INNOVATION PROCESS, INNOVATION OUTCOME AND FIRM'S PERFORMANCE IN THE MALAYSIAN ELECTRICAL AND ELECTRONICS INDUSTRY

By

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ASBTRACT

Innovation is vital in enhancing a firm’s performance and competitiveness. This study investigates the relationship between the antecedent variables (leadership, managerial levers and business processes), the innovation process and the firm’s performance. In addition, the study also examines the mediating effect of an innovation outcome on the relationship between the innovation process and firm’s performance. A total of 234 Malaysian electrical and electronics companies which are listed in the Federation of Malaysian Manufacturers 2012 were selected for this study. The data collection was obtained from the questionnaire surveys. The association between the variables was measured by depending on the extent of each company’s perception on innovation through the use of interval rating scale instruments. The Rasch Measurement Model was used for analysis and the data was then processed through the use of the Winstep Software. The results revealed that there were positive relationships between the antecedent variables and the innovation process, the innovation outcome and the firm’s performance. Further analysis through Rasch Measurement Model indicated a positive level of relationships between all three types of antecedents, innovation process, innovation outcome and the firm’s performance. The role of the innovation outcome as a mediating variable was then established. A higher probability of success in implementing the innovation process will result a higher ability level of innovation outcome. In addition, a higher ability level of innovation outcome will yield a higher firm performance. The results also revealed that the three groups of companies have performed according to their ability level (excellent, moderate and poor) when implementing innovation. Thus, companies with high ability will deliver high probability of successes in implementing innovation. The findings of this study will assist the companies in measuring their ability level when implementing a systematic innovation process in their respective organisations.

Keywords: innovation, innovation process, innovation outcome and firm’s performance

ABSTRAK

Inovasi adalah penting dalam meningkatkan prestasi dan daya saing. Kajian ini bertujuan untuk mengkaji hubungan antara pemboleh ubah *antecedents* (kepimpinan, *managerial levers* dan proses perniagaan), proses inovasi dan prestasi firma. Di samping itu, kajian ini juga mengkaji kesan pengantara daripada hasil inovasi kepada hubungan antara proses inovasi dan prestasi firma. Sebanyak 234 syarikat elektrik dan elektronik di Malaysia yang tersenarai dalam Persekutuan Pengilang – Pengilang Malaysia 2012 telah dipilih untuk kajian ini. Pengumpulan data telah diperolehi daripada kaedah soal selidik. Hubungan antara pemboleh ubah diukur melalui tahap persepsi setiap syarikat terhadap inovasi dengan menggunakan instrumen skala interval. Model Pengukurann *Rasch* digunakan untuk menganalisis data dan ia telah diproses melalui Perisian Winstep. Hasil kajian menunjukkan bahawa terdapat hubungan yang positif antara pemboleh ubah *antecedents,* proses inovasi, hasil inovasi dan prestasi firma. Seterusnya, analisis melalui Model Pengukuran *Rasch* menunjukkan tahap hubungan yang positif antara ketiga-tiga jenis pemboleh ubah *antecedents,* proses inovasi, hasil inovasi dan prestasi firma. Peranan hasil inovasi sebagai pemboleh ubah pengantara telah dibangunkan. Kebarangkalian kejayaan yang lebih tinggi dalam melaksanakan proses inovasi memberikan tahap keupayaan hasil inovasi yang lebih tinggi. Oleh itu, melalui tahap keupayaan hasil inovasi yang tinggi akan meningkatkan prestasi firma. Kajian ini juga telah mengenal pasti tiga kumpulan syarikat mengikut tahap keupayaan (tahap cemerlang, sederhana dan lemah) dalam melaksanakan inovasi. Oleh itu, syarikat yang mempunyai keupayaan tinggi akan menyumbangkan kebarangkalian kejayaan yang tinggi dalam melaksanakan inovasi. Hasil kajian ini akan dapat membantu syarikat-syarikat dalam mengukur tahap keupayaan mereka apabila melaksanakan proses inovasi yang sistematik dalam organisasi masing-masing.

Kata kunci: inovasi, proses inovasi, hasil inovasi dan prestasi firma

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LIST OF ABBREVIATIONS

AIM	Malaysia Innovation Agency
APO	Asia Productivity Organization
BP	Business Process
EPU	Economic Planning Unit
FMM	Federation of Malaysian Manufacturers
FR	Firm Performance
GCC	Group Characteristic Curve
GDP	Gross Domestic Product
ICC	Individual Charateristic Curve
IP	Innovation Process
IO	Innovation Outcome
IRT	Item Response Theory
LD	Leadership
MASTIC	Malaysian Science and Technology Information Centre
MATRADE	Malaysia External Trade Development Corporation
MITI	Ministry of International Trade and Industry
ML	Managerial Levers
MNCs	Multinational Corporations
MNSQ	Mean square
MOSTI	Ministry of Science, Technology and Innovation
MPC	Malaysia Productivity Corporation
NEAC	National Economic Advisory Council
NKEAs	National Key Economic Areas
NSRC	National Science and Research Council
OECD	Organization for Economic Co-peration and Development
PEMANDU	Performance Management and Delivery Unit
PIDM	Person Item Distribution Map
PTMEA CORR	Point measure correlation
SMEs	Small Medium Enterprises
ZSTD	Z-standard

CHAPTER 1

INTRODUCTION

1.0 Background of Study

In the era of 21st century, productivity and quality are not the only drivers that promote organisation survival. This is due to the state of change in business environment which has become more competitive. In this context, innovation has been identified as another layer of excellence, played major role in enhancing and sustaining high performance of firms in building competitiveness (Gopalakrishnan & Damanpour, 1997). Innovation is referred to the implementation of new or improved product (good or services), process, marketing method or organisational method in the organisation (OECD, 2005). Moreover, innovation is one of the main key forces stimulates growth of new products, creating new markets and transform industries to confront global competitiveness (Sood & Tellis, 2009).

At the international level, innovation is greatly highlighted in relation to the nation economic performance such as Global Innovation Index and World Competitiveness Yearbook (APO, 2009). According to a survey on investing innovation for year 2010 indicated that 40 to 70 percent of the firms in many countries invested in innovation lead to higher sales and productivity (OECD, 2010a). In light of this, it is crucial for organisation to innovate as a necessary requisite in order to obtain high performance levels. This has given indication that industries need to harness the value of excellence through innovation to achieve sustained and steady growth of firm performance (MPC, 2009).

In the context of Malaysia, albeit the productivity growth improved by 5.7 percent in 2010, the performance growth is still below from developing economies (MPC, 2011). To cope with this situation, innovation is a crucial element in increasing its productivity and competitiveness of the economy (EPU, 2010). Therefore, it is practically important for Malaysia to focus on innovation as one of the main agenda to heading towards the Innovation Driven Stage of Development path (MPC, 2011). However, Malaysia needs to confront its innovation challenges by improving innovation capabilities and enhancing the driving force of innovation (World Bank, 2010). One of the major contributors towards performance growth is the manufacturing sector (27 percent in year 2010) and although the portion to GDP is considered large, the number of manufacturing firms engaged in innovation is about 35 percent (Lim Ee & Nagaraj, 2011). This figure is still low as compared to developed countries such as France 46 percent, Germany 67 percent, Denmark 53 percent and Sweden 48 percent (Lim Ee & Nagaraj, 2011).

The above scenario depicted the important role of innovation and it is noticed that this has indirectly indicated the relation between innovation and performance which is crucial for continuing economic growth. When innovation is in its place, it can accelerate organisation in achieving its competiveness by improving business performance in terms of strategy, customers, asset and capabilities and product or service offerings (Kim & Mauborgne, 1997). There are many types of innovation approach as discussed by earlier scholars depending on the nature of the organisation

(Gopalakrishnan & Damanpour, 1997; Gupta, Tesluk, & Taylor, 2007). However, there is no sole innovation approach that one size fits for all. Therefore, it is relevant to observe the success of its implementation on performance from the perspective of 'how' it works and in 'what' form it takes. A systematic review on innovation has indicated the gap to describe this situation in the sense of innovation process and innovation outcome (Crossan & Apaydin, 2010). Innovation process (describe the how) refers to a sequence of activities from idea generation transformed into successful product or process (Lim Ee & Nagaraj, 2011). Innovation outcome (describe the what) refers to the achievement of innovation goals and orientation towards increasing organisation innovativeness (Phromket & Ussahawanitchakit, 2009; Stock & Zacharias, 2011).

There were numerous studies undertaken where the major concern is about innovation implementation and its impact on performance (Gunday, Ulusoy, Kilic, & Alpkan, 2011; Rosenbusch, Brickmann, & Bausch, 2010; Salomo, Talke, & Strecker, 2008). However there are still gaps highlighted from conflicting findings which involved the innovation process and innovation outcome (Crossan & Apaydin, 2010). Therefore, this study is motivated to fill the gap and other gaps identified in the problem statement. The focus of this study is on electrical and electronics industry where some of the issues are also related to the implementation of innovation.

1.1 Overview of Electrical and Electronics Industry in Malaysia

The electrical and electronics industry started in Malaysia in the early 1970s, as a result of government initiatives to promote labour intensive and export oriented industries (FMM-MATRADE, 2008). There are four major sub-sectors of the electrical and electronics industry namely: electronics components, industrial electronics, consumer electronics and electrical products (FMM-MATRADE, 2008). Historically, this industry has gone through the ups and downs of industrial development since its conception year in 1970s, 1980s (with the Industrial Master Plan), 1990s (with the 9th Malaysia Plan) and being highlighted as one of the key economic area. Since then, it is still one of the biggest segments which were identified as key driver to the manufacturing sector. According to MITI (2012) this industry contributes significantly to Malaysia GDP growth, export earnings, investment and employment. In year 2011, it accounted for RM37 billion (6 percent) of the gross national income and contributed RM250 billion (40 percent) of total exports and thus has created a workforce of 522,000 people (PEMANDU, 2011).

Although the performance of this sector is excellent in the past two decades, this industry faced significant challenges in maintaining growth. According to Rasiah (2010), the share towards manufacturing value added have decreased after the year 1995 from 30 percent in 1997 to 21 percent in year 2008. The industry appears to have reached saturation level and thus it is depending on the effort to increase the value added activities (NEAC, 2010). The slowdown trend of this performance is based on several factors include the slowdown contribution to export, high concentration on assembly which leads to low value added and stiff competition from countries like China, Taiwan, South Korea and Singapore with high value added activities (PEMANDU, 2011).

According to Rasiah (2010), the electrical and electronic firms have progressed at different levels of innovation activities. Nevertheless only a small number the firms engaged in high value added activities and it is found that this industry is slow in catching up with innovation activity which involved knowledge intensive (knowledge path that lead to newer path) related to creative accumulation. This kind of activity is important since it is required to generate new cycles of innovation which would encourage firms to compete in the global economy (Rasiah, 2010). Due to this situation, it might contribute to the hold back of this industry. The industry seems to have reached saturation level and innovative effort need to be expanded to more firms.

Despite, recent encouraging signs of upgrading the technological and value-added activities at the firm level, it is still not clear if the change in this industry is coming fast enough in the scale that can trigger large externalities and furthermore the innovation agenda remains driven by MNCs (NEAC, 2010). Report by NEAC (2010) has strongly pointed that the Malaysian electrical and electronics industry is still lagging far behind in terms of linkages such as technology transfer of local suppliers, and cooperative efforts between firms and other institutions on technology research and development (R&D). Given by the diverse nature of the industry, they need to confront issues to integrate into domestic economy, slow process of knowledge spillovers in the local economy and shortage of high skills talent (NEAC, 2010). Thus, this industry remains solely based on manufacturing and logistics operations.

Based on the above discussions, it is noted that the electrical and electronics industry is important contributor to Malaysia economic growth and innovation is vital for industry to move up to high value chain. To do so, this industry needs a systematic approach of innovation process and innovation outcome that would accelerate industry performance. As highlighted by NEAC (2010), the electrical and electronics industry has the potential to place at the heart of innovation within Malaysia, and with it steer integrated and high income product supply chains.

1.2 Problem Statement

The very early idea on innovation was introduced by a social scientist, Joseph Schumpeter in 1936 (Fagerberg, 2003). Since then, there were numerous studies was conducted to examine the relevant issues related to innovation. Various issues discussed include: contributing factors or determinants, types of innovation, theoretical views on innovation, definitions, its impact on performance, implementation and the drive of innovation in organisation. These were performed by namely; Hubert Gatignon (2002), Johannessen (2009), Smith, Busi, Ball, and Meer (2008), Ar and Baki (2011), Simpson, Siguaw, and Enz (2006), (Vincent, Bharadwaj, & Challagalla, 2006) and Sung, Cho, and Choi (2011). In short, innovation studies have been conducted in a broad sense however fragmented (OECD, 2010b).

Discussions with regards to performance have brought high attention due to the ultimate goal of organisation and the one that can bring the long term effect to performance is innovation (Kemp, Folkeringa, Jong, & Wubben, 2003; Redinius &

Land, 2006). Although literatures have established the importance of innovation on firm performance in terms of sales growth, market share, profitability, market value, productivity and asset growth (Akgun, Keskin, & Byrne, 2009; Bolinao, 2009; Li, Zhou, & Si, 2010; Prajogo, 2006; Salomo et al., 2008), there is a need to understand innovation in a broader perspective in terms of how it works and what was the outcome of innovation that contributes to performance (Crossan & Apaydin, 2010; OECD, 2010b).

Therefore, from a scour of literature review in Chapter 2, this study was conducted based on theoretical gaps and practical issues. The theoretical gaps include: inconsistency of previous findings with regards to innovation and issues on performance, inconsistency in findings with regards to innovation process roles, conflicting findings on relationship between innovation process and innovation outcome, inconsistency to clarify innovation outcome role, limited studies on antecedents of innovation process and lack of empirical study which involved multi-dimensional innovation framework. The practical issues identified for this study were issues on the performance in the Malaysia electrical and electronics industry and its ability to implement innovation as one of the approach to enhance industry competitiveness. These gaps will be addressed in the following discussions.

A clear understanding on the exact nature of innovations that increase the performance need to be explored (Gunday et al., 2011). This is due to the several terms used by scholars to explain the innovation types and its relation with performance and inconsistency in previous findings. There was previous finding which did not support the relationship between types of innovation (organisational, process and production) and financial performance instead it is only affected innovative performance (Gunday et al., 2011). The effect on firm performance was interacted by additional constructs which differs from one scholar to another.

Firm' innovation activities in terms of exploratory (radical innovation from emerging customer needs) and exploitative innovation (incremental innovations existing customer needs) have increased performance through additional factors such as firm's strategy and environment facto (Li et al., 2010). However there was also other variable such as organisational structure that interacted the relationship (Jansen, Van Den Bosch, & Volberda, 2006). Similarly, the relationship between innovation and firm performance is empirically tested with the influence of product fit (the degree of suitability between customer needs and product) and process fit (the extent of suitability between the product and various factors within the value chain). However, findings did not show direct effect on the firm performance (Seokin, Hyounseung, & Joonsik, 2009). Moreover, factors such as product fit and process fit is important in innovation process stage (Seokin et al., 2009). Those studies have showed that relationship between innovation and performance are depended on contextual factors (Rosenbusch et al., 2010). Hence, earlier studies were actually lacking in describing how the implementation of innovation process in the organisation that finally affect performance. This has provided important gap to study innovation process which is act as inputs to innovation.

There were also little studies which focused specifically on the relationship between innovation process and the firm performance. Previous findings on this issue were found to be debatable. These studies were Rosenbusch, et al., (2010), (Enzing, Batterink, Janszen, & Omta, 2011), Marques and Monteiro-Barata (2006) and Kemp, et al.,(2003). For instance, relationship between innovation process from the input perspective is found to be less significant on performance as compared to the output (innovation outcome) (Rosenbusch et al., 2010). However this argument is contradicts to a study done earlier which emphasised that innovation process is important as integration role which would speeding up the innovation outcome (Parthasarthy & Hammond, 2002). Similarly, although innovation process affects performance through the innovativeness of new and improved product, nevertheless the focus is limited on the product performance not the overall firm performance (Enzing et al., 2011).

Inconsistency of the findings was also found in the following study. According to Marques and Monteiro-Barata (2006), innovation process in the manufacturing firm involved innovation input, innovation output and throughput process. Instead of being postulated as the final outcome (dependent variable), firm performance was stated as the determinant to innovation process (Marques & Monteiro-Barata, 2006). Although in their study, innovation process input is influenced by firm performance however, the relationship between innovation process output and performance was not found (Marques & Monteiro-Barata, 2006). This is also proven by earlier study where Kemp, Folkeringa, Jong and Wubben (2003) managed to show the influence on performance specifically on turnover and employee growth. However their study did not find effect of innovation process on firm performance in terms of profitability and productivity.

Based on the above deficiencies, it is noted that innovation process is actually multi-aspect concept (Kemp et al., 2003) and this has motivated researcher to further investigate the issue. The implementation of innovation involved determinants, input, output and performance and this has showed that the lacking of previous research in understanding the causes, consequences, outcome and the modus operandi of innovation process in organisation (Anderson, Dreu, & Nijstad, 2004; Jain, 2010). Therefore, although this study focuses at the organisation level, understanding on innovation process through multi-aspect concept should be to keep pace with the changing nature of organisation.

Innovation process is crucial in measuring performance. Across the globe, innovation process explored the capability of idea generation, facilitate and accelerate innovation diffusion, determine innovation magnitude and involved determinants or factors that influence firm competitive position (Bernstein & Singh, 2008; Björk, Boccardelli, & Magnusson, 2010; Marques & Monteiro-Barata, 2006; Smith et al., 2008). However there was insufficient evidence of empirical study to show the details on implication of innovation process on performance.

At the firm level, Hobday (2005) claimed that there was little evidence to explain that innovation process have evolved, entailed so much academic perceptions (observe rather than empirical) and innovation process is treated isolated rather than a part of firm strategic management. Although Desouza, et al.,(2009) has outlined important dimensions of innovation process to manage innovation, their study is limited to exploration of a distinct stages of innovation process (comprise from idea generation to innovation implementation). This is unlikely to show the relationship between the outcome of innovation and performance.

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One of the contributing gaps to this study is innovation outcome. It is noted that past research did not provide a clear definition on innovation outcome. Due to this issue, the link between innovation as a process and innovation as an outcome is also imprecise (Quintane, Casselman, Reiche, & Nylund, 2011). Although Quintane, et al., (2011) managed to define innovation outcome, nevertheless the exploration was based from knowledge perspective. Due to the nature of innovation being complex and context-dependent, a clear understanding of innovation is crucial to assess the level of innovativeness that affect the organisation performance (Dodgson & Hinze, 2000; Vincent et al., 2006).

The difference between innovation process and innovation outcome is crucial because the former precedes the latter in determining influence on performance (Crossan & Apaydin, 2010). Moreover, the fact is that the difference between innovation process and innovation outcome is noted in the sense that innovation outcome is referred as new product, new process or new service whereas innovation process combine a stages of activities to create innovation outcome (Dodgson & Hinze, 2000). As such, this study intends to establish relationship between innovation process, innovation outcome and firm performance which is lacking in the previous research.

As discussed in the earlier section, it is essential to identify innovation outcome before firm could achieve their performance. It is also understood that innovation lead to outcome and at the same time a process to reach this outcome (Quintane et al., 2011). According to Jain (2010), to better understand how organisations evolved to meet the challenges of change and expectations of internal and external stakeholders, a more sophisticated understanding of process and innovation orientation outcomes is needed. Even if a firm is highly innovative, it has to exploit its innovation in terms of outcome to gain better business performance (Neely, Filippini, Forza, Vinelli, & Hii, 2001).

