THE RELATIONSHIP BETWEEN TECHNOLOGICAL CAPABILITY AND INNOVATIVE SMEs

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THE RELATIONSHIP BETWEEN TECHNOLOGICAL CAPABILITY AND INNOVATIVE SMES

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DEDICATION

To Mak & Ayah,

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ABSTRACT

Rapid changes in market condition, seen small and medium enterprises (SMEs) give major impact to Malaysian economy because it has provided a great contribution to the economy. Despite the importance of SMEs and the existence of government support from the various ministries and agencies, most literature indicated that SMEs are still having a lot of challenges that hinder their development. This research suggests the embracing of technological capability as an approach to enhance SMEs competitiveness. The objectives of this research are to identify the practices of technological capabilities among innovative SMEs in Malaysia and to investigate the relationship between technological capability and entrepreneurial orientation. The research adapted survey research design using questionnaire to obtain the quantitative data and simple random sampling was used to select the respondents. There are 51 respondents with 86% of response rate companies which are Malaysian innovative SMEs and listed under MTDC incubator programme. The data was analysed using IBM SPSS Software. Descriptive analysis, correlation and regression analytical techniques were used in analysing the research data. The findings indicated that the average mean score for the parameters of technological capability is at high level. This indicates that innovative SMEs that participated in this research have successfully practiced technological capability in their organization. The result of the hypothesis testing show an inter-item correlation that depicts positive correlation with significant relationship between innovation capability and investment capability to entrepreneurial orientation. However, there are no correlation exists between production capability with entrepreneurial orientation. This result indicate that SME entrepreneurs should understand and be aware of the importance of both organizational context and behavioural complexity in developing firm related capabilities in order to achieve the desired level of manufacturing flexibility thus boost their production more efficiently and effectively. Overall, firms need to perform an internal strategic and coherent strategy commensurate with the expected environment to get better performance.

ABSTRAK

Perubahan pesat pada keadaan pasaran, melihat perusahaan kecil dan sederhana (PKS) memberi impak besar kepada ekonomi Malaysia kerana ia memberikan sumbangan besar terhadap ekonomi. Walaupun terdapat kepentingan PKS dan kewujudan sokongan kerajaan dari pelbagai kementerian dan agensi, kebanyakan kajian menunjukkan bahawa PKS masih menghadapi pelbagai cabaran yang menghalang perkembangan mereka. Kajian ini mencadangkan keupayaan teknologi sebagai satu pendekatan untuk meningkatkan daya saing PKS. Objektif penyelidikan ini adalah untuk mengenalpasti amalan keupayaan teknologi di kalangan PKS inovatif di Malaysia dan untuk mengkaji hubungan antara keupayaan teknologi dan orientasi keusahawanan. Kajian ini menggunakan reka bentuk kajian tinjauan menggunakan soal selidik untuk mendapatkan data kuantitatif dan pensampelan rawak mudah untuk memilih responden. Terdapat 51 responden dengan 86% kadar tindak balas daripada syarikat PKS inovatif di Malaysia dan disenaraikan di bawah program inkubator MTDC. Data dianalisis dengan menggunakan Perisian IBM SPSS. Analisis deskriptif, analisis korelasi dan regresi digunakan dalam menganalisis data penyelidikan ini. Hasil kajian menunjukkan bahawa purata min skor untuk parameter keupayaan teknologi adalah pada tahap yang tinggi. Ini menunjukkan bahawa PKS inovatif yang mengambil bahagian dalam penyelidikan ini telah berjaya mengamalkan keupayaan teknologi dalam organisasi mereka. Hasil ujian hipotesis menunjukkan korelasi antara item menggambarkan korelasi positif hubungan yang signifikan antara keupayaan inovasi dan keupayaan pelaburan terhadap orientasi keusahawanan. Walau bagaimanapun, tidak ada hubungan yang wujud antara keupayaan pengeluaran terhadap orientasi keusahawanan. Keputusan ini menunjukkan bahawa usahawan PKS perlu memahami dan menyedari kepentingan konteks organisasi dan kerumitan tingkah laku dalam membangunkan keupayaan firma untuk mencapai tahap pembuatan yang diinginkan seterusnya meningkatkan pengeluaran mereka dengan lebih cekap dan berkesan. Secara keseluruhannya, firma perlu melaksanakan strategi dalaman dan koheren bersesuaian dengan persekitaran yang diharapkan untuk memperoleh prestasi yang lebih baik.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Most of the industries had changed their nature of business because of the changes in the technology and social that derives from the revolution of information to globalization and knowledge-based economy. In addition, there are also changes among the users perspective where they are now more likely to buy a user-friendly products, fast delivery, products with advance technology, good quality products, and service based on value (Fonseka, Tian, & Li, 2014). These changes encourage firms to use existing resources more wisely and to avoid wastage thus creating a new environment for the firm.

Competitiveness of firms has its own characteristics namely special assets and resources, valuable, cannot be replaced or duplicated, and heterogeneous (Wei & Olufemi, 2011). Consequently, firm position will be protected in terms of a great strategy and technology management (Guan *et al.,* 2006). Raisch and Vonkrogh (2007) point out that firm's ability to obtain competitive growth compared to other competitors those who are run the same business in that industry known as competitive growth rate.

1.1 Background of the research

Rapid changes in market condition, seen small and medium enterprises (SMEs) give major impact to Malaysian economy because it has provided a great contribution to the economy. The contribution of SMEs to the economy are creating jobs, generating income, generating export activities, increasing competition for the more advanced and innovative firm, providing training to the needy and encourage more entrepreneurs involve in business (Zakaria, 2011).

SMEs are unable to compete with multinational companies based on price due to limited financial resources. Conversely, on the basis of the corporate policy, larger firms often find it is very difficult to react to current trends in the market (Tasmin *et al.,* 2013). Therefore, SMEs need to take advantage on the weaknesses of multinational companies by quickly adapt better strategies to the specific needs of the market and a high level of commitment. This strategy is considered important to build a good relationship with their customers and gain a competitive advantage compared with others larger companies.

Sobanke *et al.,* (2013) point out that the companies may have a competitive advantage in their industry with important strategic resources of technological capabilities. Excellent technological capabilities can also guarantee advantages in efficiency of the innovation process that accelerates the development of new products as well as higher product diversity that will respond to the environment of changing market (Shu-en & Ming, 2007). Moreover, acknowledgement of technological capability and its level can helps the firm to identify its strengths and weaknesses, assist in designing technological innovation strategy and improve competitive advantage (Son, 2014). This advantage is particularly important to innovative SMEs, namely as the users of technology that will enable them to compete at a higher level. Thus, more values will create by the company and achieve higher profit than other competitors within their industry.

Other than that, innovation management studies normally focus on small high-tech companies, process of innovation and development of new product (Laforet & Tann, 2006). The government of Malaysia had also developed different strategies in order to stimulate innovation in high-tech industry, as the innovation is significant for innovative

companies (Naqshbandi & Kaur, 2015). In Malaysia, incubators are used as a part of a strategy to achieve rapid economic growth, that is, to achieve its long-term vision of transforming the country from an underdeveloped to a developed state. Technology incubators are one of the important elements required to produce technopreneurs (Said, Adham, & Abdullah, 2012). Therefore, the government agencies implemented technology incubator programmes that served as a medium for technopreneurs to increase the number of technology-based SMEs in Malaysia. One of the government agencies is Malaysian Technology Development Corporation (MTDC), a company wholly-owned by Khazanah Nasional Malaysia. Khazanah Nasional Berhad is the strategic investment fund of Malaysia Government. MTDC has established Technology Development Centers to facilitate university-research-business collaboration at Universiti Putra Malaysia (MTDC-UPM), Universiti Teknologi Malaysia (MTDC-UTM), Universiti Kebangsaan Malaysia (MTDC-UKM), Universiti Teknologi MARA (MTDC-UITM), and lastly Forest Research Institute Malaysia (MTDC-FRIM). In general, government sponsored incubators in Malaysia offers several added-value programmes such as entrepreneurial training. Young technopreneurs in Malaysia are lack of capital and basic business knowledge experience required to plan and build business operations around the technology concept they wish to develop. This is where entrepreneurial training comes handy. The trainings provided include preparation of business plan, basic company management and looking for financing.

Moreover, entrepreneurship scholars have attempted to use intangible resources that firms maintain to explain innovative performance by investigating entrepreneurial orientation (EO) (Getz & Petersen, 2005). In this research, innovative SMEs which focus on EO is used as firms' orientation and proclivity to explore new opportunities and manifests itself through a firm's tendency to accept innovativeness, risk-taking, and proactiveness (Lumpkin & Dess, 1996). In conclusion, competitiveness of innovative SMEs can be improved by identifying the practices of technological capability and entrepreneurial orientation in order to address the problems faced by them rather than only understanding their business problems. Hence, innovative SMEs should take another

initiative as a step to explore and utilize their strengths and also overcomes all the weaknesses they have.

1.2 Problem statement

There are a lot of efforts in terms of government infrastructures, incentives and policies in order to support the development of Malaysian SMEs (Abdullah & Shamsuddin, 2009). For example, government had set up various programmes in line with the objectives to support the development of SMEs through various ministries and agencies that consists of both government and private sectors (Yusoff, Yaacob, & Ibrahim, 2010).

Despite the importance of Malaysian SMEs and the existence of government support from the various ministries and agencies, most literature indicated that Malaysian SMEs are still having a lot of challenges that hinder their development and the failure rate is getting higher (Yusoff & Yaacob, 2010). This is due to the problems faced by Malaysian SMEs such as experiencing competitive challenges. The competitive challenges made up from limited capability to fulfill the market liberalization and globalization challenges, robust global competition, restricted accessibility to capital and financing, knowledge acquisition and technology management has a limited capacity, inadequate of information and knowledge resources, vigorous competition among producers, infrastructure with high cost, does not perform well in human capability, less of employees with managerial skills, less of talented employees, lack of skills for the new start-up company and less quality of output and low productivity (Doh & Kim, 2014; Hasnan *et al.,* 2014; Hilmi *et al.,* 2010; Poorangi *et al.,* 2011; Rahman & Ramli 2014; Zain *et al.,* 2012).

The main reason for the SME closure is due to the fact that SME owners are not aware of the business challenges, especially in terms of financial and management skills. The funds provided by the government or any other sources are used without proper records and future plans. Other than financial constraints, SMEs experience a lack of managerial skills, marketing issues, product/service innovation, knowledge management and internationalization (Rahman, Yaacob & Radzi, 2016).

Furthermore, innovation had been considered as the main key to success for a firm to sustain their competitive advantage (Bigliardi, Colacino, & Dormio, 2011; Rhee, Park, & Lee, 2010). According to Laforet and Tann (2006), small business are an important driving force for innovation activities and are able to become innovative as the larger companies. Innovative SMEs are firms that use the technology to produce new products, new processes and services, in order to achieve competitive advantage (Arshad *et al.*, 2014). In the same way, based on SME Corporation (2012), SME Masterplan 2012-2020 has proposed new targeted approach to promote innovative and align SME development to the broader national aspirations of achieving a high income economy by 2020 through innovation-led and productivity-driven growth. This plan aims to increase business formation, expand number of high growth and innovative firms, raise productivity and intensify formalization.

Normally, innovative SMEs utilize their own internal resources to explore competitive advantage (Qi, Yang, & Xiao, 2007). Competitive advantage, particularly in high-tech industries can be achieved within their industry by using an important strategic resource which is firms' technological capability (Duysters & Hagedoorn, 2000). Technological capability is based on the accumulated knowledge of a firm's ability to perform a set of activities that enable the development of new technologies to achieve positive economic results (Reichert & Zawislak, 2014). Hence, innovative SMEs must focus on their technological capability in order to improve its productivity, competitiveness and economic growth. Moreover, past studies had shown that technological capability is an important determinant that can enhance competitiveness and improve firm performance directly or indirectly (Kuen-Hung Tsai, 2004; Lee, Lee, & Pennings, 2001; Shu-en & Ming, 2007). With the increasing importance of entrepreneurial orientation in innovative SMEs, researchers have examined the practices of technological capability impact to the firms' entrepreneurial orientation.

In summary, this study adds the complementary analysis of competitive strategy and resource-based view perspectives to the study of the relationship between technological capabilities and entrepreneurial orientation. Despite, from the previous studies only analyze the direct effect of technological capabilities on firm performance.

This research attempts to fill the gaps in the literature as there are relatively no identified studies on technological capability relationship with entrepreneurial orientation. History shows that innovation is key to survival. With the advent of a knowledge-based economy, technological capabilities are recognized as the driver of industry performance and economic growth. A conceptual model is then proposed in the following chapter to address the above gaps. The model may help innovative SMEs to achieve higher impacts on their businesses from the utilization of technological capability and may also provide a strategic roadmap for other SMEs. Meanwhile, firms with high levels of entrepreneurial-oriented processes are proficient in creating new organizational forms and environment configurations and are capable of shaping market arrangements to their advantage.

1.3 Research questions

Research questions are used to form a basis in deciding the direction and focus of this research. The research questions are as the following:

i. What is the practices of technological capabilities among innovative SMEs in Malaysia?
ii. What are the relationship between technological capability and innovative SMEs in Malaysia?

1.4 Aim and objectives of the research

The aim of this research is to identify the practices of technological capability among innovative SMEs industries in Malaysia. Based on the research background and other related issues, the objectives of this research are as follows:

i. To identify the practices of technological capabilities among innovative SMEs in Malaysia.
ii. To investigate the relationship between technological capabilities and innovative SMEs in Malaysia.

1.5 Scope of the research

This research is focused on innovative SMEs or technology-based SMEs. Whilst, the sample for this research comprises an innovative SMEs which are list under MTDC incubator programme. The list of the companies is gathered from Malaysian Technology Development Corporation (MTDC), a company wholly-owned by Khazanah Nasional Malaysia. Khazanah Nasional Berhad is the strategic investment fund of Malaysia Government. The targeted respondents were general managers or core members of the managerial team or assigned persons by general manager who have good understanding of the firm.

The rational choice of this respondents because of the role of MTDC; overseeing the technology-based companies' development, as the key player in commercialization and promoting technology-based companies which is as innovative SMEs. MTDC provide fund management, incubation, advisory, and nurturing services. In addition, it is also relates to the graduation policy of the incubator programme laid down by the MTDC. For example, a company can only be said to have graduated from the Technology Center Program if MTDC have found that the company had complied with two or more of the conditions that have been set. Other than that, technology incubators boasts an excellent opportunity for technology startups to collaborate and network with other like-minded entrepreneurs by providing an affordable location. The five centres of incubators located at Universiti Putra Malaysia (MTDC-UPM), Universiti Teknologi Malaysia (MTDC-UTM), Universiti Kebangsaan Malaysia (MTDC-UKM), Universiti Teknologi MARA (MTDC-UITM), and lastly Forest Research Institute Malaysia (MTDC-FRIM).These five centres facilitate cross-sharing of knowledge and experience with companies and researchers alike, enabling industry and academia to leverage on each other's strength whilst accelerating commercialization activities.

1.6 Significant of the study

This study hopes that SMEs can improve their understanding on technological capability. This study also can help innovative SMEs in managing and designing organizational strategies using technological capabilities. In addition, technological capabilities of innovative SMEs can boost their production more efficiently and effectively.

Other than that, this study can also help other researchers to determine the practices of technological capabilities of the innovative firm. This will also help other researchers to obtain information related to technological capabilities and unique features of firms in the selected innovative SMEs.

