ASSESSMENT OF EARLY SUPPLIER INVOLVEMENT IN PRODUCT DEVELOPMENT IN MALAYSIA FOOD INDUSTRY

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Thesis submitted in fulfilment of the requirements for the award of the degree of

Bachelor of Industrial Technology Management with Honours

Faculty of Industrial Management

UNIVERSITI MALAYSIA PAHANG

JANUARY 2016

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in term of scope and quality for the award of the degree of Bachelor of Industrial Technology Management with Honours.

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I hereby declare that the work in this thesis is my own except for quotations and summaries which have been fully acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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Dedicated to Industrial Technology Management's lecturers and students

ACKNOWLEDGEMENTS

I would like to extend my sincere appreciation to the following people who had directly and indirectly given generous contribution towards the success of this project.

I am grateful and would like to express my sincere gratitude to my dear supervisor, Mr Mohd Ghazali Bin Maarof for his advice, invaluable guidance, continuous encouragement, and constant assistant in making this research possible. I appreciate all of the efforts and times being spent on this thesis as well as in the discussion throughout the final year of my study in University Malaysia Pahang. Without these minors but essential elements, I think this thesis would not complete on time and fulfilled the expectation.

Besides that, I would like to express my sincerity to my dearest friends, who studying in Industrial Project Management same as me by appreciate all of the cooperation and supports in all of the academic assignments throughout the years of study. Special thanks to coursemates in the enrolment of my Bachelor's degree.

Last but not least, I owe special debt to all of the parties, such as my friends, my teachers, and especially my beloved parents. Their directly or indirectly involvement in providing the valuable assistance at various occasions were highly appreciated.

ABSTRACT

Early supplier involvement (ESI) benefits product development in several ways. However, many food industries do not know the advantages of ESI and therefore do not utilize it. Therefore, it is vital for the food industries to understand the contribution and effectiveness of ESI in product development in Malaysia food industry. This study aims to analyze contribution of ESI in early product development and evaluate effectiveness of ESI in product development in Malaysia food industry. Data were collected by using a set of survey questionnaires among the managers in food industries at Kuala Lumpur and Selangor area. Results from the study indicated that the most significant contribution of suppliers in early product development in Malaysia food industry is new technologies identification. Besides, product cost ranked the most effective criteria of ESI in product development in Malaysia food industry. The results provided sufficient insight and understanding into the contribution of ESI as well as look deeply into the effectiveness of ESI in product development in Malaysia food industry.

ABSTRAK

Penglibatan pembekal awal (ESI) membawa manfaat dalam pembangunan produk malalui beberapa cara. Walau bagaimanapun, banyak industri makanan masih tidak megetahui kelebihan ESI dan mereka tidak menglibatkan pembekal awal dalam industry masing-masing. Oleh itu, adalah penting bagi industri makanan untuk memahami sumbangan dan keberkesanan ESI dalam pembangunan produk dalam industri makanan di Malaysia. Kajian ini bertujuan untuk menganalisis sumbangan ESI dalam awal pembangunan produk dan menilai keberkesanan ESI dalam pembangunan produk dalam industri makanan di Malaysia. Data telah dikumpulkan dengan cara kajian soal selidik dalam kalangan pengurus dalam industri makanan di Kuala Lumpur dan kawasan Selangor. Hasil daripada kajian menunjukkan bahawa sumbangan yang paling penting pembekal dalam awal pembangunan produk dalam industri makanan di Malaysia adalah pengenalan teknologi baru. Selain itu, kos produk menduduki kriteria yang paling berkesan dalam pembangunan produk dalam industri makanan di Malaysia. Hasil kajian ini memberi pandangan dan pemahaman yang mencukupi terhadap sumbangan ESI serta melihat secara teliti berkenaan keberkesanan ESI dalam pembangunan produk dalam industri makanan di Malaysia.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The competitive environment of food industries in the past decade has lead Malaysia food producers to investigate ways of increasing both the productivity and the quality of their products. Researchers concern about these issues and thus they had conducted extensive studies to investigate ways to attain the goals. Some researchers mention that several buyer-supplier relationships were fostered with the competition of product development activities, especially in the food industry (De Toni et al., 1998). In other countries like China, suppliers are actively involved themselves in early product development in automotive and construction industries (Sturgeon and Van Biesebroeck, 2010). Their contribution had a significant positive impact towards the industries. Thus, more researches should be conducted in Malaysia especially in food industry.

Malaysia food industry is conquered by small and medium scale firms (Malaysian Investment Development Authority, 2013). In term of the food processing industry, there are more than nine thousand firms in Malaysia that equivalent to ninety five percent are classified as small-scale (Senik, 1995). Those small-scale food processing industries display some characteristics that differentiate them from big-scale. Small-scale food industries have the characteristics of low start-up costs and have lesser employees

compared to the large scale firms. The majority of these small and medium enterprises (SMEs) are operating under a simple organizational structure. Recently, the key growth areas of the industry are health food, functional food, convenience food, halal food and food ingredients.

There are a lot of possible benefits of early supplier involvement in product development that can be categorized in short and long term. For illustration, according to Mitra (2012), cost reduction, faster project completion time, improved product quality and better design solutions are the examples of short term related performance. According to them, the advantages of supplier involvement for long term nature are customers' permanent access to supplier technologies or specialist knowledge, increases of innovative capability of customer and long term alignment of technological strategies. These show that early supplier involvement is really vital because it has direct impact to the performance and achievement of product development in Malaysia food industry in terms of short and long term benefits that the companies gained.

The purpose of this research is to enhance the understanding about the assessment of early supplier involvement in product development in Malaysia food industry. New product development in the food processing industry could range from introducing new flavours, expanding their existing product lines to changing the product's packaging to give it more appeal to current customer base (Fuller, 2011). Thus, this research tends to analyze the contribution of suppliers in early product development in Malaysia food industry. Furthermore, this research aimed to evaluate effectiveness of early supplier involvement in product development in Malaysia food industry too.

The first chapter introduces research's problem background, problem statement, research objectives, research questions, research hypothesis, scope of study, significance of study, research operational definitions, and expected results.

1.2 PROBLEM BACKGROUND

Resulting the government's focus on the agriculture sector, Malaysia food industry has become a vital part of the agro-based industry. In the Industrial Malaysian Plan 2006-2020 (IMP3) period, the food processing industry's investment target have been set at RM24.6 billion (Bustamam, 2010). For the business environment, Malaysia food industry is dominated by small and medium scale firms (Malaysian Investment Development Authority, 2013). Recently, the industry's main growth areas are health food, functional food, halal food, food ingredients and convenience food. In terms of external environment, the industry is also undergoing numerous changes brought by factors such as rising production costs, technological developments, shifting demand patterns and changes in competitive groupings. Moreover, internal factors like core values of company, organizational structure, organizational culture and strategic goals also affect the effectiveness of product development in Malaysia food industries.

Usually, most research on supplier involvement in product development has been situated in large-scale assembly industries, like the electronics and automotive areas (Sturgeon and Van Biesebroeck, 2010). Little is known about supplier involvement in the food industry. Yet, this industry has progressively been depending on suppliers for carrying out product and development activities. External resources are then essential to carry on with the high pace of innovation needed. Suppliers need to make sure the ingredients, machines and packaging materials managed to make a valued contribution in product development, by bringing in expert information in all types of relevant areas so that product development can be more efficient and effective. Hence, it would be interesting to study early supplier involvement which originally based on research in assembly industries. It would also hold for the food industry and whether there are any particular features and effectiveness of supplier involvement in this sector (Van der Valk and Wynstra, 2005).

With the fast evolvement of globalization nowadays, many types of buyer-supplier relationships were formed to keep up with the competition of product development activities especially in food industry. According to Farina (2000), technological advances in

transporting, preserving and storing food products as well as managing and exchanging information cause the buyer-supplier relationships become even closer compared to the past. Involving suppliers in product development is supposed to have positive effect on development time, product cost and product quality (Van der Valk and Wynstra, 2005). Early supplier involvements take place when a customer involves its supplier at the early phase into product development process. Product development is often complex and consists of several areas that require expertise. For illustration, expertise are required to focus on the fundamentals of product development, identify areas of depth and cultivate the right mind sets (Teresa Torres, 2014). This means that one company is rarely an expert in all those areas and for this reason, companies face make-or-buy situations. Because of this, organizations often utilize supplier' expertise in those areas that do not belong to their own core competencies.

1.3 PROBLEM STATEMENT

Consumers in developing countries like Malaysia are demanding for food products of high and consistent quality in broad assortments throughout the year and for competitive price. Consumers nowadays have become increasingly concerned about the quality and consistency of the product development and safety of food. It is estimated that millions of people in OECD countries get ill every year from food contamination (Rocourt et al., 2003). Even though food products seem to be safer than before, from a technical point of view, the perception towards the safety issue in product development of food has decreased significantly among customers. This is due to most of the food suppliers in developing countries like Malaysia is producing and consuming more perishable foods than before (Unnevehr et al., 2003). For example, meat, milk, fish and eggs are broadly consumed by the people. Thus, food safety has become especially important to domestic consumers and in trade among developing countries.

As a consequence of better customer consciousness, customers impose extra demands on food companies. However, most of the customers less realized about the contribution of suppliers in product development in food industry. Furthermore, consumers nowadays have more money to spend, thus they are expecting higher product quality in terms of freshness and storage life. In this scenario, what aspects can the suppliers contribute in improving the food industries? What criteria they are still lacking in develop the firm in early product development in food industry? Those are the doubt that still occurred among the consumers actually.

Food industries are facing problems in producing the food in a productive and effective manner. For illustration, the firms don't know about the aspect of effectiveness they can improve the process and quality in early product development stage. Thus, by conducting this research, I am going to study in deep what are the factors that contribute in the effectiveness of performances in early supplier involvement in product development in food industries in Malaysia.

1.4 RESEARCH OBJECTIVES

i) To analyze contribution of suppliers in early product development in Malaysia food industry.

ii) To evaluate effectiveness of early supplier involvement in product development in Malaysia food industry.

1.5 RESEARCH QUESTIONS

i) What are the contributions of suppliers in early product development in Malaysia food industry?

ii) How effective are the early supplier involvement in product development in food industry in Malaysia?

1.6 RESEARCH HYPOTHESIS

i) Contributions of suppliers in early product development are technological expertise, new technologies identification, support in development of product specifications and support in value analysis/engineering activity.

ii) Early supplier involvement in product development increases the effectiveness of innovation and technology, time to market of product, development and product cost and product quality.

1.7 SCOPE OF THE STUDY

Questionnaire survey type will be used in carry out this study. Scope of study is limited to the whole supply chain in food industries mainly in Kuala Lumpur and Selangor area. However, small scale food processing companies will be the scope of study too as this research wants to gain a broad and more clearly picture based on the food industries at Kuala Lumpur and Selangor area. Kuala Lumpur and Selangor are selected as the scope of study in this research due to high availability of food companies in these areas. Besides that, Kuala Lumpur acts as the federal capital and well known city in Malaysia. Thus, many food factories prefer to build their factories at Kuala Lumpur. Because of time constraints, no model is developed to assess the contribution of early supplier involvement in product development. Responses from survey conducted are limited to functional food, health food, convenience food, food ingredients and halal food industry.

1.8 SIGNIFICANCE OF THE STUDY

Friedman (2007) says that most of the organizations in the world admitted their objectives is making profit. Cost cutting is the most direct way to achieve this objective. Since the design phase of product determines majority of the product manufacturing cost, having suppliers sharing of technology, providing technical support and product specification in value chain during the early stage of product design to reduce product manufacturing cost and maximize quality becomes a trend (Nambisan, 2002). However, this is not an easy task. Early supplier involvement stretches across engineering and business management and covers a wide variety of complex issues. The early stages of product development are typically fuzzy and contain a lot of uncertainty and risk. Information sharing between supplier and customer should be strong to gain competitive advantage. Therefore, it is significant for both suppliers and customers to understand the advantages that they can be gained by the collaboration of the suppliers with the customers in the product development stage. The results can be used to assist collaboration parties to take appropriate way to manage the process during product development. Thus, this can prevent their interest being affected when risk occur.

Furthermore, this thesis is vital to evaluate the effectiveness of early supplier involvement in product development in food industry. Ingredients from suppliers, machines and packaging materials can make a valuable contribution in product development by bringing in expert knowledge in manpower management, suitability of raw materials usage, mass production by using machines and latest methods or techniques to increase the effectiveness in the performance of product development in food industry.

According to LaBahn and Krapfel (2000), early supplier involvement can get the customer promise and fulfil their demand easily. For example, suppliers who participate in early supplier involvement arrangements may be promised the production contracts, if they can meet the ‘target cost’. Secondly, interdependence relationship may occur among both parties due to the trust, dependence and jointly understood action. This indirectly can build

up the long term relationship and relationship-oriented marketing strategies among them. For illustration, suppliers can reduce their inventory holding costs and also reduce the expenses like administrative and overhead costs by having close relationship with customers. Thirdly, suppliers' technical capability can be accessed and implemented if they involved themselves earlier in the product development stage. Moreover, customer technological innovativeness can be improved too. We need to make strategic decisions when selecting the suppliers for our new product development because the resources that supplied from the suppliers are significant in product development stages. If suppliers having product contract with fair prices and their customer's product succeeds in the market place, thus they can recover their investment faster. This journal also highlighted the relationship between interdependence, technology, and customer exchange behaviours combine to inform supplier's partnering decision.

1.9 OPERATIONAL DEFINITION

1) Small and Medium-sized Enterprises (SMEs)

Small and Medium-sized Enterprises are non-subsidiary, independent firms which employ less than a given number of employees. This number varies across countries. For example, in Malaysia's manufacturing sector, the annual turnover is less than RM50 million while the workers are below 200 people. For the services sector, annual sales are not exceeding RM20 million and the workers are below 75 people (Council, 2013).

2) Value Analysis/ Value Engineering

Value Analysis is a systematic method to improve the value of goods or products and services by using an examination of function. Value can be increased by improving the function or reduce the cost. The objectives are to distinguish between the incurred costs and the costs inherent in a particular design and to minimize the locked-in costs (Miles, 1961).

1.10 EXPECTED RESULT

This research is expected to provide sufficient insight into the entire process of early supplier involvement in product development in Malaysia food industry in the aspect of quality, cost associated with product development, as well as product cycle time. Early supplier involvement is expected to increase the quality of the product because external suppliers have better access to technological resources and have more knowledge and experience that can help the company to improve the quality of products.