Nevertheless, within the list of past studies, there are arguments established that need to be clarified on the role of innovation outcome or innovativeness that has been established to influence firm performance (Gunday et al., 2011; Phromket & Ussahawanitchakit, 2009; Rosenbusch et al., 2010; Stock & Zacharias, 2011). For instance, innovation outcome is stated as one dimension of innovative performance which was used as dependent variable and finding indicated that this innovation outcome is not significant to relate the firm focus with the type of innovation (Oke, Burke, & Myers, 2007). In other study, the organisational design has influenced innovation outcome but outcome limited to the technological learning, market learning and market success and it does not showed the effect on performance (Tushman, Smith, Wood, Westerman, & O'Reilly, 2010). Indeed, innovation outcome is also portrayed as innovation effectiveness and this construct is represented by innovative capability and organisational performance (Sung et al., 2011).

Besides being studied as dependent variable, innovation outcome is also stated as independent variable when it is relate to firm performance (Seokin et al., 2009).

From the role as dependent and independent variable, innovation outcome is viewed as medium of intervention. For instance, in a study of firm strategic orientation, innovation outcome intervened between firm's market orientation and market driven and performance (Medina & Rufı´n, 2009). Based on the above discussions, it is found that the previous studies are not consistent in explaining the relationship between innovation outcome and performance and findings indicated that innovation outcome was explained either as independent variable, dependent variable or intervening variable (He & Wong, 2004; Seokin et al., 2009). Although these studies have provided an insight on innovation outcome, empirically it is noted that there is a need to further investigate the validity of the findings.

Apart from being conflicting role, innovation outcome is viewed in the form of conceptual research. Hence, it could explain only one section of the theoretical framework of the research (Kumar, 2011). For instance, a conceptual framework is proposed to enable companies to understand innovation implementation through innovation drivers, innovation outcome (positive and negative outcomes) and its impact on business performance (Laforet, 2011). Even though this framework contributed to system-wide innovation theory, the conceptualization is broad and does not permit specific innovation outcome to be studied (Laforet, 2011). Similarly, Shaochen and Dier (2010), has conceptualised the positive and negative innovation outcomes to broaden innovation research. In addition, Siguaw, Simpson and Enz (2006) has also conceptualised an understanding on innovation orientation (the strategic direction based on knowledge structure) that lead to innovative action, outcomes and firm performance. Although the above studies have provided some basis for innovation research, those research have yet to be proven empirically.

Despite the crucial role of innovation process and innovation outcome in affecting firm performance, the extent of this activity is enhanced through the presence of antecedents. Antecedents has enabled firms to increase innovation outcome and finally impact performance (Hult, Hurley, & Knight, 2004). In addition antecedents is also important to assist in understanding the complexity of innovation process (Narvekar & Jain, 2006). Relatively, it is claimed that little is known about antecedents and how it drives through innovativeness to influence performance (Peng, 2007). Long and Yuan (2010) has systematically explored the antecedents, processes and consequences of strategic innovation however it has yet to be tested.

A study on antecedents of innovativeness and business performance was conducted by Peng (2007) but antecedents were limited to market orientation and entrepreneurial orientation. Similarly, Hadjimanolis (2000) studied the relationship among three antecedents (organisation members, organisation structure and environmental factors) with innovativeness and performance. They found that organisational characteristics such as technological resources, organisational capabilities and external networking capabilities affect innovativeness. However their study was limited to self reported data on a sample of firms in a single country. Therefore, by taking consideration on the limitations of those studies, this study would propose to further investigate three types of antecedents which are appropriate in terms of its implication on innovation process, innovation outcome and firm performance.

Reviewed indicated that leadership, managerial levers and business process are antecedents that would drive innovation process before it would impact to innovation outcome and eventually firm performance (Crossan & Apaydin, 2010). These antecedents were chosen to fill the gap identified from previous study (Crossan & Apaydin, 2010). The first antecedent is leadership. There were many studies recognised the importance of leadership in implementing innovation such as (Barsh, Capozzi, & Davidson, 2008; Denning, 2010; Jansen, Vera, & Crossan, 2009; Ven, 1986). Nevertheless the relationship between leadership as antecedent and innovation process specifically is limited. Elenkov, Judge, and Wright (2005) found that strategic leadership to have a strong positive relationship on both product-market and administrative innovations. However this study showed relationship on the innovation outcome but not the innovation process. This is also indicated by another related study which stressed on the relationship between leadership and innovation outcome such as Jansen et al. (2009) and Carneiro (2008).

Although a review is conducted with regard to the influences of leaders on innovation process however the review only emphasised on the different types of innovation (Friedrich, Mumford, Vessey, Beeler, & Eubanks, 2010). This is also similar to Stamm (2009) who pointed that a leader need to be clear about selecting different level of innovation such as incremental and radical and implementing it. The need to study the leadership as one of the antecedent variable is also supported by Friedrich et al. (2010). According to the source, previous research with regards to intervention of leadership on innovation process is not consistent.

The second antecedent of the study is managerial levers. Managerial levers are important in the organisation to maximising business operation and precision (Chad, 2010). For instance, managerial levers enable organization to control the current trends to enhance their innovation Ginzburg (2006). Managerial levers are found to have high impact on three areas include value proposition, value network and target customers (Pletcher & Mann, 2013). According to David (1996), there are numerous of levers that have been utilised in the organization. It is complex and often overlaps. Chad (2010) has included leadership factor as one of the managerial levers to build strong company. Therefore, this study focuses on managerial levers as suggested by Crossan and Apaydin (2010) : strategy, structure, resource allocation, organizational learning and knowledge management and culture. Blumentritt and Danis (2006) mentioned that strategy is crucial to overcome managerial challenge and it is also served as foundation to innovation (Steward & Fenn, 2006). Application of strategy in the innovation management of SME was found to be crucial to differentiate the types of innovation and also the innovation performance (Pullen, Weerd-Nederhof, Groen, Song, & Fisscher, 2009). In this context, strategy has affected the innovation outcome. However findings indicated that the use of strategy would also enhanced innovation process (Liang-Hung & Chun-Hsien, 2008).

Similar to strategy, structure is also an important managerial lever. It has proven that structure's role is important for innovative firms and has set a standard base for innovation process (Wichitchanya, Durongwatana, & Vadhanasindhu, 2012). This is in line with previous research which conceptually portrayed that organisational structure influence the ability to manage innovation (Smith et al., 2008). However there were also studies have indicated the role of structure with the types of innovation instead of the innovation process itself such as Menguc and Auh (2010) and (Wei, Yi and Yuan (2011).

It is noted that managerial levers are interrelated and supported each other (Smith et al., 2008). For instance, strategy is implemented through the structure (Crittenden & Crittenden, 2008) and culture had impact other levers and also changed those levers (Smith et al., 2008). In fact, the role of knowledge management and also organisational learning is also related to each other. There is also study where knowledge management acted as mediating variable on innovation performance (Huang & Li, 2009). Based on the previous findings the relationship between managerial levers and innovation was established however did not specifically focus on innovation process. Furthermore, each lever inter related to each other and the relationship is also existed independently. The application of managerial levers as suggested by Crossan and Apaydin (2010) would also in line with the theoretical perspective as innovation process interlink with the resource view and capability view (Muller, Valikangas, & Merlyn, 2005).

Business processes is the third antecedent involved in the study. It has seen as strategic, operational and tactical for improvement and change in organisation (Henriksen & Andersen, 2010). There were studies that shows the importance of business process such as Ray, Barney, and Muhanna (2004), Ganesh and Marvin (2005) and Yu-Yuan (2006) however studies focused its relationship on resources and capabilities, product and service innovation and organisational performance. According Armistead, Pritchard, and Machin (1999), the connection between business processes would leads to innovation and therefore maximise value chain and this has supported the business processes dimension as suggested by Crossan and Apaydin (2010).

Following the arguments, there is also lack of empirical study which involved multi-dimensional innovation framework. The multi-dimensional framework is based on systematic review from various innovation studies where it is claimed that innovation research so far is fragmented and disconnected (Crossan & Apaydin, 2010). Therefore, a possible gap identified is by testing the connection between determinants, innovation outcome and firm performance (Crossan & Apaydin, 2010). Although, conceptually there were several studies such as (Matheus, 2009), (Galanakis, 2006), (Hivner, Hopkins, & Hopkins, 2003), (Rothwell, 1994) and (McAdam, 2005) have involved multi dimensional perspectives, it is also yet to be tested empirically.

Notably, from the perspective of innovation research, the need to further and expand the innovation research is important as this would help to understand the sources, processes and determinants of innovation (Gopalakrishnan & Damanpour, 1997). The argument is also supported by Jain (2010) who emphasised the needs to study for integrated relationship between antecedents and innovations, testing and retesting of various process models since most of the previous researchers were limited within framework of single perspective to study innovation. Beside contributing to the body of knowledge, it will provide practitioners to incorporate innovation dimensions as this will provide with specific insight on making appropriate innovation choice in different situations (Gopalakrishnan & Damanpour, 1997).

The above discussions so far have pointed out the theoretical issues on innovation process, innovation outcome and firm performance. In addition, this study is also motivated by the practical issues established in the innovation activities of electrical and electronics industry in Malaysia. Similar to other sectors, electrical and electronics is also affected by the intense competition. This industry is under constant pressure in terms of developing new product, innovative products in shorter cycle time and reduced cost with improved quality (Digitivity, 2009). In short, all these factors contribute to the industry's performance and the ability of the sector to compete and stay in business depends on how the improvement on performance managed by organisation.

A study on the status of electrical and electronics performance in Southeast Asian claimed that the innovation activities undertake in Malaysia were not significant enough to drive upgrading across industry, low technological capabilities (skill and R&D activities), weak embedded of high technology in the local firm and it is limited to labour intensive manufacturing activities among the foreign firm (Rajah & Asokkumar, 2009; Rasiah, 2009). This has contributed to the decreasing trend in manufacturing export from 65 percent in year 2005 to 56 percent in year 2010 as well as low percentage of 2.2 percent in productivity growth for year 2011(MPC, 2012; OECD, 2011)

It is noted that from all sectors in manufacturing, electrical and electronics has been identified as key role in driving the manufacturing performance by increasing its productivity and produce higher value added product and this can be achieved with innovation (NEAC, 2010). Despite being major contributor to the Malaysian manufacturing performance, there are major issues that affect this sector in terms of innovation effort such as less number of firms engaged in value added activities, slow in catching up with innovation and low manufacturing capability (NEAC, 2010).

This is also aligned with the low percentage of R & D base in electrical and electronics industry where Malaysia is accounted only 5 percent as compared to other Asian countries such as China 60 percent, Singapore 15 percent and Hong Kong 7 percent (World Bank, 2010). Electrical and electronics firms need to be expanded into more Schumpeterian Mark I, a widening pattern of innovation activities that related to innovative base through entry of new innovators and at the same time encouraged Schumpeterian Mark II, a deepening pattern of high degree of concentration innovative activities and cumulative knowledge (Breschi, Malerba, & Orsenigo, 2000; Rasiah, 2010). Therefore, although innovation is developed at certain level of capabilities in electrical and electronics industry (Ariffin & Figueiredo, 2003), further study is needed to prove the innovation implementation specifically the innovation process, innovation outcome and performance of the industry at firm level.

The above discussions have revealed both theoretical gaps and practical issues which are pertinent for this study. At the theoretical issue, it is found that none of the past studies have addressed the relationship between antecedents (leadership, managerial levers and business process), innovation process, innovation outcome and firm performance. While, little studies on the level of innovation activities in electrical and electronics industry is also an important gap explored in this study. Therefore, based on these gaps, this study intends to investigate two aspects: (i) the empirical evidence that establish the relationship between antecedents, innovation process, innovation outcome and firm performance; and (ii) the practical issues on the ability of innovation implementation and level of firm performance in the electrical and electronics industry.

1.3 Research Questions

Based on the identified gaps, research questions for this study are as follows:

RQ1: Is there any relationship between antecedents represented by leadership, managerial levers and business processes with innovation process?

RQ2: Is there any relationship between innovation process and innovation outcome?

RQ3: Is there any relationship between innovation process and firm performance?

RQ4: Is there any relationship between innovation outcome and firm performance?

RQ5: Does the innovation outcome mediate the relationship between innovation process and firm performance?

1.4 Research Objectives

The objectives of this study are as follows:

RO1: To investigate the relationship exists between antecedents represented by leadership, managerial levers and business processes with innovation process in the electrical and electronics companies.

RO2: To investigate if any relationship exists between innovation process and innovation outcome.

RO3: To investigate if any relationship between innovation process and firm performance.

RO4: To investigate if any relationship exists between innovation outcome and firm performance.

RQ5: To investigate whether innovation outcome mediate the relationship between innovation process and firm performance.

1.5 Significance of Study

Reviewed from literature have showed the importance of innovation influence on organisational performance. Some of the issues discussed were overlapping between innovation at the level of analysis and innovation orientation. As mentioned earlier, those studies are fragmented and need to test empirically on the relationship between antecedents, innovation process, innovation outcome and firm performance. Most studies attempted to establish a link between these two concepts but evidences are insufficient. Thus, the motivation of this study is influence by the role of innovation particularly the implementation process (how) and outcome (what) on the firm performance.

This study has applied the Rasch Measurement Model as research tool to analyse and present data. The use of Racsh analysis is appreciated when its application can support the study intention in examining the level of innovation implementation in the electrical and electronics manufacturing companies. This will extend the research application process particularly in the existing innovation research studies such as (Ibrahim, Elias, Saad, & Ramayah, 2008; Mat & Razak, 2011; Rasiah, 2010)).

By taking a more theoretical and empirical approach, researcher investigates the relationship between the antecedents, innovation process, innovation outcome and firm performance. The outcome of the study will provide a holistic picture on how innovation process and the intervening effect of innovation outcome on firm performance. This information is particularly desirable for electrical and electronics industry as the emphasise on innovation is vital element to increase Malaysia productivity and competitiveness of the economy (EPU, 2010). Therefore, the study would benefit the practitioners as well as academicians in enhancement to the body of knowledge. In short, the study is significant because:

a) Innovation approach is a mean to increase firm performance.
b) In the competitive environment, the knowledge on innovation process, identification of innovation outcome and management of innovation is an obligation for firm survival.
c) The level of innovation implementation is highlighted according to ability of organisation to implement innovation process and innovation outcome.

1.6 Scope of Study

The study focuses on electrical and electronics industry in Malaysia. The selection of this industry is due to its vital role as leading sector in employment and export generator. This sector is the largest in the manufacturing industry, accounting for 61 percent of manufacturing exports and it could provide as a link to higher value-added activities (NEAC, 2010). Indeed, the industry is identified in 12 National Key Economic Areas (NKEAs) which is potential to contribute to Malaysia economic growth (MPC, 2011).

The study uses the survey method. A sample comprises of small, medium and large organisations were selected from the population of electrical and electronics manufacturing firms in Malaysia. The questionnaire instrument was sent to the Chief Executive Officer (CEO), top management and executive level of the firms. Since this study focuses on the level implementation of the innovation, it is limited on the several elements such as innovation dimensions, research framework, research instruments, data collection and analysis method. This scope has assist researcher to focus discussions related to the level of innovation implementation in the sense of innovation process, innovation outcome that affects the performance of electrical and electronics firms.

1.7 Operational Definition

This section describes briefly some important key terms of the study. The key terms indicate the operational definitions of the variable and assist in understanding the concept within the context of study. The definitions are further explained in Chapter 2.

a) Innovation

An interactive process involving multidimensional of organisational factors which are implemented through stages of innovation process in producing innovation outcomes such as new ideas, knowledge, product, services, processes and business model which are relatively new to organisation.

b) Leadership (LD)

Leadership is important driving force to the innovation implementation. In this study, it refer to the innovative leadership comprise of abilities, skills and competencies that appropriate to contribute creatively, strategically and effective to enable innovation process at the firm level.

c) Managerial Levers (ML)

Managerial levers are important in facilitating innovation process. Hence, it served as basic structure to maximise efficiency to implement innovation. In this study, managerial levers consist of five sub- dimensions: strategy, structure, resource allocation, knowledge management and organisational learning and culture.

d) Business Processes (BP)

Business processes is a set of connected activities between people involvement and process alignment which will drive innovation process into creating innovation outcome. In this study business processes will continuously improve the organisation innovation operation.

e) Innovation Process (IP)

Innovation process is a dynamic approach that consist an activities or phases which include idea generation, idea mobilisation, advocacy, screening, experimentation, commercialisation, diffusion and implementation that lead to generate innovation outcome.

f) Innovation Outcome (IO)

Innovation outcome is the achievement of organisation innovativeness which include product and process innovation that leads into new creation, novelty and significant towards achieving firm performance.

g) Firm Performance (FR)

Firm performance comprise of subjective measures used to evaluate the success of particular activity in an organisation. In this study, the particular activity is referred to innovation process and innovation outcome which will affect the extent of firm performance. Thus, the aim of innovation is to boost the firm performance.

1.8 Organisation of Thesis

The thesis is divided into six chapters. The following describes briefly each of the chapter:

Chapter 1: Introduction - describes the important topic of the study. This include background of study, overview of electrical and electronics industry, problem statement, research questions, research objectives, significance of study, key terms and the arrangement of thesis.

Chapter 2: Literature Review – converses the definition and evolution of innovation, level of innovation, orientation of innovation, innovation issues in Malaysia, definitions, perceptions and findings from past studies related to innovation process, innovation outcome, importance of innovation on performance and the application of relevant theories for this study.

Chapter 3: Theoretical Framework – discusses the conceptual framework of the study. This chapter covers several topic in examining the relationship between the antecedents (leadership, managerial levers and business processes) and innovation process, relationship between innovation process and innovation outcome, relationship between innovation process and firm performance and relationship between innovation outcome and firm performance.

Chapter 4: Research Methodology - presents the research design. The topics include sampling method, construction of questionnaire, data collection and analysis method.

Chapter 5: Findings and Analysis – presents and discusses the results from data analysis.

Chapter 6: Conclusions – provides the final part of the innovation study. The topics cover conclusion, recommendation, contribution of study, limitation of research and suggestion for further research.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Chapter 2 discusses the literature review on innovation and significant findings from previous studies. Several sections are discussed in this chapter. Section 2.1 covers definition and evolution of innovation. Section 2.2 covers innovation issues in Malaysia. Section 2.3 discusses on firm performance and its relatedness with innovation. Section 2.4 elaborates overview of innovation process. Section 2.5 discusses antecedent variables comprising of leadership, managerial and business processes. Section 2.6 describes the innovation outcome. Section 2.7 discussed the relationship between innovation process, innovation outcome and firm performance. Section 2.8 discussed related theories to the study and section 2.9 summarises the chapter.

2.1 Definition and Evolution of Innovation

The very early definition on innovation is defined by Schumpeter in 1936 in the context economic development and defined as new combination of productive resources (Hidalgo & Albors, 2008). Due to the value judgment from the economic and social perspective attached to innovation, Knight (1967), defined innovation as the adoption of a change which is new to an organisational and relevant to the environment. The strength of the definition lies in the word 'adoption' indicating that innovation itself is ahead of the concept of new idea. Based on this definition, the concept of new and change in an organisation applied into products, process and organisation structure. A product is new when it is produced and used while innovation of production process is accomplished only after it is in operation and innovation of an organisation structure is achieved when the system has been set up and made operational (Knight, 1967).

Similar to Knight's definition, Damanpour (1991), has also defined innovation as adoption that occurred from new ideas or behaviours. Adoption in this context is established when innovation is new to product or services, production process technology, structure or administrative system, plan or program to the organisational members of adopting organisation (Damanpour, 1991). Adoption of innovation is intended to contribute to the organisational performance and effectiveness and thus it has acted as change medium from internal and external environment (Damanpour, 1991) . Although it has noted as medium of change in the organisation, innovation is also addressed as the process of matching organisational and environmental means and needs. This is because the result of the successful matching of those two items are the innovation outputs in the form of new ideas (products, processes, services, techniques, etc.) to be adopted by the organisation (Mohamed, 1995).

Nevertheless, Johannessen, Olsen and Lumpkin (2001), have argued that the concept of new to address innovation. Innovation is pointed to have a good 'working definition' due, to the lack of meaningful measures. With this concept, the study has addressed newness into three related questions: what is new, how new and new to whom? As a result innovation is defined into six different types of activity: new products, new services, new methods of production, opening new markets, new sources of supply and new ways of organising (Johannessen et al., 2001).