1.7 Organization of the thesis

This research consists of five chapters. The writing organization explains the transition of research progress according to chapters. *Chapter 1* is for introduction. In this chapter, the background of research title is elaborated and discussed. As the understanding of research background is cleared, the problem statement is identified from the gaps that exist in the research background, research questions are formulated and relevant research objectives are presented. Lastly, the scope of research and significant of research is discussed.

Chapter 2 reviews the aspect of technological capability (TC) so that it can give a clear knowledge of relevant research regarding this research topic. It consists of the understanding of TC, previous work on the parameters of technological capability, the background of Malaysian SMEs and the drivers of innovative SMEs. Next, the RBV theory is used and a conceptual framework is then proposed in this chapter to address the research gaps. The discussion on the relationship between each variable also discussed in this chapter.

Chapter 3 discusses the methodology and the techniques that had been used to accomplish the aim of this research and the research objectives. This chapter include philosophy of research, research design, research population and sampling, research instruments, data collection and the process of data analysis. The quantitative approach

was adopted to carry out the research. A questionnaire is the research instrument that help researcher to obtain the data. Then, the pilot test analysis examined the content of the questionnaire so that the correction can be made before the actual research is carried out. The data were analyzed using IBM SPSS Software. In short, in order to conduct an academic research, the methodology must be comprehended so that the data obtained are reliable and valid.

Chapter 4 describes data analysis and discussion. The data collected from the survey will be used to answer the two research objectives. In order to do so, there are several analyses to be done by using IBM SPSS software such as descriptive analysis, correlation analysis and regression analysis. The data had been collected by distributed the questionnaires to the innovative SMEs under MTDC incubator programme. Thus, research findings and result will be discuss further and will have short summary at the end of the discussion.

Chapter 5 explains the conclusion and recommendations. The main conclusion is drawn out in this chapter and the limitations that encountered during the whole process of collecting data. This chapter also shows the research objectives achievement; and offers conclusions with regard to the research outcomes based on the respective research questions and the contributions to the body of knowledge. Finally, recommendations for future research are proposed.

CHAPTER 2

TECHNOLOGICAL CAPABILITY AND INNOVATIVE SMEs

2.1 Introduction

This chapter reviews some of the earlier work on the application of firm's technological capability in some industries. It focuses on the understanding of technological capability, the definitions, importance of technological capability and also the parameters to measure technological capability. All the categories of the technological capability will lead to the development of an instrument for measuring technological capability in Malaysian innovative SMEs. This chapter also defines and explains the definition and the background of Malaysian SME and innovative SMEs.

2.2 Technological capability

Technological capability changed over the year because it was a dynamic or not static entity (Cobbenhagen, 2000). It is important to find out the laws of technological capabilities as it is the basis to the effective management of technological innovation (Xianjun, Ke, & Li, 2009). The evolution and development of technological capability is associated with the input and transformation of capital, human resources, equipment, and information (Vertova, 2001).

Jiang (2000) defined technological capability as the knowledge of the firm and the capacity of organizational and individual resources which includes humanware, technoware, organware and inforware. Identification, development, and utilization of techniques as the knowledge and skills required in conceptualized technological capability (Acha, 2000). While in UK aerospace industry, technological capability is an innovation of technology and awareness for the needs of future technology (Reed & Walsh, 2002).

Oyebisi, Olamade, and Agboola (2004) has been defined technological capability as the output of economic activities, as the input of economic activities and as both of output and input of economic activities. Technological capability refers to the ability to increase knowledge about the physical world in a unique way, developing and designing new products and processes as well as convert this knowledge into the design and instructions for creating the desired result (Wang *et al.,* 2006). Moreover, the ability of the company to make a choice, improve absorption, technology development and the new technology creation is a technological capability that is define by emphasize the dynamic characteristics of the company's technical development (Peng, Yan, & Zhou, 2007). García-Muiña and Navas-López (2007), understand technological capability by implement strategies for competitive and create value in the environment provided by the ability of generic knowledge-intensive to jointly mobilize technical and scientific resources in order to develop different products that are innovative and productive process.

Technological capability is as the ability to identify and exploit the technological opportunities to produce new products or noticeable improvement and successfully commercialize the products (Petti & Zhang, 2011). According to Voudouris *et al.,* (2012), the skills, knowledge and experience are necessary in order to initiate and manage changes in technology that is used by the firm refers to internal technological capability. Technological capabilities is a knowledge based and as the different scientific techniques available to the firm such as cables, generators, and lighting in electrical and electronic industry (Haeussler, Patzelt, & Zahra, 2012).

Sobanke *et al.,* (2013) mentioned that technological capability can be found at the firm and national level. At national level, technological capability can be known as the

accumulation of individual's effort and business strategies that have to select, operate, understand, adapt, install, improve, sustain and develop technology. Technological capabilities at firm level facilitate innovation and contribute to increase productivity. Based on industry reports in developing countries, there are some innovations among micro, small and medium enterprises, which prove the existence of some level of capabilities. Reichert and Zawislak (2014) define technological capability based on the accumulated knowledge of a firm's ability to perform a set of activities that enable the development of new technologies to achieve positive economic results.

On the other hand, technological capability is as the main operational capabilities require to realize the business concept, insert knowledge into production and help to get a head start in the competition between low-tech industries (Karagouni *et al.,* 2013). In low technology-based industries, top managers view that is very important to obtain and maintain competitive advantages by using technology along with marketing capability (Protogerou *et al.,* 2011).

In a nutshell, technological capability can be understood as the ability of the organizational and individual resources which consist of firm knowledge, skills and experience that can lead them to exploit the technological capability opportunities, facilitate innovation, contribute to improve productivity, enhance competitiveness, and creating desired result. The next subsection will explain on the importance of technological capability.

2.2.1 The importance of technological capability

Technological capability allows countries and companies to perform several functions, such as innovation that can contribute to economic growth and able to compete at the international level. Particularly in developing countries, the accumulated capabilities is regarded as a learning process that requires the absorptive capacity (Sobanke *et al.,* 2013).

Similarly, understanding the technological capabilities and its level is one of the main activities in helping companies to investigate the weaknesses and strengths of the firm, plan strategies for innovative technology and improve competitive advantages (Son,

2014). The accumulation of such technological capabilities concerns the development of deeper forms of knowledge that is essential to maximize effectiveness of any technology investment (Zhou & Wu, 2010).

Apart from that, excellent technology capabilities can improve competitive advantage by enhancing quality of product, add value and features, or increase scope of economies (Ortega, 2010). In addition, technological capability can be renewed by using technological forecasting and development such as adapting, integrating and reconfiguring the resources, external and internal firms' skills and functional competencies (Banerjee, 2012). Lastly, a firm will be able to gain economics returns continuously for a long time by using a great technological capability (Jiang, 2000).

Based on the discussions, it is concluded that technological capability enables the companies to study their weaknesses and strengths, gain economics return, propose strategies for an innovative technology, and enhance competitive advantages by; adding more value and features, increase the product quality and expand the economies scope. The parameters that have been used to measure technological capability will be discusses in the next subsection.

2.2.2 The practices of technological capability

There are different parameters that had been used by the previous researchers in order to measure the practices of technological capability of an organization. Researcher has issued some parameters for measuring technological capability that has been used by four previous studies that have been conducted in developed countries such as Turkey, Greece and Spain.

Firstly in Turkey, Türker (2012) highlighted innovation capability as the main components to measure technological capability of a firm in an automotive industry. Similarly, García-Muiña and Navas-López (2007) pointed out only one capability which is innovation capability in order to measure technological capability in biotechnology industry, Spain. In Greece, Voudouris *et al.,* (2012) attempt to measure technological capability using investment capability and linkages capability in the manufacturing SMEs

industry. Karagouni *et al.*, (2013), used only production capability in order to measure technological capability in low-technology sector.

While in developing countries, there are eighteen (18) authors from different countries and different industries. The countries consist of China, Malaysia, Nigeria, Vietnam, and Brazil. Lall, (1992) explores the parameters to measure level of technological capability in developing countries were investment capability, production capability and linkages capability had been applied.

In China, Jin, Fan, and Qingrui (2000), list out the indicators of technological capability on IT firms which consists of service capability, resource allocation capability, innovation capability, marketing capability, investment capability, learning capability and production capability. Shu-en and Ming (2007), measure technological capability in the optoelectronics manufacturing firm by using linkages capability, marketing capability and innovation capability. In electrical sector, Yan *et al.,* (2008) applied production capability, marketing capability and innovation capability to measured technological capability in electrical equipment manufacturing industry. Marketing capability, innovation capability and entrepreneur capability are used to measure core capability and competitive strategy in construction SMEs (Chew, Yan, & Cheah, 2008). Other than that, Shan and Jolly (2010) mentioned investment capability, linkages capability and production capability are the three variables that have been used to measured technological capability in high technology-based companies. Learning capability, R&D capability, resource allocation capability, manufacturing capability, marketing capability, organizing capability and strategic planning capability has become an imperative tool to measure technological capability in an innovative firm in China (Guan *et al.,* 2006). Zou (2010) introduced innovation capability as the key tools to measure the performance of technological capability in the local firms in China.

In Malaysia, the findings comprises production capability, resource allocation capability and organizing capability are the components to measure technological capability in construction's organizations (Omar, Takim, & Nawawi, 2012). As for the study in Vietnam, Lang, Lin, and Vy (2012) claims that the technological capability in a manufacturing firm can be measured by these seven components; investment capability,

R&D capability, resource allocation capability, manufacturing capability, marketing capability, organizing capability and strategic planning capability.

While in Nigeria, Oluwale, Ilori, and Oyebisi (2013) focuses on investment capability, marketing capability, linkages capability, and minor change capability as the tool to measure the practices of technological capability in automotive industry. Oyebisi *et al.,* (2004) presented investment capability, production capability, linkages capability, R&D capability and major change capability as the measurement of technological capability in telecommunication industry. In addition, Sobanke, Ilori, and Adegbite (2012) measure technological capability by using production capability, investment capability, innovation capability and linkages capability in the metal fabricating firms. Simultaneously, this model which consists production capability, investment capability, innovation capability and linkages capability has been used also in the metalworking firms in Nigeria (Sobanke *et al.,* 2013).

Other than that, in Nigeria, the performance of technological capability in a firm of furniture industry can be measured also by marketing capability, production capability, investment capability, minor change capability and major change capability (Joseph, Julius, & Olugbenga, 2014). While in manufacturing sectors, Azubuike (2013) applied innovation capability as the instrument to measure technological capability and firm performance in new product development. Lastly in Brazil, according to Reichert *et al.*, (2011) investment capability, production capability, and linkages capability was applied to measure technological capability in medium-low technological companies.

2.3 The development of technological capability parameters model

Analysis of studies related to the measurement of technological capabilities is to identify the models that have been used by previous researchers in different types of countries and industries. Therefore, this analysis may contribute to the formation of a new model that can be implemented in order to measure the practices of technological capability among innovative SMEs in Malaysia.

Based on Table 2.1, there are some of parameters that have been applied to measure technological capability since year 2000 to year 2014. According to Son (2014),

companies are able to investigate the weaknesses and strengths of the firm, plan strategies for innovative technology and improve competitive advantages by understanding the technological capabilities and its level. Hence, the identification of suitable model to measure technological capability is required with context to innovative SMEs in Malaysia. In this regard, most of the authors are using production capability, innovation capability investment capability and linkages capability as the parameters to measure the practices of technological capability in an organization.

There are eleven (11) authors applied investment capability as the parameters to measure technological capability (Jin *et al.*, 2000; Joseph *et al.*, 2014; Lall, 1992; Lang *et al.*, 2012; Obiora & Madukwe, 2014; Oluwale *et al.*, 2013; Oyebisi *et al.*, 2004; Reichert *et al.*, 2011; Shan & Jolly, 2010; Sobanke *et al.*, 2012, 2013; Voudouris *et al.*, 2012). Eleven (11) researches were done in developing countries while only one research had been done in developed country. The developed country refers to Greece and developing countries refer to China, Vietnam, Nigeria and Brazil.

Next, there are eleven (11) authors were used production capability as the parameters to measure technological capability(Jin *et al.*, 2000; Joseph *et al.*, 2014; Karagouni *et al.*, 2013; Lall, 1992; Oluwale *et al.*, 2013; Omar *et al.*, 2012; Reichert *et al.*, 2011; Shan & Jolly, 2010; Sobanke *et al.*, 2012, 2013; Yan *et al.*, 2008). Most of the researches are done in developing countries. Only one of them did the research in developed country which is Greece.

As for the innovation capability, there are eleven (11) authors had been used this parameters to measure technological capability (Azubuike, 2013; Chew *et al.*, 2008; Garcia-muina & Navas-Lopez, 2007; Jin *et al.*, 2000; Shu-en & Ming, 2007; Sobanke *et al.*, 2013, 2012; Türker, 2012; Xu & Chen, 2014, Yan *et al.*, 2008; Zou, 2010). Two of them were done the research in developed countries which are Spain and Turkey. Another nine of them were done the research in developing countries which consists of China and Nigeria.

In conclusion, there are established parameters of technological capability in the literature. However, the selected parameters for measuring the technological capability in this research are innovation capability, production capability and investment capability. The selection of this three parameters because of the larger amount of total frequency which is more than ten authors of past studies. Furthermore, this three parameters also mostly had been done in the developing countries which is suit for Malaysian SMEs environment. The summary of the parameters of technological capability are stated in Table 2.1.

Table 2.1: The summary of the parameters of technological capability

Technological Capabilities / Author(s)	Investment Capability	Production Capability	Linkage Capability	Learning Capability	R&D Capability	Resource Allocation Capability	Manufacturing Capability	Marketing Capability	Organizing Capability	Strategic Planning Capability	Innovation Capability	Service Capability	Entrepreneur Capability	Minor Change Capability	Major Change Capability
Lall (1992)	/	/	/												
Jin, Fan, and Qingrui (2000)	/	/		/		/		/			/	/			
Oyebisi *et al.*, (2004)	/	/	/		/										/
Guan *et al.*, (2006)				/	/	/	/	/	/	/					
Mei and Nie (2007)			/					/			/				
Garcia-Muifia and Navas-Lopez (2007)											/				
Yan *et al.*, (2008)		/						/			/				
Chew, Yan and Cheah (2008)								/			/		/		
Shan and Jolly (2010)	/	/	/												
Zou (2010)											/				
Reichert *et al.*, (2011)	/	/	/												
Lang, Lin, and Vy (2012)	/				/	/	/	/	/	/					
Omar, Takim, and Nawawi (2012)		/				/			/						
Sobanke, Ilori, and Adegbite (2012)	/	/	/								/				
Voudouris *et al.*, (2012)	/		/												
Turker (2012)											/				
Karagouni *et al.*, (2013)		/													
Oluwale, Ilori, and Oyebisi (2013)	/		/					/						/	
Sobanke *et al.*, (2013)	/	/	/								/				
Azubuike (2013)											/				
Joseph, Julius, and Olugbenga (2014)	/	/						/						/	/
Xu & Chen (2014)											/				
Total Frequency	**11**	**11**	**9**	**2**	**3**	**4**	**2**	**8**	**3**	**2**	**11**	**1**	**1**	**2**	**2**

2.3.1 Elements of the parameters

2.3.1.1 Innovation capability

The ability to invent, innovate and improve existing technology innovation is the innovation capability that is always had been used for various activities of an organization (Sobanke *et al.,* 2012). In the same way, innovation also is the collection of new ideas, activities of R&D and the experimentation to produce new products and processes. The absence of innovation leads the organization to use traditional way of conducting business activities like; traditionally producing services, products and also distribution channels (Guan *et al.,* 2006).