This research also looks into the contribution of early involvement of suppliers in terms of lead time reduction in the product development stages. When the product cycle time had been reduced, time to market of the food products will be faster. Thus, consumers can purchase the products immediately because the products are available in the market.

The cost associated with product development like the manufacturing costs and development costs are expected to be reduced as the impacts of early supplier involvement in product development in Malaysia food industry. When the resources utilization been improved, it can directly reduce these costs.

This research will also provide responses and comments from the stakeholders associated with product development in food industry. All responses will be analyzed by common parameters (questionnaires). This will help in providing the need to concern on the contractual scheme of supplier-customer relationship during product development.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In the paragraphs below, the researcher is going to review, analyze and compare literatures that are related to my study. Thus, the researcher can find out comprehensive context of this study, some intellectual progress of related topics of my research and main debates between different journals.

2.2 FOOD INDUSTRY IN MALAYSIA

Food industries have played a very important role in the Malaysian economy particularly in terms of employment generation and better income distribution. Currently, the industry's key growth areas are functional food, health food, convenience food, food ingredients and halal food. The food industry in Malaysia accounts for approximately 10% of the country's total manufacturing output. Processed foods are exported to more than 200 countries; with an annual export value of more than RM13 billion which amounts to two-thirds of the total food exports of over RM20 billion in 2012 (Malaysia Investment Development Authority, 2013) To attract investments into food projects both at the farm

level as well as the production/processing level, the Malaysian Investment Development Authority (MIDA) introduced specific incentives that will enhance the supply of raw materials for the food processing sector and thus, reducing reliance on imports of such materials.

For instances, The Halal industry in Malaysia is fast becoming a magnet for international investment, as major players move to acquire a share of the growing global market. In the early year of 2014, US food manufacturer, Kellogg's, announced plans to build a $130 million (RM425 million) Halal facility in Malaysia which will create 300 jobs when the first phase is completed in the middle of next year. The manufacturing facility is being built in Bandar Enstek, Negeri Sembilan and will help the company expand its supply chain capacity in the Asia-Pacific region (MFBD, 2014).

According to MIDA, Malaysia approved 73 food manufacturing projects with investments worth RM4.35 billion last year. Of the total amount, RM2.05 billion was from domestic sources while RM2.3 billion was from foreign investments. Meanwhile, a total of 13 food manufacturing projects worth RM738 million had been approved in Q1 2014, driven by domestic investments. In Malaysia, the food industry facing rapidly changing consumer tastes and continuously advancing technology. Under this changeable market condition, food companies need a continuous improvement on new products. Thus, several strategies have adopted to cope with the condition.

2.3 NEW PRODUCT DEVELOPMENT

The study of Wagner and Hoegl (2006) emphasized the critical importance of continued research in achieving good collaboration in new product development projects with the suppliers and also the ways to capitalize the suppliers competencies in the areas of sensitive technologies. Moreover, high quality buyer-supplier collaboration in new product development can be achieved if the suppliers' firms have an open mind set and they are

prepared to face the obstacles and challenges. The suppliers need to support the key issues of the organization and the project level as well. Furthermore, suppliers need to collaborate with the customer firm to enhance customer value and this can definitely make the firm more successful in the long run of business. In the researcher's opinion, long term relationship of suppliers with the firm can enhance the quality and service they produced for the customers in the market. When the customers are satisfied with the products manufactured by the firms with the collaboration of early involvement of the suppliers in product development, they will definitely spread the 'news' about the excellent quality and performances to the peoples around them. Thus, contribution of early supplier involvement in new product development has a significant impact towards the firms and also society.

In recent years, firms in many industries have increasingly extended their new product development activities across organizational boundaries and outsourced innovation too (Eluinn, 2000). Moreover, supplier involvements in new product development require the firm to build up and maintain appropriate routines and processes in order to generate inter-organizational competitive advantages. Firms need to work with suppliers possessing complementary competencies in product development projects (Dyer and Singh, 1998). Besides that, supplier involvement in new product development can also help the buying firm to gain new competencies by sharing risks, move faster into new markets, and conserve resources (Wagner and Hoegl, 2006).

Huang and Mak (2000) outlined a framework that encourages suppliers to participate in new product development process effectively. The framework consists of a supply chain model (known as supply explorer) that consistent with new product development process. Moreover, a mechanism that known as bid explorer that can be used by the customers to invite suppliers and for potential suppliers to submit bids for making specific components in a product. Supplier selection mechanism (partnership explorer) and mechanism of the share explorer are used by the customers and suppliers to share information of common interest. From this journal, we know that the authors tried to propose an overall methodology for enabling better supplier involvement in new product

development process and to demonstrate the framework through a prototype wed-based platform in internet using the wed technology that known as WeBid.

The new product development stages can be divided into 3 stages according to De Toni and Nassimbeni (2001). The first stage is product concept and functional design, second stage is product structural design and engineering and last stage is process design and engineering. There are many measurements or elements of each new product development stages. The distribution of new product development stage and its measurements is shown in Table 2.1.

Table 2.1: The Elements Contributing to Suppliers' Co-Design Performance

New Product Development (NPD) Stage	Measurement/Element
Product concept and functional design	(a) Technological expertise. (b) New technologies identification. (c) Support in development of product specifications. (d) Support in value analysis/engineering activity.
Product structural design and engineering	(e) Support in product simplification. (f) Support in modularization activities. (g) Support in component selection. (h) Support in standardization choices. (i) Efforts to make product and process compatible. (l) Promptness and reliability in prototyping. (m) Prompt communications of engineering changes. (n) Support in FMEA activities.
Process design and engineering	(o) Support in DFM/DFA activities.

	(p) Support in process engineering requirement.

Source: De Toni and Nassimbeni (2001)

2.4 EARLY SUPPLIER INVOLVEMENT

Supplier involvement is a source of sustainable competitive advantage. Recently, supplier involvement is increased in the food industries other than in automotive and high technology industries (Dyer and Singh, 1998). Eisenhardt and Tabrizi (1995) highlighted that early supplier involvement accelerated product development time. However, it can only occur in mature market segments and when the product development effort was well defined.

Early supplier involvement has been advocated as a means of integrating suppliers' capabilities in the buying firm's supply chain system and operations (Jiao et al., 2008). It is a practice that involves one or more selected suppliers with a buyer's product design team early in the specification development process. Tang and Qian (2008) also defined early supplier involvement as the synergistic and mutually beneficial process for joint product realization at the appropriate time, when supplier capabilities can be leverage most. For simple words, inclusion of supplier in product development process is commonly referred to as early supplier involvement. Another researcher also defined early supplier involvement a form of vertical collaboration between supply chain partners in which the manufacturer involves the supplier at an early stage of the product development process (Mikkola and Skjøtt-Larsen, 2006). Next, partnerships are formed with suppliers to take advantage of their technological expertise in design and manufacturing. The relationships between the supplier and the purchasing function are crucial in the implementation of early supplier involvement. The benefits of using early supplier involvement are perceived to be significant by many authors and practitioners in the supply chain management.

Based on the research paper by Jiao et al. (2008), early supplier involvement is viewed by some authors as a mechanism for the involvement of preferred suppliers in the early phases of product design and development. The supplier's expertise and experience can be utilized in developing a product specification that is designed for effective and efficient manufacturability. Suppliers have to work in a completely integrated fashion with the manufacturer in a systematic and formal way. As a result of this, a conceptual framework for implementation of early supplier involvement has been developed by Chen and Paulraj (2004) to monitor easily the efficiency of collaboration between suppliers and buyers.

The value of early supplier involvement has been supported by more scientific investigations as well. Strong support derives from several studies that analyze the differences in the Japanese, U.S., and European automotive industry. Lawson et al. (2009) explicitly point out that part of the Japanese automakers' competitive advantage derives from their supplier management practices and from involving suppliers in the design and development of products. If managed correctly, suppliers can help their customers reduce lead time manufacturing costs and can add to the design process.

2.5 EARLY SUPPLIER INVOLVEMENT IN PRODUCT DEVELOPMENT

Researchers have found that incorporating suppliers on project teams in electronic industries can enhances the information and expertise regarding new ideas and technology in product development (Smith and Reinertsen, 1998). In addition, it allows early identification of potential problems, thus improving the quality of the final product, eliminating rework and reducing costs (McIvor et al., 2006). Besides that, early supplier involvement provides a possible route for outsourcing that can reduce internal complexity of projects and provides extra resources that can lead to a reduction in critical path of project. Moreover, it can lead to improved buyer supplier relationships since suppliers internalize project concerns and subsequently smoother working relationships on future projects.

Studies of Lau et al. (2010) found a direct link between information sharing with suppliers and market performance in Hong Kong. Kawakami et al. (2011) found that suppliers sharing information about technologies they bring to the buying company lead individually to reduce cycle time, increased product quality and reduced costs in product development. Petersen et al. (2003) found that sharing information about technology and costs leads to higher degrees of product development's project satisfaction.

2.6 CONTRIBUTION OF EARLY SUPPLIER INVOLVEMENT IN PRODUCT DEVELOPMENT

Many previous researches have suggested that both the customer and the supplier can benefit from of involving suppliers early in product development. Some of these advantages include shorter product development cycle time, better quality of the products and lower input and production costs. For example, the advantages of practicing early supplier involvement are well observed in major US corporations such as Whirlpool, Lockheed McDonnell Douglas, Boeing, and Daimler Chrysler. These companies have shifted many of their design activities to key suppliers (Jiao et al, 2008).

One suggested advantage of early supplier involvement is reduced development and manufacturing times (Chen, 2010). Early supplier involvement often includes concurrent engineering and according to (Feng et al., 2010), it leads to better communication between companies. The other suggested advantages of early supplier involvement are decreased costs and improved quality. The cost per unit decreases because the improved manufacturability of the components results in less rework and fewer scrap parts and also due to suppliers offer another pair of eyes to identify potential problems before the product is too far along the development process (Clark, 1991). The quality of the parts can be improved by early supplier involvement because supplier's knowledge is brought in the process when it is still possible to influence on quality. The quality improvements can be improved by reliability of parts or lower maintenance costs (Le Dain et al., 2007). Tsai

(2009) suggested that a major reason for early supplier involvement is to access more and better information earlier in the development process by leveraging the supplier's expertise. For example, the automotive industry – a major user of cast components – is constantly trying to shorten the development time for new products through early supplier involvement. The companies are forming alliances with suppliers and switching their purchasing strategies from individual components to subsystems to produce maximum added value for their projects (Rocourt et al., 2003).

When firms involve suppliers in their design process they may realize an improved market position, since researchers have found that this can increase a firm's chance of being first-to-market with a new innovation and also may increase the number of new products the firm produces (Bonaccorsi and Lipparini, 1994). Better design decisions can be made when key suppliers are part of the team because the suppliers are knowledgeable of their cost structure to readily recognize performance trade-offs. Furthermore, suppliers may introduce other components that could be used more cost effectively, thus improving the supplier's operational performance (Bonaccorsi and Lipparini, 1994). The number of innovations can also be improved when suppliers collaborate with manufacturers (Hingley, 2005). Supplier early involvement helps the manufacturing firm create a better product because it often provides access to new skills, functionality, or technology, especially when a high level of innovation is a priority.

2.6.1 Benefits In Terms of Time Zone

Lawson et al. (2009) mentioned clearly that the advantages are the difference in the time horizon in which they can be reaped and the way they become visible for the company. Short-term advantages are characterized by a link to one or more specific projects, while long term advantages may not become apparent from a specific supplier involvement in a project. Some examples of the short term related performance results to which a supplier can contribute are lower development costs, lower manufacturing cost, increased product

reliability, increased product quality, technology of products that are more innovative and better design solutions.

There are also some potential benefits that are not directly quantifiable and traceable to a specific project and, which are of a long-term nature. These advantages are important for the ability of the company to assure the availability of the right type of supplier contributions for future projects. One such a long-term benefit may be that, even though supplier involvement has not led to immediate efficiency improvements for that particular project, both the customer and the supplier have learned more about each other and their collaboration, which would possibly make future collaborations more efficient and effective (Wagner, 2010).

The effect of involving suppliers could be analyzed in terms of:

1) Their strategic impact in terms of the company's way of doing business; for example, increased access to supplier's technology can change the way future projects define their product offering for their target markets

2) Their operational impact in terms of the execution success of a specific project in terms of quality, cost, and project cycle time.

(Wynstra et al., 2001) combined the strategic/long-term and the operational/short-term dimension as shown in Table 2.2.

Table 2.2: Potential Advantage for Supplier Involvement in Product Development

Nature of advantage		Potential advantages	Mentioned by
Strategic/ long term	**Effectiveness**	**Innovation and technology related advantages**	
		Increased efficiency and effectiveness of future project-collaboration	Dyer and Ouchi (1993)
		Better access to technological resources and knowledge	Ragatz et al. (1997), Bruce et al. (1995), Bonaccorsi (1997)
		Long-term alignment of technological strategies	Bonaccorsi (1992)
		Possibilities to influence future technological 'investments'	Wynstra (1998)
Operational/ short term	**Efficiency**	**Time -to market related advantages**	
		Lead-time reduction	Clark (1989), Kamath & Liker (1994), Hartley & Zirger (1997), Wasti & Liker (1997), Gupta & Souder (1998), Ragatz et al. (1997), Dröge et al. (1999), Bonaccorsi & Lipparini (1994), Bruce et al. (1995)
		Development Cost related advantages	
		Reduced development costs (improved resource utilisation)	Clark (1989), Bonaccorsi & Lipparini (1994), Dowlatshahi (1998), Birou & Fawcett (1994), Hartley et al. (1997a and 1997b) Wasti & Liker (1997)
		Reduced transaction costs	Dyer and Ouchi (1993)
	Effectiveness	**Product Cost related advantages**	
		Provide suggestions on alternative materials increasing product quality/functionality and lowering costs	Dowlatshahi (1998)
		Reduced manufacturing costs	Dyer and Ouchi (1993), Kamath & Liker (1994) Mendez & Pearson (1994)
		Product quality related advantages	
		Development of better performing designs/improved product performance/Reduction quality problems	Clark (1989), Kamath & Liker (1994), Ragatz et al. (1997), Bonaccorsi & Lipparini (1994) Mendez & Pearson (1994), Wasti & Liker (1997)

Source: van Echtelt and Wynstra (2001)

The effectiveness dimension of the supplier contribution is related to how well the supplier performs compared to desired product outcome (such as product reliability and quality, better performing designs).