Innovation is a multidimensional concept. In a study of relationship between internal and external factors, different types of innovation and business performance, Neely, et al. (2001), defined innovation as product innovation (changes in design, components and architectures) process innovation (involved manufacturing technology and information technology), management system and organisational innovation (involved managerial system, quality and production control and changes in organisational structure). In this context, innovation is influenced by firm's capacity to innovate which is potential to generate the outcome. It is noted that this definition is selected because the efficiency and usefulness of innovation is the outcome of the exploitation from different kinds of innovation (Neely et al., 2001).

A study by Parthasarthy and Hammond (2002), has emphasised the importance to examine innovation outcome within a systematic framework. This is due to the complex nature of the innovation environment and findings of the study also confirmed the importance of innovation process integration (functional integration, tool integration and external integration) role between product innovation and outcome (Parthasarthy & Hammond, 2002). Since the functional integration has significant interaction impact on the product development time and frequency, Parthasarthy and Hammond (2002) defined innovation as a manufactured product, relatively new to the industry, developed and marketed by a firm. The product can appear from existing scientific or technological information (through extension or synthesis or new information).

OECD (2005) defined four types of innovation include product innovation, process innovation, marketing innovation and organisational innovation. Product innovation involves a good or service that is new or significantly improved in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics. Process innovation involves a new or significantly improved production or delivery method which is significant changes in techniques, equipment and/or software. Marketing innovation involves a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Organisational innovation involves introducing a new organisational method in the firm's business practices, workplace organisation or external relations (OECD, 2005). This definition showed that innovation covered more than one physical operational definition such as product, service or process. Despite focusing on manufacturing based innovation, the definition has covered the innovation after operation or manufacturing process that has been completed and this has accommodated the employee and customer.

The complexity of innovation has produced theories that discussed from different perspectives (Galanakis, 2006). The reason is theories are used as medium to communicate to manager on how innovation occurred and to identify which factors affect the outcome of the process. Considering this issue, Galanakis (2006), has come out with innovation system model that constituted by five elements: knowledge creation, new product design and development, product success in marketplace, internal factors that affect firm's core innovation process and the national innovation environment. Thus, to be in-line with the approach used, innovation is defined as the creation of new products, processes, knowledge or services by using new existing technology that provide a degree of novelty either to the developer, industrial sector, the nation or the world to succeed in marketplace (Galanakis, 2006).

High interest in innovation, its processes and its management are demanded due to the dynamic criterion of marketplace. Hence, there is a need for organisation to respond to the changing lifestyle and also capitalise on technology opportunities. Due to this factor, Baregheh, Rowley, and Sambrook (2009), has undertaken a content analysis study on innovation from the perspective of economics, entrepreneurship, business management and technology, science and engineering. In order to fulfil this situation, innovation can be performed in relation to products, services, operations, processes and people (Baregheh et al., 2009). Based on the content analysis, Baregheh, et al.,(2009) referred innovation to organisational innovation which were identified as nature of innovation, types of innovation, stages of innovation, social context, means of innovation and aim of innovation. This definition is more general and the concept is integrated to each other. In the context of this study, although researcher found the definition is relevant, nevertheless it provide a mix up interpretation between innovation process and innovation outcome.

The role of innovation for firm competitiveness is studied through a systemic approach (Johannessen, 2009). This means that understanding of innovation is completely realistic and interactive rather than linear models. The interactive innovation model views connection between organisational, technology and environment and thus it is assumes that innovation process differ from organisation to organisation which cause innovation activities in that particular company (Johannessen, 2009). With that in view, the definition of innovation is referred to any idea, practice or material artefact observed to be new by the relevant unit of adoption (Johannessen, 2009). The use of the definition makes innovation different as compared to change because all innovation accepts change but not all change assumes innovation.

Similarly, the element of changes and innovation is further argued. In a comprehensive discussions about innovation in organisation, Jain (2010), pointed that all changes are not innovation although innovation in organisation involves changes. In this case innovation is the process of creative idea to put into practical use which implies change in status quo. Innovative change could overcome many of human and organisational problems. Thus, Jain (2010) has defined innovation as the intentional generation, acceptance and implementation of new ideas, processes, products or services ultimately for the actual utilisation of economic or social value.

In view of the global competition, innovation is the key driver to address issues on quality, quantity and speed. Therefore in this context, the need to create new value proposition has become an issue. Firm seeks to optimise the search and design new value in the form of new products, new processes or novel ways of doing business (Dervitsiotis, 2010). To fulfil this argument, author has referred innovation as an organisation capability to generate new value proposition for stakeholders particularly in the period of significant change (Dervitsiotis, 2010). To optimise the value proposition, innovation must be based on visionary leadership, employee creativity, and participation of customers, suppliers and partners (Dervitsiotis, 2010). According to the author, the interpretation of innovation concept works together with quality concept is referred to a value-dependent attribute aimed to satisfy human and social needs.

Innovation is not only referred to an outcome or the new idea but also a process which means how the new idea emerged (Gupta et al., 2007). This is also agreed by Smith, et al., (2008) who pointed innovation as a process of turning opportunity into new ideas and of putting these into widely used practice. This definition is also has some similarity in terms of innovation as a process and innovation as an outcome (Crossan & Apaydin, 2010; Dodgson & Hinze, 2000). However they pointed that the definition consisting of three sequential components: determinants of innovation, innovation as a process and innovation as an outcome. Due to comprehensive literature review, their definition on innovation covers broad scope: “Innovation is: production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems” (Crossan & Apaydin, 2010).

Based on the above discussions, the researcher found that there are numerous definitions given by previous scholars in the area of innovation. It is noted that those definitions are discussed from various perspectives depending on the scholars' research context. Observation showed that definitions focus specifically is on the newness, adoption and exploitation with regards to whether on products, services, processes, method, ideas and changes that would benefit organisation competitiveness and survival. In addition, the researcher found that these definitions have divided the understanding of innovation into innovation process and innovation outcome. In other words, the diverse literature review has made that understanding innovation in the organisation should be differentiated between how innovation is being implemented and what kind of innovation outcome that will finally affect organisation performance.

In summary, to align with the objective of this study, the researcher has provided the following operational definition which captures the above mentioned definitions. Therefore for this context of study, innovation can be defined as an interactive process involving multidimensional of organisational factors which are implemented through stages of innovation process in producing innovation outcomes such as new ideas, knowledge, product, services, processes and business model which are relatively new to organisation.

2.1.1 Innovation - Level of Analysis

Apart from definition, innovation is further discussed with understanding according to level of analysis, orientation of innovation and types of innovation. According to Gupta, et al. (2007), study on innovation involved at least two level which involved first a player such as an individual, a team or an organisation and second is the environment where the player is embedded. Gopalakrishnan and Damanpour (1997), has depicted that innovation can be analysed at industry level, organisational level, subunit level and innovation level. While Gupta, et al. (2007), has added three more level: innovation at individual level, innovation at group or team level and innovation at the level of geographic regions. Similarly, Jain (2010) identified only three level of analysis: individual level, group level and organisation level. The following lists the innovation according to level of analysis:

a) Individual level of analysis: Innovation studies focuses on factors that determine creativity and personality traits (Gupta et al., 2007), individual perception on change outcome and ability to generate new ideas, leadership styles and individual effort to innovate (Jain, 2010).

b) Group level of analysis: Innovation is focused on factors that restrain and promote creativity, interactive effect of group composition (affect quality of innovation) and group processes on innovation (affect overall level of innovation) (Gupta et al., 2007). The group level played significant role when new idea is initiated, implemented and absorbed into the organisation (Jain, 2010).

c) Industry level of analysis: This referred to either extra or intra-industry. Extra-industry level emphasised on factors that distinguish innovation development patterns and innovation magnitude through technological opportunity while intra-industry focused on differences in timing of adoption of an innovation across organisations and innovation implications for organisational performance such as expenditure on R&D and stages of industry life cycle (Gopalakrishnan & Damanpour, 1997).

d) Organisational level of analysis: These studies involved either the outcome approach or the process approach. The outcome approach inquires about contextual, structural and behavioural characteristics while the process approach described a broad class of events and sequences central to the innovation process (Gopalakrishnan & Damanpour, 1997). However Gupta, et al. (2007) mentioned that organisational level covered technological innovation, new product development and/or new businesses and the impact of firm linkages on various types of organisational innovation. At this level, operation aspects cover new system, policy, process, program, product or service and also effect of innovation adoption on the firm overall performance (Jain, 2010).

e) Subunit level of analysis: Studies analyse departmental context associated with innovation such as communication and decision making factors that affect R & D unit, tenure of R&D groups, diversity of R& D teams and etc (Gopalakrishnan & Damanpour, 1997).

f) Innovation level of analysis: Concentrate on the innovation characteristic such as cost relative advantage, complexity and radicalness (Gopalakrishnan & Damanpour, 1997). For instance innovation according to attributes and type such as technical vs. administrative.

g) Innovation at the level of geographic region: Focused on the emergence of innovation, national innovative capacity and contributing factors to the level of input devoted to innovation and factors drive R&D productivity (Gupta et al., 2007).

2.1.2 Orientation of innovation

Innovation is also categorized by four orientations (Johannessen, 2009):

a) Individual perspective: Emphasised on concepts like age, educational level, personal features, sex, cognitive style and creativity.

b) Structural perspective: Focuses on organisational characteristics

c) Interactive perspective: Focuses on dynamic changes over time, i.e. how an action influences structure over a period of time in the innovation process.

d) National and regional systems of innovation: Focuses on how national and regional innovation systems influence innovation activities in companies where organisation and distribution of knowledge become the main agenda.

2.1.3 Type of innovation

Different type of innovation has been argued by past research. According to Damanpour (1991) and Gopalakrishnan and Damanpour (1997), three types have gained the most attention and most frequently employed are administrative and technical, product and process and radical and incremental. Li, et al (2010), have analysed the internal and external fit of two types of innovation: exploratory innovation and exploitative innovation with the aimed to explore the firm innovation activities on performance. Exploratory innovation is referred to radical innovation such new design, new market segments and new distribution channel while exploitative innovation is incremental innovation aimed to improve current situation such as improve established design, enhance product line, increase efficiency and etc. (Li et al., 2010). In seeking the effects of marketing and organisational innovation strategies on technological performance, Mothe and Thi (2010), has identified two types of innovation: technological and non-technological innovation.

An extensive literature review on types of innovation from year 1960 to 2007 conducted by Rowley, et al (2011) has produced innovation type mapping tool and revealed four type of innovation: product innovation which refer to product, service and hybrid (mix between service and product); process innovation which refer to technical, administrative, production, organisational, management and business system; position innovation which refer to commercial or marketing innovation and to some extent business system innovation and paradigm innovation which is similar to position innovation.

Review on the level of analysis, innovation orientation and types of innovation are beneficial to this study. It is found that some of the issues discussed were overlapping between innovation at the level of analysis and innovation orientation and furthermore innovation is also can be considered complex in nature. Three points that can be extracted from the above analysis are: 1) On the issue of how the innovation is being implemented (innovation process); 2) On the issue of what kind of innovation (innovation outcome) established in particular organisation and 3) An involvement of innovation factors that serve as the antecedents or drivers. It is clear that this study will undertake the organisational level of analysis which is based on interactive orientation.

2.2 Issues of Innovation in Malaysia Manufacturing Sector

The beginning of innovation era in Malaysia started since late 1990s, in line with the aimed of national mission to move the economy up the value chain (MOSTI, 2007). Innovation has been identified as the key drivers of Malaysia economic growth due to necessitate moving from resource based economy (1980s to mid 1990s) to innovation-led economy. The significance of innovation to be the country source of growth and key for long term prosperity is also emphasised by World Bank (2010). This is in line to increase competitiveness and to fulfil Malaysia aspiration towards high income economy. Although the movement towards innovation is outlined in the government policy, the innovation agenda in Malaysia is merely systematically structured since the establishment of National Innovation Model (MOSTI, 2007).

The manufacturing sector is very prominent and identified as the major driver to Malaysia's economic growth. According to MOF (2011) the sector contributed about 28 percent share to the gross domestic product in year 2011. The innovation activities undertaken at the firm level in the manufacturing sector is measured according to number of innovators, firm size, geographical distribution, types of innovation (product or process innovation), sources of information, government support and incentives and resources devoted to innovation (MASTIC, 2003). According to MPC (2011) the manufacturing sector registered a growth of 11.4 Although it has significant contribution, the overall, level and pattern of innovation Malaysia's manufacturing sector is below that what is achieved in developed countries (MASTIC, 2003). Data from the 2007 climate survey revealed that innovation effort of Malaysian manufacturing firms (Table 2.1) had deteriorated across most dimensions between year 2002 and 2007 (World Bank, 2010). Furthermore, the performance of the sector has showed a decreasing growth trend in productivity growth from 9.4 percent in 2010 to 2.0 percent in 2011 (MPC, 2012).

Table 2.1
Share of manufacturing firms carrying out innovation activities (%)

Innovation Activity	**All firms**	
	2007	**Change from 2002**
Upgraded existing product line	48.0	-4.6
Develop a new major product line	26.2	-3.6
Upgraded machinery and equipment	60.3	-2.0
Introduced new technology to change production process	27.6	-1.7
Filed patent/utility or copyright protected materials	11.1	-3.2
Subcontracted R&D projects to other organisations	6.1	1.5
Agreed a new joint venture with foreign partner	5.2	1.0

Source: World Bank: Malaysia Economic Monitor, Growth through Innovation April 2010

In line with the scenario, the current initiatives delineated in the New Economic Model and 10th Malaysia Plan has emphasised the importance of improving innovation capability (Thiruchelvam, Chandran, Boon-Kwee, & Chan-Yun, 2013). The need to enhance innovation in Malaysia's manufacturing scenario is highly emphasised as this is one of the important contributing factor toward economic growth and transition to high income nation (MPC, 2011; National Economic Advisory Council [NEAC], 2010). Although, great emphasis is given to innovation in the manufacturing sector, there were barriers surrounded the manufacturers such as limited technology diffusion and transfers, low innovation capability especially among the SMEs, weakness in procurement practices with regards to innovative products or processes and the absence of innovation culture and community (National Economic Advisory Council [NEAC], 2010).

A study from National Innovation Survey found that only 35 percent from 749 manufacturing companies have carried out innovation activities (Govindaraju, Sundram, Kamil, Ibrahim, & Ghapar, 2005). In a study on the level of manufacturing best practices in Malaysian ISO9000 certified, the area which focused on innovation scored the smallest portion of 2.95 out of score 5 (Anuar & Yusuff, 2011). Hence it has indicated the need to further investigation the innovative capability of the firms.

Besides the information on innovative activities undertaken in the manufacturing firm, there is a review of several institutional structures supporting innovation and R&D which is vital to improve innovation outcome (EPU, 2010). The Tenth Malaysia Plan (2011-2015) has outlined several institutional. Among them are National Innovation Council (NIC), Innovation Malaysia, PM's Department, Ministry of Science, Technology and Innovation Malaysia (MOSTI), Ministry of International Trade and Industry (MITI), National Science and Research Council (NSRC), Malaysia Productivity Corporation (MPC) and other ministries, agencies, universities and research institutions (EPU, 2010). The latest is the establishment of Malaysia Innovation Agency (AIM) as a catalyst to promote innovation in helping Malaysia to achieve high income status (The Star, 2011). Apart from the information on the importance of innovation and its activities in the manufacturing context, there are several related innovation studies in Malaysia which is summarised in the following Table 2.2 :

Table 2.2
Previous studies on innovation in Malaysia

Authors / Year	**Issues**
Mohamed (1995)	• Issues occur in eight manufacturing firms, where more innovative firms were more successful in implementing innovation than the less innovative firms. • Several critical success factors were identified comprised of clear mission, strategies, objectives and directions, commitment from top management, realistic project scheduled, project management supervision, culture, adaptability and leadership style.
Tidd and Brocklehurst (1999)	• Review about the path of early effort towards innovation journey in Malaysia. • During the period of 1990s it was found that government policies have succeeded in export-led industrialisation by utilising the low labour cost and natural resources and also mastered in advanced production technologies in the process and assembly industries. • Two major weaknesses have been identified: Little technological and marketing know-how and lack of indigenous expertise due to insufficient high level technical and managerial education. • Malaysian industry needed to involved, shaping and developing new processes and products. • Culture and skills upgrading were suggested to be crucial factors to prepare for innovation led growth.
Zain, Richardson and Adam (2002)	• Issues on innovation activities and processes of the MNC in Germany and Malaysia. • Both electrical and electronic and engineering firms applied similar innovation processes. • Malaysia firm faced more behavioural problems and less innovative while German firm faced more technical problem and more innovative. • Lack of knowledge was common problem faced by both firms. Study listed favourable factors to implement innovation and types of innovation implemented in their firms.

Table 2.2 *Continued*

Authors / Year	Issues
Ariffin and Figueiredo (2003)	• Issues on electronics firms in Malaysia and Northern Brazil. • Study found the level of innovative capabilities are associated with higher capabilities for local decision making and control, automation level and efforts to increase exports. • Innovation also leads firms to be competitive by reducing cost, being more productive, reducing lead time and producing better products.
Lee (2003)	• Study indicated a positive correlation between firm size and propensity to innovate and negative correlation between age of the firm and share of exports in sales.
Govindaraju, Sundram, Kamil, Ibrahim, and Ghapar (2005)	• Study analysed assessment on innovation system in Malaysia through three main indicators: input, output and innovation indicators. • It is found that Malaysia was lacking in setting suitable mechanism to accelerate the process of innovation in the country.
Nasrudin, Jantan and Fadzil (2004)	• Study showed organizational structure has impact on organizational innovation. • Organizational innovation is classified into three types namely technological and process innovation, administrative innovation and product innovation. • The formalisation and centralization structures have positive effects on administrative innovation but did not have any impact on technological and process innovation and also product innovation. • It has suggested to using more formalised work process and centralised decision making to foster administrative innovation.
Lee and Ging (2007)	• Findings from national survey showed 21- 42 percent of the manufacturing firms surveyed were innovators. Source of financing was a serious problem to these firms especially SMEs.

Table 2.2 *Continued*

Authors / Year	Issues
Ibrahim et al. (2008)	• The study identified variables that categorised Malaysia innovative firms. • Findings indicated that a set of determinants of innovation and the extent of technological innovation differs for firms with different innovation processes. • Findings showed the importance of incorporating R&D, marketing activities, strategic business planning, favourable organization structure, education and training, teamwork, internal communication and utilization of professional staff and shop floor employees as sources of innovative ideas.
Chandran, et al.,(2009)	• Findings indicated low manufacturing systems of innovation particularly in process innovation. • Process innovation conducted by foreign subsidiaries increased in electronics industry.
Man (2009b)	• A study on 121 SMEs in manufacturing sector indicated a significant relationship between innovativeness and performance. • Five dimensions used in the innovativeness include lowering cost, changing product design, manufacturing cycle time, product variety and organization restructure. • It is found that innovativeness of changing product design is strongest determinant for the performance of SMEs while a weak relationship between innovativeness and firm's sales performance.
Bakar and Ahmad (2010)	• Study revealed that an intangible resource such as product reputation is the main indicator for product innovation performance.
Ling and Nasurdin (2010)	• Findings on 171 large manufacturing firms indicated that there was a significant positive effect between knowledge acquisition effectiveness on administrative innovation. • Knowledge sharing effectiveness and knowledge application effectiveness has no relationship with administrative innovation.