In developing countries, technological advances can be attributed to some major changes in manufacturing that has produced many innovative products in various sectors (Sobanke *et al.,* 2013). One of a key factor in achieving competitiveness is innovativeness of workers. Furthermore, employee innovation can translate into competitiveness by systematically developing innovation and innovation capability with the right innovation strategy (Husain, Dayan, & Di Benedetto, 2015).

The measures for innovation capability are technology in IT, innovation in finance and operation mechanism, process and technology competency and expertise in managerial and technical (Chew, Yan, & Cheah, 2008). Other than that, the performance evaluation of innovation capability in a firm more focused on the output and resources such as product's speed to market, expenditure in R&D activities and the resulting amount of new products (Wallin *et al.,* 2007).

Moreover, the characteristics of innovation capability such as heterogeneous, cannot be duplicated and replaced will give more benefits to the company and contribute to enhance its competitiveness (Guan *et al.,* 2006).

2.3.1.2 Production capability

More sophisticated production and implementation of process innovation is one of strategic investment carried out by the firm to reduce costs. A combination of production cost efficient and high product differentiation can be produced from a new production technology and innovation in terms of system or organization (Leitner & Güldenberg, 2009).

Innovative company usually does not need to invest in buying production equipment. On the other hand, the companies that are not active in the field of products and processes innovation, they need to invest and re-invest in the purchase of their production equipment (Keizer, Dijkstra, & Halman, 2002). However, the company's production process can be improved if a company has a good allocation of resources capabilities (Hamid *et al.*, 2014).

In short, a better system of production must be carried out by a firm in order to better adapt to its capacity, products and finally the needs and satisfaction from the customer (Zawislak *et al.*, 2012).

2.3.1.3 Investment capability

Investment capability known as the skills and information needed to identify investment projects qualified; provide, seek and buy technology; staff, design and manage the construction design and staff employees; accreditation and commencement *(Sobanke et al.,* 2012). Voudouris *et al.,* (2012) mentioned that one set of positive technological capabilities with both investments itself and its performance depends on the effectiveness of technology investments.

Technology-driven companies are usually accumulate knowledge in technology through significant investment in R & D and rapid acquisition of new technologies, which is facilitate the capability of a firms to refine technology and product differentiation (Hao & Song, 2016).

2.4 The definition of Malaysian SMEs

In 1996, The Small and Medium Industries Development Corporation (SMIDEC) were established to promote and coordinate the development of Malaysian SMEs. SMIDEC was renamed as SME Corp or SME Corporation Malaysia in 2008. SME Corp is responsible to formulate strategies and policies, and coordinate SME events or programs. The new definition for Malaysian SMEs is effective 1st January 2014. The Council endorsed new definition are influenced by the measures of SME Masterplan (2012-2020), price inflation, changes in business trend, changes in our economy and the new definition is about to cover all sectors include construction, mining and quarrying.

The definition is based on two criteria; the business total sales turnover or revenue in a year and the number of full-time employees. Therefore, SMEs in Malaysia generally defined as; manufacturing sector where sales turnover not exceeding RM 50 million OR full-time employees not exceeding 200 employees. For services and other sectors; sales turnover not exceeding RM 20 million OR full-time employees not exceeding 75 employees. Table 2.2 and Table 2.3 shows the simplified of new definition by the three categories namely Micro, Small and Medium for SMEs in Malaysia:

Table 2.2 : Definition based on annual sales turnover (National SME Development Council, 2014)

Size	Manufacturing	Services and Other Sectors
Micro	Less than RM 300,000	Less than RM 300,000
Small	From RM 300,000 to less than RM 15 million	From RM 300,000 to less than RM 3 million
Medium	From RM 15 million to not to exceeding RM 50 million	From RM 3 million to not exceeding RM 20 million

Table 2.3 : Definition based on number of full-time employees (National SME Development Council, 2014)

Size	Manufacturing	Services and Other Sectors
Micro	Less than 5 employees	Less than 5 employees
Small	From 5 to less than 75 employees	From 5 to less than 30 employees
Medium	From 75 to not exceeding 200 employees	From 30 to not exceeding 75 employees

2.4.1 SMEs in Malaysia

The latest statistics from the department of statistics Malaysia present that SMEs in Malaysia indicates the number of total business establishments constituting 97.3% (645,136) in the country. Generally, there is a total of 10,898 large firms in the services sector, 1,808 in the manufacturing, 2,857 in the construction, 2,121 in the agriculture and 119 in the mining and quarrying sector. Of the total percentage of SMEs, SMEs in the services sector possess about 98.2% or 580,985, in manufacturing sector, they possess about 95.4% or 37,861, in construction sector, they made up about 87% or 19,283, in agriculture they possess about 76% or 6,708 and lastly in mining and quarrying sector they possess 71.5% or 299. Table 2.4 shows the current status of establishments by sector in Malaysia.

Table 2.4 : Establishment by Sector in Malaysia (Department of statistic Malaysia, 2013)

	Total SMEs	**Percentage of SMEs**	**Large Firms**	**Total Establishments**
Services	580,985	98.2%	10,898	591,883
Manufacturing	37,861	95.4%	1,808	39,669
Construction	19,283	87%	2,857	22,140
Agriculture	6,708	76%	2,121	8,829
Mining & Quarrying	299	71.5%	119	418
Total	**645,136**	**97.3%**	**17,803**	**662,939**

In terms of employment, the total employment increased from 2010 to 2012 in both SMEs and large firms. SMEs contribute 4,854,142 employees while large firms contribute 3,606,829 employees of total employment which is 8,460,971. Of 2012, figure points out that SMEs have the most number of employment in the country rather than large firms. Overall labor market condition is improved by the gains in employment during the year. The unemployment rate also decreased from 3.1% in 2011 to 3.0% in 2012. Table **2.5** shows the total employment in Malaysia.

Table 2.5: Total employment in Malaysia (Department of statistic Malaysia, 2013)

	2010	**2011**	**2012**
SME Employment	4,389,823	4,562,815	4,854,142
Employment in Large Firms	3,294,714	3,403,549	3,606,829
Total Employment	**7,684,537**	**7,966,364**	**8,460,971**

2.5 Innovative SMEs

Innovation has gained numerous attentions among the scholars and taking interest in innovation related studies. According to Laforet and Tann (2006), innovation is seeking new or better products, processes and/or work methods. Thus, when the existing product or services has been improved or introduced a new product or services are known as product or service innovation. On the other hand, when the products or services has been developed and shaped by new means and alter the traditional approach, it is known as process innovation. Bigliardi, Colacino, and Dormio (2011) defined an innovation as a successful introduction of something new and useful to a firm.

Innovation plays an important role toward financial gain, increase productivity and enhance efficiency of organizations (Gunday *et al.,* 2011). Therefore, innovation received great attention and most of the developed and developing nations are putting more emphasis and attention towards innovation. Yusuf (2009) puts emphasis on the importance of innovation with a view that innovation is raising the firm's efficiency, increase productivity and play as the central character in the global market. Innovation has recognized as a source of development and sustainability (Gunday *et al.,* 2011).

The studies on innovativeness among SMEs are diverse. In literatures, there are no clear definitions available that differentiate between innovative and non-innovative SMEs. A firm's capacity to engage in innovation which include development of new processes, products, or ideas in an organization known as innovativeness (Hult, Hurley, & Knight, 2004; Rhee, Park, & Lee, 2010). Mambula & Sawyer (2006), stated that innovative SMEs appreciates new ideas, adoption of right management systems and has an innovative vision of the management.

Keizer, Dijkstra, and Halman (2001) discovered internal conditions and external variables that influencing innovativeness to SMEs. External variables consist of collaboration with other firms, linkages with other knowledge centers, and utilizing financial resources. Internal conditions consists of risk taking, strategic planning, better technology policy, level of education of the founder, and investment in R&D activities. The other determining factors that contribute to innovative SMEs are market orientation,

strategic orientation, leadership, financial commitment and better technology and system in the company (Bigliardi *et al.*, 2011; Laforet & Tann, 2006). Salavou, Baltas, and Lioukas (2004), point out that market orientation, strategic orientation and investment in R&D are the three main characteristics which drives to innovativeness.

The market orientation used as the characteristics of innovative SMEs which frequently linked to firm performance (Mashahadi, Ahmad, & Mohamad, 2016; Song, Wei, & Wang, 2015; Wang & Miao, 2015). Next, Yan, Maladzhi, and Makinde (2012) assert that a visionary leadership were the key drivers to remain innovative and competitive. The valuable intangible assets which play an important role to drive an organization become more innovative are creativity and risk taking (Kanchan & Gupta, 2009). Moreover, Olsson and Backstrom (2012) holds that creativity and good leadership are required for a successful innovative SMEs.

Furthermore, innovative SMEs tend to have these two criteria such as strong intellectual property rights (IPR) protection system and proactiveness (Zhang, Peng, & Shou, 2012). Other studies by Lechler and Teichert (2011), also mentioned proactiveness as the important force of the innovative SMEs. Ren, Zhang, and Yi (2010) suggest leadership, market orientation, networking, financial resources, high risk taking and proactiveness as the six drivers of innovative SMEs. Indeed, through proactiveness, high-risk nature, leadership and strategic planning could effects the SMEs to become more innovative (Maladzhi, 2015).

Based on Zhu (2010), the key characteristics that were applied to develop the innovative culture in SMEs is high risk-taking. Other than that, Chen, Xu, and Wang (2009) stated that innovative SMEs equipped with high-risk nature, financial commitment, and market orientation. Martinez-Roman, Gamero, & Tamayo (2011), focus on strategic orientation, market orientation, risk taking and leadership as the unique characteristics of the innovative SMEs. Lastly, innovative firms increasingly rely on the market orientation, strategic orientation, investment in R&D, networking and high-risk nature in order for a firm to become more competitive (Berte, Rodrigues, & Almeida, 2010).

After all, there is no definite definition of innovative SMEs in the literature. However, there are all the characteristics that drive to innovative SMEs. In a nutshell, to draw conclusions regarding the characteristics of innovative SMEs was not easy. Researcher used entrepreneurial orientation as the elements that should be used in describing the innovative SMEs in this research, although there are many different meanings of the term innovative SMEs. In this regard, entrepreneurial orientation which include risk taking and proactiveness are the two drivers of innovativeness (Chen, Du, & Chen, 2011; Zehir, Can, & Karaboga, 2015).

EO is also a driver of an organisation's performance to excellence and serves as competitive advantages (Buttar & Kocak, 2011). EO describes an attempt to explain management-related preferences and beliefs with regards to a firm's overall business operations in responding to customers' needs, product offerings an interactions with competitors (Covin, Green & Slevin, 2006). Managements with EO, therefore, tend to have high risk-taking ability in making bold decisions about resource commitments, especially in uncertain environments (Rauch et al., 2009).

2.6 Resource based view theory

The resource based view (RBV) theory has been commonly used to analyze characteristics at firm level under various element such as capabilities, resources, and routines, which are important to competitive advantage and better firm performance. Penrose (1959) known as one of the earliest person contribute to the RBV's theoretical background (Bakar & Ahmad, 2010).

A firm does not achieve competitiveness because of their resources, however entrepreneur need to interact with their resources and make right decisions regarding maintenance, resource allocation and deployment to enable firm better utilize their resources (Penrose, 1959). This RBV idea demonstrates that a company's success is based on its entrepreneur skills to manage their resources. RBV also can be related as the foundation of competitiveness and financial rent by accumulation of inimitable, rare, precious, and non-substitute assets (Peteraf, 1993). Moreover, a firm can achieve

competitive advantage by concentrating on their resources, including physical, natural, social, economic and organizational resources (Barney, 1991).

Through the RBV point of view, a major concern of the RBV is how an organization's capabilities develop and affect its competitive position and performance. Thus, the recombination of resources, activities and linking routines within the firm is the implementation of the strategic choice and it leads to a new set of activities, new sources of revenue and a new business model for the firm. This study highlights the need for a complementary interaction between these technological capabilities and the competitive tactics developed by the firm. The main aim of this study consists of determining the practices of technological capabilities and entrepreneurial orientation in the innovative SMEs and the positive influence of technological capabilities and competitive strategies on entrepreneurial orientation.

2.7 Conceptual framework

Figure 2.1 demonstrates the conceptual framework investigated in this study. The framework indicates that the adoption of technological capability is affected by three resource factors of a firm: innovation capability, production capability and investment capability. For dependent variable is entrepreneurial orientation.

This framework development is as a guideline provided in assessing the relationship between the practices of technological capability and competitive strategies on entrepreneurial orientation. This is consistent with the RBV paradigm which assumes that strategic resources (including capabilities) are needed in order to gain competitive advantages. Specific hypotheses relating to the relationship among the variables, and their underpinning logic, are described in the following section.

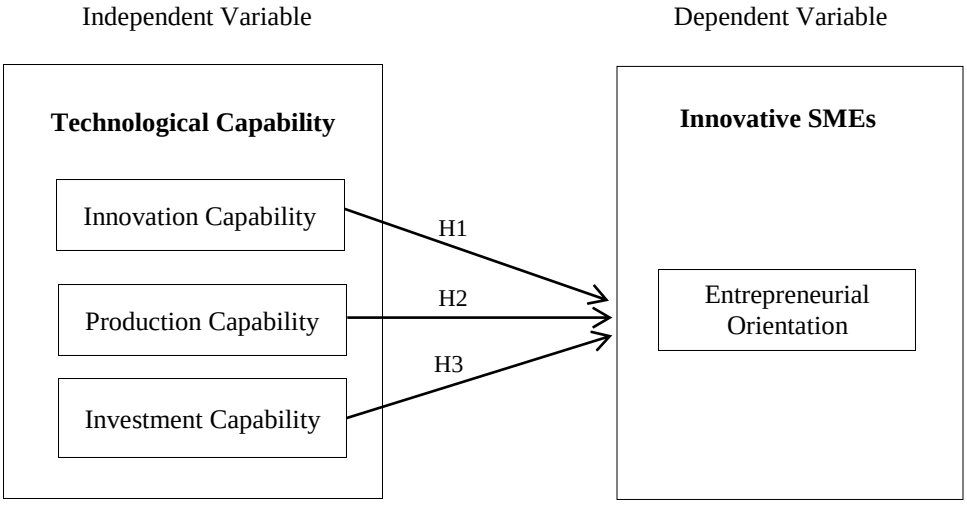

Figure 2.1: Conceptual Framework of the Relationship between Technological Capability and Innovative SMEs.

2.8 Research hypothesis

From the conceptual framework, there are three (3) hypotheses that have been developed in order to examine the relationship between the technological capability and innovative SMEs. Researcher used entrepreneurial orientation as the elements that should be used in describing the innovative SMEs in this research. Therefore, the discussions of the hypotheses that have been developed for this study are as follows.

2.8.1 Innovation capability and entrepreneurial orientation

Recently, the concept of innovation has been given a new aspiration due to the rationality of companies with high interest in evaluating and promoting innovation capabilities (Wallin, Isaksson, Larsson, & Larsson, 2007). The entrepreneurial orientation is a significant way to exploit and find opportunities to become more competitive and profitable (Li, Huang & Tsai, 2009).