2.7 BUYER-SUPPLIER RELATIONSHIP

Since the mid-1990s, the strategic role of customer and supplier involvement has received considerable attention in academic and business journals as well as in the business practices especially in China (Chang et al., 2006). As firm recognized the importance of customer and supplier involvement in their new product development, the resource and co-producer role of customer and supplier involvement in the area of competitive advantage has become significantly important (Nambisan, 2002).

Buyers can act as new source of competitive advantage. Kaulio (1998) argues that involving customers in new product development is a way for generating new ideas. Nambisan (2002) addresses that customers involved not only in generating ideas for new products but can co-creating them with the firms to test the finished products, providing product support, and continuous improvement. The supply chain and operations management literature offers various ways that firm can improve their competitive advantage by involving the suppliers in early stage of product development (Chang et al., 2006). Handfield and Bechtel (2002) argue that early supplier involvement in new product development is a way to leverage the supplier's knowledge to reduce costs and lead times. Besides that, Chang et al. (2006) also investigate the influence of supplier involvement on manufacturing flexibility. Li et al. (2006) also argue that strategic partnerships with suppliers enable organizations to work more effectively with a few important suppliers who are willing to share responsibility for the success of the products. Although there were many studies about competitive advantage in the past, those studies only focus internally improvement within the firm. Thus, it is interesting to investigate the competitive advantage that can be gained between the collaboration and close relationship of buyer-supplier relationship in product development in food industry in Malaysia.

The relationship between buyer and supplier has always been a popular topic in literature nowadays. Many authors highlighted that closeness of the buyer-supplier relationship is a vital foundation for effective joint new product development especially

when the outcome of a project is risky or unclear (Liker et al., 1996). This is due to external suppliers maybe are specialists in some particular area in production development and they can contribute their knowledge and experience to the company. The collaboration between suppliers and the internal production party can definitely reduce the cost in production of food. Long term collaboration benefits can be captured if a company builds long term relationships with the key suppliers where it builds learning routines and ensures the capability sets of both parties are still aligned and still useful for new joint projects.

Scholars have recognized commitment as an essential ingredient for successful long-term relationship (De Ruyter et al., 2001). In the present study, commitment encourages partners to resist attractive short-term alternatives in favour of the expected long-term benefits of staying in a relationship (Ryu et al., 2007). Thus, the study come out with the idea that higher supplier commitment leads to greater supplier involvement in customer new product development. Besides that, studies by scholars linked to the Industrial Marketing and Purchasing group have long advocated the need to understand dyadic buyer-supplier relationships as parts of complex industrial networks (Johnsen, 2009).

Furthermore, Schoorman et al. (2007) said that trust is included in most of the relationship models. Empirical findings suggest that trust is an integral feature of successful relationships (Ritter and Walter, 2003). For instance, supplier trust exists to the extent that the supplier believes his customer to be honest, benevolent, and competent (Walter et al., 2003). If partners trust each other, constructive dialogue and cooperative problem solving allow difficulties to be worked out. Thus, trust reduces fears of exploitation and minimizes feelings of vulnerability (Behnia, 2008). Higher supplier trust leads to greater supplier involvement in customer new product development.

2.8 BUYER-SUPPLIER INTEGRATION

Hagedoorn (2002) found that supplier’s early integration into the innovation process significantly increased innovation performance. Additional studies find that buyer-supplier

integration can lead to shorter time to market, reduced costs, higher quality, and better performance for radical new products (Lawson et al., 2009, Wagner, 2012). For example, Ragatz et al. (2002) empirically test the benefits associated with buyer-supplier integration into new product development and found a significant positive relationship between integration strategies and project outcome specially cycle time, quality and cost reduction.

Buyer-supplier integration in the new product development can directly improve performance in terms of customer satisfaction and sales (He et al., 2014). This is because it ensures that the products the company is providing are what its customers are demanding. Supplier integration also allows a firm access to the knowledge and expertise of suppliers that can complement their own internal capabilities.

2.9 BUYER-SUPPLIER PERFORMANCE EVALUATION METHOD

Quesada et al. (2006) divided the discussion of relationship between buyers and suppliers into four quadrants by supply chain and development chain, and targets of interest, vendors and buyers (Table 2.3). With regard to early supplier involvement, Primo and Amundson (2002) indicated suppliers' performance evaluated by the variables of supplier' on-time delivery, quality and cost were proved to be significantly related to supplier involvement. Although Quesada et al. (2006) identified suppliers' influence in development chain, there had no systematic tool to numerically measure suppliers' influential level for industries' reference and comparison. Looking for a tool to evaluate buying company's ability to collaborate with suppliers, the quadrant three, (Chen, 2010) proposed a Customer Performance Evaluation model. To evaluate suppliers' performance in new product development (Quadrant four), Le Dain et al. (2007) also introduced a Supplier Performance Evaluate model, in which suppliers' contribution was categorized into: (a) product related, (b) process related, (c) project management related, and (d) social relation such as contractual commitment and bids response. Each category was further separated into three phases in new product development process (Figure 2.1). Although the Customer Performance Evaluation and Supplier Performance Evaluate frameworks take almost every

aspects of buyer-supplier interaction into consideration, these models are conceptual and not ready to be applied to industries or future research. Different from the evaluation methods above, the framework presented by De Toni and Nassimbeni (2001) can numerically measure suppliers' co-design ability and was validated in their research. Fourteen measurements used in De Toni's and Nassimbeni's research (2001) are illustrated in Table 2.3. Therefore, this research adopted the framework of De Toni and Nassimbeni (2001) as a tool to evaluate suppliers' co-design.

Table 2.3: Four Quadrants of Buyer and Supplier Performance

Area/Performance	Firm Performance	Supplier Performance
Operations (The Supply Chain)	Q1	Q2
NPD (The Development Chain)	Q3	Q4

Source: Quesada et al. (2006)

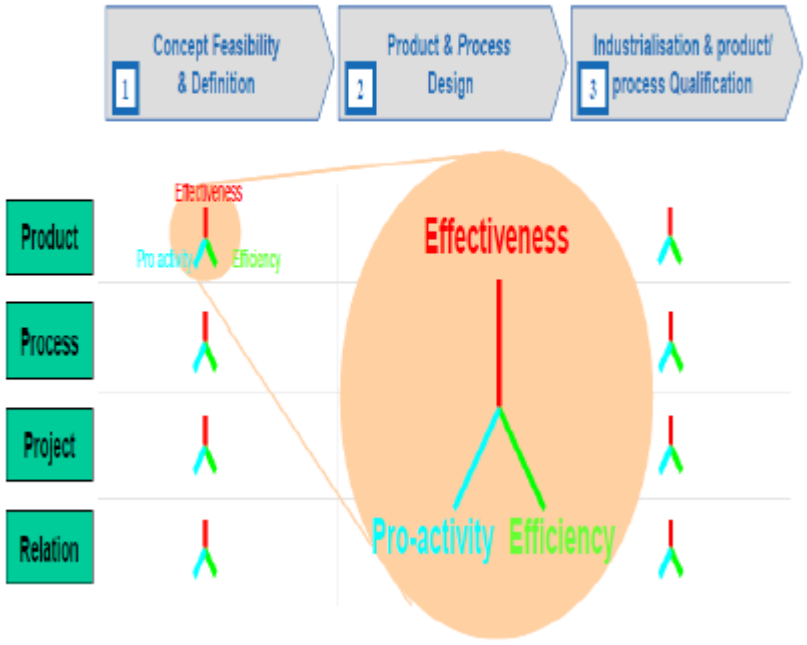

Figure 2.1: Structure of the Supplier Performance Evaluation Mode

Source: Le Dain et al. (2007)

2.10 SUMMARY

The results of literature review provided a wide knowledge of assessment of early supplier involvement in product development in food industries around the world in many regions such as Thailand, UK, Hong Kong and etc. There are also similar objectives with this study conducted at other region, but many of it comes with different preference results and model. This is due to the uniqueness of each project and cultural difference and legislation. The literature review provided a comprehensive estimate for taking the research methodology, method for data analysis and to underpin the development of the questionnaire.

In conclusion, by reviewing through various literatures that related to the study, most of the studies agreed that early supplier involvement contribute a lot in product development in food industry. Suppliers' contributions can be viewed from the aspects of increasing the quality of product, reduce the cycle lead time and reduce the development cost of the product. The manager could use that information to predict the future performance.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter defined the methodology used when conducted this study. The research methodology is necessary in providing a guide to the researchers to achieve the purpose and the objectives of the study. This chapter commenced with the rationale for the research method, design and procedures, including the population, sample, and instruments. In addition to these, data collection, analysis of the data, validity and reliability are discussed.

3.2 RESEARCH DESIGN

This research was conducted by following the research processes flow as shown in Figure 3.1. It started with the first step which was problem identification. Then, this research moved to second step which was identifying the valid sources. The researcher had identified the sources and had collected all the information in a logical manner. Besides, all of the articles or journals were tangible proved to support the research problem. Thus, the answers for the research problem were conceptualized and tested.

After that, this research had moved to the research objectives step. From here, research objectives were formulated in order to conduct the study. Next, research method regarding sampling and population were planned. Participants of this study had been identified and they were mainly the food industries in Selangor and Kuala Lumpur areas.

The development of questionnaire was the next step. The quantitative analysis was chosen to conduct the study. The developed questionnaire was aimed to achieve the research objectives. A pilot study was conducted to verify the questionnaire. If the reliability test of Cronbach's Alpha value is below 0.70, some items should be deleted to increase the value. Modification of questionnaire was conducted.

The eighth step was data analysis which analyzed all the available valid data received from the respondents. The purpose of data analysis is to examine whether the research objectives have been achieved and the solutions for the research were found. At last, the conclusion was produced. In this step, recommendation, limitation and summary of results of the research problem had been discussed.

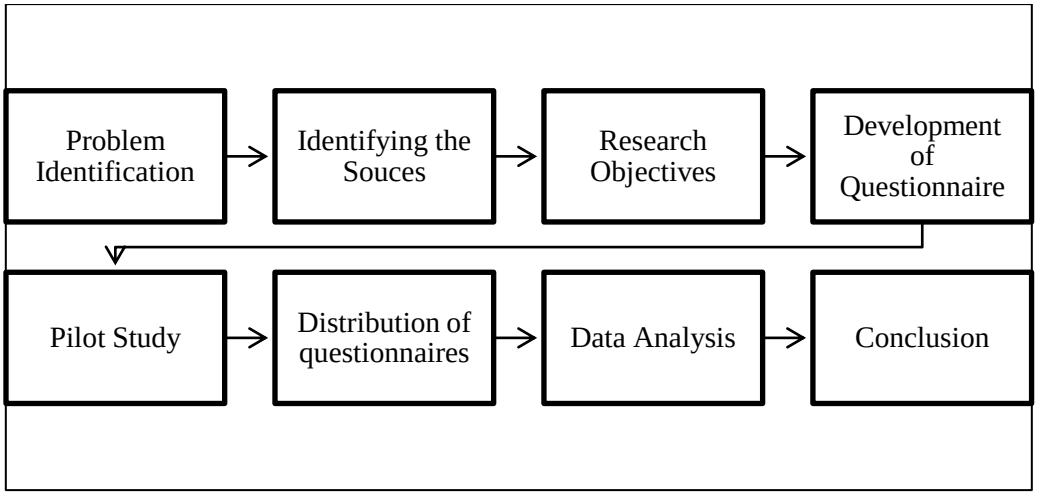

Figure 3.1: Research Process Flow

3.3 RESEARCH METHOD

According to Cavana et al. (2001), there are two research methods available to conduct a research and they are quantitative and qualitative research. For illustration, quantitative research method is the identifying of the research hypothesis or expected solution for the research problem. It included the questionnaires method. On the other hand, the qualitative research method roots out how human construct meanings in their contextual setting. It included the focus group and interview method (Cavana et al., 2001).

In this study, the quantitative research method was applied. This research employed questionnaire survey as the data collection method in order to present a picture of early supplier involvement towards contribution of early supplier involvement in Malaysia food industry. It had provided efficiency in terms of time, cost, energy and quality during data collection (Duflou et al., 2012). Besides, questionnaire was used to retrieve respondents' opinion on rating the contribution of early supplier involvement in product development. From the results, it determined the mean of each measurement. The mean had answered the first objective of the contribution of early supplier involvement in product development. For the second objective, respondent was asked to rate the effectiveness of early supplier involvement in product development. The answer was based on their preference opinion, expertise and experience.

The questionnaire is the simplest tool for collecting and recording information from the respondent (Lever, 2014). The lists of questions which related to the study was formed and the instructions and details had been prepared so that the respondent clearly understood the ideas and concepts. The reason of using the questionnaire method was because it helped to contact large number of people at a relatively lower cost compared to others.

Besides that, the researcher had identified the independent variables and dependent variables from two objectives of this research. The evaluation of the contribution of early supplier involvement in product development in Malaysia food industry was depend on the

new technological identification, technological expertise, support in development of product specifications and support in value analysis or engineering activity of the suppliers. Furthermore, evaluation of the level of effectiveness of early supplier involvement in product development in Malaysia food industry was also depend on the innovation and technology, time to market, development and product cost and product quality.

3.4 DATA COLLECTION TECHNIQUES

The targeted respondents of this study were representative from the food industries in Kuala Lumpur and Selangor. Data were collected and gathered by using a questionnaire survey with valid respondent. Questionnaire was used as an instrument for data collection. According to Muijs (2004), questionnaires are useful in acquiring a huge quantity of data with low cost compared to observation.

The questionnaires have been distributed to the respondents through emails, mail postage and personally administered. The online questionnaire method able to cover the wide spread of geographical area by reducing effort and dealing with a time constraint (Sekaran, 2003). Moreover, questionnaire that distributed by mail posting to each company enhanced high degree of privacy for the respondents, as well as increased the level of honesty and validity of the answer provided by respondents (Scheuren, 2004).

There are different ways that the questionnaires can be carried out from administration of the data bring effects to the quality of data obtained (Bowling, 2005). According to Bowling, different mode of administration of data had significant impact on the validity of the results in a study. This is supported by Zhang (2004) because due to his research, a quality questionnaire survey is an effective tool for gathering data and sampling the opinions of respondents. Moreover, the survey questionnaire method is less time-consuming and less skill required to conduct the questionnaires rather than interview method.