Table 2.2 *Continued*

Authors / Year	Issues
Man (2009a)	• Study focused on strategic management variables: distinctive capabilities, innovativeness and strategy types on export performance. • No significant relationship between distinctive capability and performance of SME. • There was also no relationship between innovativeness and export performance. • Further studies to provide broader view on the innovativeness variable.
Rasiah (2010)	• Study examined the development of technological capabilities and economic performance (labour productivity and export intensity) of electronics firms in Malaysia. • It is found that firm participation in higher level of knowledge intensities innovation activities was very low.
Lim Ee and Nagaraj (2011)	• Several obstacles found that affected innovation in the manufacturing firms. • Firms that engaged in innovation activities were the larger size and encountered more obstacles. • Economic factors such as cost, risks and financing were the most important obstacles. • Early obstacles were easily overcome by firms with accessed with better resources.
Rasiah, Kanagasundram, and Keun (2011)	• A synthesis of East Asian experiences to stimulate innovation. • Study highlighted several issues such as technology and technical change, the R&D and export intensities among local and foreign firms, collaborative government effort, training and technological upgrading, obstacles during innovation process in the manufacturing firms and adoption of innovation system approach.

In a field study about innovation implementation in eight Malaysian manufacturing firms, several issues were identified (Mohamed, 1995). Those issues are the implementation process, technical and behavioural problems faced, favourable factors, working climate between firm and industry sectors. The study found that the more innovation active firm, therefore more successful in implementation effort than less innovation active ones. Besides, study on determinants of innovation in the manufacturing sector indicated larger firm have greater capacity to innovate and are more innovative than small firms (Lee, 2003). While the established firms with larger size having opportunities in gaining product innovation performance compared to younger firm (Bakar & Ahmad, 2010).

According to Tidd and Brocklehurst (1999), there is little evidence of the implementation of innovation in manufacturing to increase high value added activities. Study found that two major weaknesses in policies were identified to have contributed to those problems. An assessment on Malaysia's innovation policy and performance indicated a lack of strategic intent to exploit alliances and lack of indigenous expertise. In fact, the profound assessment on technology, which is one important factors influence innovation is also lacking (Rasiah et al., 2011). Technological convergence is restricted by the ability of catching up economy to move into frontier of knowledge creation and innovation (Rasiah et al., 2011).

This indeed related to the technological capabilities in the manufacturing firm such as electronic and electrical sector (Rasiah, 2010). In this context, there are six level of knowledge depth with regards to technological capacity and innovation activity. Level 1: simple activities; Level 2: Minor improvements; Level 3: Major improvements; Level 4: Engineering; Level 5: Early R&D and Level 6: Mature R&D. For instance, it is found that Malaysia electrical and electronics firms were not engaged beyond creative high value added innovation activities where most of the firms involved in level 1 to level 4 (involved low level of knowledge intensity such as simple activities, minor and major improvement type and engineering activities) as compared to level 5 and level 6 (knowledge –intensive activities related creative accumulation) (Rasiah, 2010).

Innovativeness in the manufacturing firms is important to identify the stages involved in the implementation process of innovation, types of problems faced, key success factors and attributes of innovative companies. A comparison study of two subsidiary firms operating in German and Malaysia indicated both firm followed similar innovation process however different in other aspects (Zain et al., 2002). This study found that differences in terms of problems and critical success factors. German subsidiary is innovation active, had better working climate and knowledgeable as compared to Malaysian subsidiary.

Specifically, organisation structure has also become the dimensions in the Malaysia innovation study (Nasurdin et al., 2004). Both dimensions of organisational structure: formalisation and centralisation were found to have positive effects on administrative innovation. Formalisation and centralisation did not have any impact on technological and process, as well as product innovation. Both the levels of technological and process innovations, as well as administrative innovation were discovered to be high amongst American multinationals.

In refining capabilities to keep up with accelerate changes in technology and global market, the role of knowledge management is a considerable factor affect innovation in manufacturing firm. In a study of the influence of knowledge management effectiveness on administrative innovation among Malaysian manufacturing firms, Ling and Nasurdin (2010) revealed that knowledge acquisition effectiveness has significant effect on administrative innovation as compared to knowledge sharing effectiveness and knowledge application effectiveness.

Among other issues discussed above, Lee and Ging (2007) revealed that innovating firm faced problem in finding appropriate source of financing. According to the National Innovation Survey, more than two third of innovating firms claimed lack of source of finance either from government, internal or others and this situation is very crucial to the micro, small and medium industries (Lee & Ging, 2007). Findings from the surveys stated that innovation and R&D routinely carried out in Malaysia since year 1995 to 2001 depicted the proportion of innovating firms in the manufacturing sector is between 21 and 42 percent. This is also supported by the study on the obstacles that impede innovation activities in manufacturing firm (Lim Ee & Nagaraj, 2011). For instance, the obstacles are such as lack of skilled personnel, cost, risk, financing, lack of information about market and technology, inadequate flexibility of regulations and standards and internal organisation rigidities. Impediments from the study has covered the shortcoming outcome of innovation activities and the obstacles faced during undertaking innovation activities (Lim Ee & Nagaraj, 2011).

The determinant factors of Malaysian manufacturing sector are also assessed from the perspective of technological innovation and competitiveness. Ibrahim et al. (2008) found five important determining factors of technological innovation: intensity of R&D, technological trajectories, intensity of marketing, engineers, scientist and managers with experience locally and technical competency of personnel. This study helps to identify and distinguish characteristics of innovative firms.

Although the above studies have pointed the determining factors, characteristics of innovation in manufacturing firm, Chandran, et al., (2009) argued that Malaysian manufacturing systems of innovation is weakly positioned but shows limited evidence of process innovation and not product innovation. Innovation differs among states and sectors owing to differences in the systems of innovation. One important driver of innovation is the central role that multinational enterprises play in the Malaysian manufacturing systems of innovation. Process innovation is conducted by foreign subsidiaries and is on the rise in key the electronics industry. It is also found that technological learning by local firms is mainly through linkages, sub-contracting and technological transfer.

Based on the review from many authors discussed above, it is found that innovation issues in Malaysia are studied in the form of various perspectives. Studies have bring forward issues on the importance of influencing factors, problems, characteristics, level of innovation and the proportion of innovating firm, innovation capabilities and also the technological activities with regards to innovation. In other words, these issues are relevant to this study as it occurred during the implementation of innovation process and determinants factors discussed can also be considered as antecedents. The following discussions will continue with review from past studies on firm performance and its relation with innovation as well as innovation process, innovation outcome and antecedents factors which become the major focus of the study.

2.3 Firm Performance

Firm performance is often be the primary focus in the organisational management studies (March & Sutton, 1997). Objective to improve and increase in performance is manifested in most studies because it inquires about understanding competitive survival of an organisation and reaction from its environment adaptation (March & Sutton, 1997). Emphasise on organisational performance or in this context of study, firm performance indicates that it is an important indicator and the concept is very common in academic literature (Gavrea, Ilies, & Stegerean, 2011).Scholars have focused on explaining firm performance from various perspectives. For instance, the definition of performance evolved according to organisation context and its focus on work, people, organisational structure, organisation ability to exploit resources and ability of organisation to accomplish its goals (Gavrea et al., 2011)

2.3.1 Firm Performance and Innovation

Studies have recognised the importance of innovation on firm performance. These studies were discussed in various perspective of academic research in the form of conceptual and empirical researches (Damanpour & Evan, 1984), (Han, Kim, & Srivastava, 1998), (Danneels & Kleinschmidt, 2001), (Neely et al., 2001), (Calantone, Cavusgil, & Zhao, 2002), (Baer & Frese, 2003), (Jin, Hewitt-Dundas, & Thompson, 2004), (Prajogo, 2006), (Salomo et al., 2008), (Akgun et al., 2009), (Rosenbusch et al., 2010) and (Gunday et al., 2011).

In describing the connection between innovation and organisational performance Gopalakrishnan (2000), claimed that different dimensions are linked with different measures of performance. In this context, performance has included the efficiency related measures and effectiveness related measures. The author has also conceptualised the financial and non financial measures. Financial measures used are return on asset, return on investment and profit growth while the non financial measures are the employees rating on overall effectiveness (S. Gopalakrishnan, 2000). This has signified a range of ways innovation could be related to firm performance.

Organisation introduced changes in their structure and processes with the objective to strive or improved performance level. An empirical study of organisational innovation and performance indicates that high performance organisation have a stronger association between the rate of innovations in their social and technical system (Damanpour & Evan, 1984). This means that the rate of relationship among people in the organisation who interact to achieve innovation goal with those people in the technical system that directly related to the primary activity in an organisation. This study has showed the contribution of both technical and administrative innovation to the organisation performance.

It is found that administrative innovations could change an organisation climate, communication, interdepartmental relations, and personnel policies. Administrative innovation might have greater impact in the long run on the overall performance as compared to technical innovations (Damanpour & Evan, 1984). Hence, the ability of organisation to maintain a balance between their social and technical systems would determine their innovativeness as well as their level of performance (Damanpour &

Evan, 1984). In this context, performance is the ability of an organization to deal with all four processes namely inputs, outputs, transformation and feedback effect.

In another related study in the banking service industry, it has showed the relationship of technical and administrative innovation with organisation performance is important in providing synergies between the two types of innovation, enhancing overall corporate performance (Han et al., 1998). According to Han et al. (1998) , both types of innovation have played as mediator role between market orientation and performance and it has found that market orientation makes a significant contribution towards superior performance. Although there is a mediating role exists, the term innovation combined both technical and administration where technical is related to the basic activities pertaining to product and services while the administration involved organizational structure and administrative process.

Gunday, et al (2011) empirically studied the relationship between innovation process, innovation types and firm performance. In this study, firm performance is referred to innovative performance, production performance, market performance and financial performance (Gunday et al., 2011). While innovation is classified into four types: product innovation, process innovation, marketing innovation and organisational innovation. Findings have revealed the positive effect of innovations on firm performance in manufacturing industries. Besides, it also showed innovative performance as a mediator role between innovation types and performance aspects. In this context, financial performance is the output of innovative, production and market performance. An increase in financial performance occurred as the result of increased market and production performances. The findings supported the innovation strategy as the main driver of firm performance and should be executed as an integral part of business strategy in boosting operational performance (Gunday et al., 2011).

A significant of firm's market performance could be achieved if firm prioritise innovation and manage innovation from a strategic perspective. This is showed through a study by Salomo, et al.(2008) which suggested innovation field orientation has strong indirect performance effects mediated by the innovativeness of firm's new product portfolio. Innovation field orientation is analysed in the form of four elements: focus area specification, foot print of focus area, organisational formality of focus area and stimulation of synergies (combined action from common resources, people, equipment, the exchange of existing expert knowledge and sharing of ideas) between related projects in focus area (Salomo et al., 2008). From this four elements, organisational formality and footprint focus area has a direct performance effect on the firm's performance while other two elements, specification of focus areas and stimulation of synergies are not significant predictors of firm performance (Salomo et al., 2008).

Neely, et al., (2001) proposed a conceptual framework for analysing business performance, firm innovation and related contextual factors. This framework could facilitate innovation within a company. Five construct are used: business performance, outcomes of innovation, innovation, capacity to innovate and external contextual environment. According to the framework, business performance is mediated by the outcomes of innovation such as lower cost and better service. Company's innovation is influenced by firm's capacity to innovate. The framework is latter applied and has prove the main outcomes of innovation impacted business performance by enhancing competitive position(Neely et al., 2001).

Similarly the relationship between innovation and business performance has empirically explored to compare between manufacturing and service firm (Prajogo, 2006). Business performance is analysed via three constructs: sales growth, market share and profitability. Manufacturing firms showed a relatively stronger correlation between innovation and business performance as compared in the service firm. Latest technology and early market entrances have strongest effect on business performance. Process innovation showed a significant effect on the business performance parameters in the manufacturing firms (Prajogo, 2006).

Both exploratory and exploitative innovations have a positive effect on firm performance (Li et al., 2010). The exploratory innovation is the radical type of innovation which pursues the new market segment for emerging customer while exploitative refers to incremental innovation meant for improvement. Therefore, fit between the two is needed in terms of to complement each other and to establish balance effect on performance. Firm needs to introduce exploratory innovation in dynamic environment so that it will find premium market segment to develop and survive, while in less competitive environments, firm could keep their current business system with the low cost risk exploitative innovation which is more beneficial to improve firm performance (Li et al., 2010). Hence, the internal fit between exploratory and exploitative innovation whether fit as moderating or matching has no significant effect on firm performance. Instead, the fit between innovation activity and firm strategy has significant effect on firm performance (Li et al., 2010).

The above discussion has showed the relationship between innovation and firm performance. Whether conceptual or empirical, both have observed a positive influence of innovation on performance. It is found that firm performance has been defined in different ways and different perspectives depending on the context of innovation studies. The following table summarises the measurement of firm performance used in the innovation studies.

Table 2.3
Sample of previous studies on firm performance measurement

Author/s (Year)	**Firm Performance Measures**
Damanpour and Evan (1984)	Eleven performance indicators which is categorized under five types of measures: efficiency measure, service measure, input measure, output measure, subjective measure
Han et al. (1998)	Business performance measures were assessed on growth and profitability
Calantone et al. (2002)	Objective measures (ROI, ROA and ROS) and Subjective measure (overall profitability)
Kemp et al. (2003)	Turnover growth (between two years), Employment growth (between two years)
Baer and Frese (2003)	Use subjective performance: Firm goal achievement and return on asset
Jin et al. (2004)	Sales growth and employment growth
He and Wong (2004)	Average Sales growth rate -measured as self-reported compounded average sales growth rate in the last three years (from 1996 to 1999 with 1996 as the base year).
Hult et al. (2004)	The achievement of organisational goals related to profitability and growth in sales and market share, as well as the accomplishment of general firm strategic objectives.

Table 2.3 *Continued*

Author/s (Year)	Firm Performance Measures
Prajogo (2006)	Business Performance – Sales growth, market share, profitability
Salomo et al. (2008)	Tobin's q capital-market based metric – measures of investors' expectation concerning a firm's potential to generate future profit.
Akgun et al. (2009)	Performance compared to the main competitors (5 point scale): • Return on investment • Market share • Sales • Profitability Earnings • Gross margin (profitability / total sales) • Market Value
Bolinao (2009)	Financial performance indicators- return on assets (ROA), return on equity (ROE), and owner or shareholder return over a three-year period for each SME. Non-financial - reputation, goodwill and public image, fostering innovative culture, innovative capacity, competitive advantage, and the commitment and satisfaction of employees as a well as a personal satisfaction and fulfilment from the business and harmonious labour-management relation as among the ultimate goals of an entrepreneur
Miller and Del Carmen Triana (2009)	Return on investment (ROI, measured as net income divided by invested capital) and return on sales (ROS, measured as net income divided by net sales)
Seokin et al. (2009)	Market share, revenue growth, net income, liability ratio, productivity per individual
Medina and Rufı´n (2009)	Increase in return on investments, earnings growth (before taxes, depreciation, and amortisation), turnover growth, successful implementation of innovations, and increase in market share.
Li et al. (2010)	Performance compared to the main competitors (5 point scale) with regards to market share, turnover, profitability, asset growth, turnover growth and staff morale.
Camison and Lopez (2010)	Economic performance and satisfaction performance

Table 2.3 *Continued*

Author/s (Year)	Firm Performance Measures
Phromket, Prajudtasri, Phangkhot, and Phromket (2010)	Amount of money a firm has invested in doing business
Rhee, Park, and Lee (2010)	Profitability, Sales Growth and Market Share
(Rosenbusch et al., 2010)	Return on asset, return on sales, sales growth, market share growth, stock market based measures of financial performance (e.g. Tobin Q, market to value)
Ar and Baki (2011)	Sales, Profitability and Market Share
Gunday et al. (2011)	Innovative Performance, Production Performance, Market Performance and Financial Performance

Based on the table 2.3, there were many types of indicators used to measure firm performance in the context of innovation study. Generally, the summarise table showed that firm performance were measured according to the objective measures, subjective measures, financial measures and non financial measures. This study is keen to use the subjective measures in line with the many studies as described in the literature review.

2.4 Overview of Innovation Process

The evolution of innovation process is concurrent with the development of world economic growth, its environment and industrial expansion (Rothwell, 1994). Movement of innovation process has been identified from the first generation of Technology Push (1950s to 1960s) to second generation of Market Pull (1970s to 1980s) to third generation of Coupling Model of Innovation (1970s to 1980s) to fourth generation of Functional Integration Innovation Process (1980s to 1990s) to the fifth generation of System Integration and Networking Innovation Process (Galanakis, 2006). The new sixth generation is the open innovation model which focus internal and external ideas, internal and external path to market with advance of new technologies (Preez & Louw, 2008). This evolution has pointed that innovation process is one important element of innovation as it is essential in determining the success of innovation implementation (Marques & Monteiro-Barata, 2006).

From the first to fifth generation, innovation process is needed due to several factors. Among the factors are technological change and expansion through the R&D, high competition, high growth of manufacturing output, to reduce economic effect that cause waste and failures, growing needs to focus on core business and to cater with increasing development speed and efficiency (Rothwell, 1994). Indeed, in this recent competitive environment where knowledge is highly available, result has showed that the leading innovation organisations have fully utilise the innovation process in its innovation management and techniques (Hidalgo & Albors, 2008; Scarbrough, 2003).

Considering the significant role of innovation process, it is noted that its establishment is through interaction and also collaboration by the employees, management, organisation culture, resource allocation, supplier and also the customer (Hidalgo & Albors, 2008; Rothwell, 1994). Furthermore, this stage is complex but if the stage is successfully managed, it will affect the innovation outcome and finally the performance of the organisation (Bolinao, 2009). For instance, a systematic innovation process will be more effective in structuring organisation to become more robust as compared to the brittle ones (Desouza et al., 2009).

In simple description, any innovation must progress through a number of phases before it is commercialised. Thus, whether it is a new product, a new process, an improved process of combination of these, they need to go through the respective phase – innovation process which begin with generation of ideas, the implementation and finally the commercial success (Goffin & Mitchell, 2005). Generally the word process can be referring to an activity, practices or event that occurred in the innovation stage. In the context of organisational view, it is noticed that process involved action, change, cause and effect. Thus, when it relate to firm performance, a process is needed so that it can be served as the basic element required in improving performance and innovation process is claimed to be established from the perspective of 'Process View'(Xu, Liang, & Zhu, 2004). In the innovation process stage, the whole organisation functional divisions are involved to improve efficiency in the innovation management. Thus, innovation process will manage organisational actions accordingly from the earlier ideation to the commercialisation stage of innovation (Desouza et al., 2009).

Earlier studies have come up with various types of innovation process framework such as (Galanakis, 2006), (Hidalgo & Albors, 2008),(Desouza et al., 2009), (Marques & Monteiro-Barata, 2006). Regardless these framework, from the management perspective, innovation process can be explored through innovation context it occurs, organisational integration and technology strategy (Dodgson & Hinze, 2000). In fact, the context where innovation occurred is differentiated by internal organisation environment: type of innovation and type of organisation and external environment: type of industry and type of country or culture (Ortt & Duin, 2008). For instance, the development of innovation process has been studied empirically in the service sector is one of the example that considered context and internal organisation environment type (Alvano & Hidalgo, 2011)

Innovation process is discussed from the aspects of knowledge based competition, time base strategies, creativity and learning, technology fusion and globalisation (Dodgson & Hinze, 2000), The organisational integration for innovation aspects cover process based organisation, strategic R&D unit, integration of suppliers and customers, networks, use of electronics, computer integrated manufacturing and lean production. While technology strategy cover existing resources that combined all elements of people, equipment, organisation routine and finance (Dodgson & Hinze, 2000). In line with the literature, this study will take the innovation context and internal organisation approach to indicate how the innovation process establishes in particular organisation.

The above discussions have pointed the overview on innovation process and also the justification to show why innovation process is essential in the implementation of innovation in organisation. It is noted that innovation process involved activities, phases or paths before organisation could actually extract the outcome of the process. This is also demonstrated by the previous literature such as (Hung, 2004), (Alvano & Hidalgo, 2011) and (Hossain, Kumar, & Kumar, 2010). Apart from various types of frameworks that were discussed in empirical and conceptual, this has also contributed to the different perspective definitions of the innovation process.