Zhu (2010) define that the main characteristics of entrepreneurship are innovativeness and risk-taking. Furthermore, leading in technology exploration can be very beneficial with risk-taking culture of entrepreneurs (Kharabsheh, 2012). Past studies have revealed that successful entrepreneurs are individuals who are not afraid to fail by taking risks (Mambula & Sawyer, 2006). Entrepreneurial behavior of firms can generate more technological possibilities and competitive pressure with fast technological growth (Arshad *et al.*, 2014).

In addition, Zhang, Peng, & Li (2009) also supported this statement, concluding that technological entrepreneurship as the important means thus technological innovations can be commercialized. A firm is organized to utilize their market opportunities by using entrepreneurship as the important ways. Overall, firms need to perform an internal strategic and coherent strategy commensurate with the expected environment to get better performance.

H1: Innovation capability has a positive effect on entrepreneurial orientation

2.8.2 Production capability and entrepreneurial orientation

Quality of production, low cost, value and speed are the steps of the production processes with newly improved advantages for innovative solutions (Gunday, Ulusoy, Kilic, & Alpkan, 2011). Hence, business strategies related to appropriate product and technology capabilities are required by a clear strategic technology management.

Technological capacities are technical, information and skills, managerial and institutional data that enable productive companies to make use of machinery and technology efficiently (Biggs *et al.*, 1995). Technological capability include a much wider range of effort that each of company must undertake to absorb and build on the knowledge to be used in production. The role of the entrepreneur refers to renew or revolutionize the production pattern by exploiting the invention to generate a new commodity or create the old one in an advanced way (Zehir *et al.*, 2015).

A cultural perspective on entrepreneurship provides a possibility of a much richer and more nuanced understanding of entrepreneurship discourses and firm change as an ongoing cultural production, by focusing on how the standards and practices of entrepreneurship are combined, formulated and disposed of in the organization of daily job (Crevani, Lindgren, & Packendorff, 2010). Production capability can improve the chance of the product's new components, technical specifications, ingredients, functionalities to meet the desires and needs of the customers better than before.

H2: Production capability has a positive effect on entrepreneurial orientation

2.8.3 Investment capability and entrepreneurial orientation

Technology entrepreneurship is known as the ability to exploit and identify opportunities of creating and upgrading the technology of new products and their effectiveness in commercialization (Petti & Zhang, 2011). Organizational members shall be involved in the growth of entrepreneurial orientation through knowledge-intensive operations (Li, Huang, & Tsai, 2009).

Efficiency in technology investment relies on a range of technological capabilities which are positive related to investment and performance at the same time (Aral & Weill, 2007). Investments in technological capability have become a dominant part of the capital expenditure budgets manufacturing organization. In determining the firm performance and competitiveness of an organization, researchers have emphasized the significance of investment in innovation (Higgins, 1995; Porter, 1990).

In addition, firms should make a certain amount of funding available to promote innovation. This is because the contribution of R&D funds by firms has a positive effect on its performance in innovation (Zhu, 2010). Similarly, Rothaermel and Deeds (2006) find that an entrepreneurial venture with strong technological capabilities tends to engage in more exploitation alliances to gain access to complementary assets such as manufacturing. Thus, improvement of investment capability as key firm's beneficial resources can enhance innovativeness through entrepreneurial orientation.

H3: Investment capability has a positive effect on entrepreneurial orientation

2.9 Summary

In conclusion, this chapter discusses on the definition of technological capability, the parameters of technological capabilities and drivers of firm innovativeness that have been proposed earlier and supported by past researches. It can help researcher to have a clear research objective and help the research take place efficiently. The RBV theory is used and a conceptual framework is then proposed in this chapter to address the research gaps. The discussion on the relationship between each variable also discussed in this chapter. The information could lead to the formulation of a questionnaire that has been used to collect the related information in this research. The next chapter will discuss on research methodology adopted for this research.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the selected methodology is discussed in order to gather required information from the respondents. It is also provided how the data and information were analyzed and the final conclusion is included. In addition, the aspects that have been discussed in this section include research philosophy, research design, population and sampling, research instruments, data collection and how to analyze the data. The effectiveness of a methodology depends on the method used and the achieved results in the research.

The importance of research methodology is to ensure that the techniques used to obtain the data were aligned with the objectives of the research. This methodology is used to avoid an error occurred while doing this research. Figure 3.1 illustrates the flow of the research process in order to study the research objective.

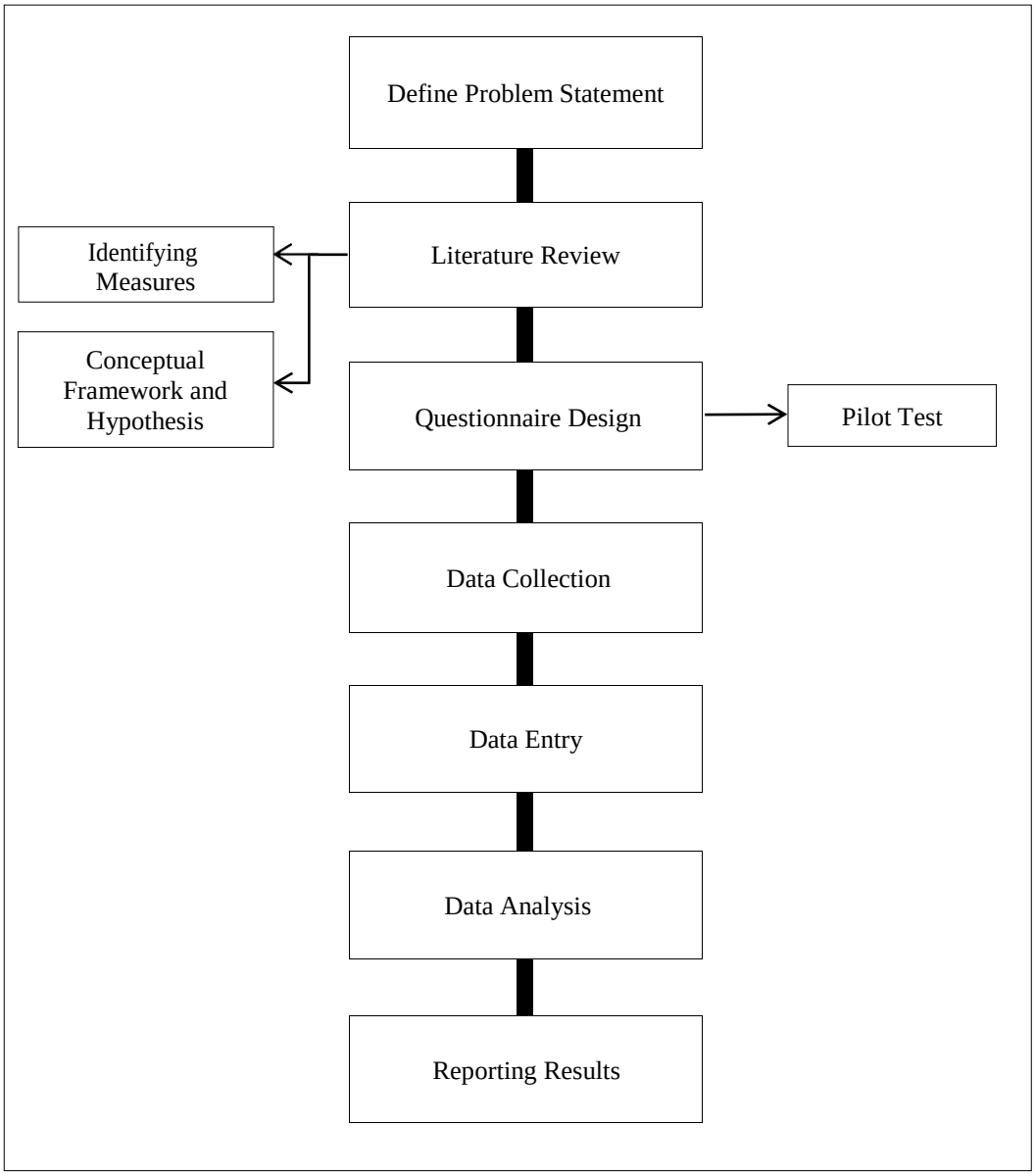

Figure 3.1: The research process

3.2 Philosophy of research

The research philosophies will provide important assumptions on how to draw the conclusion of a research by examine social phenomena (Saunders, Lewis, & Thornhill, 2009). Thus, it will support research strategy and the method to be used in complete the quality of research outcomes. Table 3.1 shows the summary of research philosophies.

Table 3.1: The summary of research philosophies

Types	Summary
Positivism	• Objective and independent of social actors • Observable phenomena give facts, credible data; focus on law and causality • Value-free way research and researcher is independent of data and maintain objective stance • Large samples, quantitative method
Realism	• Objective and independently of human knowledge or beliefs • Observable phenomena give facts, credible data; focus on explaining within a contexts • Value laden research; researcher biased by cultural experiences and world views • Qualitative or quantitative method
Interpretivism	• Multiple, subjective and may change • Focus the details of situation and subjective meaning • Value bound; researcher part of what being researched • Small samples, qualitative method and in-depth investigation
Pragmatism	• Multiple, external and view chosen to best answering research question • Focus on practical applied research • Values play a large role to interpret results; researcher adopt objective and subjective points of view • Mixed method

From Saunders, Lewis, & Thornhill (2009), the epistemology of positivism is only observable phenomena will lead to credible data. The collection of data need to use existing theory to develop hypotheses then tested using statistical analysis. Thus, this research used existing theory of resource based view and develop hypotheses. Then, the hypotheses tested using correlation and regression.

3.3 Research design

Research design is the overall plan of the study and about answering the research questions (Saunders, Lewis, & Thornhill, 2009). It provides a framework for the collection, measurement and analysis of the data (Sekaran & Bougie, 2013). There are many methods that can be used for data collection. The probability of achieving an excellent research approach and process should involve some constrains of obtaining necessary information such as access to data, time, location, money and also ethical issues (Saunders, Lewis, & Thornhill, 2009). This research adopted a quantitative method for generating hypotheses and applying data collection tools. The aim of the quantitative research is to identify the level of technological capability that practiced by industries among innovative SMEs in Malaysia. Next sub-section will elaborate more about the quantitative method.

3.3.1 Quantitative method

A quantitative research method involves systematic empirical investigation of social phenomena through statistical, mathematical or numerical data or computational techniques (Neuman, 2012). Quantitative approach takes a linear path and emphasize on objectivity (Awang, 2012). It uses explicit, standardized procedures and casual explanation. To test hypothesis is normally based on a quantitative data. The language of variables and hypotheses are found more accurate across many areas of science that are based on positivism philosophy (Saunders, Lewis, & Thornhill, 2009). Apart from that, it is used to suggest possible causes of a certain relationship between the variables and to produce a model to the relationship. The process is known as deductive approach with a

sequence of discrete steps that precede data collection (Schutt, 2012). Quantitative data can be collected by using the survey strategy and analyze quantitatively using descriptive and inferential statistics (Sekaran & Bougie, 2013). This research used survey strategy to collect the data. The survey strategy is a popular and common strategy used in business and management research.

3.4 Research population and sample

Population is a larger collection of units covers the entire group of people, events, or things of interest that the researcher plans to examine. Sample is the subgroup or a subset of the population and as a representative for the selected population in the research (Neuman, 2012). The population for this research is innovative SMEs or technology-based SMEs. Whilst, the sample for this research comprises an innovative SMEs which are list under MTDC incubator programme.

There are two categories of sampling techniques; probability sampling and non-probability sampling. Probability sampling refers to the probability for each member in the population of being chosen is equal chance or randomly will be selected. On the other hand, non-probability sampling is the probability of members in the population being chosen is at based on researcher personal judgment rather than equal chance to be selected (Neuman, 2012). There are four types of sample strategies in probability sampling namely, simple random, systematic, stratified, and cluster sampling. Whereas, non-probability also has four types of sampling strategies, namely convenience, quota, purposive or judgmental and snowball sampling .

In this research, probability sampling had been used, it is simple random sampling. Simple random sampling is also known as random sampling. Random sampling is best used when have an accurate and easily accessible sampling frame that lists the entire population (Neuman, 2012). Random numbers allow to select the sample without bias. The sample selected, therefore, can be said to be representative of the whole population. The aim of this research is to identify the practices of technological capability and

innovative orientation that practiced by innovative SMEs in Malaysia. Therefore, this sampling method had been chosen in order to achieve the research objectives.

The population was selected from the innovative SMEs which are under the incubator program of MTDC. The source of the total number of companies is taken from the website of MTDC. Krejcie & Morgan (1970), came up with a table for determining sample size for a given population for easy reference. For this study, sample size is 51 which represent the amount of the respondents who had answered the questionnaire. According to Krejcie & Morgan (1970), the minimum sample for the total population of 59 should be 48. Therefore, a sample of 51 completed questionnaires was accepted. Table 3.2 shows the total number of the sample size.

Table 3.2: The total number of the sample size

Incubator	**Amount of Innovative SME**
1. UiTM - MTDC	6
3. FRIM - MTDC	10
4. UTM - MTDC	12
5. UPM - MTDC	23
Total	**51**

3.5 Questionnaire development

Questionnaire is a tool or medium that had been applied in this research. Questionnaire is a set of structured questions design to obtain required data for the research and gather information from the target respondents (Neuman, 2012). A questionnaire is an instrument that able to collect large amount of quantitative data, low cost and less time consuming rather than observation and interviews . Other than that, the purpose of questionnaire is to provide smoothly and orderly structure of interviews, provides a standard format of questions which the data easily can be recorded and analyzed (Neuman, 2012).

This set of questionnaire was written and give to the respondents who are Malaysian innovative SMEs and listed under incubator programme of MTDC. This set of

questionnaires will be answered by the general managers or core members in the managerial team or assigned persons by general manager who have good understanding of the firm. The main objective of this questionnaire is to collect information about the practices of technological capabilities among innovative SMEs in Malaysia and to investigate the relationship between technological capability and innovative SMEs.

The questionnaire is developed by adapting existing survey questionnaires (Rhee *et al.,* 2010; Sobanke *et al.,* 2013, 2012). The questionnaire consists of three sections; Section A: Demographic Background, Section B: Technological Capability, and Section C: Innovative SMEs.

Section A is a general questions that contain six questions about the demographic background such as the position in the company, working duration in the current organization, type of industry, firm ownership, number of full time employees in the company and annual revenue of the company. Section B comprises 21 items grouped into three categories (innovation capability, production capability and investment capability). This section is used to measure the practices of technological capabilities in innovative SMEs. Next, Section C consists of innovative SMEs which is entrepreneurial orientation element with 6 items of questions. This section is used to identify the practices of entrepreneurial orientation in innovative SMEs.

Each of the construct of the questionnaire was measured using Likert scale. In the Section B and C of the questionnaire, contains of the questions for Objective 1 by asking the respondents that indicated them to pick the choice on how far their concern and intention toward practicing technological capability and innovative orientation in innovative SMEs using a five point Likert. For instance, five point scale with the categories (1) strongly disagree, (2) disagree, (3) natural, (4) agree and (5) strongly agree. Table 3.3 summarizes all the parts in the questionnaire of this study.