Besides, phone calls were made to the company to validate the exact address. Due date to return back the questionnaires were set on 23 October 2015. Last but not least, phone calls were repeated to the company to confirm that they had received the questionnaires as well as to convey sincere gratitude to the participation of respondents.

3.5 POPULATION AND SAMPLING

Latham (2007) mentioned that there are two types of sampling which are probability sampling and non-probability sampling. In this study, simple random sampling had been used because it was a good method to conduct a pilot study specially when make an effort to question the group that sensitive to the question. The objective of using probability sampling was to select sample from the population so that each sample had an equal chance of being selected.

The targeted population for this study were representative of the food manufacturers in the different food company in Kuala Lumpur and Selangor in Malaysia. Furthermore, the simple random sampling was applied because this research wants to focus on the food and beverage companies in Selangor and Kuala Lumpur area. There are around 180 food-related companies registered in Malaysia External Trade Development Corporation (MATRADE) which is a National Trade Promotion Agency of Malaysia. The targeted respondents are come from low, middle and top management level, who assumed the responsibility and credibility of the person.

For the sample of the study, the simple random sampling ensured the selected respondents were normal distributed and it helped in enhancing the goodness of data. The sample size of this study is 123 food companies in Selangor and Kuala Lumpur. The sample size was determined by using sample size table provided by (Krejcie, 1970). According to Krejcie and Morgan (1970), 123 food companies is a sufficient number to generate the result for the population proportion. Simple random samples were used to

select 123 from the 180 companies. Simple random sampling is a sampling method where items in the research population are uniform and have an equal probability of being included in the sample (Cavana et al., 2001).

Table 3.1: Determination of Sample Size by Using Krejcie and Morgan Table

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

Source: Krejcie and Morgan (1970)

3.6 DEVELOPMENT OF MEASURES: DESIGN OF QUESTIONNAIRE

In order to evaluate effectiveness and contribution of suppliers, measurements in the study of De Toni was used. According to De Toni's and Nassimbeni (2001) work, fourteen measurements were categorized by three stages in new product introduction process (see Table 2.1). The three stages are (a) product concept and functional design, (b) product structural design and engineering and (c) process design and engineering. This research focuses on the early stage of new product introduction process, only four measurements of the product concept and functional design were used. Among the four measurements (see Table 3.2), technology expertise and new technologies identification assess how agreeable of suppliers' involvement in product development will contribute to the projects. Support in the development of product specifications and support in value analysis (VA)/engineering (VE) activities are techniques and methodologies suggested beneficial and contribute to supplier's co-design.

Table 3.2: List of Survey Questions

Measurement	Survey Questions
(a) Technological expertise.	(a1) It is very important that the supplier provides complete and true information regarding the technological expertise.
	(a2) The supplier has provided complete and true information regarding the technological expertise.
	(a3) The information system in your company has significantly helped the supplier provide complete and true information regarding the technological expertise.
(b) New technologies identification.	(b1) It is very important that the supplier contributes to the identification of new materials and new product and process technologies.
	(b2) The supplier has contributed to the identification of new

	materials and new product and process technologies.
	(b3) The information system in your company has significantly helped the supplier contribute to the identification of new materials and new product and process technologies.
(c) Support in the development of product specifications.	(c1) It is very important that the supplier makes significant contribution to the product specifications.
	(c2) The supplier has made significant contribution to the product specifications.
	(c3) The information system in your company has significantly helped the supplier make contribution to the product specifications.
(d) Support in value analysis/engineering activity.	(d1) It is very important that the supplier contributes significantly to the activity of VA/VE.
	(d2) The supplier has contributed significantly to the activity of VA/VE.
	(d3) The information system in your company has significantly helped the supplier contribute to the activity of VA/VE.

Source: Nassimbeni and Battain (2003)

In order to evaluate the effectiveness of early supplier involvement in product development in food industry, the study of Van Echtelt and Wynstra (2001) was referred as a guideline to develop the questionnaires of the research. In Van Echtelt and Wynstra (2001) work, ten measurements were categorized by five aspects to evaluate the effectiveness and potential advantages that can be gained from early supplier involvement in product development (see Table 2.2). The five aspects are (a) innovation and technology related advantages, (b) time-to market related advantages, (c) development cost related advantages, (d) product cost related advantages and (e)) product quality related advantages.

For the study of contribution of early supplier involvement in new product development in Malaysia food industry, each measurement was considered as a group under the main three research questions. There were twelve survey questions in total. On the other hand, in the study of effectiveness of early supplier involvement in product development in food industry, there were total of twelve survey questions. Besides, five-point likert scale was used in the survey questions. In this research, the scale of five-point was used in order to investigate the spread of respondent data in more detail. The Likert scale was describing the quantitative value into qualitative data after analysis (Lee et al., 2002). Likert developed the principle of measuring attitudes by asking people to respond to a series of statements about a topic, in terms of the extent to which they agree with them, and so tapping into the cognitive and affective components of attitudes. The questionnaire used the scale from 1 to 5 which represented from strongly disagree to strongly agree. The Likert scale method was used to measure attitudes directly from the respondents (Polit and Beck, 2008). Table 3.3 is the example of the scale used in the questionnaire.

Table 3.3: The Likert Scale - Questionnaire Scaling

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	2	3	4	5

3.7 VALIDITY AND REALIBILTY OF STUDY

Participants been asked to specify the level of their educational level, knowledge, experience or interest with product development in the questionnaire. It ensured the validity of the survey instrument. Next, the respondents which involve in management in their organizations were invited to take part in the survey because they had equipped to answer questions related strategic matters such as product development. They were equally asked to show their level in management which are low level, middle level and high management level. Cronbach's Alpha coefficient of reliability had been used for each variable in order to

test for the stability and consistency of the variables. Moreover, all respondents were required to currently hold or to had held management position in the past. It was vital to ensure the participants were knowledgeable and had experiences in product development. The diverse practical working experience and relevant organization background of the respondents can support the validity of this study.

3.8 DATA ANALYSIS

The analysis of the survey results was obtained by using Statistical Package for the Social Science (SPSS) software program. The respondent's demography variables, which included sector, working experience, knowledge or experience with new product development, level in the organization were analyzed through descriptive statistic. The frequency, mean and standard deviation on the respondents' profile were presented in the table and histograms.

The data were analyzed by using descriptive statistics. Descriptive statistics involved transformation of raw data into word description to describe a set of factors in a situation, the description data can be obtained through manipulation of collecting raw data by SPSS software which can be in the form of frequencies, mean, median, mode, range, variance and standard deviation.

With the application of SPSS, the data were analyzed from complicated statistical and mathematical procedures and therefore could increase the speed of data analysing process compared to the manual data analysis process. In advance, the data generated from SPSS were displayed in graphics and an instant report was created from it. In this study, for the data evaluation, measure of central tendency was used.

3.8.1 Mean Analysis

The frequency and mean of each item were tabulated. From the frequencies, it illustrated the mean, median and mode were useful measures of central tendencies, depending on the type of available data. The mean was a measure of central tendency that offered a general picture of the data without unnecessarily inundating one with each of the observation in a data set (The Research Advisor, 2006).

For ease of categorizing the obtained value, a categorizing framework was proposed. The purpose of the framework is to decide the mean value generated from each item in the questionnaire analysis falls within the level of implementation (Cavana et al., 2001).

Table 3.4 is the proposed categorizing framework for mean value categorization. In all sections**,** the frequencies of the respondents indicated the outcomes of the pre-defined variables. For instance, if the levels of agreement with the average mean that equivalent to or higher than 3.6, then it reflected that the level of agreement on the contribution of early supplier involvement in product development is positioning in high level.

Table 3.4: Range of Mean

Lower range	**Upper Range**	**Range of mean**	**Level of Agreement**
0.0	$\left[\frac{(2-1)}{2}\right]+1=1.5$	0.0 – 1.5	Strongly Disagree
$\left[\frac{(3-2)}{2}\right]-2=1.5$	$\left[\frac{(3-2)}{2}\right]+2=2.5$	1.6 – 2.5	Disagree
$\left[\frac{(4-3)}{2}\right]-3=2.5$	$\left[\frac{(4-3)}{2}\right]+3=3.5$	2.6 – 3.5	Neutral

$\left[\frac{(5-4)}{2}\right] - 4 = 3.5$	$\left[\frac{(5-4)}{2}\right] + 4 = 4.5$	3.6 – 4.5	Agree
$\left[\frac{(5-4)}{2}\right] - 5 = 4.5$	5.0	4.6 – 5.0	Strongly Agree

The range of mean that formed the categorizing framework was calculated based on midpoint method (Cavana et al., 2001). Table 3.5 showed methods or formulae to calculate the mean value that used in the categorizing framework.

Table 3.5: Midpoint Method

Midpoint method	**Lower range** $\left[\frac{(x_2 - x_1)}{2}\right] - x_1$	**Upper range** $\left[\frac{(y_2 + y_1)}{2}\right] + y_1$

The formula was interpreted as:

To determine lower range:
x_1 = The existing level scale
x_2 = The subsequent level scale

To determine upper range:
y_1 = The existing level scale
y_2 = The subsequent level scale

3.8.2 Reliability Test

Assessment of the goodness of developed questionnaires is very important. In order to test the stability and consistency of the variables, the Cronbach's Alpha coefficient of reliability been used for each variable. Besides that, the Cronbach's Alpha coefficient range can hold a value of zero to 1. When the closer the Cronbach's alpha coefficient values towards 1, the higher is the internal consistency reliability (Gliem and Gliem, 2003). The acceptable level of Cronbach's Alpha coefficient value is 0.70. From the internal

consistency tests, items that are not significant were deleted in order to achieve highest reliability of the measurement.

3.9 PILOT STUDY

For this study, a pre-test questionnaire was conducted before the questionnaire given to the respondent to gather the actual data needed. Cronbach's Alpha coefficient of reliability was used to determine the consistency of variable. According to Streiner and Norman (2008), the range of Cronbach's Alpha value that within 0.50 to 0.70 was reliable and acceptable. Nevertheless, the best level of Cronbach's Alpha should be more than 0.70 and closer to 1.00 to indicate high consistency and reliability of questionnaire data.

In this study, 15 sets of questionnaire had been distributed among employees of managerial position in food industries at Selangor to test for the reliability of the questionnaire. SPSS 22 was used to test the collected questionnaire results. Few researchers mentioned that the closer the Cronbach's Alpha coefficient value to 1, the higher is the internal consistency of reliability (Gliem. J and Gliem. S, 2003).

The analysis of the pilot test in this study declared that the Cronbach's Alpha coefficient value range from 0.833 to 0.878. The Cronbach's Alpha coefficient value for contribution of early supplier involvement in product development in Malaysia food industry is 0.833. The Cronbach's Alpha coefficient value for effectiveness of early supplier involvement in product development in Malaysia food industry is 0.878. The Cronbach's Alpha coefficient value for these two groups were in the acceptance level. The Cronbach's Alpha coefficient value is more than 0.7, thus the elements would continue to be analysed without any variable been deleted.

Table 3.6: Cronbach's Alpha for Pilot Test

Variable	Number of Items	Cronbach's Alpha Value
Contribution of early supplier involvement in product development in Malaysia food industry	12	0.833
Effectiveness of early supplier involvement in product development in Malaysia food industry	12	0.878

3.10 SUMMARY

The study main interest is on assessment of early supplier involvement in product development in Malaysia food industry. The objectives of the study will be tested by using a questionnaire distribution method which would be answered by the company's managers from the food industry in Kuala Lumpur and Selangor area.

Overall, this chapter outlined the research method, research design and sampling which including the population and instruments. It also presented the procedures for data collection and analysis of the data. It equally showed the validity and reliability of the study.

CHAPTER 4

RESEARCH FINDING AND ANALYSIS

4.1 INTRODUCTION

This chapter outline the quantitative findings of the research study. The objective of this study is to analyze contribution of suppliers in early product development in food industry and evaluate effectiveness of early supplier involvement in product development in Malaysia food industry. The study was designed to answer two research questions. Thus, descriptive analysis was performed to measure the profiles of the respondents followed by the reliability of the variables in this study.

The first section of the questionnaire is about the demography background information of the respondents. Information of individual and organizational background such as gender, age group, educational qualification, position in the organizational level, working experience and the type of food product produced were asked in the first section. The second section attempts to evaluate the importance and contribution of early supplier involvement in product development in Malaysia food industry from the aspects of technological expertise, new technologies identification, support in the development of product specifications and support in value analysis activity. The third section is the evaluation of effectiveness of early supplier involvement in product development in

Malaysia food industry from the perspective of time to market, innovation and technology used, development cost, product quality and product cost.

This chapter also reveals the results of data analysis by using Statistical Package for Social Science Software (SPSS 22). Demographic Analysis, Reliability Analysis, Normality Test and Mean Analysis were carried out. All of the findings are presented accordingly in the forms of tables, graphs and pie charts. The discussion and summary are also included in this chapter.

4.2 RESPONSE RATE

In this research, the targeted respondents are the managers of food industries located at Kuala Lumpur and Selangor area. The survey questionnaires were distributed to the managers by using online (e-mail), mail postage method and personally administered. It is vital to ensure the questionnaires are distributed to different company. Table 4.1 below shows the response rate yielded from the questionnaires.

Table 4.1: Response Rate

Methods of Questionnaires Distribution	**Number of Questionnaires Distributed**	**Number of Completed Questionnaires**	**Response Rate (%)**
Online (E-mail)	90	38	42.22
Mail Postage	50	11	22.00
Hand Distributed	40	13	32.50
Total	**180**	**62**	**34.44**

Based on Table 4.1, a total of 62 completed questionnaires were received, which yielded 34.44% of the response rate. For the online survey distribution method, 90 questionnaires were e-mailed to the managers but only 38 questionnaires were completed. Besides, 50 questionnaires were posted to the manager by using mail postage and only 11 completed questionnaires were successfully received. Hand distribution of questionnaire were given to 40 companies and 13 questionnaires were completed. According to Sekaran (2003), 30% of response rate is the minimum acceptable level of response rate for statistical analysis. Moreover, Chatman (2007) also supported that the response rate of 30% or more than 30% was adequate and valid for research analysis. Groves (2004) said that there is no bias even using internet collection, mail postage or hand distribution in collecting data of questionnaires.

4.3 DEMOGRAPHIC ANALYSIS

The purpose of conducting demographic analysis of respondents is to provide the descriptive statistics of the gender, age, years of experience in the company, position, qualification and type of food produced in the company.

