who talk about something else..because we are in quite a small community in the car industry

NY: What would your company do after you hear about the news, for example YYY wants to build a new car? Do you contact them directly or just wait for the RFQ?

Mr XXX: Normally yes..but the key things of all these are the warm relationships that we have before rather than the formal one. And because they don't really launch the new new car, no one ever does. It more the questions of so and so car is having a facelift and they looking at bringing the new system or this car is

going to be sold in that market now, so changing the system for example...so it more incremental changes rather than building the new car..

NY: Is there an official invitation to become involved with the customer? For example YYY sent you the letter invite the company to involve in the product development process?

Mr XXX: That the RFQ really..

NY: Could you please describe the price setting process between you and your customers? How does the process start?

Mr XXX: We were quite fortunate because we produce primarily software. Because YYY or most automotive companies don't know how to price the software. They don't know how to manage with the company with software businesses. If you go to companies who produce nuts and bolts, they will tell you a very different story of how to shape and cost the product and for example cut 3p per part that sort of thing ...but because we delivering the software based product they don't how to cost it. So there wasn't really a cost elements on it, more to the cost of services for example how many man per hour will be required to support testing and integration..those sort of costs..

NY: How about the negotiation process?

Mr XXX: Because we were selling primarily services, what would normally happen is you have a range of engineering skills grade for example chief engineer, engineer and technician ok...so we will cost the project base on the number of man per hours...for example the 3000/hour for chief engineer, 2000/hour for senior engineer....so if your have more chief engineers, the cost would be expensive....that sorts of negotiation which take place... but the main for the commercial side was the fixed contract...the fixed price contract where you say you do this work for £1000...

NY: Normally who or which department are involved in price setting process?

Mr XXX: Everyone really..the big, like the big proposal back to YYY will be managed by a project manager. He will calculate the costs and put together the plan..that need to be approved by the quality manager to make sure that he defining the correct processes. And it need to be approved by the finance director to make sure that he was asking for enough money..so primarily 3 people involve in the business, engineering, quality and finance..

NY: Who is directly discuss with for example YYY about the price?

Mr XXX: We normally discuss with the local budget holder..the program manager, program director who has the cash....we will correspond them directly. But, from experience working and dealing with YYY the people who at the final stage is the purchasing. What normally happen is we will normally agree the scope, the contract and that will go out internally and get lost in the system for about 3 -4 months and before it come back..

-continues-

## APPENDIX 6

### Excerpt of company interview

Interview with Mr. YYY, local vehicle manufacturer YYY

-continues-

NY: Could you please describe your new vehicle development process? Are your company will do all the design yourselves or you call suppliers to involve in the process?

Mr YYY: Normally we call design consultant to design the whole vehicle..of course the vehicle concept is come from us....we call vehicle engineering consultant like XXX1, XXX2 or XXX3...so far we have 3 consultants work with us...

NY: Does design consultant do all the design project...include the components?

Mr YYY: Depends on the model...if we build totally new car...we need them to work out on every single component but not on standard parts

NY: Do any other supplier involve at this stage of designing new car?

Mr YYY: Initial stage of design for example with design consultant XXX1....XXX1 will design the parts...we will approve the design..then we issue the RFQ to suppliers..we appoint supplier and we talk to suppliers about our new vehicle..... We normally will list out our potential vendors...shortlisted according to our accreditation system...we call them for RFQ, give them briefing of RFQ....our volume forecast, technical specification...we also give them an information about the model life for the new vehicle..for example 5 years or less...some parts need investment from suppliers...they will put that on part cost and some part need less investment...supplier has to submit two proposal..technical and commercial proposal.....proposal includes time line...for example drive shaft..drive shaft from design to mass production..how

long supplier take....and time line for product valuation includes testing so on.....depends on the part, some part need long time frame and some need less time to produce..but all time frame must meet our requirements and schedule..our milestones stages by stages until the vehicle is complete...from new build up to prototype...the terms are used by Japanese and our design consultant XXX2....