Table 3.3: Sections of the questionnaire

Section	Contributions
A	Demographic Background
B	Technological Capability (Objective 1)
C	Innovative SMEs (Objective 1)

3.5.1 Pre-Testing the questionnaire

The next stage in the questionnaire is pre-testing. According to Awang (2012), pretesting process helps to examine all items in the questionnaire such as wordings, instructions, question content and instructions. Therefore, pre-testing is used to identifying some weaknesses to improve the questionnaire based on the response from the respondents. Pre-testing the questionnaire was send to three academic staff at the Universiti Tun Hussein Onn (UTHM). The respondents for pre-testing were conducted through personal interview with debriefing technique. Debriefing technique is the procedure of pretesting that researcher does not inform the respondents until they have completed the questionnaire (Awang, 2012).Then, the researcher asked the respondents whether they have some encountered problems while answering the questionnaire. The responses from the respondents then were presented. After the amendments as suggested from the respondents, the questionnaire was reviewed by one of the respondents. Every item in the questionnaire will be thoroughly supervised and distribute to the qualified respondents. The response from the respondents consists of the font size should be enlarged to make it easier for respondents to read it some statements in the questionnaire need to be re-arranged and re-write. After the amendments as suggested from the respondents, the questionnaire has been reviewed by one out of three respondents. Every item in the questionnaire has been thoroughly supervised and has been distribute to the qualified respondents.

3.6 Pilot test analysis

A pilot test survey was conducted to test the validity and reliability of the survey instrument before a full scale survey is deployed which is the completion of the questionnaire development. The pilot test examined the content of the questionnaire so that the correction can be made before the actual research is carried out. This is to prevent errors occurred that might affect the research outcome. For this research, 30 sets of questionnaire were sent to the SMEs. After completion of the survey, the data was tested

for its validity and reliability. The purpose of conducting a pilot test is to ensure that the questions in the questionnaire are valid and are align with the objectives of the research. After completion of the survey, the data was tested for its validity and reliability. The pilot test was conducted so that the research would yield encouraging results which is up to the standard and quality.

Table 3.4 shows the George and Mallery (2003), the rule of thumb for Cronbach's alpha. According to George and Mallery (2003), the overall Cronbach Alpha should be more than 0.700, any number less than that would demonstrate that the questionnaire is somehow questionable, vague in nature, or being ambiguous to the respondents.

Table 3.4: Value number of internal consistency range

Cronbach's alpha	**Internal consistency range**
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

According to the result of pilot test, the values of Cronbach's alpha in Table 3.5 shows that innovation capability and investment capability of internal consistency range is acceptable. Lastly, entrepreneurial orientation and production capability have excellent internal consistency range. This means that all of the questions that build up each variable are reliable and valid to be used in this research.

Table 3.5: Values of Cronbach's Alpha for each variable

Variables	**Cronbach's Alpha**
Innovation Capability	0.740
Production Capability	0.846
Investment Capability	0.717
Entrepreneurial Orientation	0.880

3.7 Data collection

Data collections can be obtain from two sources of data; primary data and secondary data. Primary data refers to information obtain first-hand by the researcher on the variable of interest for the specific purpose of the study (Awang, 2012). This study conducted by using questionnaires as the primary data source. Researcher had distributed and collect questionnaires by hand to the respondents. This method is very effective because the respondents do not entertain any calls or email from researcher. Therefore, researcher need personally met them and asked to fill the questionnaire. The data collection for this study had successfully finished in a period of three months. The total set of questionnaire had been collected are 51 over 59 of respondents and represent the response rate of 86%. According to Krejcie & Morgan (1970), the minimum sample for the total population of 59 should be 48. Therefore, a sample of 51 completed questionnaires was accepted.

Secondary data refer to the information gathered from source that already exist, by someone other than the researcher conducting the current study. Besides, it is easy and quick to get because the source of the data that is already available (Sekaran & Bougie, 2013). However, in-depth research needs to be given when searching and collecting all the data in order to ensure that the information is very appropriate to the study (Awang, 2012). For this research, researcher obtains the secondary data from historical information such as government publications, organizations website, books, and journals.

3.8 Data analysis

Data analysis was a body of methods to help in describes facts, developed explanation, and test hypothesis (Sekaran & Bougie, 2013). The process of data analysis is to highlight useful of information, suggestion and support decision making. IBM SPSS Statistics software is used in this research to analyze the gathered data and to respond to the research objective and answered the research question. The data collected from the questionnaires and entered into IBM SPSS software where the mean, median, mode, percentages and frequencies come out.

3.8.1 Descriptive analysis

Descriptive analysis is the method that is used to summarize the information about the distributions of the variables (Pallant, 2016). The data were analyzed by percentage, frequency, mean, mode and median. Mean is a set of data with average value; median is the value that was in the middle of a data set that has been arranged from a small value to a larger value or vice-versa; and mode refers to a set of data with the most frequently value (Fah & Hoon, 2009). Descriptive data can be done or explain in the form of graphs, tables, charts, diagrams, average, mean and mode, frequency distribution and so on. It is used as the easier way to explore, present, describe and examine relationships and trends within the data (Saunders, Lewis, & Thornhill, 2009).

3.8.2 Correlation and regression

A correlation wills clarify the direction and significance of the bivariate relationships among all the variables at an interval or ratio level (Sekaran & Bougie, 2013). Correlation is also a statistic used to measure the relationship between two variables. The variables usually represent by alphabet *x* and *y* respectively. The three possible relationship that will exist between this two *x* and *y* are; no correlation at all, negative linear correlation or positive linear correlation (Fah & Hoon, 2009).

The correlation test will measure on every of the technological capability parameters that are under independent variables (innovation capability, production capability, and investment capability) with innovative SMEs element under dependent variables which is entrepreneurial orientation. Results from the correlation is to determine the extent to which two variables are related directly (positive correlation) or reverse (negative correlation).

As for the regression analysis, the result is to assess the strength of a relationship between one dependent and one independent variable. Other than that, it is also to evaluate the importance of each of the independent variables in the model and to test the overall fit of the model to the data (Saunders, Lewis, & Thornhill, 2009).

3.9 Summary

This chapter has presented philosophy of research, research design, research population and sampling, research instruments, data collection and the process of data analysis. In order to conduct an academic research, the methodology must be comprehended so that the data obtained are reliable and valid. The quantitative approach was adopted to carry out the research. A questionnaire is the research instrument that help researcher to obtain the data. Then, the pilot test analysis examined the content of the questionnaire so that the correction can be made before the actual research is carried out. The data were analyzed using IBM SPSS Software. The next chapter will discuss on results and findings based on the information gained from the data collection.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

4.1 Introduction

The purpose of this chapter is to analyze the data that are extracted from questionnaires distributed among respondents of this research. Analyses were accomplished with the use of Statistical Package Social Sciences (SPSS) to assess the relationship between innovative SMEs and technological capability in Malaysia.

4.2 Normality test

Normality data can be testing by using Kolmogorov-Smirnov and Shapiro-Wilk. Kolmogorov-Smirnov test can be used if the sample size is larger than 50. In contrast, if the sample size is 50 and less, the Shapiro-Wilk is a better test to use (Ahmad, 2016). Kolmogorov-Smirnov test had been used for this research since the sample size is 51. The result of the Kolmogorov-Smirnov statistic assesses the normality scores of the distribution. A non-significant result (Sig. value more than 0.05) indicates the data is normal and parametric test could be used (Pallant, 2016). In this case, all the Sig. value is more than 0.05, indicates that the data is normal and use parametric test. Start with

innovation capability with significant value of 0.727, production capability with significant value of 0.515, investment capability has recorded significant value of 0.193 and lastly, entrepreneurial orientation with significant value of 0.223. The result of One-Sample Kolmogorov-Smirnov test shows in Table 4.1.

Table 4.1: One-Sample Kolmogorov-Smirnov test

	N	Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
Innovation Capability	51	0.691	0.727
Production Capability	51	0.818	0.515
Investment Capability	51	1.082	0.193
Entrepreneurial Orientation	51	1.047	0.223

4.3 Descriptive analysis

Descriptive analysis summarizes vast amounts of data and information in a manageable and organized manner. In addition, descriptive analysis provides straightforward process that can easily translate results into a distribution of frequency, percentage and overall averages. The researcher uses descriptive analysis to analyze the demographic data in section A.

Moreover, the questionnaire in section B and C consists of likert scale questions, where the mean, frequency and the percentage of the data will be calculated, thus descriptive analysis suit the research well. Descriptive analysis was used to achieve research objectives 1 (to identify the level of technological capability among innovative SMEs in Malaysia). Descriptive analysis via the use of IBM SPSS software would simplify the huge amount of data collected and also determine the level of technological capability in every company.

4.4 Analysis of demographic factors

This section focused on the background information of the respondents. Items that were analyzed consists of the position in the company, working duration in the current company, type of industry, firm ownership, number of full time employees in the company, and annual revenue of the company. Frequency and percentage were used for analysis and discussion.

Table 4.2 shows that the position of the respondents in the company. According to the table, respondents with the position of managerial position were the highest percent which is 59.0 % followed by general manager with percentage of 25.5%, CEO/CFO/COO were 13.7% and least among the respondents of the research were those with director position which is 3.9%. With regard of respondents' working duration in the current company. Most of the respondents were working in the current company 1 – 5 years with percentage of 49.0 %. Next with the 6 – 10 years with percentage of 39.2 % followed by respondents having less than 1 year working duration with percentage 9.8 % and least percentage of respondents with working duration above 10 years with 2 %.

Next, most of the respondents were belonging to services sector with percentage of 54.9%, followed by manufacturing sector with percentage of 33.3%, and the lowest percentage is agriculture sector with 11.8%. As for the mining and quarrying sector, there are no respondents that contribute to this research. The respondents' firm ownership in this research consists of private limited company and partnership only. Private limited company ownership has the highest percentage of 68.6% and the partnership ownership with the percentage of 31.4%. The result for number of full time employees shows that most of the company has 30 - 74 of full time employees with the percentage 45.1%, followed by those companies with 5 - 9 full time employees with 43.1%. There are no respondents that have the full time employees between the ranges of 75 – 200 employees and respondents with less than 5 employees have the lowest percentage of 11.8%. Lastly, the highest percentage of the annual revenue for the company is 41.2% with the range of amount of RM 300, 000 - less than RM 3 million, followed by 31.4% of the company with the range amount of RM 3 million - less than RM 15 million and 21.6% of the company

with the range amount of less than RM 300, 000. Lastly, respondents with the lowest percentage which is 5.9% has the range amount of annual revenue RM 15 million - not to exceeding RM 20 million.

Table 4.2: Analysis of respondents' background

Demographic Factors	Criteria	Frequency (N)	Percent (%)
Position in the company	Director	2	3.9
	CEO/CFO/COO	7	13.7
	General manager	13	25.5
	Managerial position	29	59.0
Working duration in the current company	Less than 1 year	5	9.8
	1 - 5 years	25	49.0
	6 - 10 years	20	39.2
	Above 10 years	1	2.0
Type of industry	Services	28	54.9
	Manufacturing	17	33.3
	Construction	0	0
	Agriculture	6	11.8
	Mining & quarrying	0	0
Analysis of firm ownership	Private limited company	35	68.6
	Public limited company	0	0
	Sole proprietorship	0	0
	Partnership	16	31.4
	Cooperative	0	0
Firm ownership	Private limited company	35	68.6
	Public limited company	0	0
	Sole proprietorship	0	0
	Partnership	16	31.4
	Cooperative	0	0
Full time employees in the company	Less than 5 employees	6	11.8
	5 - 29 employees	22	43.1
	30 - 74 employees	23	45.1
	75 - 200 employees	0	0
Annual revenue	Less than RM 300, 000	11	21.6
	RM 300, 000 - less than RM 3 million	21	41.2
	RM 3 million - less than RM 15 million	16	31.4
	RM 15 million - not to exceeding RM 20 million	3	5.9
	RM 20 million - not to exceeding RM 50 million	0	0

4.5 Distribution of mean score and standard deviation

Descriptive analyses of the study were processed using SPSS software to determine the mean score and standard deviation for the innovative SMEs and technological capabilities. This study aimed to determine the frequency response of respondents to the three dimensional of technological capability and one dimensional of innovative SMEs with five alternative answers strongly disagree, disagree, natural, agree and strongly agree.

The mean tendency level is considered as an average response of each question where as standard deviation is used to describe dispersion of data collected (Neuman, 2012). The mean score for this study is also used to measure the level technological capability and entrepreneurial orientation for the innovative SMEs. The mean tendency level is shown in the table 4.3 below.

Table 4.3: Mean tendency level (Chua, 2006)

Mean Score	Level of Tedency
< 2.33	Low
2.34 – 3.67	Medium
3.68 – 5.00	High

4.6 Analysis on technological capability

This section discusses the analysis of mean scores obtained from this study, which covers three dimensions of technological capabilities; innovation capability, production capability and investment capability. The table below shows the mean scores and standard deviation for each question related to technological capabilities.

4.6.1 Innovation capability

Table 4.4 shows the distribution mean for each item related to innovation capability. Based on the table, the total mean score average was 3.968 with standard deviation of 0.834 and level of tendency is high. The highest mean are 4.18 with standard deviation of 0.793 and the item are modification to existing production method and modification to existing product(s). The item with lowest mean of innovation capability is copy or imitation of imported product(s), the mean was 3.37 with standard deviation of 1.166 and tendency level is medium.

Table 4.4: Mean score and standard deviation of innovation capability

No.	Items	Mean	Std. Deviation	Level
1	Develop new production method	4.10	0.728	High
2	Introduce new production method	3.90	0.781	High
3	Modification to existing production method	4.18	0.793	High
4	Develop new product(s)	4.08	0.744	High
5	Copy/imitation of imported product(s)	3.37	1.166	Medium
6	Modification to existing product(s)	4.18	0.793	High
	Mean Score Average	**3.968**	**0.834**	**High**

4.6.2 Production capability

The mean score and standard deviation for production capability has been shown in Table 4.5. Based on this table, the total mean score average was 3.924 with standard deviation of 0.825 and level of tendency is high. The highest mean is 4.33 and standard deviation of 0.816 that represents the item of qualitycontrol (Automated/Vision). As for the lowest mean, the item is design & introducing new products in-house with the mean score of 3.57 and standard deviation of 0.831. The tendency level for the lowest item is medium.

Table 4.5: Mean score and standard deviation of production capability

No.	Items	Mean	Std. Deviation	Level
1	Debugging & calibration of new equipment	3.96	0.894	High
2	Do routine maintenance operation	3.96	0.799	High
3	Replacing original equipment parts	3.61	0.802	Medium
4	Quality control (Automated/Vision)	4.33	0.816	High
5	Reproduce fixed specifications and designs	3.63	0.799	Medium
6	Accreditation/certification of product quality	4.02	0.735	High
7	Design & introducing new products in-house	3.57	0.831	Medium
8	Operating inventory control system	4.08	0.891	High
9	Scheduling production	3.96	0.824	High
10	Monitoring of productivity	4.12	0.864	High
	Mean Score Average	**3.924**	**0.825**	**High**

4.6.3 Investment capability

Table 4.6 illustrates the mean score and standard deviation for the items of investment capability. According to the table, the total mean score average was 3.85 with standard deviation of 0.835 and level of tendency is high. The highest mean value is 3.96 with standard deviation of 0.824 that represents the item recruitment & training of technical personnel. Lowest mean value is 3.69 with standard deviation of 0.969 represents the item of construction of workshop facilities. The level of tendency for the lowest mean value is high.