4.3.1 Gender of Respondents

Table 4.2: Gender of Respondents

Gender	Frequency	Percentage (%)
Male	42	67.7
Female	20	32.3
Total	**62**	**100**

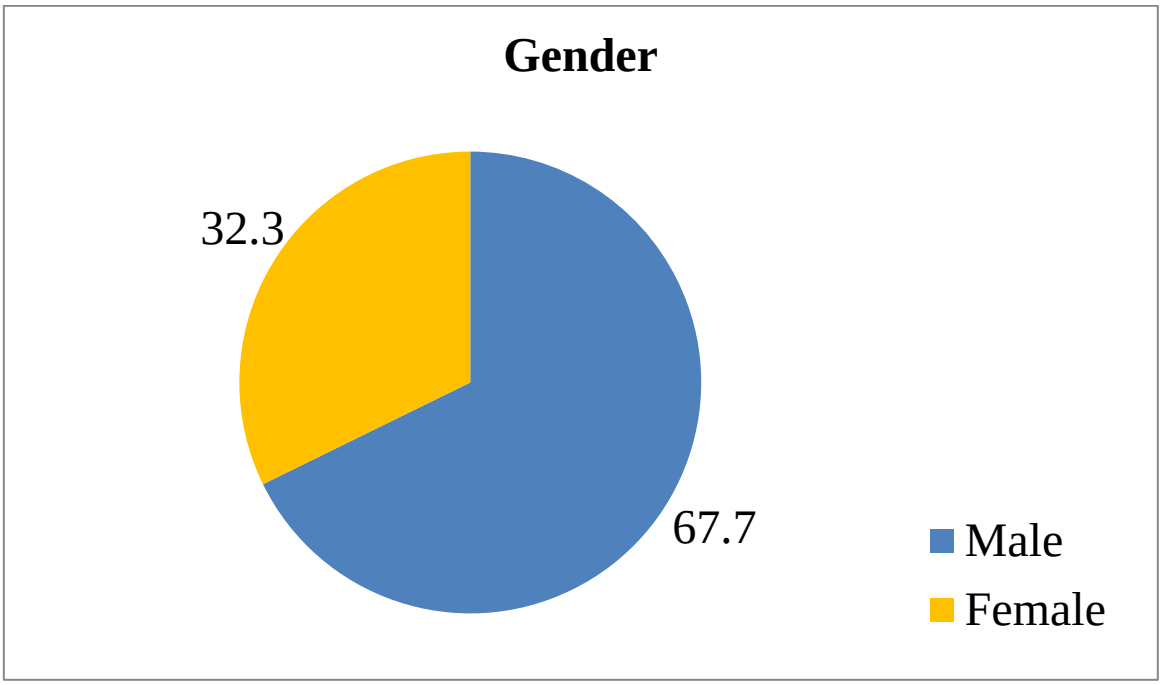

Figure 4.1: Gender of Respondents

Based on Table 4.2 and Figure 4.1, there are 42 males (67.7%) and 20 females (32.3%) involved in this research. Thus, there are more than half of the respondents participated in this questionnaire survey is male.

4.3.2 Age Group of Respondents

Table 4.3: Age Group of Respondents

Age	Frequency	Percentage (%)
21 to 30	27	43.5
31 to 40	12	19.4
41 to 50	18	29.0
More than 51	5	8.1
Total	**62**	**100**

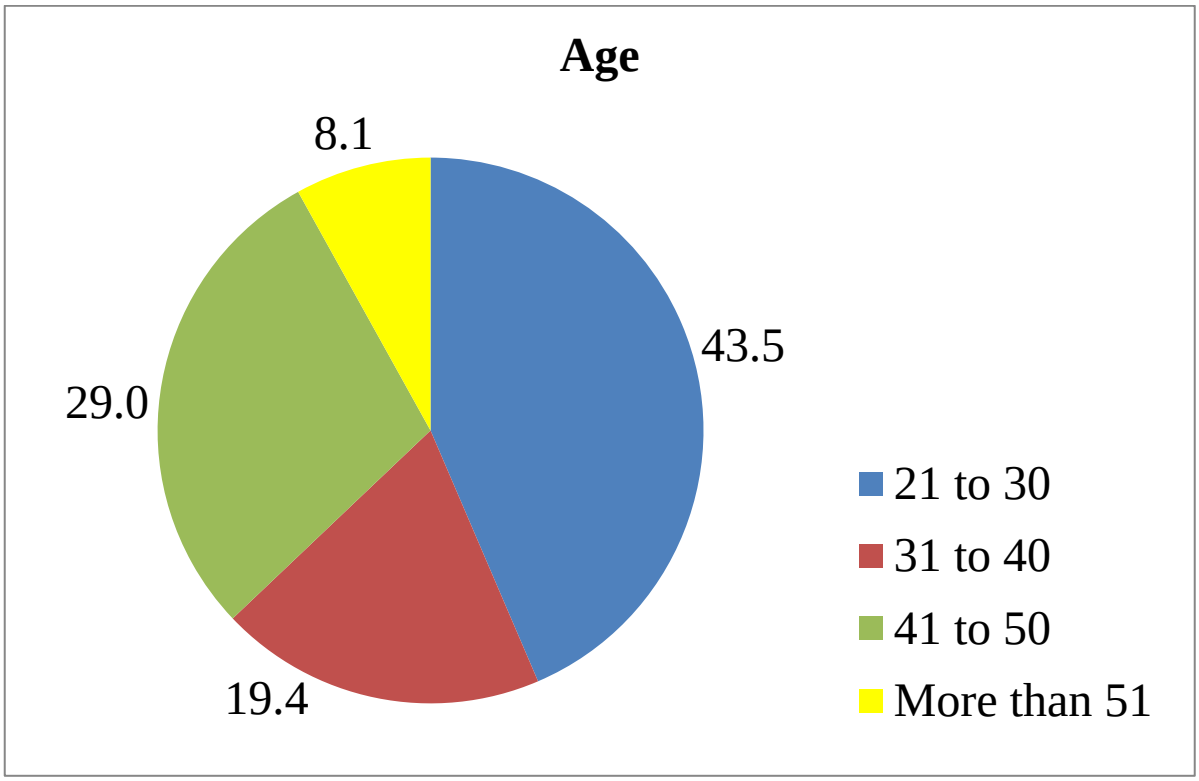

Figure 4.2: Age Group of Respondents

Table 4.3 and Figure 4.2 show most of the respondents are in the age group of 21 to 30 years old, with a frequency of 27 managers (43.5%), whereas the least frequent of the age group is the manager that are more than 50 years old, with a frequency of 5 managers (8.1%). Meanwhile, the age group of 41 to 50 years old is yielded with a frequency of 18 managers (29.0%). Lastly, there are 12 managers (19.4%) are in the range of 31 to 40 years old.

4.3.3 Qualification of Respondents

Table 4.4: Qualification of Respondents

Qualification	Frequency	Percentage (%)
High School	9	14.5
Bachelor	30	48.4
Master	14	22.6
PhD	4	6.5
Others	5	8.1
Total	**62**	**100**

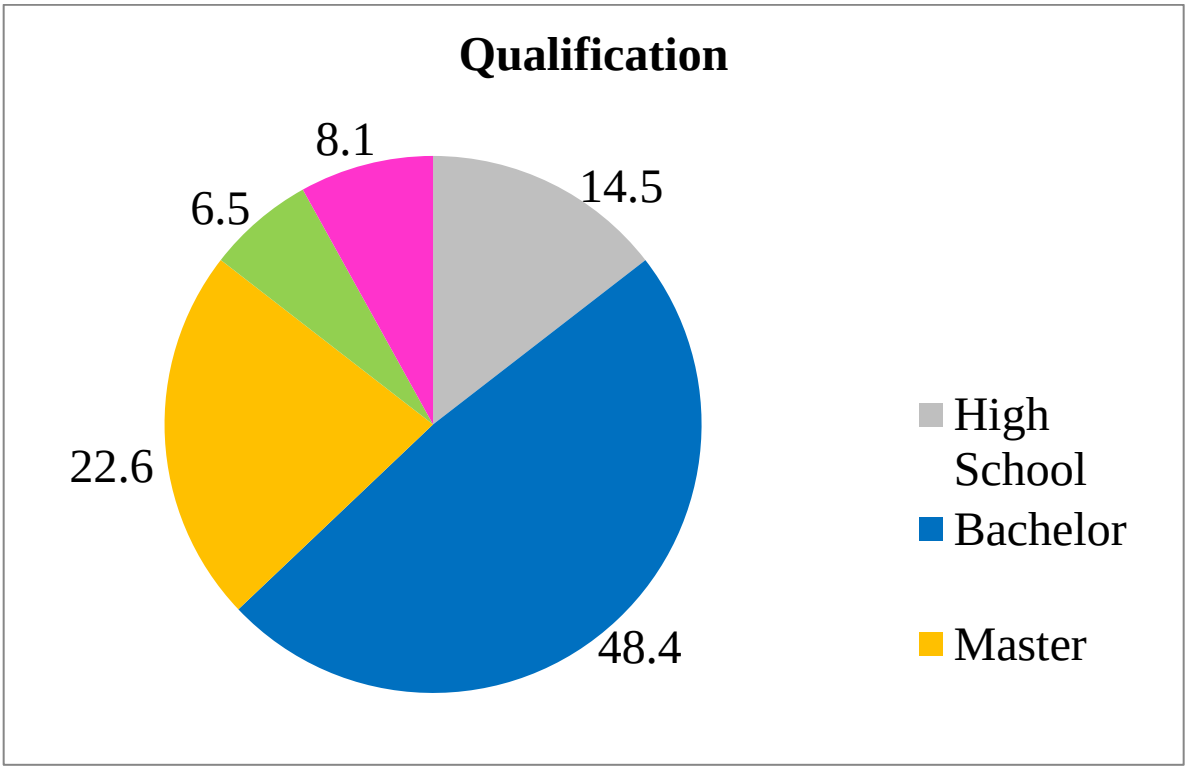

Figure 4.3: Qualification of Respondents

The educational level of respondents had been illustrated as a pie chart and table as shown in Table 4.4 and Figure 4.3. There are five categories included in the educational level of respondents which are high school, bachelor, master, PhD, and others. Others were represented by accountancy related certificates. Majority of respondents are represented by bachelor with a frequency of 30 managers (48.4%) whereas only 4 people study in PhD with percentage of 6.5%. Basically, most of the respondents are graduated with bachelor's degree.

4.3.4 Current Position of Respondents

Table 4.5: Current Position of Respondents

Position	Frequency	Percentage (%)
Low Management Level	6	9.7
Middle Management Level	19	30.6
High Management Level	37	59.7
Total	**62**	**100**

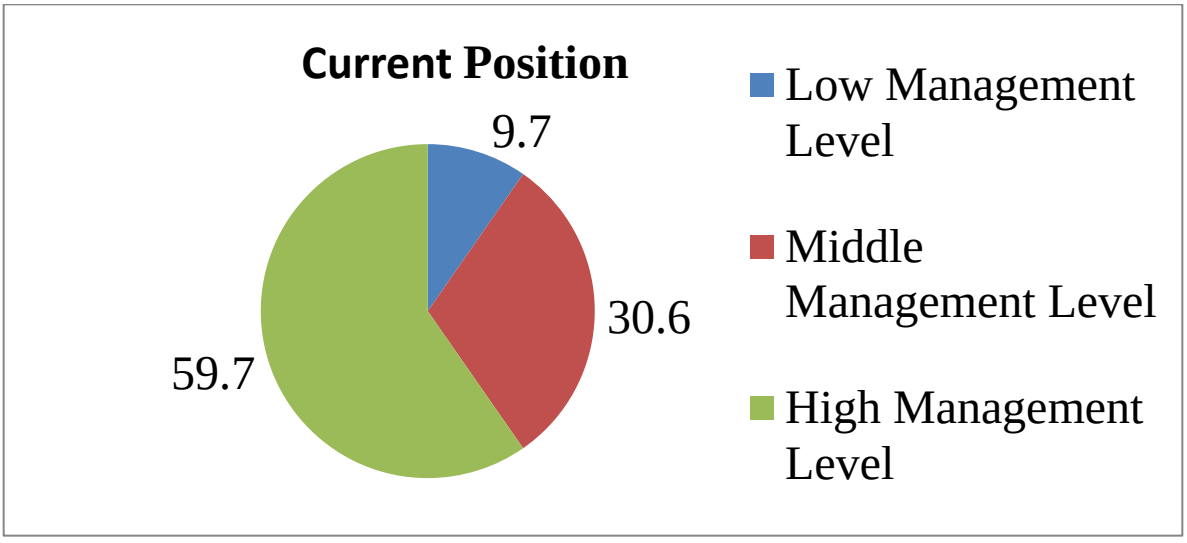

Figure 4.4: Current Position of Respondents

Referring to Table 4.5 and Figure 4.4, there are three categories of position of respondents which are low management level, middle management level and high management level. Top-level management is made up of senior-level executives in an organization like Chief Operating Officer (COO), Chief Executive Officer (CEO), President or Vice President. Majority of middle-level management are head of departments or specialized units. Lower level of management consists of supervisors, operator or first line workers. Most of the respondents (59.7%) are in the current position of high management level with a frequency of 37. Meanwhile, 30.6% of respondents are from middle management level with a frequency of 19. Lastly, there are 9.7% of respondents are from low management level with a frequency of 6.