Consequently, this will bring the following elaboration on the definitions of innovation process and the key factors that affect innovation process.

2.4.1 Innovation Process Definitions

Innovation process is described as activities that are performed at each stage of the development of innovation (Ortt & Duin, 2008). A structured innovation process that is established in an organisation will focused more on creating and predicting the customers future needs rather than the organisation which operate without a more defined innovation process (Harper & Becker, 2004). This is because there will be a procedure in evaluating and screening of ideas, established process, have a framework for management of ideas from their inception to commercialisation (Desouza et al., 2009).

The innovation process has been defined in various ways and perspectives. For this context of study, the researcher needs to identify the appropriate definition so that it will reflect the perception of innovation process being applied in the particular organisation. Gerybadze, et al. (2010) described innovation process as a phases of process which started from strategy planning, innovation planning, generating idea, screening, project selection, project development, market test, production, market introduction and innovation controlling. It is noted that the definition indicates that innovation process is complex and dependent on each other. It has emphasised the importance to monitor innovation from different perspectives such as strategy related, market related, product/project related, process/performance related and culture related (Gerybadze et al., 2010).

In a longitudinal study of a hospital ward, innovation process is defined as the sequence of activities of new elements, involved some visible change. This process must transform or challenge the current status and condition with the objective to provide benefit to the organisation or the wider society (King, 1992). In this context, since it involved diverse changes to individual, group or organisation, the definition chosen is focused on process of innovation. Two stages of innovation process: initiation and implementation is adopted where it has divided into five sub stages: knowledge awareness, formation of attitude, decision an evaluation on potential innovation, initial implementation and continued-sustained implementation (King, 1992). This definition quite similar to Gopalakrishnan & Damanpour,(1997) because the emphasised is on organisational changes.

Gopalakrishnan and Damanpour (1997) defined innovation process depended on whether innovation process acts as a generator or an adopter of innovation. When it is viewed as generation of innovation, it is defined in terms of problem solving and decision making where innovation process is divided into five stages: idea generation, project definition, problem-solving, design and development, and marketing or commercialisation. The success of generation phase depended on organisation ability to exploit innovation for its own performance improvement.

Consequently, the adoption of innovation is viewed as a process of organisational change that directly affects the technical and social systems of an organisation (Gopalakrishnan & Damanpour, 1997). This stage consists of two phases: initiation and implementation. Initiation stage is characterized by three sub-stages: awareness of innovation, formation of attitude towards it and evaluation from organisational standpoint. Implementation stage includes two sub-stages: trial implementation and sustained implementation (Gopalakrishnan & Damanpour, 1997). The success of adoption stage depended on the integration of the innovation and its contribution to organisational outcome (Gopalakrishnan & Damanpour, 1997).

Innovation process is also referred or used interchangeably as technological change, technical progress or technological development and thus definition is discussed from the technological perspectives (Nieto, 2004). Innovation process is defined as technological innovation in companies where it involved a learning process through which a flow of new knowledge competencies and capabilities is generated (Nieto, 2004). The definition is based on some characteristics such as continuous in nature, path dependent, irreversible and affected by uncertainty (Nieto, 2004). This definition shared similar criteria with the work done by Narvekar and Jain (2006) where it proposed that innovation process is an interactive three stages of ideation, incubation and demonstration. As innovation process is needed to transform technologies into new products frequently, it interacted innovation input involved R&D spending in relation to sales or R&D intensity (Parthasarthy & Hammond, 2002). Thus, innovation process is referred to the integration of organisational mechanisms that consist of functional integration (operational task that connect to work routine), tool integration (operation design connected with manufacturing tools) and external integration (operation linking the customers and suppliers) (Parthasarthy & Hammond, 2002).

Innovation process could assist organisation to examine innovation pattern. In a case study, it is found that the innovation activities in the facility management is an incremental of routine activity and therefore innovation process is defined as management process of multiple activities, involving multiple actors from one or several organisations during combinations of means or ends which are new creation, adoption, developed, transferred and implemented (Mudrak, Wagenberg, & Wubben, 2005). In this case, innovation process is viewed within organisational environment that is from decision to innovate, input, throughput to output and finally affect firm performance. The concept of input-output style of innovation process similar to other studies such as (Kemp et al., 2003) and (Marques & Monteiro-Barata, 2006). It is observed that the input output style is considered process approach because it differentiates between input, throughput and output stage (Kemp et al., 2003).

It is noted that many of the previous studies have defined innovation process according to steps, stages or cyclic such as (Desouza et al., 2009), (Bernstein & Singh, 2008) and (Björk et al., 2010). According to Desouza et al. (2009), there is also most common innovation process conducted in stages that are interlinked in cyclic manner. The process begins with idea generation, mobilization, advocacy and screening, experimentation, commercialisation and diffusion and finally implementation. Table 2.4 summarised the definitions that have been discussed. As observed, these definitions indicate that innovation process occupied multiple actors, role and its application is different according to the organisational context. Therefore, for this study the researcher will use a definition that is applicable from the management's perspective.

Table 2.4
Sample of previous studies innovation process definition

Author/s (Year)	Innovation process definitions
King (1992)	Innovation is the sequence of activities by which a new element is introduced into a social unit, with the intention of benefiting the unit, some part of it, or the wider society. The element need not be entirely novel or unfamiliar to members of the unit, but it must involve some discernible change or challenge to the status quo.
Nieto (2004)	Innovation process defined as technological innovation in companies is a learning process through which a flow of new knowledge competencies and capabilities is generated.
Tomas Mudrak, Wagenberg, & Wubben (2005)	Innovation process (consisting of scanning, strategy, resourcing, implementation, and learning and re-innovation phase) within the organisational environment (consisting of effective implementation mechanisms, effective external linkages, strategic approach, and supportive organisational context).
Marques & Monteiro-Barata (2006)	Innovation process contains three main blocks of variables: the variables of innovation input, throughput (the specific process of transforming inputs into outputs), and innovation output.
Narvekar & Jain (2006)	Innovation process refers to technological innovation process. Involved three stages: ideation, incubation and demonstration.
Bernstein and Singh (2008)	Idea generation, Innovation Support, Innovation Development and Innovation Implementation.
Desouza, et al., (2009)	Innovation process is a cyclic process which includes six stages: idea generation, idea mobilisation, advocacy & screening, experimentation, commercialisation, diffusion & implementation.
Björk, Boccardelli and Magnusson (2010)	Stimulation of ideas, Identification of ideas, Selection of ideas and Integration of ideas
Enzing et al. (2011)	Innovation process refers to upfront activities, organisational routines and company culture.

Based on these definitions, innovation process involves a series of activities internally where various inputs, factors and also variables are used when innovation is undertaken by an organisation. It is noted that this phase involves almost all means included employees, resources, strategy and culture. This is in line with what has been proposed conceptually by (Dewett, Whitter, & Williams, 2007), who claimed that by delineating the internal diffusion it can synthesise the innovation research. It is observed that the numerous definitions given by previous scholars indicate one thing in common which is innovation process involved a series of steps, phases or stages and it is found that the advantages of the stages type ensured better quality in innovation process (Preez & Louw, 2008).

Therefore, the above definitions have provided guidelines for researcher to define innovation process for this study. Based on the reviewed definitions, specifically innovation process is defined as the dynamic approach that consist an activities or phases which include idea generation, idea mobilisation, advocacy, screening, experimentation, commercialisation, diffusion and implementation that lead to generate innovation outcome. This dynamic approach requires firm capability to utilise leadership traits, effective managerial levers and appropriate business process.

2.4.2 Issues in Innovation Process

There are issues with regards to innovation process. According to Desouza, et al.(2009), although innovation process is divided into several stages, any single organisation may not participate in all of the stages. Therefore, competencies and deficiencies need to be identified in improving organisation’s innovation overall success. It is found that although many organisation emphasised more on innovation, the initiative did not achieve satisfactory profit or competitive advantage because they need to encounter difficulty in managing the innovation process from an idea to a successful product in the market (Preez & Louw, 2008). This means that although organisation spends more on innovation, there is still difficulty in managing innovation process due to its rigorous process. Common language for analysing and discussing innovation and establishing goals at specific stages of innovation process is needed and this would advocate employee to innovate (Desouza et al., 2009). In other words, this issue need to be tackled because innovation process is the backbone of innovative effort and displayed commitment and also direction to the stakeholders (Desouza et al., 2009).

Marques and Monteiro-Barata (2006), emphasised that innovation process possessed three general characteristics : the multifaceted nature of success, the universalisation of success factors and the fundamental role played by people in the process. In implementing successful innovation, organisation requires several techniques to support innovation process such as Business Modeling Techniques (Scozzi & Garavelli, 2005). Business Modelling Technique is a technique used to support and improve innovation process through such as information system development. Insight on innovation process in SMEs has postulated that innovation development process are complex, knowledge intensive and often definable (Scozzi & Garavelli, 2005). The issues here are the innovation process occurred as a sequence of task demands coordination, management interdependencies and control. This is needed to accountable for the evolved decision making, strategic process, political process difficulties, lacking in interpretative process, creative process and communication and information flow needs (Scozzi & Garavelli, 2005). Therefore, it is noted that the several factors has defined enabling features of innovation process included the underlying strategies in the organisation, the overall organisation's system integration and structures, fully develop internal and external databases on organization networking system (Rothwell, 1994).

The effectiveness of management of innovation process requires a balance set of innovation metrics related to all innovation drivers such as leadership innovation process, culture and people participation and also innovation result such as time to market and economic performance (Dervitsiotis, 2010). In this context, innovation utilises all inputs: leadership innovation process, employee participation process, innovation strategy, innovation resources, customer feedback process, innovation project portfolio, supplier participation process to produce innovation process result (Dervitsiotis, 2010). The author further adds that this would provide results in the sense of customer impacts, employee impacts, organisation impacts and overall performance impact.

In a systematic review on innovation, it is noted that innovation process depended on several dimensions such as level, driver, direction, source and locus (Crossan & Apaydin, 2010). The level dimension divided between individual, group and firm processes. The driver deals both, either internal (available knowledge and resources) or external driver (a market opportunity or imposed regulations). The direction dimension considers how the innovation process starts and develops, whether it is top-down or bottom-up. The source dimension involved the internal source of innovation is ideation, whereas an external source of innovation is adoption of innovation invented elsewhere. Finally, the locus dimension defines the extent of an innovation process that is whether firm only (closed process) or network (open process) (Crossan & Apaydin, 2010).

The most important issue is how the innovation process itself affects the firm performance since the contribution from firm will accumulate and contributes towards competitiveness and growth of a sector, industry and finally a nation. For instance, performance such as innovative performance, production performance, market performance and financial performance will be affected by innovation (Gunday et al., 2011). Nevertheless, before performance is achieved, innovation process need to generate an innovation outcome because this will provide a holistic approach towards performance of whole organisation that excels with innovation. In other words, this would also result a significant linkage between outcome of innovation and firm performance in terms of the return it could bring back to organisation, increase competitive position and value to the organisation (Neely et al., 2001). As mention earlier, the importance to carry out this study is to seek the relationship between innovation process, innovation outcome and firm performance. Based on the above arguments, the researcher would consider the steps, stages or phases used by previous scholars to describe the innovation process. This will be elaborated in the subsequent section.

2.4.3 The Stages of Innovation Process

Various studies have been undertaken to show the stages, phases or steps that can be used in constituting the innovation process (Desouza et al., 2009; Galanakis, 2006; Goffin & Mitchell, 2005; Preez & Louw, 2008; Sheu & Lee, 2011). It is claimed that quality of innovation strongly depended on the quality of the process used to develop because innovation process would be effective as decision made as efficient as the speed with the information required is made available (Preez & Louw, 2008). From the innovation literature, the innovation process described based on several stages of activities from ideas to commercialised product (Preez & Louw, 2008). The following describes the stages involved in innovation process.

2.4.3.1 Idea Generation

Innovation is earlier sourced from new idea generated either internally (employees) or externally (customers, business partners, academia, government, and competitors). These ideas were established through redefinition of concepts, changes in processes, new components or new development of service (Desouza et al., 2009). This is a creative stage where new opportunities are identified (Preez & Louw, 2008). In this stage, information about the current problem, competitors, clients, markets, technologies, strategies and objectives are crucial (Preez & Louw, 2008). The technology and market related information is considered to be an upfront activities which is also sourced of ideas (Enzing et al., 2011).

2.4.3.2 Idea Mobilisation

The movement of ideas when there are conditions such as modification of product, processes, service or frameworks. In this stage idea must be well treated and shared across organisation so that it could suit the organisation settings. Idea mobilisation could alter business models, service or products for applicable use (Desouza et al., 2009). Correct information is stimulated and available to the right people and this would establish a formalised flow of knowledge that significantly improves and support innovation (Preez & Louw, 2008).

2.4.3.3 Advocacy and Screening

This process covers evaluation of potential opportunities for ideas within a particular organisation's context. Ideas need to be evaluated to make sure that it is worth for implementation. Both advocacy and screening must do simultaneously during the refinement stage of innovation process. In the input-output style of innovation process, this activity is also referred as scanning, an effective mechanism during the innovation implementation (Mudrak et al., 2005). This stage is crucial for adoption new practices or new product development. Both action assist in making ideas more explicit and communicable. This is important because ideas with high probability of success are the needed in the stage of innovation process (Desouza et al., 2009). This process is needed as it will filter and select the promising ideas to determine its feasibility (Preez & Louw, 2008).

2.4.3.4 Experimentation

Experimentation is needed to test the suitability of an idea for particular organisation at a particular time. It is an iterative process of development. Thus, it might be continuous or occurred in fits and starts depending on the advocates, screening and resources. This process must be conduct internally for business model, strategy or business changes however for the case of product development and consumer respond testing; experimentation could be implemented externally through outsourced (Desouza et al., 2009). Detail project planning, design and implementation projects is reviewed in this stage (Preez & Louw, 2008).

2.4.3.5 Commercialisation

Commercialisation focuses upon the potential impact of an idea. It clarifies how and when ideas can be used by people other than the group that developed them, through data or prototypes from the experimentation process to reveal tangible benefits. Possible ideas are taken to create internal or external market value, within which value can be expressed or shared in a logical manner. Therefore, commercialisation established the specifications of an idea and the output of a commercialised idea is a defined product or service or a combination of the two (Desouza et al., 2009).

2.4.3.6 Diffusion and Implementation

Diffusion is the process of acceptance for a new innovation, while implementation is the process of setting up the structures, maintenance and resources to let the innovation to develop and be operated or produced. Organisational members need to actively engage in this stage. At the end of the stage of innovation process, the application of the innovation should be accomplished and turn the innovation into a service or product. Diffusion process needs an open culture and/or strong support all the way through the organisation. Therefore, organisation needs to consider two critical factors in this stage: resources and unlearning. Resources are needed whether in the form of time, money, equipment or materials. It must be offered for the new process, product, service or strategy to be implemented. Unlearning and deprogramming must be eliminated so that it will allow the new process, product or strategy to be used in that particular organisation (Desouza et al., 2009). In the last phase, organisation is encouraged to promote learning as this would enhance innovation process based on the reviewing the difference between objective and results, achieving knowledge and improvement opportunities (Alvano & Hidalgo, 2011).

2.5 Antecedents

The competitive success of organisation in managing innovation process depends on many factors or determinants. According to Ven (1986), understanding on innovation process is achieved if the factors that facilitate and inhibit the development of innovation is also understood. Antecedent factors also useful in explaining innovation types, dimensions and application (Ar & Baki, 2011). For instance, Adams, Bessant and Phelps (2006) has proposed seven factors: inputs management, knowledge management, innovation strategy, organisational culture and structure, portfolio management, project management and commercialisation. These factors are reviewed where they are identified to be significant in the innovation process. In a study on investigation of innovation antecedents, Hadjimanolis (2000) has distinguished the antecedents into three: organisational members, size and the structure of organisation and environment factors that affect the innovativeness and performance.

From the theoretical lenses, Crossan & Apaydin,(2010) has reviewed and consolidate three major determinants: leadership, managerial levers and business process. The leadership constructs cover the individual and group level factor. Managerial levers cover mission, goals and strategy, structure and system, resource allocation, organisational learning and knowledge management; and organisational culture and the third construct which is business process cover initiation, portfolio management, development and implementation, project management and commercialisation.

According to Crossan and Apaydin (2010), the three constructs are based from comprehensive review, involved multi-dimensional factors, supported by theory and it can be practical at the firm level.

According to Chang, Hughes and Hotho (2011), internal and external antecedents is important element that influence the development of a balance dimensions of innovation between exploration and exploitative types. In the study, internal antecedents is referred to organisational structure (centralisation and interdepartmental connectedness) while the external antecedents is referred to dynamic environments and environmental competitiveness. (Chang et al., 2011). Their findings have proved that both antecedents stimulated the relationship between innovation and firm performance (Chang et al., 2011).

Garcı´a-Morales, Llorens-Montes and Verdu´-Jover, (2006) found that antecedents comprise of strategic factors that affect the innovation. The strategic factors are personal mastery, transformational leadership, shared vision, proactively and environment. The study proven that all antecedent has help an organisation to become more innovative and encourage in learning (Garcı´a-Morales et al., 2006). In this context, organisation must practically manage the strategic factors because it leads to improvements in organisational performance.

Similarly, there were other studies which emphasise the importance of antecedents. These studies are conducted by several authors: (Long & Yuan, 2010), (Peng, 2007), (Ar & Baki, 2011) and (Jansen et al., 2006) and (Crossan & Apaydin, 2010). These studies have also added several factors for antecedents such as R&D strategy, top management support, customer focus, organisational learning, creative capability, organisational collaboration, supplier relationship, market orientation and entrepreneurial orientation.

In short, the above literatures have indicated that antecedent's factor is crucial in determining the relationship between innovation and organisation performance. It is noted that the role of antecedent has drive and facilitate the implementation of innovation process before it could finally affect the overall performance. Considering its valuable function, the researcher is interested to consider these antecedents as the driving factors of innovation. For this context of study, the researcher will utilise three antecedent factors suggested by Crossan & Apaydin (2010), since it is more practical to micro level and almost all internal factors that affect innovation are covered through these factors. Thus, the following literature review will focus on each factor: leadership, managerial levers and business process which is establish as the innovation antecedents for this study.

2.5.1 Leadership

Leadership is seen as internal competitive force to foster innovation. In a research of 600 global executives and professionals, it is reported that leadership is the best predictor of innovation performance (Barsh et al., 2008). This can be seen through its role in affecting core value of organisation, influence on the social psychology of its members, involved in the processes of decision flows and become a formal and informal role sets of individual and groups (McMillan, 2010). Earlier study on innovation management shows that the structure and system focus of the organisational members only to routine work not innovation activities if there is no leadership intervention (Ven, 1986). Furthermore, the more successful an organisation, it is also more difficult to activate people action into new ideas, needs and opportunities (Ven, 1986). Thus, it is noticeable that the role of leadership is significantly important for the research.

As innovation is an evolving activity, the complexity of its process demand more than a simple structured traditional task of leadership (Denning, 2010). In the innovation nature, it is noted that new management is more radical in terms of achieving goals towards continuous innovation value, working in self-organising teams, progress is measured through customer delivering value and improvement process is more interactive (Denning, 2010). Thus, as to fulfil with these requirements, the approach of leadership must complement with the whole process of innovation. In coping with innovation, there were many studies emphasised on leadership importance such as leadership style, role, skill and abilities such as (McMillan, 2010), (Bel, 2010), (Krause, 2004), (Jansen et al., 2009), (Friedrich et al., 2010) and (Gumusluoğlu & Ilsev, 2009).

Effective approach of leadership is needed to promote innovation within the organisation. This due to competitive forces such as core values and the social psychology of its members that will affect the decision making process (McMillan, 2010). Thus, to be effective a leader must possess capacity to listen, to motivate, to learn, must have skills and competencies in order to achieve high organisational innovation (McMillan, 2010). In cooperating with the skill and abilities of being a good leader, there are many style of leadership portrayed by previous studies to confront with innovation such as transformational and transactional (Eisenbeiss, Van Knippenberg, & Boerner, 2008) and (Bossink, 2004a).