NY: What exactly your design consultant does?

Mr YYY: We will send design work to our consultant...our consultant will discuss with us about the design we request...we have our own designer to look at the out put from the consultant and approve the design before pass it to purchasing department...purchasing will issue the RFQ to suppliers... for standard part..or we say the existing part like gear box...we select gear box base from range of suppliers that produce gear box...we will not develop new gear box...either we carry out from our previous model or buy new from suppliers...because it will be costly for us to build new gear box for example..... we modified our transmission to fit our new engine..we will call suppliers to do the modification works... we give them our requirements...we will try to minimize the modification work...to avoid tooling cost..for standard parts that need some modification like drive shaft...the suppliers will come out with the design..

NY: Do you mean suppliers are not invited before the RFQ?

Mr YYY: Depends on the product actually...some suppliers invited before the RFQ....some are after the RFQ...we will call suppliers to involve in the process...but it depends...for big supplier or well known company we appoint them directly....direct appointment normally to big suppliers...because they produce complicated parts with long lead time...

NY: Are you called suppliers before the product been launch or plan?

Mr YYY: That includes on our feasibility study...we have stage call feasibility study..we can call suppliers from all over the world....we have budget..we also can go anywhere all over the world to learn...then after that we come out with the proposal..

NY: Does that means you can call and meet suppliers any time?

Mr YYY: Suppliers with expertise...yes if we want to meet them...we call them or we go to them....for example we go to XXX4 ....XXX4 give us privileged to deals with them...for new product...totally new product we will start with technical planning...normally after the top management confirm the vehicle concepts, we will start technical planning...we will come out with our planning and discuss with our consultant about our technical plan for new transmission system for example...we put our target, volume on our technical plan as well as details specification..after that we will start the design..

NY: For suppliers with know-how...well known companies like ZZZ1, ZZZ2 or ZZZ3, do you call them earlier or before RFQ?

Mr YYY: because of mutual understanding....and most of them are our only suppliers...for the new project we call them earlier before RFQ...but without any commitment from us to select them until we finalised our suppliers... to get technical info, because of our mutual understanding we will call current suppliers for their know-how.. ...once we appoint them as our supplier, we will call them to discuss deeply about the product with our team..

NY: When they formally involve on the product development process?

Mr YYY: On our side, we involve suppliers after we issued letter of intent...the assignment of suppliers consider official when they received letter of intent from us....before the letter of intention we consider it as informal discussion..For some components that supply by the companies you informed...well known companies...the components normally involve with the system...I mean transmission or brake system...we have to involve them early on the

process....we need to integrate their component to our system...we develop with them the system.... design consultant design the system, but for the parts individually, we will give suppliers to design it...so basically we work with design consultant and suppliers for design the parts...suppliers with complicated parts will involve early basically... but for informal discussion as I said before...we call suppliers for informal discussion for their expertise and knowhow...but that not formal...because we respect their knowledge and we need their know-how...and most of them are potential vendors...that we knew they have expertise...

NY: Do you feel any different working with foreign multinational companies and local suppliers?

Mr YYY: Yes...we can feel the different...we categorized suppliers...like local suppliers, suppliers from overseas but have factory in Malaysia or suppliers solely from overseas...the wok culture is different..know-how yes...overseas suppliers have higher degree of know-how compare to local suppliers... some local suppliers they have technical assistant from overseas.....they try to gained experience and transfer knowledge form overseas partner to Malaysia.

NY: Are they local or overseas suppliers?

Mr YYY: Most of them are overseas suppliers...that we knew they have good know-how on the component or system...there are some parts, complicated parts, that we give vendor general specs and requirement and suppliers have to come out with the proposal to design and develop the parts..we give our specs, suppliers will work on detail drawing and everything and come back to us before we agree the final drawing..

-continues-