4.3.5 Work Experience in the Company

Table 4.6: Work Experience in the Company

Work Experience	Frequency	Percentage (%)
Less than a year	4	6.5
2 to 5 years	22	35.5
6 to 10 years	14	22.6
11 to 20 years	13	21.0
More than 20 years	9	14.5
Total	**62**	**100**

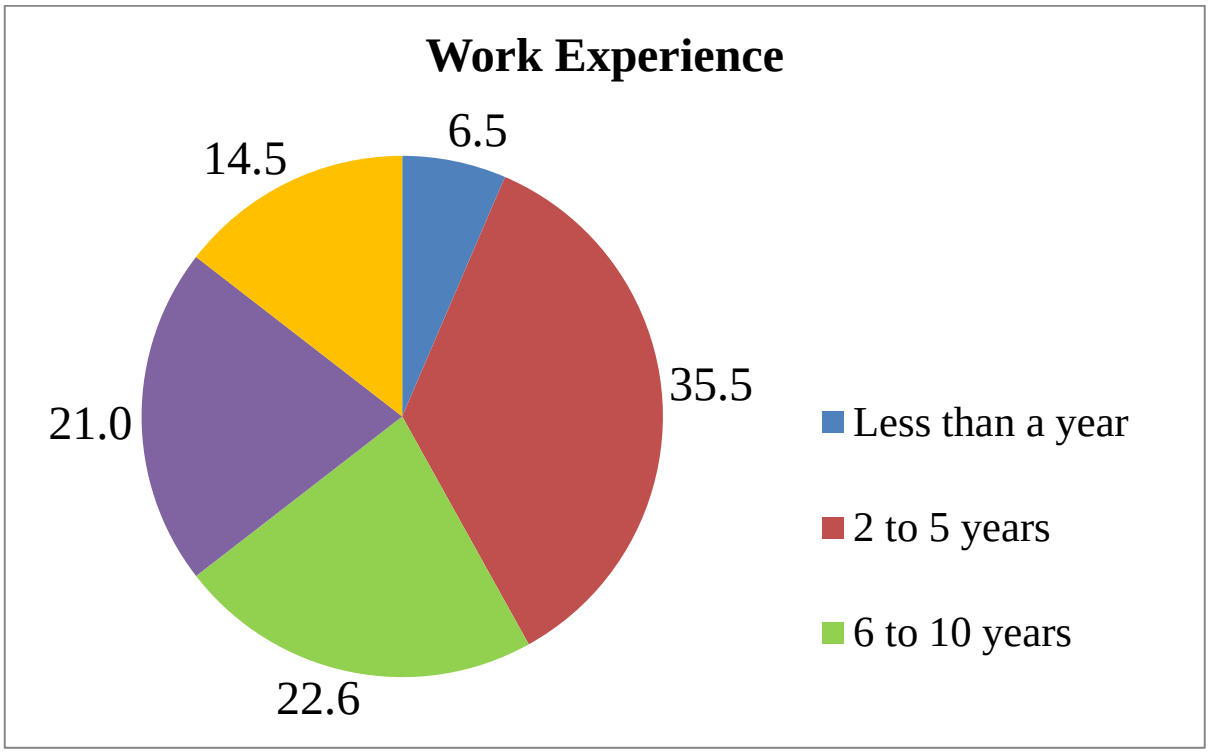

Figure 4.5: Work Experience in the Company

Table 4.6 and Figure 4.5 show the years of working experience by managers in the food industries. Statistics displays that most of the respondents (35.5%) with the frequency of 22 managers served between two to five years in the company, followed by 14 respondents (22.6%) with six to ten years of experience, 13 respondents (21.0%) with eleven to twenty years of experience, 9 respondents (14.5%) with more than twenty years of experience, and 4 respondents (6.5%) with less than one year of experience in descending order.

4.3.6 Type of Food Produced in the Company

Table 4.7: Type of Food Produced in the Company

Food Type	Frequency	Percentage (%)
Functional Food	12	19.4
Health Food	11	17.7
Food Ingredients	12	19.4
Convenience Food	17	27.4
Halal Food	10	16.1
Total	**62**	**100**

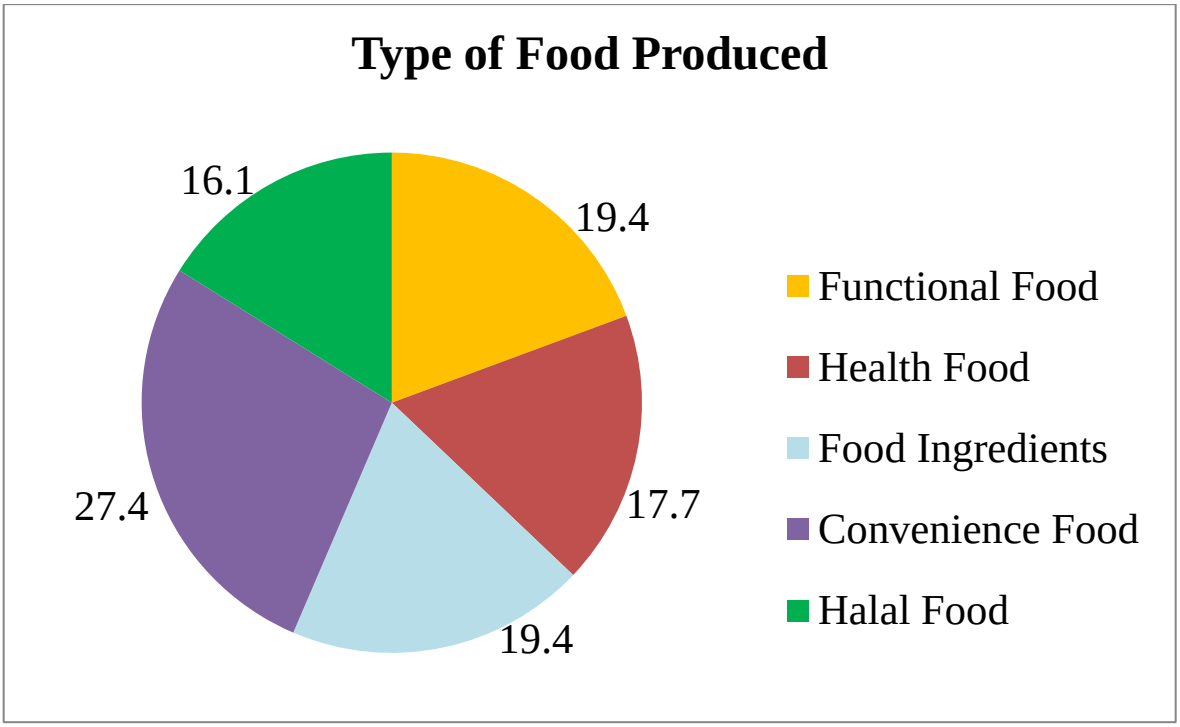

Figure 4.6: Type of Food Produced in the Company

Table 4.7 and Figure 4.6 show the type of food produced in the food companies. From the data analysis, convenience food category ranked the highest (27.4 %) among others with frequency of 17. Companies that produce functional food and food ingredients

both yielded the same 19.4% with frequency of 12 companies. It is followed by health food category which has 17.7% with frequency of 11 companies. Lastly, halal food category yielded 16.1% with frequency of 10 companies.

4.4 RELIABILITY ANALYSIS

After the pilot test is carried out for 15 sample size of firm, 180 questionnaires are distributed to food processing companies at Kuala Lumpur and Selangor and an overall of 62 completed questionnaires were successfully collected.

Therefore, 62 completed questionnaires were used to conduct the reliability analysis. Reliability analysis is a method to ensure the internal data consistency by using the rule of thumb to ascertain the Cronbach's Alpha is reaching the acceptable range which is from 0.50 to 0.70 (Yusoff,2012). The closer the reliability coefficient to 1.0, the greater the internal consistency reliability (Glem, J and Gliem, R. 2003). Besides that, according to Glem, J. and Gliem, R (2003), Cronbach's Alpha less than 0.6 is considered as poor and those in the 0.7 range are considered acceptable while those over 0.8 are considered good.

Table 4.8: Reliability of Variables

Variables	**Cronbach's Alpha**	**Number of Items (N)**	**Item Deleted**	**Cronbach's Alpha if Item Deleted**
Contribution of early supplier involvement in product development in Malaysia food industry	0.748	12	0	0

Effectiveness of early supplier involvement in product development in Malaysia food industry	0.809	12	0	0

The Cronbach's Alpha values of the variables in this study are shown in Table 4.8 above. The analysis in this study declared that the Cronbach's Alpha coefficient value range from 0.748 to 0.809 which implies that the data are statistically significant and normal for all the variables. In addition, since all of the variables in questionnaires are reliable and consistent, no items are required for deletion.

4.5 NORMALITY TEST

4.5.1 Normality Test of Contribution of Supplier Involvement in Early Product Development in Malaysia Food Industry

Table 4.9: Contribution of Supplier Involvement in Early Product Development in Malaysia Food Industry

Scale	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
1	0	0	0	0
2	0	0	0	0
3	154	20.7	20.7	20.7
4	348	46.8	46.8	67.5
5	242	32.5	32.5	100.0
Total	**744**	**100.0**	**100.0**	

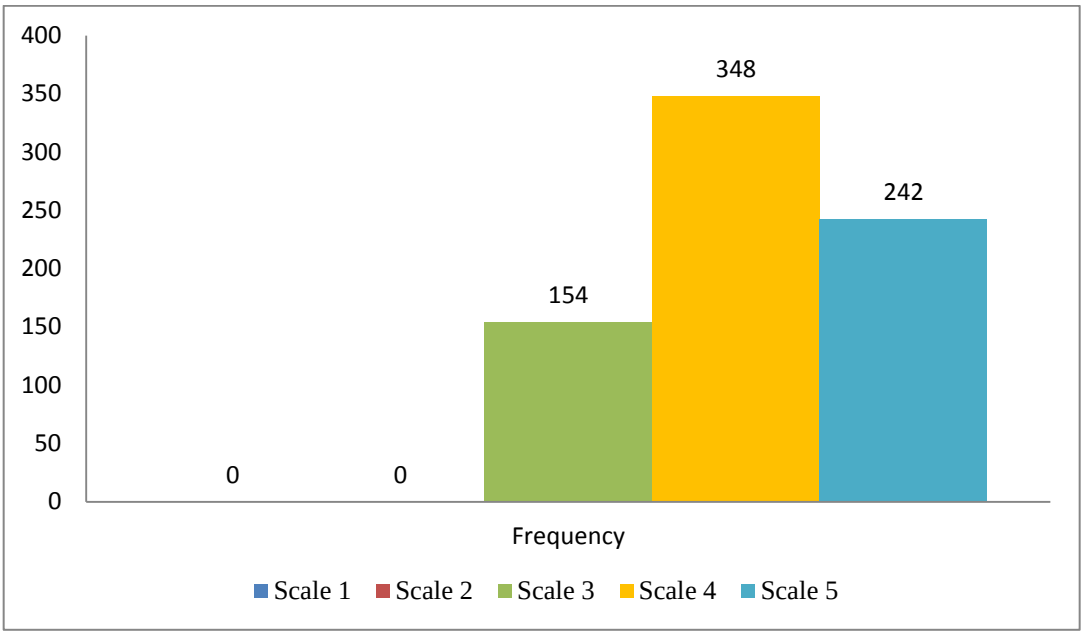

Figure 4.7: Histogram of Contribution of Supplier Involvement in Early Product Development in Malaysia Food Industry

Based on Table 4.9, the scale 1 represents strongly disagree, scale 2 represents disagree, scale 3 represents neutral, scale 4 represents agree and scale 5 represents strongly agree. According to the table, scale 4 has the highest frequency of 348 and covered about 46.8% compared to other scales. Second highest is scale 5 which is 242 or 32.5% and the third highest is scale 3 which is 154 or 20.7%. There were no any frequency in scale 1 and scale 2 from the questionnaires collected.

According to Figure 4.7, it shows a histogram that is normally distributed. From the histogram above, the highest peak is scale 4 which has frequency of 348 or 46.8%. The second highest peak is scale 5 which is 242 or 32.5% and the third highest peak is scale 3 which is 154 or 20.7%. Scale 1 and scale 2 have 0 frequencies from the questionnaires collected.

4.5.2 Normality Test of Effectiveness of Early Supplier Involvement in Product Development in Malaysia Food Industry

Table 4.10: Effectiveness of Early Supplier Involvement in Product Development in Malaysia Food Industry

Scale	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
1	0	0	0	0
2	0	0	0	0
3	235	29.1	29.1	29.1
4	278	34.5	34.5	63.6
5	293	36.4	36.4	100.0
Total	**806**	**100.0**	**100.0**	

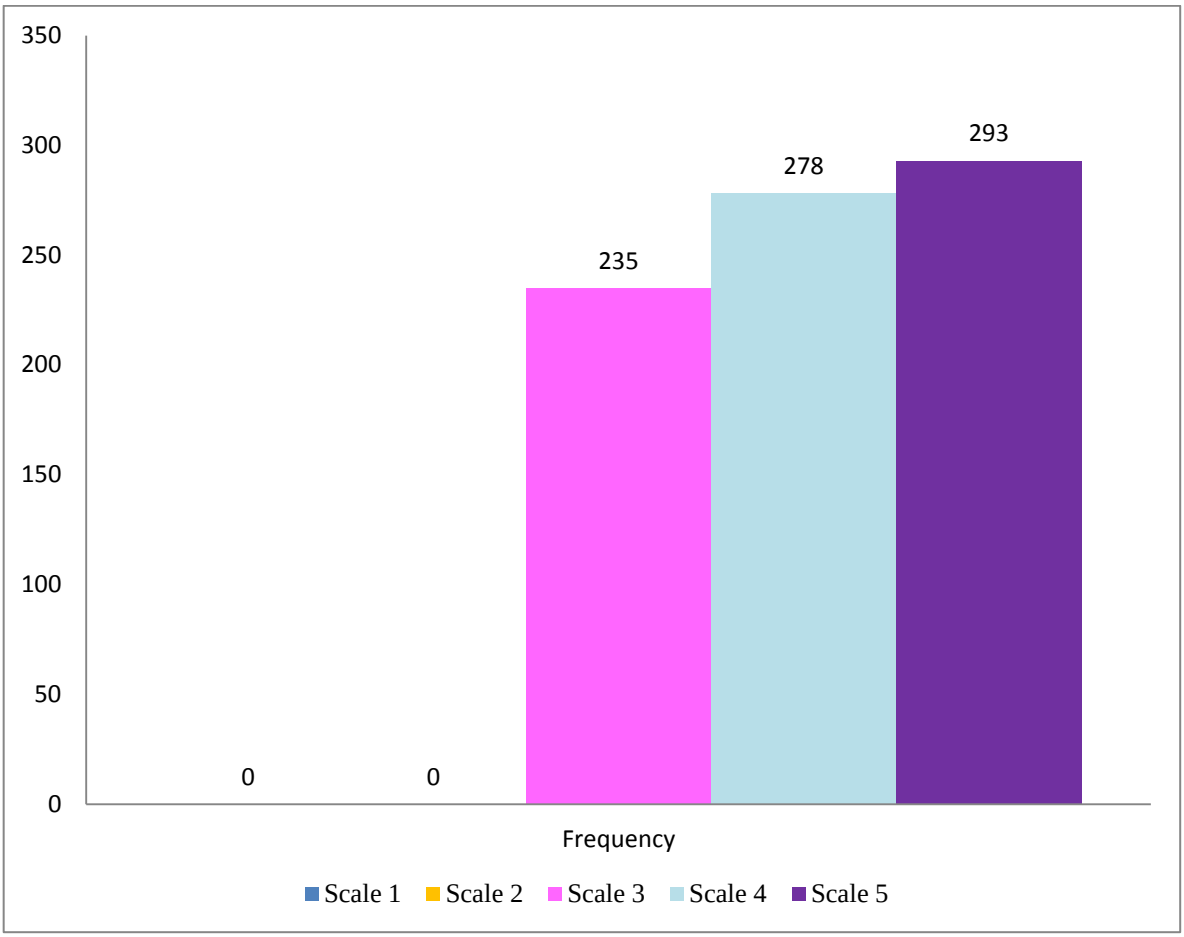

Figure 4.8: Histogram of Effectiveness of Early Supplier Involvement in Product Development in Malaysia Food Industry

Based on Table 4.10, the scale 1 represents strongly disagree, scale 2 represents disagree, scale 3 represents neutral, scale 4 represents agree and scale 5 represents strongly agree. According to the table, scale 5 has the highest frequency of 293 and covered about 36.4% compared to other scales. Second highest is scale 4 which is 278 or 34.5% and the third highest is scale 3 which is 235 or 29.1%. There were no any frequency in scale 1 and scale 2 from the questionnaires collected.