Table 4.6: Mean score and standard deviation of investment capability

No.	Items	Mean	Std. Deviation	Level
1	Feasibility studies for new factories, workshop or projects	3.78	0.783	High
2	Search for & select technology for new projects	3.88	0.816	High
3	Detailed engineering for new projects	3.94	0.785	High
4	Construction of workshop facilities	3.69	0.969	High
5	Recruitment & training of technical personnel	3.96	0.824	High
	Mean Score Average	**3.85**	**0.835**	**High**

4.7 Summarize of mean score average for technological capability

Table 4.7 shows the average mean score and standard deviation for technological capability. Innovation capability has the highest mean average which is 3.968 with the standard deviation of 0.834 and level of tendency is high. The lowest mean average is 3.85 with the standard deviation of 0.835 which is investment capability and the level of tendency is high. Overall, the three capabilities indicate levels of tendency are high. It is assumed that the effective use of resources reflects in positive results for the firm. This indicates that innovative SMEs that participated in this research have successfully practices technological capability in their organization.

Table 4.7: The average mean score and standard deviation of technology capability

No.	Average	Mean	Std. Deviation	Level
1	Innovation Capability	3.968	0.834	High
2	Production Capability	3.924	0.825	High
3	Investment Capability	3.85	0.835	High

4.8 Analysis on Entrepreneurial orientation

This section discusses the analysis of mean scores and standard deviation obtained from this study, which is entrepreneurial orientation. Table 4.8 illustrates the mean score and standard deviation for the items of entrepreneurial orientation. According to the table, the total mean score average was 3.555 with standard deviation of 1.000 and level of tendency is medium. The highest mean value is 3.98 with standard deviation of 0.883 that represents the item when confronted with decision-making situations involving uncertainty, their company typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities. Lowest mean value is 3.25 with standard deviation of 1.055 represents the item that their company typically adopts a very competitive, 'undo-the-competitors' posture in dealing with competitors.

Table 4.8: Mean score and standard deviation of entrepreneurial orientation

No.	Items	Mean	Std. Deviation	Level
1	In general, the top management of our company has a strong proclivity for high-risk projects with chances of very high returns	3.53	1.120	Medium
2	In general, the top management of our company believes that bold, wide-ranging acts are necessary to achieve the firm's objectives	3.65	0.955	Medium
3	When confronted with decision-making situations involving uncertainty, our company typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities	3.98	0.883	High
4	In dealing with its competitors, our company typically initiates actions which competitors then respond to	3.45	1.064	Medium
5	In dealing with its competitors, our company is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc	3.47	.924	Medium
6	In dealing with its competitors, our company typically adopts a very competitive, 'undo-the-competitors' posture	3.25	1.055	Medium
	Mean Score Average	**3.555**	**1.000**	**Medium**

4.9 Correlation analysis

Pearson correlation is used to explore the strength of the relationship between two continuous variables. This will give an indication of both the direction (positive or negative) and the strength of the relationship. A positive correlation indicates that as one variable increases, so does the other. A negative correlation indicates that as one variable increases, the other decreases (Pallant, 2016).

This relationship is expressed as the correlation co-efficient, represented by a value within the range of –1.00 to +1.00. The value for a Pearson's correlation can fall between 0.00 (no correlation) and 1.00 (perfect correlation). A correlation co-efficient of +1.00 indicates that two variables move in the same direction at all times, and a correlation co-efficient of 0 indicates that the two variables are random, and a correlation co-efficient of -1.00 indicates that the two continuous variables move in the opposite direction at all times. Correlation is measure on a scale of -1 to +1, where 0 indicates no correlation and either -1 or +1 suggests high correlation. Both -1 and +1 are equally high degree of correlation (Pallant, 2016).

Table 4.9 shows the correlation matrix for variables which should be put in regression equation. As it can be seen from matrix, technological capabilities have direct linear correlation with entrepreneurial orientation as dependent variable. The result of the analysis has fulfilled and answered the second objective of the study, which is to investigate the relationship between technological capabilities and innovative SMEs in Malaysia. The independent variables are innovation capability, production capability, investment capability and the dependent variable is entrepreneurial orientation. Correlations indicated that there are moderate to strong relationships between the items.

Results show positive correlation between innovation capability and entrepreneurial orientation (r=0.555, n=51 p=0.000) at 0.01 level of significance. Moreover, positive correlation was found between investment capability and entrepreneurial orientation where the values is (r=0.572, n=51, p=0.000) at 0.01 level of significance. However, it is observable that there are no correlation exists between production capability and entrepreneurial orientation (r=0.137, n=51, p=0.339).

Table 4.9: Pearson correlation

		Innovation capability	Production capability	Investment capability	Entrepreneurial orientation
Innovation capability	Pearson correlation	1			
	Sig. (2-tailed)				
	N	51			
Production capability	Pearson correlation	0.109	1		
	Sig. (2-tailed)	0.448			
	N	51	51		
Investment capability	Pearson correlation	0.404**	0.290*	1	
	Sig. (2-tailed)	0.003	0.039		
	N	51	51	51	
Entrepreneurial Orientation	Pearson correlation	0.555*	0.137	0.572**	1
	Sig. (2-tailed)	0.000	0.339	0.000	
	N	51	51	51	51

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4.10 Regression analysis

Regression analysis is concern with finding a formula that represents the relationship between variables so as to find an approximate value of one variable from the value of the others. In this section, the strength of the relations between technological capability and entrepreneurial orientation was calculated. First, the correlations amount between variables was estimated. Linear Regression as the scales used in each variable represent a linear equation, where estimations of the coefficients of the linear equation were calculated. Each independent variable was tested against dependent variable which was run simultaneously.

The hypothesis testing was conducted via regression analysis. A linear model estimated using the ordinary least squares method was developed. Entrepreneurial orientation was used as the dependent variable in this model. The independent variables

of the model are the three parameters of technological capability. The scores of extracted practices were standardized by mean measure before they were put into the regression analysis. The regression was estimated so that inferences could be made regarding the linear relationships existing between technological capability and innovative SMEs. The regression model was operationalized using the following linear form shown as follows;

$$Y = A_0 + b_1X_1 + b_2X_2 + b_3X_3$$

Where,

Y = Technological Capability
X_1 = Innovation Capability
X_2 = Production Capability
X_3 = Investment Capability

4.10.1 Regression analysis on technological capability and entrepreneurial orientation

Table 4.10 shows the results for regression analysis. The findings indicate that correlation coefficient (R), using all independent variables simultaneously, is 0.6473(R^2 = 0.453) and the adjusted R^2 is 0.419 illustrates that 4.53% of the variance can be predicted by the independent variables combined.

The model summary determines strength of the model where the significance of the independent Variables is tested against the dependent variable. The R value, as the correlation coefficients, represents the linear correlation between the observed and model-predicted values of the dependent variable. The larger the value, the stronger is the relationship. The R Square value, as the coefficient of determination, represents the square value of the correlation coefficients, which in turn, becomes the determinant value of the strength of the model. In this study the linear regression analysis have been assessed in steps, in order to observe the significance of the model by measuring the variation in regression against the dependent variable.

Table 4.10: Model summary of regression analysis

Model	R	R square	Adjusted R square	Std. error of the estimate
	0.6473[a]	0.453	0.419	0.60504

Predictors: (Constant), Innovation Capability, Production Capability, Investment Capability
Dependent Variable: Entrepreneurial Orientation

Table 4.11 shows coefficients and t-value results. Coefficient *B*, standard error of *B*, standardized coefficient *Beta*, *t* value for *B*, and two-tailed significance level of *t* are displayed as estimations. When testing hypotheses, the most relevant values are the standardized coefficient *Beta*, and the significance level. The *Beta* coefficient determines the intensity (weight) of the independent variables against the dependent variable. The sig. indicated the positive or negative relationship between the independent variables and the dependent variable. The significance level of *t* determines the level of significance of the independent variables over the dependent variable (the closer to 0 the higher the significance).

Next, one variables and constant value is significant which is less than 0.05 and the T-values greater than 1.65. B weights are used to predicting changes while Beta weights are used for determining amount of impacting an independent variable on dependent variable. Therefore with these regression weights, the regression equation on dependent variable (entrepreneurial orientation) is the sum of independent variables (innovation capability, production capability, and investment capability) which they have multiplied to its regression weight plus the constant value in equation. From the table it can be seen that innovation capability and investment capability has contributed to the entrepreneurial orientation (r=0.550, t=3.284, p=0.002); (r=0.586, t=3.6458, p=0.001) and having a positive correlation.

Table 4.11: Regression results for independent and dependent variables

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	-0.716	0.861		-0.832	0.410
Innovation capability	0.550	0.167	0.387	3.284	0.002
Production capability	0.042	0.167	0.028	0.252	0.802
Investment capability	0.586	0.169	0.424	3.6458	0.001

4.11 Discussion on the practices of technological capability among innovative SMEs

This part will elaborates the outcome of this study where it has been done through the process of quantitative data analysis which is questionnaire. There are some parameters that had been used by previous researchers to measure the practices of technological capability in an organization. The analysis contributes to the formation of new parameters to identify the practices of technological capability among innovative SMEs in Malaysia. The companies under MTDC incubator programme had been selected as respondent. Thus, production capability, innovation capability and investment capability had been used as the parameters in this study. These three capabilities had been chosen because of the larger amount of past studies had been done in developing countries and suit for Malaysian SMEs environment.

The findings of this research show that the mean tendency level for the production capability, innovation capability and investment capability are high. It is assumed that the effective use of resources reflects in positive results for the firm. This indicates that innovative SMEs that participated in this research have successfully practices technological capability in their organization. Innovation capability indicates the highest mean average which is 3.968. As proposed by Sobanke *et al.,* (2012), the findings of this research verify that innovation capability is very important for an organization to invent,

innovate and improve existing technology that is always had been used for various activities and as a key factor in attaining competitiveness. Therefore, innovations provide firms with strategic orientation to overcome the problems they encounter while striving to achieve sustainable competitive advantage.

Next is production capability with the mean average of 3.924. The result show that the company's production process can be improved if a company has a good allocation of resources capabilities (Hamid *et al.,* 2014). The finding support that firms are endowed with resources and improve their innovative capabilities could expect a more significant improvement on their production. Lastly, with value of mean average 3.85 which is investment capability. This can be conclude that the result support the statement Hao & Song, (2016) where technology-driven companies are usually accumulate knowledge in technology through significant investment in R&D and rapid acquisition of new technologies, which is facilitate the capability of a firms to refine technology and product differentiation. It is also indicate that internal capability seems to provide the basis for a successful technology investment and being necessary for the accomplishment of technological change. In conclusion, acknowledgement of technological capability and the practices can helps the firm to identify its strengths and weaknesses, assist in designing technological innovation strategy and improve their competitive advantage.

4.12 Discussion on the relationship between technological capability and entrepreneurial orientation

The result of correlation test indicated that items were correlated. This allowed predicting relationships of technological capability and innovative SMEs in MTDC. The result of the hypothesis testing shows an inter-item correlation that depicts positive correlation with significant relationship between innovation capability and investment capability to dependent variables which is entrepreneurial orientation. However, there are no correlation exists between production capability with entrepreneurial orientation.

Next, to discuss the strength of the relations between technological capabilities and entrepreneurial orientation using three types of elements were used in independent

variables. Hypotheses H1 and H3 were supported, whereas hypotheses H2 is not supported. The relationship relating to hypothesis 1 (innovation capability to entrepreneurial orientation) and hypothesis 3 (investment capability to entrepreneurial orientation) reported as significance where t value greater than 1.65. In contrast, one hypothesis is not supported. The relationships relating to hypothesis 2 (production capability to entrepreneurial orientation) reported t value of 1.65 or less, and therefore is not significance.

Innovation capability and investment capability was found to be significant factor in determining entrepreneurial orientation. The result is consistent with previous findings by (Zhang, Peng, & Li, 2009) concluding that technological entrepreneurship as the important means thus technological innovations can be commercialized. A firm is organized to utilize their market opportunities by using entrepreneurship as the important ways. Consequently, this result also shows that efficiency in technology investment relies on a range of technological capabilities which are positive related to investment and performance at the same time (Aral & Weill, 2007). Indeed, entrepreneurs wherever they are can be creative in alleviating constraining factors themselves.

In addition, unlike to prior research by (Zehir *et al.*, 2015) production capability have significant effect on entrepreneurial orientation which is contrast with the findings. This is because entrepreneurial with strong technological capabilities is supposedly tends to engage more in exploitation alliances to gain access to complementary assets such as manufacturing. An important lesson that can be learned from this study is that entrepreneurs should not always depend on external support that are sometimes inadequate and a waste time by “sitting and waiting” for aid that may never surface to aid them. It is important to identify the boundary conditions under which production capability improves firm performance. Because the commercialization of a product innovation requires that the innovation be utilized in conjunction with firm's capabilities. Practitioners should consider combinations of adoption practices to achieve the desired level of manufacturing flexibility. Overall, firms need to perform an internal strategic and coherent strategy commensurate with the expected environment to get better performance.

4.13 Summary

This chapter discusses the details on how to analyze the questionnaires which was distributed to the innovative SMEs under MTDC incubator programme. All the information gathered, analyzed data and discussion are in this chapter. Next chapter 5 is for conclusions and recommendations.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter explains the conclusion and recommendations. It this chapter also shows the research objectives achievement; and offers conclusions with regard to the research outcomes based on the respective research questions. Limitations that encountered during the whole process of collecting data, recommendation and further research will be also included in this last chapter. Lastly, the main conclusion is drawn out in this chapter.

5.2 Research objectives achievement

The result from research findings determined whether the objectives of this research are successfully achieved by the researcher. This research has two objectives needs to be achieved, which are:

i. To identify the practices of technological capabilities among innovative SMEs in Malaysia.
ii. To investigate the relationship between technological capabilities and entrepreneurial orientation among innovative SMEs in Malaysia.

5.2.1 Practices of technological capability among innovative SMEs

From past literature, researcher found out that the adoption of technological capability is affected by three resource factors of a firm: innovation capability, production capability and investment capability. The findings of this research show that the mean tendency level for the production capability, innovation capability and investment capability are high. This indicates that innovative SMEs that participated in this research have successfully implemented technological capability in their organization. Thus, research objective 1 is achieved.

5.2.2 The relationship between technological capability and entrepreneurial orientation

From past literature, researcher found out that the technological capability (Innovation capability, production capability, investment capability) have a significant affect with entrepreneurial orientation. But, from the result of the research, the researcher found that not all of the technological capability constructs have a significant affect with entrepreneurial orientation. The findings revealed that positive correlation with significant relationship between innovation capability and investment capability to dependent variables which is entrepreneurial orientation. However, there are no correlation exists between production capability with entrepreneurial orientation. It is important to identify the boundary conditions under which production capability improves entrepreneurial orientation. Because the commercialization of a product innovation requires that the innovation be utilized in conjunction with firm's capabilities and practitioners should consider combinations of adoption practices to achieve the desired level of manufacturing flexibility. Thus, research objective 2 is achieved.

5.3 Contribution of research

This part discusses the contribution of this study where it focuses on technological capability that practiced by industries among innovative SMEs in Malaysia. This research measures the current practices of technological capability among the companies under MTDC incubator programme. Based on the result attained, the suitable parameters to measure the practices of technological capability among the innovative SMEs in Malaysia had been identified. Moreover, the findings indicate that the mean score for innovation capability, production capability and investment capability were at high level. The average mean score of the entrepreneurial orientation of innovative SMEs were at medium level.