According to Bossink (2004a), the degree of managers facilitate their subordinates to be innovative is measured through transformational-transactional leadership. There are three factors describing transformational leadership as charismatic, individualized consideration, intellectual stimulation and two factors describe the transactional leadership: contingent reward and management by exception. Both transformational and transactional leadership behaviours contribute to management innovation (Vaccaro, Jansen, Bosch, & Volberda, 2010). Smaller and less complex organisations benefited more from transactional leadership in realizing management innovation. On the other hand, larger organisations need to draw on transformational leaders to compensate for their complexity and allow management innovation to flourish (Vaccaro et al., 2010).

Notably, innovation in the organisation would also depend on innovative behaviour of employees. Transformational leadership relates to followers' innovation implementation behaviour (Michaelis, Stegmaier, & Sonntag, 2010). According to Michaelis, et al. (2010) companies should invest in transformational leadership training and select supervisors with this kind of leadership style before initiating innovation.

In a case study of innovative construction projects, the application of innovative leadership is proven (Bossink, 2004a). Innovative leadership style covers four factors: charismatic, instrumental, strategic and interactive. It is found that in instrumental leadership style, leader started to control the innovation process and the structured the process. Strategic leadership implied where leader started to commit project members to innovation and then enable project members to be innovative. Interactive leadership started cooperates with innovative project members and the developed additional leadership in the organisation. While charismatic leadership exist when leader energised project members, communicated with vision and then accelerated the innovation process (Bossink, 2004b). However, when information, knowledge and competence of personnel were injected into the project, it has assisted in stimulating project innovativeness as compared to project without those injection (Bossink, 2004b).

Strategic leadership contributes to increase innovative efforts and innovation positive result. According to Carneiro (2008), the need to develop, improve performance and quality are always demanded for change. Thus, a strategic leader has to understand how to link leadership approaches to the needs of higher performance levels. For instance, there are three aspects contribute to strategic leadership namely knowledge, innovation challenge and the needs to change (Carneiro, 2008). Besides these aspects, several considerations are needed to stimulate the innovative effort such as quantifiable goals, innovation culture and program, knowledge and training education and value of teamwork (Carneiro, 2008). Similarly, the strategic leadership is found to have influence and moderating effect of top management team tenure heterogeneity and social culture. This is also supported by other studies which found strategic leadership to have a strong positive relationship with executive influence on both product-market and administrative innovations (Elenkov et al., 2005).

In one of the previous study, it is found that there is also relationship between this leadership approach and innovation outcome (Jansen et al., 2009). There are two different style of strategic leader differently effect on innovation outcome between exploratory and exploitative innovation. Transformational leadership behaviours contribute significantly in pursing exploratory innovation while transactional leadership is associated with exploitative innovation (Jansen et al., 2009). In the dynamic environment where the rate of change (technologies, customer preference and fluctuation in product demand or supply) is unpredictable, transactional leadership is not suitable for learning process that challenges the institutional learning. Therefore, transactional leadership had negative effect on exploratory innovation (Jansen et al., 2009).

Friedrich, et al.,(2010) claimed that previous research on the intervention of leader at multiple level and across stages of innovation process is not consistence. Leaders have exclusive opportunity to influence innovation at every level and across stages of innovation. In this context, Friedrich, et al., (2010) proposed the influence of leadership characteristics in terms of expertise and creative problem skills towards the product, process complex, simple innovation. Expertise is an acquired skill and knowledge gained from experience and practice while creative problem skill refers to the ability of leader to push creative effort which facilitate innovation (Friedrich et al., 2010). According to this author, technical expertise and generative problem skills is more beneficial for product innovation. While for the process innovation, it is proposed that organisational expertise and evaluative skills is more beneficial. However, for complex and simple innovation, both technical and organisational expertise is needed. On the other hand, evaluative skills are proposed to focus on the long term outcome in the complex innovation where this type of skill focused on the contribution of ideas.

Prior study has indicated conceptually the importance of transformational leadership at different phases of the innovation process (Waldman & Bass, 1991). Nurturing and persistence are two distinct roles that are believed to be identified in an innovation process. According to the author, nurturing role is oriented toward the development and support new ideas while persistence is about the determination of a leader to maintain the energy and enthusiasm related to idea generation through realisation and diffusion of innovation in the form of products and processes (Waldman & Bass, 1991). In addition, the two roles are affected by four transformational leadership factors: individual consideration, intellectual stimulation, charisma and inspirational leadership. This has showed that leadership behaviour can play substantial role in innovation where the nurturing and persistence are necessary to build a combination of individuals at each phases of innovation process (Waldman & Bass, 1991).

Leadership would contribute to innovation success if we could examine the role and responsibilities in terms of level and phases of the innovation process. In this context, it would be more specific and diagnostic to reflect on innovation effort that fail because of leadership issues (Storti, 2006). According to Storti (2006), these leadership roles is considered strategic and applied to a single leader or to a leadership team along the five phases of innovation process: preparation, invention, validation, development and refinement and implementation. Table 2.5 summarised several of leadership role in the innovation process. In support of this argument, Stamm (2009) pointed that a leader need to search for innovation opportunities, be clear about selecting different level of innovation such as incremental and radical and implementing it.

Table 2.5
Leadership role according to five phases of innovation process

Preparation Phase	Invention Phase	Validation Phase	Development and Refinement Phase	Implementation or Commercialisation Phase
Sponsor, Intelligence Officer, Challenger and Resource Provider	Connector, Guide and Counsellor	Critic Agent of advocate, Advisor, Expeditor and Judge	Champion, Provider, Optimiser(Market) and Strategist	Director and Ambassador

Innovation process is also viewed in two key steps: idea generation (the front end) and conceptualization (the back end) (Bel, 2010). The first step involved uncertain condition and requires creativity and vision while the second step requires discipline and efficiency. Thus, in this context, two different kinds of leadership are required. Since the first stage of innovation process involved idea generation, employees behaviour towards innovation process depended on leader influence to lead and stimulate idea generation and application in organisation (Jong & Hartog, 2007). In a study on how leader influence on employees' behaviour, thirteen leadership behaviours were found to be relevant. These behaviours are innovative role model, intellectual stimulating knowledge diffusion, providing vision, consulting, delegating, support for innovation, organising feedback, reward and recognition, providing resources, monitoring and task assignment (Jong & Hartog, 2007). With these behaviours, there is potential for idea generation and opportunity exploration to be enhanced by directly stimulating and probing employees.

According to Bel (2010), successful innovation leader are characterized by a set of common attributes:

a) A mix of emotion and realism – leader must be creative in a balance way
b) Acceptance of uncertainty, risk and failures – leader is one who know key success and handles risk successfully
c) A high degree of passion – showing passion and enthusiasm for new products or features
d) The willingness to proactively search for external technologies and ideas – leader is curious and willing to use what has been discovered and inspired by knowledge
e) The courage to stop project but not just to start them – Decision to stop project due to time, budget and manpower constraint.
f) A talent for attracting innovators, building and steering winning teams – leader recognised team effort.

The above attributes also shared common traits such as will and humility, skill and abilities, specialist and generalist (Bel, 2010). Thus, from these explanation, innovation leadership involves diverse roles, abilities and strategic orientation across organisational level and its innovation life cycle (Bel, 2010). According to the author, innovative leadership role is about inspiration of generating ideas, a vision and strategy together in building organisational structure and flexible culture with the objective to enable the process of innovation. Besides, innovation leadership is also important at the individual and also group level. Therefore, the attributes, traits, skill and abilities would influence the organisation success rates in implementing change and driving organisation (Bel, 2010; Crossan & Apaydin, 2010).

Based on the above discussions, it is noted that the leadership influence is important as antecedent to innovation context. It is observed that almost all elements in transformational and transactional leadership style contribute to innovative leadership. For this study, researcher will consider the leadership dimensions which is based on its attributes that promote innovation. Hence, leadership is refer to the innovative leadership comprise of abilities, skills and competencies that appropriate to contribute creatively, strategically and effective to enable innovation process at the firm level.

2.5.2 Managerial Levers

Managerial levers are basic formation of any organisation that must be linked in order to maximising business operation and precision (Chad, 2010). According to Ginzburg (2006), levers enable organization to control the current trends to enhance their innovation. With the current economic situation, most companies are struggle within seven types of managerial levers namely: strategy, structure, leadership, information and decision processes, people, culture, reward and incentives (Chad, 2010). In one of the past study on enlightening new mindset for business innovation, managerial levers operate as a technique that facilitate organisations to higher levels of innovation as well as its sustainability (Leibold, Voelpel, & Tekie, 2004). From the perspective of innovation, managerial levers are found to have high impact on three areas include value proposition, value network and target customers (Pletcher & Mann, 2013).

The important of managerial levers which involved structural and skill were proven in building a capable organisation (Crittenden & Crittenden, 2008). Therefore organisation needs to have a clear understanding of each lever role so that it could really bring impact on organisation ability to succeed (Crittenden & Crittenden, 2008). According to David (1996), there are numerous of levers that have been used for organizational change which is complex and often overlap. Therefore, this study focuses on managerial levers as suggested by Crossan and Apaydin (2010).

In a systematic review of organizational innovation, Crossan and Apaydin (2010) has proposed managerial levers which include a meta-construct consolidating firm level variables that support innovation. Since this study is focusing on innovation implementation at the firm level, it is practical for managerial levers to be applied as one of the antecedent variables. As for this study, the researcher utilises five types managerial levers namely: strategy, structure, resource allocation, organisational learning and knowledge management tool and culture (Crossan & Apaydin, 2010). The following discussions describe each of the managerial levers applied in this study.

Strategy is the first managerial levers. According to White (2011), strategy refers to coordinated set of actions that accomplish firm's objectives, purposes and goals. Strategy is perceived as a continuous management activities (Drejer, 2006; Li et al., 2010). Apart from being the most necessary form of activity in the organisation, strategy is also act as foundation for innovation (Steward & Fenn, 2006). In order to overcome managerial challenge that might occurred from potential difficulties with existing resource endowments, capabilities and organisational routines, strategy is highly needed (Blumentritt & Danis, 2006).

The role of strategy and firm's innovation implementation target should be linked with the competencies and strategic orientation. (Blumentritt & Danis, 2006). For instance, a study conducted in the electronic industry in Denmark found that Business Excellence Model strategy is applied into product development (Martensen & Dahlgaard, 1999). In addition, a study of 600 Australian manufacturing SME firms, indicated that innovation strategy with formal structure are key drivers to their performance (Terziovski, 2010). The study also found that innovation strategy is similar between SME and large firms and strategy is aligned closely throughout innovation process. Nevertheless, due the size and the incremental type of innovation in SME, they still faced some problems in innovation process. Hence it is found from previous research that the SME organization combined both analyser and prospector business strategy to achieve their innovation performance (Pullen et al., 2009). According to the source, the analyser strategy promotes incremental innovation by improving efficiency through product enhancement while the prospector strategy promotes radical innovation focused on market opportunities and emerging trend.

Innovation implementation vary among firms with different strategic orientation of between defender, analyzer and prospector (Blumentritt & Danis, 2006). It is found that prospector was dedicated to innovation (aggressive type of idea generation from manager level) as compared to defender and analyzer. Defender uses other ways to maintain innovation efforts such as price and cost cutting and exceptional relationships with their customer while analyzer operates innovation via combination of those practiced by prospectors and defender. This means that the strategic orientation played an important role on how innovation process is managed among firms. The above findings were important because strategy concerned with the survival of entire organisation and involved large portion of resources. (Drejer, 2006).

Innovation occurred when there is a new competition arises. This means that the new business concept is expressed in the sense of value creation. According to Drejer (2006), value creation processes are the basis on how the products or services are design, developed, produced, distributed and marketed. In view of this, strategy needs to represent innovative thinking about new activity, translating business ideas into market, resources and structure and finally operating within boundaries available. Different kind of strategy was also applied into different types of innovation outcome. For instance, one study conducted in Taiwanese electronics industry, indicated a strong relationship between product innovation and differentiation strategy while the process innovation was strongly related to cost leadership strategies (Liang-Hung & Chun-Hsien, 2008).

As mentioned in earlier discussions, the strategy adopted towards innovation implementation was varying across firms. According to Chen and Yijun Yuan (2007), a firm needs to seek optimal balance when formulating innovation strategy. Based on their study, the contribution from outsourcing strategy was found to have smaller impact on innovation as compared to internal R&D strategy. This means that strategy adopted must take into account factors such as cost and the duration involved in the innovation process. The discourse is also essential in determining organisation direction in the long run, to generate innovation outcome and finally contributes to the different pattern of innovation orientation (Stock & Zacharias, 2011). A study with regards to patterns and performance outcome of innovation orientation found the strategy that search for opportunities, continuous new product creation and proactive to competitive positioning contributed to high scores to integrated innovator and top-down innovator while scored low to the internally driven and proactive customer innovator type (Stock & Zacharias, 2011). In this context, the integrated innovator refers to companies that implemented innovation in highly uncertain environment such as high rate of technological change and competitive market.

Apart from being specific in using the business strategy, corporate strategy or specific innovation strategy, there is also combination of other type of strategy which would push the innovation activity. A case study research of Chinese firms done earlier by Xu, Liu and Chen (2002), has argued the use of knowledge strategy to be integrated with technological innovation. Due to the fast changing environment, it is important for firm to articulate with the knowledge strategy so that it would stimulate innovative activities to ensure that their companies are effective and efficient (Xu et al., 2002).

Past scholars have used diverse of measures to represent strategy in the innovation study. A study of 600 Australian SME manufacturing companies found that innovation strategy has emphasised on several measures namely: vision or mission, strategic goals, increase in production, customer satisfaction, administrative, employee skill and employee commitment (Terziovski, 2010). As for research conducted by Stock and Zacharias (2011), the strategies were focused on first to entry product and services into the market and product offering that will increase the performance. While Blumentritt and Danis (2006) utilised business strategy which involved marketing, R&D, project based, new lines of product or service, dealing with competitors, managing procedures and firm activities.

Consequently, initiative to utilise the organization strategy in the innovation process is showed from the previous study that differentiates innovation outcome between radical and incremental type. Ettlie, Bridges and O'Keefe (1984) for instance, used technology policy as a strategy measure for radical innovation. As for incremental innovation, the study indicated market dominated growth, diversification and organisation size are strategies for incremental innovation. According to Liang-Hung and Chun-Hsien (2008), the use of corporate strategy such as differentiation and cost leadership have enhanced innovation process. In this context, the differentiation strategy focused on creating new market via new products while the cost leadership strategy focused on low cost and efficient production (Liang-Hung & Chun-Hsien, 2008).

The following discussion focuses on structure, the second type of managerial lever used in this study. Structure of an organisation refers to the way employees are grouped and work. Therefore, organisation should provide sufficient freedom during the innovation implementation for creativity as well as able to manage innovation efficiently (Adams et al., 2006). According to the organisational theory, structure is about distribution of tasks, responsibilities and power to determine organisation's standardization, complexity and the extent of centralisation role (Shen, Xu, & Shu, 2010). Structure can be tailored to impact innovation activity of organisation and it also assisting to set a balance between idea generation and implementation (Prakash & Gupta, 2008). A study of manufacturing sector in India revealed a significant positive relationship between horizontal structure and perceived innovation and also between formalisation structure and perceived innovation. In this context, the formal structure helps innovation to become efficient through various rules and procedures and this leads to employees commitment. This is contradicting to centralisation context as it would not allow flexibility in decision making and employee empowerment. Hence, finding has showed a negative significant relationship between centralisation and perceived innovation (Prakash & Gupta, 2008).

According to Keely, Pikkel, Quinn, and Walters (2013), structure are focused on organising company asset namely: hard, human and intangible in unique ways to create value. Therefore structure communicates the means of various parts of organisation are configured with organisation's ability to manage innovation (Smith et al., 2008). Structure can differentiates between innovative and non innovative organisations (Adams et al., 2006). A case study in Thailand has proven that structure's role is important for innovative firms. In this context, structure has transformed the participating organisation to motivating employees creativity, boosting innovative culture and set a standard base on innovation process (Wichitchanya et al., 2012). This is in line with previous research which conceptually portrayed that organisational structure influence the ability to manage innovation through its direct relationship with employee (Smith et al., 2008).

A research conducted by Chang et al. (2011) has revealed that internal organisational structure which is based on centralisation decision making and interdepartmental connectedness stimulated the innovation at firm level. (Chang et al., 2011). However the extent of how structure influence depended on type of innovation. For instance, as portrayed in the study relationship between the role of organisational structure towards product innovation capabilities, the effect of radical product innovation capability on new product performance is insignificant under a formal structure, while the effect under the informal structures is positive (Menguc & Auh, 2010). As for the incremental product innovation it has a positive effect in the formal structure and negative effect in informal structures (Menguc & Auh, 2010).

There was also empirical evidence by the work of Terziovski (2010) showed that a formal structure combined with innovation strategy. Several items used to measure the formal structure stressed on the allocation of resource within the cross functional teams, monitoring system by the employees, facilitation of formal communication by managers, procedures and flat structures (Terziovski, 2010). The research is in fact supported by one study that showed the evidence of organisational formalisation increase the positive effect of bottom-up learning on the incremental innovation due to the reason that employees focus more on the dynamic change of the job (Wei, Yi, & Yuan, 2011). It is noted that structure blend together with other factors such as strategy, system, type of innovation and the employees. At the firm level, Stock and Zacharias (2011) revealed that the structure of innovation orientation in an organisation depended on a specific unit was allocated with competencies, sufficient resource and it is clearly regulated.

In India manufacturing sector a study has explored the relationship between organisation structure and perceived innovation. There were five components of structure used namely: vertical complexity, horizontal complexity, formalisation, centralisation, concentration of authority and participation in decision making (Prakash & Gupta, 2008). Results have indicated that positive relationships were established between horizontal complexity, formalisation, participation in decision making and innovation, however the relationship between centralisation structure and innovation was negative (Prakash & Gupta, 2008). Therefore, the result from their study has suggested focusing on the participation in decision making, decentralisation through staff empowerment and informal network within the organisation would increase the number of innovation. In line with the above study in manufacturing sector, similar result was occurred in the logistic service innovation. It is found that the decentralisation and formalisation structure showed a positive relationship whereas the specialisation structure showed negative relationship (Daugherty, Chen, & Ferrin, 2011).

The organisational structure is also need to balance the demands for efficiency and flexibility in the high technology firms. This is needed in order to facilitate innovation and adapt the dynamic change of environment (Sholes, Barnett, & Utley, 2011). In a stable environment in terms of demand, competitors, low level product change, it is best suited by centralised decision making, formal job description and, emphasis on chain of command and well process control (Sholes et al., 2011). This situation occurs when the organisation organised in centralised structural forms which promote efficiency. On the other hand, decentralize structure is suited for the dynamic, complex technologies and competitive instable environment (Sholes et al., 2011).

As mentioned earlier, the situation also differs according to innovation types. Technological innovation which is a more complex process is affected by the R&D level, managerial ability and investment. Hence this type of innovation needs for a structure that has rules and regulation (Shi & Xin, 2006). For instance, the rule and regulation outlines some basic procedures which is important for employees to implement R&D, technology management, engineering design and manufacture. The objective is to encourage creativity, self-directed work and learning, few layers of hierarchical to enable quick response, high level of horizontal integration to increase knowledge transfer, decentralised decision making and high level of vertical and horizontal communication to ensure action (Shi & Xin, 2006). Although few layers hierarchical is better, organisation also need to have flat organisation so that it could made close contact among employees, department and top management (Wichitchanya et al., 2012).

Subsequently, the third managerial lever is resource allocation. The following review describes the important of resource allocation as one dimension of managerial levers which beneficial in innovation management. In general, resources that will support innovation success depended on twofold: allocation based on the type and amount of resources and decision to put aside before resources are needed (Bacon, 2011). According to Lau, Yam and Tang (2010), resource allocation is referred to firm's ability to mobilise and expand its technological, human and financial resources in the innovation process. In their study, result showed that resource allocation has improved the performance rate of a new product which contributes to the technological innovation capabilities of an organisation (Lau et al., 2010).