According to Figure 4.8, it shows a histogram that is normally distributed. From the histogram above, the highest peak is scale 5 which has frequency of 293 or 36.4%. The

second highest peak is scale 4 which is 278 or 34.5% and the third highest peak is scale 3 which is 235 or 29.1%. Scale 1 and scale 2 have 0 frequencies from the questionnaires collected.

4.6 MEAN ANALYSIS

4.6.1 Mean Analysis of Contribution of Supplier Involvement in Early Product Development in Malaysia Food Industry

The first objective of the research is aimed to analyze contribution of suppliers in early product development in food industry. The average mean of each dimension is calculated. Respondents were given five-point scale to answer the question, 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The total score of each item will be summed up and divided by the number of items for that specific variable. The mean score were then calculated by using SPSS software.

4.6.1.1 Technological Expertise

Table 4.11: Average Mean of Technological Expertise

Summary Item Statistics

	Mean	**Minimum**	**Maximum**	**Range**	**Maximum / Minimum**	**Variance**	**N of Items**
Item Means	3.968	3.919	4.048	.129	1.033	.005	3

Based on Table 4.11, the average mean score of technological expertise is 3.968. It means that technological expertise is a factor that affects the degree of contribution of early supplier involvement in product development in Malaysia food industry. According to

Smith and Reinertsen (1998), incorporating suppliers on project teams can enhance the information and expertise regarding new ideas and technology in product development. In addition, it allows early identification of potential problems thus improving the quality of the final product.

4.6.1.2 New Technologies Identification

Table 4.12: Average Mean of New Technologies Identification

Summary Item Statistics

	Mean	**Minimum**	**Maximum**	**Range**	**Maximum / Minimum**	**Variance**	**N of Items**
Item Means	4.258	4.210	4.306	.097	1.023	.002	3

Based on Table 4.12, the average mean score of new technologies identification is 4.258. The result indicated that new technologies identification is a factor that affects the outcome of contribution of early supplier involvement in product development in food industry. Kawakami et al. (2011) found that suppliers sharing information about technologies they brought to the company increased new technology identification in product development. Petersen et al. (2003) found that sharing information about technology leads to higher degrees of product development's project satisfaction.

4.6.1.3 Support in Development of Product Specifications

Table 4.13: Average Mean of Support in Development of Product Specifications

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.011	3.855	4.113	.258	1.067	.019	3

Based on Table 4.13, the average mean score of support in development of product specifications is 4.011. The result indicated that support in development of product specifications is a factor that affects the outcome of contribution of early supplier involvement in product development in food industry. Tsai (2009) suggested that a major reason for early supplier involvement is to access more information about product specifications earlier in the development process by leveraging the supplier's expertise.

4.6.1.4 Support in Value Analysis / Engineering Activity

Table 4.14: Average Mean of Support in Value Analysis / Engineering Activity

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.237	4.161	4.290	.129	1.031	.005	3

Based on Table 4.14, the average mean score of support in value analysis or engineering activity is 4.237. The data indicated that support in value analysis or engineering activity is a factor that affects the degree of contribution of early supplier involvement in product development in food industry. Tang and Qian (2008) said that early supplier involvement can improve the value of products by improving the function or reduce the cost. Besides, it helps the products which are not fulfilling the specified requirements and incurring more cost in the manufacturing be replaced accordingly.

Table 4.15: Summary of Average Mean Score of Contribution of Supplier Involvement in Early Product Development in Malaysia Food Industry

Dimension	Average Mean Score	Level of Influence	Ranking
Technological Expertise	4.0	Partially effect	3
New Technologies Identification	4.3	Highly Effect	1
Support in the Development of Product Specifications	4.0	Partially effect	3
Support in Value Analysis/Engineering Activity	4.2	Highly Effect	2

Based on Table 4.15, new technologies identification with average mean score of 4.3 has the highest average mean score among other variables. This dimension was ranked in first position that indicates it has the greatest contribution towards early supplier involvement in product development in food industry. It was followed by support in value analysis or engineering activity with the average mean score of 4.2. There were two dimensions shared the third rank which are technological expertise and support in the

development of product specifications. The average mean score for both of these dimensions were 4.0.

4.6.2 Effectiveness of Early Supplier Involvement in Product Development in Malaysia Food Industry

4.6.2.1 Innovation and Technology

Table 4.16: Average Mean of Innovation and Technology

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.931	3.742	4.081	.339	1.091	.020	4

Based on Table 4.16, the average mean score of innovation and technology activity is 3.931. The data indicated that innovation and technology activity is a factor that affects the degree of effectiveness of early supplier involvement in product development in food industry. When firms involve suppliers in their design process, they may realize an improved market position due to early suppliers involvement that contributed in increasing a firm's chance of being first-to-market with a new innovation and technology. By having innovation and technology improvement, it helps to increase the number of new products the firm produces (Bonaccorsi and Lipparini, 1994). The number of innovations can also be improved when suppliers collaborate with manufacturers (Hingley, 2005).

4.6.2.2 Time to Market

Table 4.17: Average Mean of Time to Market

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.855	3.855	3.855	.000	1.000	.000	2

Based on Table 4.17, the average mean score of time to market is 3.855. The data indicated that time to market is a factor that affects the degree of effectiveness of early supplier involvement in product development in food industry. According to Kawakami (2011), effectiveness can be achieved by suppliers share their knowledge with the company in order to release their product fast into the market compared to competitors.

4.6.2.3 Development Cost

Table 4.18: Average Mean of Development Cost

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.242	4.000	4.484	.484	1.121	.117	2

Based on Table 4.18, the average mean score of development cost is 4.242. The data indicated that development cost is a factor that affects the degree of effectiveness of early supplier involvement in product development in food industry. When the cost per unit decreases due to the improved manufacturability of the components, development cost can be reduced. This cause less rework, fewer scrap parts and reduces potential problems before the product is too far along the development process (Clark, 1991).

4.6.2.4 Product Cost

Table 4.19: Average Mean of Product Cost

Summary Item Statistics

	Mean	**Minimum**	**Maximum**	**Range**	**Maximum / Minimum**	**Variance**	**N of Items**
Item Means	4.476	4.452	4.500	.048	1.011	.001	2

Based on Table 4.19, the average mean score of product cost is 4.476. The data indicated that product cost is a factor that affects the degree of effectiveness of early supplier involvement in product development in food industry. Handfield and Bechtel (2002) said that early supplier involvement in new product development is a way to leverage the supplier's knowledge to reduce product costs.

4.6.2.5 Product Quality

Table 4.20: Average Mean of Product Quality

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.032	4.032	4.032	.000	1.000	.000	2

Based on Table 4.20, the average mean score of product cost is 4.032. The data indicated that product quality is a factor that affects the degree of effectiveness of early supplier involvement in product development in food industry. The quality of the parts can be improved by early supplier involvement because supplier's knowledge is brought in the process when it is still possible to influence on quality. The quality improvements can be achieved by reliability of parts (Le Dain et al., 2007). Tsai (2009) suggested that a major reason for early supplier involvement is to access more and better information earlier in the development process by leveraging the supplier's expertise.

Table 4.21: Summary of Average Mean Score of Effectiveness of Early Supplier Involvement in Product Development in Malaysia Food Industry

Dimension	Average Mean Score	Level of Influence	Ranking
Innovation and Technology	4.0	Partially Effect	3

Time to Market	3.9	Lower Effect	5
Development Cost	4.2	Highly Effect	2
Product Cost	4.5	Highly Effect	1
Product Quality	4.0	Partially Effect	3

Based on Table 4.21, product cost with average mean score of 4.5 is the highest mean score among other variables. This dimension was ranked in first position which indicates it is most effective towards early supplier involvement in product development in food industry. It was followed by development cost with the average mean score of 4.2. There were two dimensions shared the third rank which are innovation and technology and product quality. The average mean score for both of these dimensions were 4.0. Time to market with the average mean score of 3.9 ranked the last among other variables which indicates it is least effective towards early supplier involvement in product development in food industry.

4.7 SUMMARY

In a nutshell, this chapter presents the descriptive analysis of the whole study. There are total of 62 sets valid questionnaires being collected and analysed using Statistical Package for the Social Science (SPSS) software program version 22. For Section A, Demographic Analysis is used to obtain background information of targeted respondents which included gender, age, educational level, current position, work experience and type of food the company producing. Then, the collected data were tested and analysed using

Reliability Test. The values of Cronbach's Alpha of the variables are exceeded 0.7 which indicate the variables are reliable and consistent.

Besides, Normality test is used to test whether the samples are normally distributed. Histograms were constructed and they showed a normal distributed shape of 'bell shape'. Next, Mean Analysis is used to test the variables for contribution of early suppliers and also effectiveness of suppliers' involvement in food industries. For contribution of suppliers involvement in product development, there are total of 4 variables which are technological expertise, new technology identification, support in development of product specifications and support in value analysis or value engineering activity. Based on the result, new technology identification has the highest average mean value and ranked the first position. For effectiveness of suppliers' involvement in food industries, there are total of 5 variables which are innovation and technology, time to market, development cost, product cost and product quality. Based on the result, product cost has the highest average mean value and ranked the first position.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The main purpose of this research was to analyze contribution of suppliers in early product development in food industry and evaluate effectiveness of early supplier involvement in product development in food industry. Data was analysed by using SPSS version 22 to perform Demographic Analysis, Reliability Test, Normality Test and Mean Analysis. Mean Analysis was used to conduct hypothesis testing. Moreover, this chapter is covered with limitation of study, recommendations for future research and conclusion.

5.2 LIMITATION OF STUDY

The limitation of this study can be considered mild due to only a few of constraint being deleted. The potential constraints are included population inaccurate, goodness of data and data collection method.

First of all, the limitation of this research is the list of food companies at Kuala Lumpur and Selangor from Malaysia External Trade Development Corporation

(MATRADE) which is not up to date. There are some wrong information on the contact number and address which cause the survey questionnaire hard to be carried out. Besides that, some of the food companies that are located at Penang and Ipoh are also included in the list, this caused the researcher has to screen the actual food company list one by one and recalculate the total population.

The second limitation is the goodness of data. The quality of data may be affected due to time constraint in collection of data within two months. In addition, the time constraint may reduce the return rate of questionnaire. Most of the respondents that hold the management position were too busy and cannot spend extra time to answer the questionnaire. Thus, this causes the late return of the questionnaires from the companies.

The third limitation is that some of the companies rejected to answer the questionnaires when the researcher distributed the questionnaire to the company by walk-in method. This is due to they do not have extra time to answer the questionnaires or maybe they think that answering questionnaires cannot make profit for the company. Moreover, questionnaires distributed through e-mail method have low reply rate from the companies. Researcher has to take follow up action from time to time to call and e-mail the companies to collect back the questionnaires.

The last limitation is that this research only focused on limited population and sampling frame that derived from Malaysia External Trade Development Corporation (MATRADE). Kuala Lumpur and Selangor are the chosen population among other states in Malaysia.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

This research is considered as the first attempt to analyze the contribution of suppliers in early product development in food industry and evaluate effectiveness of early

supplier involvement in product development in food industry. Thus, in future research, it is advisable to study the other dimensions of the factors that affect the contribution of suppliers and also effectiveness of early supplier involvement.

Secondly, the sample size should be enlarged by adapting several resources and different context for future research. Different states in Malaysia can be taken into consideration for similar study for future research.

Thirdly, the target respondents should only limit to the top management level of managers that are more understand about the nature of buyer-supplier relationship and contribution of supplier in the collaboration to produce their products. The data provided by the right respondent can increase the quality and accuracy of data analysis.

Fourthly, the questionnaire distribution method can be combined with a short session of oral interview. The researcher can explain the content in the questionnaire more clearly to the target respondent in future rather than just leaved the questionnaire inside the office without any further information given. This can prevent the respondents from simply answer the questionnaires due to lack of understanding on the questionnaires.

5.4 CONCLUSION

As a nutshell, this research intended to analyze contribution of suppliers in early product development in food industry and evaluate effectiveness of early supplier involvement in product development in Malaysia food industry. The research was achieved by investigating and analysing the dimensions of contribution and degree of effectiveness from the suppliers.

Several advantages and challenges related to early supplier involvement were found. For a food company, the advantages result in shorter product cycle time, lower price of

parts and fewer quality problems. The advantages would motivate companies to apply early supplier involvement in relationships but the challenges often occur. Some of the challenges that need to be overcome are lack of trust, willingness to share information and other more. The challenges must be overcome to enable a well-functioning relationship with early supplier involvement.

For the statistical analysis, the Mean Analysis was carried out to calculate the average mean of each dimension of early supplier involvement. For analysis of contribution of suppliers in early product development in Malaysia food industry, the result showed that technological expertise, new technologies identification, support in the development of product specifications and support in value analysis or engineering activity are computed with average mean above 4.0. Besides, for evaluation of effectiveness of early supplier involvement in product development in Malaysia food industry, innovation and technology, development cost, product cost and product quality are computed with average mean above 4.0 except time to market that has 3.9 of average mean.