The result of this research help SMEs to foster innovation in managing and designing organizational strategies using technological capabilities. In the context of an innovative organization, technology-based SMEs must have a stronger commitment towards innovation compared to their less innovative counterparts. SMEs in Malaysia are encouraged to have flexible management practices, in which promotes entrepreneurial orientation that are more likely to develop beneficial characteristics for the individual. Therefore, leaders, as the key drivers, have to play a significant role in ensuring that the mission of the organization is achieved through effective entrepreneurial orientation.

As the Malaysian government continues to invest and plan for more SME related programmes to spur the entire industry, they would take into consideration the development and importance of entrepreneurial characteristics for owner-managers. Hence, the government could integrate a different element of creativity and entrepreneurial spirit into its education system to further enhance future entrepreneurs.

5.4 Limitation of research

This part discusses about the limitation which is faced by the researcher while doing this research. First and foremost, the list of the companies under MTDC incubator programme is not updated at their website. Besides, it is also hard to get the updated list of the companies from the person in charged. Researcher already makes a phone call and sends email to MTDC in order to apply the list of companies in a formal way. Unfortunately,

there is no feedback from them. Due to the lack of information, researcher went through the list of companies in MTDC website, and selects all companies that lie under MTDC incubator programme.

The second limitation is related to while conducting the data collection, the companies refused to cooperate and answer the questionnaire. Researcher went to the listed companies but yet only few were willing to answer. Some of the companies are not exist anymore and some of them said that they have no time to answer the questionnaire because they are so busy doing their work. However, after several times of contacting the companies, make an appointment and reach them at their office, they were willing to answer the questionnaires.

The third issue is the risk of sample bias with regards to the distribution of questionnaire in different locations. The small sample size is the major hindrance in generalizing the results to the entire Malaysian innovative SMEs. This is because the study only focus on the companies listed under MTDC incubator programme.

5.5 Recommendation for further research

This part presents the recommendations that could be done for future research. In addition, it is expected that the recommendations can help and give ideas to future researchers to get a better results. Firstly, researchers who intend to conduct a similar study should consider large sample size to generalize the findings of the study. In this regard, it is suggested to conduct quantitative research (Survey) and considered all innovative SMEs in Malaysia.

Secondly, this research found that production capability in practice showing inconsistent result to the entrepreneurial orientation. There are some barriers that might influence them not fully practicing their production capability. Thus, future studies should highlight the challenges and barriers on why they are not utilize the production capability in their company. Next, the study recommended to conduct a similar nature of research in developed countries and to match the finding of this research (developing countries) to further increase the level of validation and generalization of the findings.

Consequently, the research done only covers the three parameters of technological capabilities which are innovation capability, production capability and investment capability. It is recommended to add other parameters to study generational differences on the practices of technological capability in an organization. Lastly, this research has been carried out in innovative SMEs, so it is recommended to conduct a comparative study between innovative SMEs and traditional SMEs in order to identify the different level of technological capability among these two of SMEs.

5.6 Conclusion

Overall, this study has achieved its objectives and obtains some findings that can assist in identifying the practices of technological capabilities and innovative SMEs. This study has obtained the influence of technological capability on entrepreneurial orientation which is used in this research as firm innovativeness performance in SMEs. Is it vital for SME entrepreneurs to understand and be aware of the importance of both organizational context and behavioral complexity in developing firm related capabilities. Therefore, is it important for entrepreneurs to carefully cultivate the firm's culture, manage tension arise, experience and specialize in building relevant capabilities. Above all, if it is managed efficiently, it will further enhance SMEs to be better positioned for long-term survival in the competitive environment.

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APPENDIX A

FACULTY OF TECHNOLOGY MANAGEMENT AND BUSINESS
UNIVERSITI TUN HUSSEIN ONN MALAYSIA
86400 PARIT RAJA, BATU PAHAT
JOHOR DARUL TAKZIM, MALAYSIA
Tel No. : 07 - 453 3842
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http://fptp.uthm.edu.my/v3

THE RELATIONSHIP BETWEEN TECHNOLOGICAL CAPABILITY AND INNOVATIVE SMEs

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Dear respondents,

Thank you for participating in this research. Your cooperation in completing this questionnaire is highly appreciated. The purpose of this survey is to collect information on technological capabilities and innovative Small and Medium Enterprises (SMEs) in Malaysia.

There are three (3) sections in this questionnaire. This survey will only take about 10 minutes to be completed. The contents of this questionnaire will be kept PRIVATE and CONFIDENTIAL and be used solely for academic purposes. If you have any questions regarding this survey, kindly contact the below mentioned.

Thank you for your cooperation and participation.

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SECTION A : DEMOGRAPHIC BACKGROUND

Please fill or tick [/] the answer at relevant box
Sila isikan atau tandakan [/] jawapan anda pada ruangan yang disediakan

1. What is your position in the company?
(*Apakah jawatan anda dalam syarikat?*)

Director	
CEO/ CFO/ COO	
General Manager	
Managerial Position	

2. Working duration in the current organization?
(*Tempoh bekerja dalam organisasi kini?*)

Less than 1 year	
1 – 5 years	
6 – 10 years	
Above 10 years	

3. Type of industry
(*Jenis industri?*)

Services	
Manufacturing	
Construction	
Agriculture	
Mining & quarrying	

Others : ……

4. Firm ownership
(*Pemilikan firma?*)

Private limited company	
Public limited company	
Sole proprietorship	
Partnership	
Cooperative	

5. Number of full time employees in the company
(*Bilangan pekerja sepenuh masa dalam syarikat?*)

Less than 5 employees	
5 – 29 employees	
30 - 74 employees	
75 – 200 employees	

6. Annual revenue of the company
(*Pendapatan tahunan syarikat?*)

Less than RM 300, 000	
RM 300, 000 – less than RM 3 million	
RM 3 million – less than RM 15 million	
RM 15 million – not to exceeding RM 20 million	
RM 20 million – not to exceeding RM 50 million	

SECTION B : LEVEL OF TECHNOLOGICAL CAPABILITY

This section serves the purpose to obtain information regarding the parameters of technological capabilities of the firm. Please tick [/] your answer in the space provided below.

Bahagian ini adalah untuk mendapatkan maklumat tentang parameter keupayaan teknologi syarikat. Sila tandakan [/] jawapan anda pada ruangan yang disediakan di bawah.

Feedback / Maklum Balas	**Likert Scale / Skala Likert**
Strongly disagree / Sangat tidak setuju	1
Disagree / Tidak Setuju	2
Natural / Sederhana	3
Agree / Setuju	4
Strongly Agree / Sangat Setuju	5

1. INNOVATION CAPABILITY (KEUPAYAAN INOVASI)

Our company practices the following:						
No.	Items	Scale				
1	Develop new production method *Membangunkan kaedah pengeluaran baru*	1	2	3	4	5
2	Introduce new production method *Memperkenalkan kaedah pengeluaran baru*	1	2	3	4	5
3	Modification to existing production method *Pengubahsuaian kaedah pengeluaran yang sedia ada*	1	2	3	4	5
4	Develop new product(s) *Membangunkan produk baru*	1	2	3	4	5
5	Copy/imitation of imported product(s) *Meniru produk yang diimport*	1	2	3	4	5
6	Modification to existing product(s) *Melakukan pengubahsuaian kepada produk sedia ada*	1	2	3	4	5

2. PRODUCTION CAPABILITY (KEUPAYAAN PENGELUARAN)

Our company practices the following:						
No.	Items	Scale				
1	Debugging & calibration of new equipment *Menghapuskan kesilapan dan memperbaiki peralatan baru*	1	2	3	4	5
2	Do routine maintenance operation *Melakukan operasi penyelenggaraan rutin*	1	2	3	4	5
3	Replacing original equipment parts *Menggantikan bahagian peralatan asal*	1	2	3	4	5
4	Quality control (Automated/Vision) *Melakukan kawalan kualiti*	1	2	3	4	5
5	Reproduce fixed specifications and designs *Menghasilkan semula spesifikasi tetap dan reka bentuk*	1	2	3	4	5
6	Accreditation/certification of product quality *Akreditasi / pensijilan kualiti produk*	1	2	3	4	5
7	Design & introducing new products in-house *Merekabentuk & memperkenalkan produk baru secara dalaman*	1	2	3	4	5
8	Operating inventory control system *Melakukan operasi sistem kawalan inventori*	1	2	3	4	5
9	Scheduling production *Melakukan penjadualan pengeluaran*	1	2	3	4	5
10	Monitoring of productivity *Membuat pemantauan produktiviti*	1	2	3	4	5

3. INVESTMENT CAPABILITY (KEUPAYAAN PELABURAN)

Our company practices the following:						
No.	Items	Scale				
1	Feasibility studies for new factories, workshop or projects *Kajian kebolehlaksanaan bagi kilang-kilang baru, bengkel atau projek*	1	2	3	4	5
2	Search for & select technology for new projects *Mencari dan memilih teknologi bagi projek-projek baru*	1	2	3	4	5
3	Detailed engineering for new projects *Kejuruteraan yang terperinci untuk projek-projek baru*	1	2	3	4	5
4	Construction of workshop facilities *Pembinaan kemudahan bengkel*	1	2	3	4	5
5	Recruitment & training of technical personnel *Pengambilan dan latihan bagi kakitangan teknikal*	1	2	3	4	5

SECTION C : INNOVATIVE SMEs

This section serves the purpose to obtain information regarding the innovativeness level of the firm. Please tick [/] your answer in the space provided below.

Bahagian ini adalah untuk mendapatkan maklumat tentang tahap inovasi firma. Sila tandakan [/] jawapan anda pada ruangan yang disediakan di bawah.

Feedback / Maklum Balas	Likert Scale / Skala Likert
Strongly disagree / Sangat tidak setuju	1
Disagree / Tidak Setuju	2
Natural / Sederhana	3
Agree / Setuju	4
Strongly Agree / Sangat Setuju	5

1. ENTREPRENEURIAL ORIENTATION (ORIENTASI KEUSAHAWANAN)

Risk-taking						
No.	Items	Scale				
1	In general, the top management of our company has a strong proclivity for high-risk projects with chances of very high returns. *Secara umumnya, pengurusan tertinggi syarikat kami mempunyai kecenderungan yang kuat untuk projek-projek yang berisiko tinggi dengan peluang pulangan yang sangat tinggi.*	1	2	3	4	5
2	In general, the top management of our company believes that bold, wide-ranging acts are necessary to achieve the firm's objectives. *Secara umumnya, pengurusan tertinggi syarikat kami percaya bahawa, berani dan tindakan yang meluas adalah perlu untuk mencapai objektif firma.*	1	2	3	4	5
3	When confronted with decision-making situations involving uncertainty, our company typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities. *Apabila berhadapan dengan keadaan dalam membuat keputusan yang melibatkan ketidakpastian, syarikat kami biasanya mengamalkan sikap berani, postur agresif untuk memaksimumkan kebarangkalian dalam mengeksploitasi peluang yang berpotensi.*	1	2	3	4	5

Proactiveness						
No.	Items	Scale				
1	In dealing with its competitors, our company typically initiates actions which competitors then respond to. *Dalam berurusan dengan pesaing, syarikat kami biasanya memulakan tindakan yang kemudiannya boleh bertindak balas terhadap pesaing.*	1	2	3	4	5
2	In dealing with its competitors, our company is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc *Dalam menangani pesaing, syarikat kami seringkali menjadi yang pertama dalam memperkenalkan produk / perkhidmatan baru, teknik pentadbiran, teknologi operasi, dan lain-lain.*	1	2	3	4	5
3	In dealing with its competitors, our company typically adopts a very competitive, 'undo-the-competitors' posture. *Dalam menangani pesaing, syarikat kami kebiasaannya menerapkan sikap persaingan yang tinggi, postur 'undo-the-competitors'.*	1	2	3	4	5

APPENDIX B

List of Incubatees at MTDC Technology Centre

a) List of Tenants in UiTM-MTDC Technology Centre

No.	Company Name	Contact No.	Business Activity
1.	Redajaya Sdn Bhd	Office Suite 1.9 UiTM-MTDC Technoprenuer Centre Universiti Teknologi MARA, Shah Alam 40000 Selangor Darul Ehsan. Tel: 012-633 3799	Redajaya Sdn Bhd is involved in supplying and installation of computers, software design and website, produce network systems, application development, multimedia development, geographic information systems and IT training.
2.	T-Ract Services Sdn Bhd	Office Suite 1.5, UITM-MTDC Technoprenuer Centre Universiti Teknologi MARA Seksyen 7 40450 Selangor. Tel: 03- 80631999 Fax: 03- 80631999 Web: http://www.t-ract.com.my/	T-Ract Services Sdn Bhd is involved in providing pest control, fumigation, cleaning, hygiene and sanitation services.
3.	Little Botz Academy	Office Suite 1.5, UiTM-MTDC Technoprenuer Centre Universiti Teknologi Mara (UiTM), 40450 Shah Alam, Selangor, Malaysia. Tel: 03-5524 5294/ 013-3306177 013-3308545 Email:info@littlebotz.com	Little Botz™ Academy is a technology hub that provides a fun and interactive platform for the community to express their creativity and innovation while learning.
4.	Enviromet Technologies Sdn. Bhd	Office Suite 3.7, UiTM-MTDC Technopreneur Centre, Universiti Teknologi MARA, 40450, Shah ALam, Malaysia. Tel: 03 -55247474 Fax: 03- 55247373 Email: sales@enviromet.my	Enviromet Technologies Sdn. Bhd is Malaysia's leading meteorological and environmental expert with years of experience in meteorological and environmental equipment (hardware & software), operations (System & Procedures) and specifications.

5.	Advertising Lab Sdn Bhd	Office Suite G.4, UiTM-MTDC Technoprenuer Centre Universiti Teknologi Mara (UiTM), 40450 Shah Alam, Selangor, Malaysia.	AdLAB is an independent creative agency that loves to challenge the predictable. Their approach delivers results that are compelling to consumers, drawing them into our clients' brands.
6.	Akari Software Asia Pacific Sdn Bhd	Office suite 1.11, Level 1 UiTM-MTDC Technopreneur Centre Universiti Teknologi MARA (UiTM) 40450 Shah Alam Selangor Tel: 03- 55244941 Email: info@akarisoftware.asia	Akari Software develops curriculum development & management software for Higher Education Institutions. The software helps institutions design, manage and publish their curriculum while saving time and money on programme development, management and publication. In addition it helps institutions comply with national and international quality standards including any existing reporting requirements.

b) List of Tenants in FRIM-MTDC Technology Centre

No.	Company Name	Contact No.	Business Activity
1.	BizBridge International Sdn Bhd	Block A-G-W1, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor Tel: 012-3299708	Research and development of herbal supplements and beauty products.
2.	Nourish Care Sdn Bhd	Block A-G-W2 & C-G-D2, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor Tel: 03-62610753 / 013-2902529	T-Ract Services Sdn Bhd is involved in providing pest control, fumigation, cleaning, hygiene and sanitation services.
3.	Borneo Rainforest Vanilla Sdn Bhd	Block A-G-TG3, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor Tel: 085-433511 / 019-8251511 Fax: 085-432679	The company's activities include processing the crops into industrial raw material and extracting active ingredient to produce various downstream products, such as herbal tea, health supplements, flavouring, and fragrances.