Based on previous research conducted in 1500 German firms, resource allocation is found to have impact on performance and it is also significant if resources were allocated at the later stages of innovation process (Klingebiel & Rammer, 2011). Organisation performance increases when innovation expenditure is separated into resource allocation size and project resourcing. For instance, when a firm make a selective choice on innovation project, a broad resource allocation strategy is needed where resource needs are lower at early stage than the later stage. Besides, resource allocation is also identified as one of the important lever due to its interdependence with business models and knowledge creation (Grand, Krogh, Leonard, & Swap, 2004). The importance of resource allocation is proven by a study conducted in SME in Malaysia where firm resource drive product innovation performance (Bakar & Ahmad, 2010).

The fourth managerial lever of the study is knowledge management and organisational learning. Knowledge management is identified as an important factor of firm competitiveness (Darroch & McNaughton, 2002; Rasmussen & Nielsen, 2011). Three main elements comprise of creating, transforming and utilizing various kinds of knowledge were contained by employees relations, routine and practices (Rasmussen & Nielsen, 2011). In this context, the knowledge management is closely related to organisational learning initiatives (Mundra, Gulati, & Vashisth, 2011). Nevertheless, learning is embedded in social collaborative process which is more informal. This is because an organisation depended on their own component of learning process and the challenges faced by its existing knowledge base (Weerd-Nederhof, Pacitti, Gomes, & Pearson, 2002). According to Garcı´a-Morales, et al., (2006), both organisational learning and innovation are working together in determining organisational performance. It is found that with the organisational learning carried out in the organisation, imitation would be difficult and this would lead to higher performance. The situation also almost similar to the non manufacturing environment such as study in conducted in a cultural organisation, it has revealed that learning orientation influences innovativeness and performance (Garrido & Camarero, 2010).

Issues with regard to broad perspective of innovation have been emphasised in the early section of this chapter. In view of this, the learning has enabled the implementation of new idea, product and process, new management styles in communication and marketing, organisational structure and relations with clients (Garrido & Camarero, 2010). The impact of learning orientation is also studied through three dimensions: commitment to learning, an open mind and a shared vision (Phromket & Ussahawanitchakit, 2009). In their study, the organisational learning is found have positive effect on innovation outcome and export performance. In this context, organisational learning comprises of four dimensions: unique knowledge establishment, useful knowledge integration, holistic knowledge expansion and effective knowledge utilisation (Phromket & Ussahawanitchakit, 2009). Since the organisational learning role on innovation outcome is clearly emphasised, organisation needs to fully understand the market conditions and evaluate their organisational learning plan.

According to Weerd-Nederhof et al. (2002), there were four processes integrally linked organisational learning : information acquisition, information distribution, information interpretation and organisational memory used as tool for improvement. It is noted that both knowledge management and organisational are interrelated in terms of their components to facilitate innovation implementation. It involves the plain and implied knowledge to move the innovation activity. Therefore one of the past study by Plessis (2007), defined the value proposition of knowledge management in innovation process. The definitions include assisting in creating tools, platform and processes for tacit knowledge creation and sharing, converting tacit knowledge to explicit knowledge, facilitating collaboration in the innovation process, ensuring the accessibility of both tacit and plain knowledge in innovation process, flow of knowledge, integration of organisation's knowledge base, identifying gaps in the knowledge, building competencies, providing organisational context, gathering explicit and tacit knowledge and providing knowledge-driven culture.

Innovation process involves a dynamic form of activities. In the innovation process activity, Adams, et al., (2006) mentioned that there are three areas within the knowledge management that is important for innovation management: idea generation, knowledge repository (including implicit and explicit knowledge), and information flows (information gathering and networking. Therefore, the discussions so far have proved that knowledge management such as knowledge creation and knowledge sharing is much needed in the innovation process phase of the firm (Chen, Huang, & Hsiao, 2010). Empirical evidence revealed that knowledge management is positively related to firm innovativeness; however it is moderated by organisational structure. In their study, employees are inclined in managing knowledge and translating new knowledge when the structure is less formalised, less centralised and more integrated (Chen et al., 2010). There was also other study where knowledge management played a mediating role. Apart from being direct influence on innovation, knowledge management is crucial as mediating role when examining the relationship between social interaction and innovation performance (Huang & Li, 2009). However, the dimensions used in their study only focuses on knowledge acquisition, knowledge sharing and knowledge application (Huang & Li, 2009).

Consequently, the final managerial lever is culture. Organisational culture refers to shared vision where clearer vision would act as effective facilitator to innovation (Adams et al., 2006). Adaptation of culture in the respective organisation brings values and beliefs, attitudes and experiences which is shared by personnel in organisation (Kanchan & Gupta, 2009; Martins & Terblanche, 2003). Creativity is of great influence in the innovation process and culture is the key to influence creativity. In view of this, culture is also influenced by several determinants such as strategy, structure, support mechanisms, behaviour, and open communication (Martins & Terblanche, 2003). Culture also reflects a degree to which values, norms and artifacts support the organisation's innovativeness and hence, it is noted that organisational culture will push organisational members towards creating innovation mentality (Stock & Zacharias, 2011).

According to Ahmed (1998), culture has multiple elements which could enhance the tendency to innovate. It was pointed that culture should not be isolated and need to match with organisational context. Thus, balance and understanding of context is important because culture will determine a strong drive towards innovation. For instance, the Malaysian Innovation Climate Report has found that culture has determined the direction to innovate, ideas to innovate and the degree of willingness to take risk. Nevertheless the report produced low score in terms of direction to innovate and ideas to innovate. In fact the culture of willingness to take risk is also low in the manufacturing sector (Pawanchik & Sulaiman, 2010).

Implementing innovation in the organisation might encounter risk of failure and uncertainty. Therefore, Kanchan and Gupta (2009) has suggested to change the corporate culture. According to their study, the culture must have a set of understanding for people of the organisation to share in common. Thus, several criteria have been highlighted to change corporate culture which include: committed in becoming an innovative organisation through informed decision and investment, consistent communication, physical and organisational support, stimulating environment, encouragement for innovation and compensation (Kanchan & Gupta, 2009). Beside those criteria, Madan (2000), has stressed a culture that empowers people to take part in the innovation activity. This would allow people to share newer innovative solutions and provide insight of a larger picture to entire organisation.

Culture is an operating mechanism to support innovation. This condition has been proven in the research conducted in the Chinese manufacturing firms. For instance, a strong human oriented management style is formed to enhance employees' abilities (Qingrui, Ling, & Zhangshu, 2003). In this approach, firm need to cultivate employee individual innovative ability via a 'culture field' so that their firm will form core competencies in all elements of innovation (Qingrui et al., 2003). In this context, the culture field supported the innovative environment in all elements such as management innovation, institution innovation, market innovation and strategy innovation.

Besides being specific to innovation culture, empirical finding in SMEs has proven that general organisation culture when combine together with specific organisation culture with regards to innovation projected good impact on innovation levels (Kenny & Reedy, 2006). General organisation culture is referring to the familiarity of mission statement and R&D aspects of the company while specific culture of innovation were the innovation strategy, type of innovation engaged, drivers and constrains of innovation (Kenny & Reedy, 2006). It is noted most authors have stressed on the importance of innovative culture. This is due to the innovation activities surrounded by competitive differentiation and ways of customer value creation. For that matter, there are various types of constructs that represented innovation culture used in the past studies. For example, there were several constructs introduced by Dobni (2008) based on seven factors namely: innovation intention, organisational constituency, creativity, empowerment, market orientation, value orientation and implementation context.

Culture also played as determinant to the innovation strategy. According to Valencia, Valle, and Jimenez (2010), their study has focused on the relationship between organizational culture and product innovation. Their finding indicated that the types of culture engaged in the organisation have affected product innovation. The results showed that companies should cultivate cultures with external and flexibility orientation. (Valencia et al., 2010). In this context, the hocratic cultures (emphasises flexibility and change) enhanced the development of new products or service while hierarchical cultures inhibited product innovation (Valencia et al., 2010). It is noted that in order for innovation process to flourish into organisation, past scholars have really emphasised the concept of flexibility in the culture element.

Consequently, culture that engaged in learning and knowledge sharing has also provide impact on organisation that implemented both radical and incremental innovation (Lin & McDonough, 2011). With the right types of norms that is widely shared, this would activates creativity (Ahmed, 1998). Among the norms that stimulate innovation activity include challenge and belief in action, freedom and risk taking, dynamism and future orientation, external orientation, trust and openness, cross functional interaction, leadership commitment, rewards, innovation time and training, corporate identification and unity and organisational structure (Ahmed, 1998).

The above literatures have reviewed the managerial levers as one of the important antecedents in determining the success of innovation implementation. Five managerial levers: strategy, structure, resource allocation, knowledge management and organisational learning and culture have their own strength in assisting innovation implementation. It is adequate to conclude that those five are interrelated and supported each other (Smith et al., 2008). For example, structure is a lever that is constructed for organisation to operate effectively and it is noted that strategy is implemented through the structure (Crittenden & Crittenden, 2008). In addition, culture has acted as the key factor of innovation management because it impact other levers and also the changes of those levers (Smith et al., 2008). In fact, the role of knowledge management and also organisational learning is also related to each other. Through learning and sharing of knowledge, it is noted that firm is able to bring their abilities and innovative thinking of individuals to create competitive advantage (White, 2011). Thus, in this study, the researcher would be interested to assess the role and relationship of those levers in driving the innovation process of organisation. Furthermore, the use of managerial levers would be in line with the theoretical perspective as innovation process interlink with the resource view and capability view (Muller et al., 2005).

2.5.3 Business Processes

Business processes is a structured approach used to analyse and constantly improve fundamental activities such as manufacturing, communication or other major elements of an organisation operation (Elzinga, Horak, Lee, & Bruner, 1995). It begins with objectives and end with the achievement of the particular objective where the outcome of the well design goal is increased in effectiveness and efficiency (Wikipedia, 2012). Although many organisation found difficult to define the concept of business processes, the expectation of the benefit is actually for organisational performance (Armistead et al., 1999).

Business Processes is a meta-construct consolidating process level variables (Crossan & Apaydin, 2010). In the context of innovation, business processes include initiation, portfolio management, development and implementation, project management and implementation (Crossan & Apaydin, 2010). For instance, portfolio management involved the act of making strategic choice on resources consumed in innovation process. According to Antonucci and Goeke (2011) business processes have evolved from being functional and system oriented to management practice where the general discipline has integrate management, people, process and technology for both operational and strategic activities. Therefore, the business processes management does not only focus on what the organisation does, but how to do it in efficient and effective manner (Antonucci & Goeke, 2011).

Business processes is seen as strategic, operational and tactical where tactical enables adaptability, improvement and change in the organisation (Henriksen & Andersen, 2010). In fact, the way business processes have been managed is regarded as the best management practice principle that will sustain competitive advantage (Yu-Yuan, 2006). Tactical process is also related to knowledge creation and knowledge transfer in innovation and R&D projects (Henriksen & Andersen, 2010). Lewis, et al. (2007) described business processes based on stakeholder perceptions. The approach of business process is segmented according to four stages engage process stakeholders, collect process data, explicate process knowledge and design process innovation (Lewis et al., 2007). The benefit about this model is that the stakeholder becomes more aware of structures that influence their behaviour when they engage to describe their processes in the organisation. The business processes will be understood based on leveraging differences in stake holder perceptions (Lewis et al., 2007).

In a study of the relationship between resources and capabilities, business processes is identified as significant action or routines that firms engage to accomplish business objective (Ray et al., 2004). It has found that resources and capabilities cannot have positive impact on firms performance if they did not convert into business processes (Ray et al., 2004). Hence, from the perspective of resource based view, business processes is becomes a path-dependent process through which the firm developed its resources and capabilities (Ray et al., 2004). In fact, a study of 'Fortune 500' firms have indicated that the business processes has directly affected customer responsiveness and product or service innovation (Ganesh & Marvin, 2005). This is achieved from the improvement and initiative of firm's business processes towards efficiency (Ganesh & Marvin, 2005). For instance, by proactively keeping in track from customers feedback and also sequential decision making between manufacturing, marketing and research department in developing new product or services, business processes can increase productivity and enhance customer focus (Ganesh & Marvin, 2005). In other words, business processes is done across functional which spans all organisation functions and it starts with top management understanding, focuses on process improvements and instils a structured approach to change, highlighting people management and development (Al-Mudimigh, 2007).

Tinnila (1995), recognised business processes into three perspectives: 1) Business Processes as means to operative efficiency; 2) Business Processes as organisational units and 3) Business Processes as objects of strategic planning. The first perspective has focus business processes in streamlining operative process by using information system and networks. The second perspectives would improve corporate performance by undertaking functional business processes, organisation and human resources and information technology through four fundamental processes which include technical, innovation, enabling and social. The third perspective proposed business processes as object of strategic planning which connects processes to capability based strategy. In the third perspective, the key processes have to be transformed into strategic capabilities in order to provide superior value to customer (Tinnila, 1995). Besides providing three different perspectives of business process, Tinnila (1995) also argued various definitions of business processes form the earlier studies from the operational and organisational aspects.

Besides the three perspective discussed by Tinnila (1995), an empirical study has argued two key concepts of business processes: Process Alignment and People Involvement and this two dimensions have showed positive relationship on organisational performance (Yu-Yuan, 2006). For that matter, it has been defined as integrated set of practice that includes incremental and radical change which is viewed as a part of continuous improvements efforts (Yu-Yuan, 2006) . In this context, process alignment has captured the way organisation managed its processes and it's institutional so that it could pursuit organisation goals. While people involvement involved executive commitment and employee involvement with objective to blend it management processes (Richard Yu-Yuan, 2006).

Based on the above discussion, it is noted that business processes is relevant to this study. From the operational and organisational perspectives it contributes to performance and sustained competitive advantage through the connection between people and process. Therefore, in this context, business processes is appropriate to act as the driver to the innovation process. In line with Armistead, et al., (1999) mentioned that the link between business processes leads to the innovation will maximise the market value chain. Considering the above explanation and definitions, the definition of business processes for this study is a set of connected activities between people and process which will drive innovation process into creating innovation outcome.

2.6 Innovation Outcome

Innovation outcome is acknowledged as another important concept in the innovation management studies. An outcome driven innovation is highlighted in creating a breakthrough product and services move beyond the customer and organisation current needs (Pinegar, 2006). Furthermore, the focus on innovation outcome has become the CEOs positive direction on how firms identify, build up and deploy new technologies over time (Yadav, Prabhu, & Chandy, 2007). It is indeed has become a fact that one of the area that contributes to innovation studies. For instance, the highlight about innovation outcome recently emphasised its role in achieving organisational performance (Phromket & Ussahawanitchakit, 2009; Stock & Zacharias, 2011; Sung et al., 2011).

In the light to understand the innovation, innovation outcome should answer the question 'what' and 'what kind' of innovation exist or produced in the organisation and Crossan and Apaydin (2010), has revealed that several dimensions are used to describe innovation outcome include referent, form, magnitude, type and nature. Referent means newness of innovation to the firm, market, or to industry. Form refers to product or service innovation, process innovation and business model innovation. Magnitude refers to the degree of newness of the innovation outcome. As for the type, it differentiates between technical and administrative innovation. While nature refers to the how and what kind of innovation applied (Crossan & Apaydin, 2010). In fact the element of radicalness and speed affect influenced innovation outcome in terms of efficiency, quality and project success (Kessler & Chakrabarti, 1996). It is noted that innovation outcome measure the success of innovation through it newness such as the degree of radicalness (Johannessen et al., 2001) or a different pattern of innovation orientation in terms of new product program, new product program value and new product program frequency (Stock & Zacharias, 2011) .

The importance of innovation outcome in the management studies is determined more by the extent of its innovation adoption because it has been examined from various angle of research. For instance, it is found that the impact on innovation outcome is significant when an ambidextrous (multiple way of organisational design) being applied to manage the innovation stream (the radical and incremental) (Tushman et al., 2010). The multiple way of organisational design is the organisation design based on business unit structure with distinct innovation unit with general manager control and senior team support. In obtaining organisational performance, firm need to utilise the role of innovation outcome in the form of product, process and organisational innovation as the interaction medium between manufacturing flexibility and firm performance (Camison & Lopez, 2010). Moreover, innovation outcome is relevant to measure the importance of product innovation performance efficacy and efficiency in the context of firm competition (Alegre, Lapiedra, & Chiva, 2006).

The success of innovation implementation is likely depended on the innovation outcome. Apart from market environment, business and quality aspects, Laforet (2011), has proposed that innovation is driven by desire for firm to be successful and improve in working conditions. Therefore innovation outcome is foreseen to bring the impact of positive and negative outcome which is finally affect firm reputation, operational efficiency, financial and the workforce. This has also shared some similarity with other studies such as (Shaochen & Dier, 2010) and (Sung et al., 2011). In this context, innovation outcome has showed how it related to several issues such as quality innovation, employee-customer and competition-related advantage and operational excellence. In addition, Siguaw, Simpson and Enz (2006) has conceptually proposed that the organisational competencies are also derived from strong innovation outcome that were based on form, rate and type of innovation which will then affect the performance. Apart from impacting the performance, innovation outcome is used to matching goals and collaboration effort with the customers and suppliers, universities and technology institutes and also competitors whereby this would assist in innovation process and management practice (Santamaria & Surroca, 2011).

Therefore, based on the aforementioned findings, it is obvious that innovation outcome is of great contribution to the implementation of innovation in the organisation. In this context of study, the researcher hopes that the innovation outcome role could be further explored to research the relationship between innovation process and firm performance. In order to assess the important role of innovation outcome, the following discussion will provide several reviews on the definitions from previous studies that will later assist the researcher in generating the operational definition for this study.

2.6.1 Innovation Outcome Definitions

Innovation outcome has been defined in the previous research from different perspectives. Quintane, Casselman, Reiche, and Nylund (2011) have argued both from the knowledge- base definition and traditional definition. Based on the knowledge-based perspective, innovation outcome referred from the essence of new knowledge and its attributes. It is revealed that innovation process cannot be foreseen but the process guided to innovation can be understood by the creation of knowledge. In other words, the knowledge that is created during innovation process allows the process to be understood composed the core of the innovation process and it has defines the innovation as innovation outcome. In order to be defined as new knowledge, innovation outcome needs to fulfil duplicability new in the context it is introduced and demonstrated usefulness. This means that innovation can be imitated by others because it is replicable of an outcome without having to create knowledge for second time and capable in improving the current situation.

For the pupose to compare with the knowledge perspective, Quintane, et al.,(2011) also explained innovation outcome from the traditional perspective. In this case innovation is referred as being novelty, useful, in use, or significant. This definition has identified innovation outcome in terms of what constitute an innovation and classified innovation into several categories such as technical vs. administration, product vs. process and radical vs. incremental innovation. It is noted that novelty or newness is the major concern to define innovation outcome. However the basic degree of novelty is linked to the individual judgment and depends on the specific context.

When innovation introduced to the market, it is not necessarily new. This means not the innovation existed is not original or novelty. In this context, although there is no originality, innovation is considered new to the organization that just engaged innovation in their structure or administration system. In this context, innovation outcome indicates the degree of innovation accomplishment and this has affected the organisational learning effectiveness (Phromket & Ussahawanitchakit, 2009). For this matter, innovation outcome is defined as the achievement of innovation goals related to introduction new process, product, idea in the organisation, a new production process, and a new structure or administrative system (Phromket & Ussahawanitchakit, 2009). Several elements used to measure include creativity and experimentation, originality, technological leadership, R&D development in processes or product and new management. This definition is viewed from the perspective of internal process of innovation adoption where it includes implementation of new ideas and behaviour (Damanpour, 1991).