The results denoted that most of the respondents agreed that the factors affected the contribution and effectiveness of early supplier involvement. Moreover, new technologies identification and support in value analysis or engineering activity are considered as highly effect factors while technological expertise and support in the development of product specifications are considered as partially effect factors. Furthermore, development cost and product cost are considered as highly effect factors. Innovation and technology with product quality are considered as partially effect factors and time to market considered as low effect factor.

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APPENDIX A

PROJECT ACTIVITIES MILESTONE/ GANTT CHART

Gantt chart for Final Year Project 1

No		Week													
	Research activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Briefing by FYP coordinator														
2	Meeting with supervisor, discussing project title and objective														
3	Deciding the topic and objectives														
4	Getting supervisor's approval of the topic and objectives														
5	Preparing project proposal														
6	Preparing chapter 1,2,3														

7	Submitting draft chapter 1,2,3														
8	Correcting and editing chapter 1,2,3														
9	Preparing cover page, content, preference list, questionnaire														
10	Submitting full report of FYP 1														
11	Preparing slide for oral presentation														
12	Presenting the FYP1														

Gantt chart for Final Year Project 2

No		Week													
	Research activity	2	4	6	8	10	12	14	16	18	20	22	24	26	28
1	Distribution of Questionnaire														
2	Analysing the														

	Data														
3	Preparing Chapter 4														
4	Preparing Chapter 5														
5	Submitting First Draft of Chapter 4 and 5														
6	Final Editing of FYP2														
7	Submitting FYP														

APPENDIX B

FACULTY OF INDUSTRY MANAGEMENT

QUESTIONNAIRE

Dear Mr / Mrs / Ms,

First of all, I would like to thank you for taking part in this survey. This questionnaire is designed to study ***Assessment of Early Supplier Involvement in Product Development in Malaysia Food Industry.*** I sincerely invite you to take part in this survey and thank you for your kind contribution.

For your information, this study is conducted in fulfilment of Final Year Project for Bachelor of Industrial Technology Management in Universiti Malaysia Pahang. All of your responses will be kept strictly private and confidential and will be used as academic purpose only. A summary of this result will be mailed to you after the data are analyzed, if you would like to have a copy.

Thank you for your co-operation in this survey. Your involvement in this study would be very much appreciated. If you have any further question, please do not hesitate to contact with us.

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Industrial Technology Management

Faculty of Industry Management

Universiti Malaysia Pahang

Introduction

This survey is part of a study about the Assessment of Early Supplier Involvement in Product Development in Malaysia Food Industry. The main objective of this survey is to analyze the contribution of suppliers in early product development; to evaluate the effectiveness of early supplier involvement in product development in Malaysia food industry. This study will help in enhancing and increasing the effectiveness of product development in Malaysia's food industry as the early involvement of suppliers in the early stages of product development. Study data and findings may also be presented in academic platforms including published academic papers.

Confidentiality

The information obtained will be strictly used for academic research purpose only and no attempt will be made to identify any individual or organization in any of the publications. All questionnaires will be concealed, and no one other than the Final Year Project Supervisor access to these materials.

Participation

Participation in this research study is completely voluntary. You have the right to withdraw at any time or refuse to participate entirely in this questionnaire.

Instruction

The questionnaire will take approximately 15 minutes or less. Questions are designed to determine the contribution and effectiveness of early supplier involvement in product development. This questionnaire consists of three (3) main sections. Please read the statement carefully before answering the question.

By using the following scale, please select the appropriate number to indicate the extent to which how frequently you as the project practitioner performs with each other following statements:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SD	D	N	A	SA
1	2	3	4	5

SECTION A

The questions of this section are about respondents' individual and organizational background. Please tick (/) (or fill in the blank) in correct category representing the most appropriate responses for you in respect of the following items.

1. You are:

   ☐ Male ☐ Female

2. Your age are:

   ☐ 21 – 30 ☐ 41 – 50

   ☐ 31 – 40 ☐ > 51

3. What is your highest educational qualification?

   ☐ High School ☐ Master

   ☐ Bachelor ☐ PhD

   ☐ Other (please specify): _____

4. What is your current position: _____

5. How many year you had been working in current position?

   ☐ < 1 year ☐ 6 – 10 years ☐ > 20 years

   ☐ 2 – 5 years ☐ 11 – 20 years

6. Which food do your company produce?

   ☐ Functional food ☐ Food ingredients ☐ Halal food

   ☐ Health food ☐ Convenience food

SECTION B

This section is attempts to evaluate the importance and contribution of early supplier involvement in product development in Malaysia food industry.

No	Statement	SD	D	N	A	SA
Technological Expertise						
a1	It is very important that the supplier provides complete and true information regarding the technological expertise.	1	2	3	4	5
a2	The supplier has provided complete and true information regarding the technological expertise.	1	2	3	4	5
a3	The information system in your company has significantly helped the supplier provide complete and true information regarding the technological expertise.	1	2	3	4	5
New Technologies Identification						
b1	It is very important that the supplier contributes to the identification of new materials, new product and process technologies.	1	2	3	4	5
b2	The supplier has contributed to the identification of new materials, new product and process technologies.	1	2	3	4	5
b3	The information system in your company has	1	2	3	4	5

	significantly helped the supplier contribute to the identification of new materials, new product and process technologies.					
Support in the Development of Product Specifications						
c1	It is very important that the supplier makes significant contribution to the product specifications.	1	2	3	4	5
c2	The supplier has made significant contribution to the product specifications.	1	2	3	4	5
c3	The information system in your company has significantly helped the supplier make contribution to the product specifications.	1	2	3	4	5
Support in Value Analysis/Engineering Activity						
d1	It is very important that the supplier contributes significantly to the activity of VA/VE.	1	2	3	4	5
d2	The supplier has contributed significantly to the activity of VA/VE.	1	2	3	4	5
d3	The information system in your company has significantly helped the supplier contribute to the activity of VA/VE.	1	2	3	4	5

SECTION C

This section is attempts to evaluate the effectiveness of early supplier involvement in product development in Malaysia food industry.

No	Statement	SD	D	N	A	SA
Innovation and Technology						
e1	Effectiveness of early supplier involvement in product development increases efficiency and effectiveness of future collaboration.	1	2	3	4	5
e2	Effectiveness of early supplier involvement in product development makes better access to technological resources and knowledge.	1	2	3	4	5
e3	Effectiveness of early supplier involvement in product development creates long term alignment of technological strategies.	1	2	3	4	5
e4	Effectiveness of early supplier involvement in product development creates strong influence for future technological investments.	1	2	3	4	5
Time to Market						
f1	It is effective that the early supplier involvement in product development reduce lead time.	1	2	3	4	5
f2	It is effective that the early supplier involvement in product development can	1	2	3	4	5

	predict schedules and launch dates of products.					
Development Cost						
g1	It is effective that the early supplier involvement in product development reduce development costs (improved resource utilization).	1	2	3	4	5
g2	It is effective that the early supplier involvement in product development reduces transaction cost.	1	2	3	4	5
Product Cost						
h1	Effectiveness of early supplier involvement in product development in providing suggestions of alternative materials to increase product quality/functionality and lowering cost.	1	2	3	4	5
h2	Effectiveness of early supplier involvement in product development in reducing manufacturing cost.	1	2	3	4	5
Product Quality						
i1	It is effective that the early supplier involvement in product development can develop better performing designs/ improved product performance	1	2	3	4	5
i2	It is effective that the early supplier	1	2	3	4	5

	involvement in product development can reduce quality problems.					

END OF QUESTION.

THANK YOU.

Kindly reply this Questionnaire via fax to number 09-5665075.

Your kind co-operation is highly appreciated.

APPENDIX C

SPSS OUTPUT

Pilot Test of Cronbach's Alpha (Section B of Questionnaire)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.833	.836	12

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
It is very important that the supplier provides complete and true information regarding the technological expertise	45.93333	20.352	.766	.798
The supplier has provided complete and true information regarding the technological expertise	46.06667	20.210	.965	.788

The information system in your company has significantly helped the supplier provide complete and true information regarding the technological expertise	46.13333	22.838	.403	.827
It is very important that the supplier contributes to the identification of new materials, new products and process technologies	45.80000	19.886	.757	.797
The supplier has contributed to the identification of new materials, new product and process technologies	45.46667	23.267	.264	.838
The information system in your company has significantly helped the supplier contribute to the identification of new materials, new product and process technologies	45.46667	23.552	.378	.828
It is very important that the supplier makes significant contribution to the product specifications	45.80000	20.886	.597	.811
The supplier has made significant contribution to the product specifications	46.33333	20.952	.640	.808

The information system in your company has significantly helped the supplier make contribution to the product specifications	45.80000	19.886	.757	.797
It is very important that the supplier contributes significantly to the activity of value analysis / value engineering	45.73333	22.638	.273	.842
The supplier has contributed significantly to the activity of value analysis / value engineering	45.93333	24.067	.167	.844
The information system in your company has significantly helped the supplier contribute to the activity of value analysis / value engineering	45.53333	24.695	.096	.847

Pilot Test of Cronbach's Alpha (Section C of Questionnaire)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.878	.892	12

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Effectiveness of early supplier involvement in product development increases efficiency and effectiveness of future collaboration	44.9333	28.638	.670	.864
Effectiveness of early supplier involvement in product development makes better access to technological resources and knowledge	45.1333	29.410	.489	.873
Effectiveness of early supplier involvement in product development creates long term alignment of technological strategies	45.2000	28.171	.427	.882
Effectiveness of early supplier involvement in product development creates strong influence for future technological investments	45.0000	27.000	.638	.864
It is effective that the early supplier involvement in product development reduce lead time	45.3333	26.810	.748	.857

It is effective that the early supplier involvement in product development can predict schedules and launch dates of products	45.3333	26.810	.748	.857
It is effective that the early supplier involvement in product development reduce development costs (improved resource utilization)	45.2667	27.352	.824	.854
It is effective that the early supplier involvement in product development reduces transaction cost	44.4667	30.838	.452	.875
Effectiveness of early supplier involvement in product development in providing suggestions of alternative materials to increase product quality/functionality and lowering cost	44.3333	29.810	.724	.866
Effectiveness of early supplier involvement in product development in reducing manufacturing cost	44.6000	29.686	.655	.867

It is effective that the early supplier involvement in product development can develop better performing designs/ improved product performance	45.0667	29.210	.407	.880
It is effective that the early supplier involvement in product development can reduce quality problems	45.0667	29.210	.407	.880

Demographic Analysis

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	42	67.7	67.7	67.7
	Female	20	32.3	32.3	100.0
	Total	62	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21 to 30	27	43.5	43.5	43.5
	31 to 40	12	19.4	19.4	62.9
	41 to 50	18	29.0	29.0	91.9

	More than 51	5	8.1	8.1	100.0
	Total	62	100.0	100.0	

Years of Working in Current Position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than a year	4	6.5	6.5	6.5
	2 to 5 years	22	35.5	35.5	41.9
	6 to 10 years	14	22.6	22.6	64.5
	11 to 20 years	13	21.0	21.0	85.5
	More than 20 years	9	14.5	14.5	100.0
	Total	62	100.0	100.0	

Highest Educational Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School	9	14.5	14.5	14.5
	Bachelor	30	48.4	48.4	62.9
	Master	14	22.6	22.6	85.5

	PhD	4	6.5	6.5	91.9
	Others	5	8.1	8.1	100.0
	Total	62	100.0	100.0	

Type of Food Produced

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Functional Food	12	19.4	19.4	19.4
	Health Food	11	17.7	17.7	37.1
	Food Ingredients	12	19.4	19.4	56.5
	Convenience Food	17	27.4	27.4	83.9
	Halal Food	10	16.1	16.1	100.0
	Total	62	100.0	100.0	

Reliability Analysis

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.748	.758	12

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
It is very important that the supplier provides complete and true information regarding the technological expertise	45.37097	15.581	.619	.970	.704
The supplier has provided complete and true information regarding the technological expertise	45.48387	14.942	.859	.981	.681
The information system in your company has significantly helped the supplier provide complete and true information regarding the technological expertise	45.50000	17.598	.222	.829	.749

It is very important that the supplier contributes to the identification of new materials, new products and process technologies	45.20968	15.382	.613	.889	.703
The supplier has contributed to the identification of new materials, new product and process technologues	45.16129	17.351	.197	.940	.756
The information system in your company has significantly helped the supplier contribute to the identification of new materials, new product and process technologues	45.11290	17.774	.186	.859	.753
It is very important that the supplier makes significant contribution to the product specifications	45.30645	15.232	.618	.982	.701

The supplier has made significant contribution to the product specifications	45.56452	16.283	.388	.855	.731
The information system in your company has significantly helped the supplier make contribution to the product specifications	45.35484	15.249	.620	.884	.701
It is very important that the supplier contributes significantly to the activity of value analysis / value engineering	45.12903	17.196	.217	.888	.754
The supplier has contributed significantly to the activity of value analysis / value engineering	45.25806	18.654	.018	.467	.772
The information system in your company has significantly helped the supplier contribute to the activity of value analysis / value engineering	45.16129	17.449	.227	.276	.749

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.809	.811	12

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Effectiveness of early supplier involvement in product development increases efficiency and effectiveness of future collaboration	44.8548	23.765	.227	.	.815
Effectiveness of early supplier involvement in product development makes better access to technological resources and knowledge	44.9839	22.049	.475	.	.793

Effectiveness of early supplier involvement in product development creates long term alignment of technological strategies	45.1935	22.159	.378	.	.804
Effectiveness of early supplier involvement in product development creates strong influence for future technological investments	44.9839	20.475	.635	.	.777
It is effective that the early supplier involvement in product development reduce lead time	45.0806	20.797	.618	.	.779
It is effective that the early supplier involvement in product development reduce lead time	45.0806	20.797	.618	.	.779

It is effective that the early supplier involvement in product development reduce development costs (improved resource utilization)	44.9355	21.111	.655	.	.777
It is effective that the early supplier involvement in product development reduces transaction cost	44.4516	23.268	.442	.	.798
Effectiveness of early supplier involvement in product development in providing suggestions of alternative materials to increase product quality/functionality and lowering cost	44.4355	23.397	.349	.	.804
Effectiveness of early supplier involvement in product development in reducing manufacturing cost	44.4839	23.631	.433	.	.799

It is effective that the early supplier involvement in product development can develop better performing designs/ improved product performance/ reduce quality problems	44.9032	22.613	.354	.	.805
It is effective that the early supplier involvement in product development can develop better performing designs/ improved product performance/ reduce quality problems	44.9032	22.613	.354	.	.805