4.	Nature Profusion Sdn Bhd	Block C-G-TG1, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor Tel: 03-62625776 / 019-2942205	Commercialization of Natural Based Anti-MRSA Antiseptic and Disinfectant.
5.	Bio-Nature Formula Sdn Bhd	Block C-G-D3, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor. Tel: 019-5517618 / 019-4509049	Commercialization of Malaysian Concept SPA product utilizing bio-functional ingredients from natural plant extracts and essential oils.
6.	Agriclone Tech Sdn. Bhd	Forest Research Institute Malaysia (FRIM), 52109 Kepong, Selangor Darul Ehsan, Malaysia Tel: 06-2311371	Supplying of planting material using tissue culture technology for Aquilaria malaccensis (Karas), oil palm and Eucalyptus hybrid.
7.	AntiShock Sdn Bhd	Block B-F-W1, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor Tel: 016-6962007	Manufacturing, sales, marketing, installation, service and maintenance of electrical and electronic products.
8.	Imectronic Sdn Bhd	Block C-G-TG2, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor	Specialize in design and manufacture of control, instrumentation and automation system. The company involved in service and maintenance, custom made and upgrades machines & systems and also supply lab equipment.
9.	Nutratix Biotech Sdn. Bhd.	Block B-G-1, FRIM-MTDC Technology Centre II, Jalan Kapur, FRIM, 52109 Kepong, Selangor Tel: 019-2626137	Nutratix Biotech Sdn Bhd is a R&D set-up which is involved in the discovery & research & development of plant and herbal based materials which can benefit mankind & to improve quality of life.
10.	PhytoTech Sdn. Bhd.	A-G-TG4 FRIM-MTDC Technology Centre (FMBioSis) Forest	To produced and supply good quality plantlets and other planting materials

		Research Institute Malaysia (FRIM), 52109 Kepong, Selangor Darul Ehsan, Malaysia Tel: 013-355 6600 Email: phytotechsdnbhd@gmail.com	originated from elite selected clones through the tissue culture technology.

c) List of Tenants in UTM-MTDC Technology Centre

No.	Company Name	Contact No.	Business Activity
1.	Asma Agro (M) Sdn Bhd	Block 4, UTM-MTDC Technology Centre Technovation Park, Universiti Teknologi Malaysia Skudai 81300 Johor Darul Takzim Tel: 07 521 1759/ Fax: 07 521 2759	Asma Agro (M) Sdn Bhd is involved in commercialisation of fruit plantlets through micro propagation tissue culture technology that produces a higher yield crop.
2.	Drawbridge Technologies (M) Sdn Bhd	Block TG-F-09 UTM-MTDC Technology Centre Phase II Universiti Teknologi Malaysia, Skudai 81300 Johor Darul Takzim Tel: 03-9224 6880/ Fax: 03-9224 7305	An authorised value added reseller and software distributor for engineering software Autodesk and authorised distributor for CTREAFORM 3D Scanner in Malaysia
3.	E Elements Technology Sdn Bhd	Block 3-2 UTM-MTDC Technology Centre Phase I Universiti Teknologi Malaysia, Skudai 81300 Johor Darul Takzim	The company develops Advanced Thermal Control Solution (ATCS) for energy efficient operating of non-residential building air conditioning system.
4.	Bioswitch Technologies Sdn Bhd	UTM-MTDC Symbiosis Program Level 2, Industry Centre Technovation Park, UTM, Skudai 81310 Johor	An active packaging using smart bio switch concept.
5.	HQ Nutraceuticals Sdn Bhd	Block 3-1 UTM-MTDC Technology Centre Phase I Universiti Teknologi	Commercialisation of pineapple fiber-based product for nutraceuticals application. The company also

		Malaysia, Skudai 81300 Johor Darul Takzim Tel: 07-585 0225	designs ready-made hi-fiber flour mix formulation for bakery use.
6.	Johor Biotechnology & Biodiversity Corporation	Level 2, UTM-MTDC Technology Centre Phase II Universiti Teknologi Malaysia Skudai 81310 Johor Darul Takzim. Tel: 07-520 7810 / 07-520 8810/ Fax: 07-520 7811 Web: www.jbiotech.gov.my	Johor Biotechnology & Biodiversity Corporation (J-Bio) is a development unit of Unit Perancang Ekonomi Negeri Johor (UPENJ). J-Bio's main task is to develop bio-entrepreneurs in the state of Johor
7.	Kid Noise Studio	Block TG-F-10 UTM-MTDC Technology Centre Phase I Universiti Teknologi Malaysia, Skudai 81300 Johor Darul Takzim Tel: 07-6605087	The company providing services in developing multimedia content including 3D animation video, mobile apps content and learning tools of interactive CD/DVD.
8.	Longevity Wellness Industries Sdn Bhd	Block TG-LG-03 & TG-LG-04 UTM-MTDC Technology Centre Universiti Teknologi Malaysia 81300 Johor Darul Takzim Tel: 07-2386612/2386613/ Fax: 07-2381600	Longevity Wellness Industries Sdn Bhd is involved in farming, producing and trading of bird's nest for brand "Yong Kang Birds Nest". The company has developed the cleaning process for Yong Kang bird's nest using Reverse Osmosis water.
9.	Membrane Technology (M) Sdn Bhd	Block DLAB-LG-06, UTM-MTDC Technology Centre Universiti Teknologi Malaysia 81300 Johor Darul Takzim Tel: 07-353 6023/ Fax: 07-353 4023	The company commercialize the production of advanced reverse osmosis membrane system for application in drinking water and waste water treatment.
10.	Twin Systems Sdn Bhd	Block TG-F-06, UTM-MTDC Technology Centre Phase II Universiti Technology Malaysia Skudai 81300 Johor Darul Takzim Tel: 07-558 2109/	Twin Systems main activities are developing software and multimedia application. They are specialized in open source framework based programming; interactive media content development, and system integration.

11.	Ventionex International Sdn Bhd	Block 2, UTM-MTDC Technology Centre Technovation Park, Universiti Teknologi Malaysia Skudai 81300 Johor Darul Takzim Tel: 07 234 2363/ Fax: 07 244 2363	Ventionex International Sdn Bhd specialize in the design, engineering, manufacturing, integration and supply of industrial grade and hazardous area certified surveillance camera system, security system, and communication system for the Oil & Gas, and Ener
12.	WCC Telco Sdn Bhd	Block TG-F-04 UTM-MTDC Technology Centre Universiti Teknologi Malaysia, Skudai 81310 Johor Darul Takzim	WCC Telco Sdn Bhd is a UTM-spin-off company incorporated through UTM-MTDC symbiosis Programme. The company is involved in the commercialization of UTM patented technology in RF Flat antenna and wireless equipment.

d) List of Tenants in UPM-MTDC Technology Centre

No.	Company Name	Contact No.	Business Activity
1.	Absec MSC Sdn Bhd	Block F1, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-8940 9444	Absec MSC Sdn Bhd is involved in providing software development and implementation services for their parent company i.e. Absec Malaysia Sdn Bhd. Absec Malaysia Sdn Bhd is a provider of cashless payment and control system.
2.	Agribolics Technology Sdn Bhd	Block DC3-A, Server Farm Complex, UPM-MTDC Technology Centre, Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-8959 7343 Fax: 03-8959 7342	Agribolics Technology Sdn Bhd is a biotechnology company that successfully commercialising the bio products for crop protection by using a US technology through Brain Gain Malaysia Program run by Ministry of Science, Technology and Innovation (MOSTI).
3.	Archtron Research & Development Sdn Bhd	Block TG1-3, UPM-MTDC Technology Centre Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-8060 0646 Fax: 03-8060 2646	Archtron Research & Development Sdn Bhd is involved in R & D, manufacturing & marketing of smart home technology, home automation, energy management and security system products known as Bluguard.

4.	Asoft Digital Sdn Bhd	Block P5, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor . Tel: 03-8945 3316 Fax: 03-8945 4497	Asoft Digital Sdn Bhd is involved in the design and development of software solutions for a wide range of commercial applications.
5.	Borneo IT Enterprise Sdn Bhd	Block B-G-4, UPM-MTDC Technology Centre III Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-8957 4547	Borneo IT Enterprise Sdn Bhd is an ICT company that develops technology-based systems and applications for logistic industries, warehouse management, retail industries, enforcement and e-commerce.
6.	Braintree Technologies Sdn Bhd	Block TG1-2, UPM-MTDC Technology Centre Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-8948 5678 Fax: 03-8948 5678	Braintree Technologies Sdn Bhd conduct consultancy and research & development of satellite remote-sensing RS/GIS and GPS for natural resources management, oil palm plantation planning, plantation design, and disaster management.
7.	Centracs Technology Sdn Bhd	Block P3-B, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Tel: 03-9132 8600	Centracs Technology Sdn Bhd is involved in research and development on Central Revenue Apportionment and Clearing System (CENTRACS) Application. It is a solution for payment (electronic) and clearing and settlement of transaction.
8.	Gates IT Solution Sdn Bhd	Block D-G-6, UPM-MTDC Technology Centre III Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-8953 9555/ 07-520 4992	GATES IT Solutions Sdn Bhd is a software developer company specializing in enterprise resource planning (ERP) solution.
9.	Gigalink Solutions Sdn Bhd	Block TG1-1, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Tel: 03-8957 1234 Tel: 019-2626137	Gigalink Solutions Sdn Bhd is a University Technology Malaysia (UTM) spin-off company through UTM-MTDC Symbiosis Programme. The company produce a unique digital signage-advertising platform known as SmartaxiAds and to provide mobile hotspot services in taxis.

10.	Itosys Sdn Bhd	Block P3-A, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-9132 8600	Itosys Sdn Bhd is a software developer doing R&D, customisation, maintenance of toll collection and management systems for highway toll operators.
11.	Merimen Online Sdn Bhd	Block D, Level 1, UPM-MTDC Technology Centre III Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-8942 8281 Fax: 03-8942 8318	Merimen Online Sdn Bhd is a leading developer of enterprise solutions serving the related parties of the insurance industry within Asia and the Asian Pacific.
12.	Nex Intelligence MSC Sdn Bhd	Block D-G-4, UPM-MTDC Technology Centre III Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-6206 1202	Nex Intelligence MSC Sdn Bhd is an ICT company that focuses on the development of middleware infrastructure software and Executive Information System (EIS).
13.	Pencil Brand Sdn Bhd	Block C-F-4, UPM-MTDC Technology Centre III Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 03-5524 0822 Fax: 03-5524 0822	Pencil Brand Sdn Bhd is an educational service provider that focuses on innovation on how knowledge is delivered to students. Their product can be viewed at www.pencil.my, is an Addictive Social Learning platform designed to enhance learning experience.
14.	Scan Associates Berhad	Block M1, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-8958 2580/ 03-8938 1580	Scan Associates Berhad is involved in the development of Enterprise Public Key Infrastructure (PKI) Security Solution, development of Managed Security Services (MSS) solution, Provision of Managed Security Services to enterprises, and security consultancy and maintenance services.
15.	Szar Solutions Sdn Bhd	Block C3-A, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-8959 1928	Szar Solutions Sdn Bhd is an ICT company that provides comprehensive ICT solutions by utilizing industry-leading products and technologies.

16.	V.Net Computer Services Sdn Bhd	Block TG1-7, UPM-MTDC Technology Centre Universiti Putra Malaysia Serdang 43400 Selangor Darul Ehsan Tel: 1-700-81-4222	V.Net Computer Services Sdn Bhd is a system integrator, involved in software development, system engineering and infrastructure services.
17.	HCA Products Sdn Bhd	Block N1-A, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 012-329 1607/ 017-434 6858	HCA Products Sdn Bhd is involved in producing, extracting and formulating Roselle into pro-health drinks, nutritional supplements and slimming products.
18.	Trek Systems (M) Sdn Bhd	Block P1, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-8941 1143/ 1146	Trek Systems (M) Sdn Bhd is a subsidiary of Trek 2000 International Ltd, a public company based in Singapore, and the patent owner of thumb drive (i.e. USB flash drive).
19.	ViewPoint Research Corporation Sdn Bhd	Block B, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Tel: 03-8656 0662 Fax: 03-8656 0668	Viewpoint Research Corporation Sdn Bhd is a software developer company specializing in business solution. The product is a comprehensive solution designed for entity and wealth management professionals.
20.	Emgraft Systems Sdn Bhd	Block C2, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-8959 1928 Fax: 03-03-8941 1689	Emgraft Systems Sdn Bhd is focusing on open source products and applications.
21.	Zymeratics Sdn Bhd	Block K3, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 013-432 8400	Zymeratics Sdn Bhd is an enzyme manufacturing company specialising in industrial enzyme production and distribution.
22.	Sena Traffic Systems Sdn Bhd	Block M2, UPM-MTDC Technology Centre Universiti Putra	Sena Traffic Systems is a R&D company for traffic control system. The company designed, developed,

		Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-9055 3511	manufactured and commercialised the intelligent traffic controllers.
23.	Persada Digital Sdn Bhd	Block P6, UPM-MTDC Technology Centre Universiti Putra Malaysia, Serdang 43400 Selangor Darul Ehsan Tel: 03-6141 8151 Fax: 03-6141 8010	Persada Digital Sdn Bhd is an ICT solution provider, providing sophisticated internet-based solutions, application development, system integration, mobile solutions and networking system services to government agencies and private corporations.

APPENDIX C

PUBLICATION

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Enhancing the Competitiveness of Malaysian SMES Through Technological Capability: A Perspective

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Abstract: Global business environment that is constantly changing has given new challenges and opportunities for SMEs. The demand of competitive environment caused the firm to respond, formulate strategies and develop capabilities. Technological capability is the ability of organizational and individual resources which include firm knowledge, skills and experience to design and produce new innovative products, improve competitive advantage, thus achieve desired result. Understanding technological capability can help firms assess their weaknesses and strengths in order to plan for innovative technology strategies. The definitions, importance, parameters of technological capability and also background of Malaysian SMEs are determined based on review of journal study as well as reports from Department of Statistics Malaysia (DOS) and from Small and Medium Corporation Malaysia (SMECorp). This study aims to identify the relevancy of technological capability approach in order to enhance competitive advantage for Malaysian SMEs. All the definitions, categories and determinants of technological capability for SMEs must be developed because this will lead to the development of an instrument to measure technological capability for SMEs in Malaysia. The reviews indicate that certain level of technological capability in SMEs brings additional positive effects such as act as a strategic tool to compete with others, produce innovative product, growth in the innovation process, respond to the market changes, increase firm performance and improve the awareness of technological capability's role and its importance.

Key words: Competitiveness, small and medium enterprises, technological capability, new challenges, opportunities

APPENDIX D

VITA

The author was born on 6 May 1991, in Tanjung Karang, Selangor. She went to Sekolah Menengah Kebangsaan Agama (P) Almashoor, Penang, Malaysia for her secondary school. She continued her study at Perlis Matriculation College in Accounting course. She received her bachelor degree of Technology Management in October 2014 with second class upper. After that, she entered the same university with Master of Science in Technology Management (KPP) by research. During her Master study, she had presented a paper in Malaysian Technical Universities Conference on Engineering and Technology 2015 (MUCET 2015) at KSL Hotel, Johor Bharu. The paper with tittle "Enhancing the Competitivenenss of Malaysian SMEs Through Technological Capability: A Perspective" had been published at The Social Sciences, Medwell Journals (2017). She managed to complete her Master of Science Technology Management and hope to continue her study in Ph.D. in future.