Due to the resource constraint, organisation must identify and combine the most effective factors to maximise innovativeness (Stock & Zacharias, 2011). This has provided good reason and it is very important for firm to know the patterns of innovation orientation and their associated performance outcome. Innovation orientation refers to the internal factors that drive innovation such as strategy, structure, human resource system, culture and leadership. With this in view, innovation outcome is defined as strategy implementation with the aim of increasing organisation's innovativeness. Innovation outcome is represented by three aspects of innovativeness.

According to Stock and Zacharias (2011), innovativeness cover New Product Program (NPP) Newness (the degree of difference between company's product program and existing alternatives), NPP Value (known as meaningfulness, usefulness, utility or advantage) and NPP Frequency (frequency of new product introduction in the market). It is noted that the definition on NPP frequency shared similar definition with the earlier study conducted by scholar (Parthasarthy & Hammond, 2002). The three aspects of innovativeness are important to this study as it describes the innovation outcome that the researcher is interested in investigating. Furthermore, the outcomes will reflect the what kind of innovation at company level (Stock & Zacharias, 2011). However the definition later will not cover the financial performance since this is defined under the firm performance measures.

As mention in the previous discussion, past studies interchangeably used the innovation outcome as firm innovativeness. These past scholars are (Bell, 2005), (Prajogo, 2006), (Calantone et al., 2002), (Akgun et al., 2009) and (Nukhlet Harmancioglu, Grinstein, & Goldman, 2010). Based on their research, several dimensions have been included were the subjective measures focuses on introduction of new and novelty of products, services and processes, new technology adoption speed, consistency of firm innovate over time, strategy and capability of being new entrant, rate of adoption and organisation's willingness to change.

The definition is also exploited from the firm-wide perspective of innovation orientation. According to this perspective, innovation can be utilised by indentifying positives and negatives outcomes (Simpson et al., 2006). In this context, innovation outcome consist of positive outcome and negative outcome. The positive outcome include market advantages, employee advantages and operational excellence while the negative outcome has consider several elements such as an increased in cost, changes, and market risk and employee attitudes. This definition is also in line with Laforet (2011) however the focus is more towards performance. Although Laforet (2011) definition is conceptual, but it contribute to the theoretical basis for understanding organisational innovation. The definition is link between innovation, productivity, and operational efficiency at the firm level which are more impending.

Conceptually, this definition covers three types of innovation: new product development, process innovation, and new ways of working. It focuses all aspects of organisational innovation and its specific outcomes (positive and negative). Specifically, positive innovation outcome for organisational innovation is operational excellence, market advantage, company image and reputation, employees' satisfaction, improved financial performance, acquisition of skilled workers, in-house expertise, technical ability and sustained innovation. While negative innovation outcome includes risk of failure, company image, reputation, and employees dissatisfaction. Employees dissatisfaction exists when they are unable to adapt to innovation-oriented environment and this would finally increase in staff turnover, unprofitability, promote chaos and mistakes. (Laforet, 2011). As this approach is more relevant to manufacturing firms involved in company-wide innovation, innovation outcome can be studied in depth to keep abreast through its, processes, behaviours, strategies and also competencies (Laforet, 2011).

Nevertheless, the negative innovation outcome is discussed more on the innovation-oriented environment.

Innovation process involved two stage such as adoption and implementation (Sung et al., 2011). Both stages involved decision to used innovation as action and adoption order to obtain anticipated benefit to organisation. In line with this approach, Sung, et al.(2011) defined innovation outcome as innovation effectiveness which refers to benefits or positives outcomes build up from given innovation. This definition provides some similarity with the previous mentioned and thus could also be consider by the researcher for this study.

Apart from positive and negative outcomes, innovation outcome is defined in very much related to the performance of innovation activities. For instances, Terziovski (2010),defined innovation outcome as innovation activities that lead to successful performance while Santamaria and Surroca (2011), defined innovation outcome as performance of incremental versus radical innovations. These studies have used measures such as number of product configuration, success of product launched, improvement in production, work method and quality, market opportunities and reduction in waste.

Based on the above description on definitions and measures by previous scholars, innovation outcome has been defined according to the context of extensive research. Most of the definitions are explained from the perspective of result or effect of innovation implemented in the organisation. Therefore, it is noticed that innovation outcome occurred in the form of innovation achievement, targeted goals, orientation of positive and negatives consequences, benefits, innovativeness of the product, process or service produced, leading activities of innovation, technology adoption and exploitation of ideas. These definitions are very much in line with the arguments by Crossan and Apaydin (2010) who highlighted that innovation outcome should include dimensions such as referent, form, magnitude and type.

Considering the above analysis, for this context of study, the researcher is interested to adapt the measures established by previous studies which include: (Phromket & Ussahawanitchakit, 2009), (Stock & Zacharias, 2011), (Laforet, 2011), (Terziovski, 2010), (Paladino, 2008), (Prajogo, 2006), (Calantone et al., 2002), (Akgun et al., 2009), (Seokin et al., 2009), (Sung et al., 2011) and (Pla-Barber & Alegre, 2007). Therefore, in line with this study, innovation outcome can be defined as the achievement of organisation innovativeness which include product and process innovation that leads into new creation, novelty and significant towards achieving firm performance.

2.7 The relationship between innovation process, innovation outcome and firm performance

It is interesting to note that innovation process, innovation outcome and its influence on firm performance have put on interest by the academician and practitioners (Augusto, Lisboa, & Yasin, 2011; Brown, 2010; Crossan & Apaydin, 2010). As claimed by Anderson, et al., (2004) the research on innovation need to expand upon performance, psychological processes and outcomes at the organisational level. This means that the focus of understanding key aspect of innovation process has undoubtedly developed to more than just a task in keeping with changes. In this study it is noted that the relationship between innovation process, innovation outcome and firm performance would permit the role of innovation is investigated in the sense of how innovation is implemented (innovation process) and what form of innovation generated (innovation outcome). As the approach will provide new potential for future research into the effect of innovation process upon organisational member, this study is also in line with the suggestion by previous reviews on innovation research (Anderson et al., 2004).

Therefore, if innovation process and innovation outcome can be considered as the important factor of innovation implementation in the organisation, one can then conclude that innovation outcome can best accomplished by means of effective innovation process which will lead to adequate firm performance. Based on this reason, researcher is motivated to examine on the how innovation process and what innovation outcome will improve firm performance.

2.8 Underpinning Theories of the Study

Theory is important to understand what is the concept embedded in the phenomena under investigation. Therefore, theory presents a systematic set of relationship which provides a consistent and comprehensive explanation of phenomena (Hair, Black, Babin, & Anderson, 2010). In other words, theory permits us to understand, specify the entire relationship among constructs and explain on how the constructs affected one another. According to the source, the real situations we intended to investigate are explained by alternatives theories

Three types of antecedents (leadership, managerial levers and business processes) in the study contribute an important role towards innovation process. Hence, based on the literature review, the researcher finds four related theories are used to describe the conceptual framework of the study. The Upper Echelon Theory, Resource-Based View and Dynamic Capability Theory will explain the antecedent variables. The selection of these theories are in line with Muller, Valikangas and Merlyn (2005) . According to the source, a framework combined three views on innovation (resource view, capability view and leadership view) will assist and develop organisation capacity for innovation. The Process Theory will explain the innovation process and innovation outcome and Item Response Theory will explain the ability level of implementing innovation in the organisation.

2.8.1 Upper Echelon Theory

The leadership antecedent is supported by upper echelon theory. According to the theory, organisational outcomes strategic choices and performance levels are partially predicted by characteristics on managerial background. Seven observable characteristics of the top managers which comprises of age, functional tracks, other career experience, education, socioeconomic roots, financial position and group characteristic were portrayed as determinants for strategic choice (Hambrick & Mason, 1984). This can be related to determine the factors that affect strategic choice where in this context of study, strategic choice toward innovation in achieving firm performance.

Olson, Parayitam and Twigg (2006) revealed the role of top management team indirectly affect firm performance through its strategic choice i.e. innovation. The finding has provided support for upper echelon theory. It is noted that the leadership trait through heterogeneity of top management team has been the leading force to contribute firm overall performance and firm required this diverse capability in order to bring greater variance in strategic choice such innovation, ideas and creativity to enable firm to perform better (Olson et al., 2006).

2.8.2 Resource Based View and Dynamic Capability Theory

The resource base view approach observes the firm is determined by a collection of asset or resources that attached to the firm's management (Locker & Thompson, 2001). Resources that managed by firm includes the tangible and intangible asset (Knott, 2009). Intangible asset is referred as skills, human asset, information, organisational asset and relational asset and reputational asset and also competencies owned by firm (Knott, 2009). Resources are valuable and rare would enable firm to lead to performance and achieve competitive advantage (Wade, 2005). Apart from resource, it is claimed that resource based theory provide important insight to show the boundaries of the firm, firm performance and economic organisation (Locker & Thompson, 2001)

Based on relevant literature researcher discovers that the resource base theory would be suitable as the underpinning for this study. The increase of innovation research which is based on resource based theory has been recognised in making significant contributions (Nukhet Harmancioglu, Droge, & Calantone, 2009). As noted in the earlier section, the antecedent variable for this study is managerial levers (strategy, structure, resource allocation, organisational learning and knowledge management tool and culture). Therefore it is noted that these variables represent the resources of the firm which is best explained and supported by those theory. A resource-based view theory is important to direct strategy toward resources as important antecedents to product and ultimately firm performance (Wernefelt, 1984).

From the resource-based view perspective, the factors or antecedents contributed to the innovation process in this study are the tangible and intangible assets which is tied to the firm at a given time that will lead high return to firm performance (Wernefelt, 1984). The dynamic theory is needed in this study as to expand the understanding of how competitive advantage of an organisation is achieved through innovation. Therefore, according to Teece, Pisano, and Shuen (1997), this theory is relevant to the study because it would reflect organisation's ability to put together internal and external capability to attend to rapidly changing environments. Beside relevant to a Schumpeterian world of innovation-based competition, the theory also builds a better theory of firm performance, as well as managerial practice (Teece et al., 1997).

According to (Liao, Kickul, & Ma, 2009), both theory explored theoretically the different role played by a firm's endowment of resources, capabilities and also ability to recognise opportunities as well as to deploy resources. From the dynamic capability perspective, Liao et al. (2009) has revealed that firms ability to mobilise resources and capabilities constantly innovate in order to survive and create its own competitive advantage. Thus, researcher finds that dynamic capability theory is applicable to managerial levers construct because the dynamic capabilities perspectives stressed on exploiting existing internal and external firm specific competences to address changing environments (Teece et al., 1997). Furthermore, dynamic capabilities are potentially an integrative approach to accepting innovation as the newer sources of competitive advantage.

Miguel, Franklin and Popadiuk, (2008) revealed the effect of the organisational knowledge creation on innovation which can be considered a significant dynamic capability of the organisations. Innovation is seen as strong competitive advantage which is based on knowledge and thus to enable it, firm needs to enable dominating the organisational process learning (Garrido & Camarero, 2010). In this context, the dynamic capability theory has proven organisation knowledge is one of the important dimensions to enable them in the innovative environment.

In assessing the relationship between product innovation performance and firm resources, the resource based theory is used as basis to explain the intangible resources as key drivers (Bakar & Ahmad, 2010). The author has focused on six types of intangible resources: physical, human intellectual, financial, technological resources, organisational and reputational as strategic factor to increase performance. The product innovation performance is viewed one of the firm's specific performance and this has support the resource base theory view from the perspective innovation capability to increase firm's growth and business opportunities (Bakar & Ahmad, 2010). This is in line with the study done earlier which claimed the resource based theory need to be synthesised in a practice-relevant form in order to describe a concrete practice that relate the dynamic capability to manage resource and competence (Knott, 2009). Indeed, Locker and Thompson (2001), has showed the use of resource base theory in explaining innovation activity among firms by depicted that through innovation, firms are found to have dynamic capability that offer them a comparative advantage in developing new product or process.

Similarly, Sundbo (1996), revealed that the resource based view theory has emphasised the role of management resource that firm possesses through empowerment of employees on innovation. The author has contributed to the theory and innovation studies by using human resource as innovative capability in the innovation process of an organisation. Innovation process is found to utilise the expert system (R&D Department) and employee empowerment. This is in line with firms in conceiving and implements value creating strategies where R&D Department is considered as physical capital resources and employee empowerment considered as human capital resource (Barney, 1991).

2.8.3 Organisational Process Theory

The objective of previous scholars to explained on how and why organisation change has been well used in management research (Ven & Poole, 1995). Therefore, this theory is selected to be one of the underpinning for this study as it involved processes or sequence of events that clarify the changes. According to (Ven & Poole, 1995), changes such as transitions in individual, group formation and development and organisational innovation, growth and reorganisation. According to the theory, process referred as the progression (the order and sequence) of events in an organisational entity's existence over time. The researcher found that this theory is useful as a basis to explain the innovation process variable. It is noted that, with process theory, it would assist the researcher to explain two folds. First, change is an empirical observation in form of quality or state overtime in an organisational entity (individual, work group, organisational strategy, a program, a product or overall organisation) while secondly, this theory involved development which is referred as progression of change that is from the change of the entity to the end of execution (Ven & Poole, 1995).

2.8.4 Item Response Theory (IRT)

IRT or latent trait theory is an important theory that becomes the basis in undertaking this study. This is a modern theory, used to indicate the alternative way of conceptualising and analysing measurement in social science (Adrich, 1988). IRT highlights that individual's response to particular test item is influenced by qualities of the individual and by the quality of the item. In other words, it describes the test performance which related to the abilities of the item measured. According to Bond and Fox (2007) and Adrich (1988) , two basic form would affect the psychological measures are individual trait's level and the item's difficulty and hence the following would be the fundamental for the theory to be applied in the social science research:

a) Respondent trait level as determinant of item responses: Individual with high ability level will be more likely to response correctly to the item as compared to the individual with low ability level.

b) Item difficulty as determinant of item responses: A more difficult item level indicate higher trait level for participants to have 50/50 chance of answering those items correct. While the easy items indicate only relatively low trait managed to have 50/50 chance of answering the item correctly.

c) Item discrimination as determinant of responses: Item on test can differentiate individuals who have high ability level from those who low ability levels.

Although there are various models from the IRT perspective, this study utilised the Rasch Model, the simplest form of IRT (Adrich, 1988). Rasch model is usable in the psychological investigation as it makes sense to measure the relationship between what is happening between human and their observable action (Azrilah, 1996). Beside its simplicity, this model is relevant to contemporary measurement practice and embracing potential for solving measurement problems (Wright, 1977). Hence this model would addresses five principles of measurement model which are able for linear equal scale, overcome the missing data, estimates precisions, detecting outliers and replicability (Azrilah, 1996).

2.8.4.1 Rasch Model

The model is expressed in terms of probability of person or individual with particular ability will response correctly to an item that has a particular difficulty (Adrich, 1988). Rasch model was first started with the dichotomous model (Bond & Fox, 2007). The dichotomous model shows the individual response to a binary item such as true or false, agrees or disagrees. As for this study, the Polytomous Rasch Model is applied due to the use of rating scales. This model is also referred as Rating Scale Model or Partial Credit Model (Bond & Fox, 2007). Indeed the polytomous model would allow the researcher to access to a wider range of information over the trait continuum than the dichotomous items (Thorpe & Favia, 2012).The following mathematical equation served as a basic of approach of dichotomous Rasch Model:

$$P(\square) = \frac{e^{(\beta n - \delta i)}}{1 + e^{(\beta n - \delta i)}}$$

where;

$P(\square)$ = Probability of answering positively (score 1) for person n

e = base of natural logarithm or Euler's number ; 2.7183

βn = person's ability

δi = item difficulty

While for the polytomous model is expressed as:

$$P_{nix} = \frac{\exp \sum_{j=0}^{x} (\beta n - (\delta i + \tau j))}{\sum_{k=0}^{m} \exp \sum_{j=0}^{k} (\beta n - (\delta i + \tau j))}$$

where;

P_{nix} is the probability that a person n will respond x to item i, xni #{0,...,m}; k is the response category on a rating scale that has (m+1) rating categories. βn is the latent trait ability measure of a person n. While δi is the difficulty level of item i and τj are the thresholds (location of the latent trait where adjacent categories are equally probable (Iramaneerat, Everett, & Smith, 2008).

2.8.4.2 Basic Concept of Rasch Model Analysis

There are several fundamental elements of Rasch approach which are used in the analysis of this study. These elements are logit value, item difficulty, person ability, unidimensionality, person-item distribution map (PIDM), item characteristic curve (ICC), reliability, and Rasch factor analysis. All the elements can be derived from the output of Winstep software.

2.8.4.3 Logit Value

Rasch denotes that each item response as an outcome of the linear probabilistic interaction between person's ability and question difficulty (Hambelton & Jones, 1993). Therefore, *logit* is a unit measurement in the Rasch model which convert the raw score from ordinal data to ratio on common interval scale (Bond & Fox, 2007).

2.8.4.4 Item Difficulty

Item difficulty describes where the item functions beside the ability scale. Each item is located along the logit scale according to its estimated value. The higher (more positive) the location, items are more difficult. While the lower (more negative) the location, items are easier (Bond & Fox, 2007).

2.8.4.5 Person Ability

This is referring to an estimate of person's performance on a set of items that measure a single attribute. Thus, more positive (higher) persons are more able and more negative are persons with low ability (Bond & Fox, 2007).

2.8.4.6 Unidimensionality

Rasch emphasises a basic scientific measurement that one attribute of an object be measured at a time. Thus, it requires a single construct to be the underlying the items that form a hierarchical continuum (Bond & Fox, 2007).

2.8.4.7 Person-Item-Distribution Map (PIDM)

The PIDM or variable map is one of the useful outputs in Rasch analysis. The map provides a picture to show the arrangement of difficulty level of an item (on the left) correspond to the arrangement ability level of a person (on the right) (Wright & Stone, 1999). It is organised as two vertical histograms where item and person are located side by side so that both measures could share the same linear measurement unit.

2.8.4.8 Item Characteristic Curve (ICC)

ICC is an ogive-shape plot to show the probability of correct response of an item for any value of person ability (Bond & Fox, 2007). This can provide a clear picture of item characteristics in terms of difficulty and item discrimination which is important to evaluate the overall quality of a test. Item discrimination is used to detect differences between persons at different ability and hence the test provides better information between the higher and the lower ability level.

2.8.4.9 Reliability

Rasch reliability concept is similar to the traditional test reliability i.e., the Cronbach α as it measures internal consistency. Reliability issues in Rasch are focus on the separation in difficulty to identify the variable direction and its meaning. In other words, reliability is used to assist in determining whether items and persons sufficiently well separated along the continuum in the variable map. Therefore, there are two reliability indices involved in the analysis: Person Separation Reliability and Item Separation Reliability (Wright & Stone, 1999). Person Separation Reliability indicates the extent of how well a set of items able to separate person measured while the Item Separation Reliability shows how well items are separated by persons taking the test. This statistics range from 0.0 to 1.0 and hence the indicative is the higher the value, the precise the measurement.

2.8.4.10 Parameter for Fit Analysis

A complete Rasch analysis must include the evaluation of how well the data fit the model specification (Bond & Fox, 2007). Fit analysis is essential as this is to fulfil two requirements in Rasch:

a) More able person always have high probability of success on any item as compared to less able person

b) Any person is more likely to do better on easier items as compared to hard items.

According to Wright and Stone (1999), the fit statistics are referred as ‘outfits’ due to influenced of outlying, off-target and unexpected responses. Since these are the outliers, researcher must make sure that analysis must consider three parameters for fit statistics in Rasch analysis: Outfit Mean Square (MNSQ), Outfit Z-Standard (ZSTD) and Point Measure Correlation (PTMEA CORR). In the traditional analysis, the mean square is the chi-square statistic divided by degree of freedom. Outfit MNSQ indicates the size of distortion to the measurement. The MNSQ value is always positive and value that near to 1.0 shows a small distortion which is productive for measurement (Azrilah, 1996). The Outfit ZSTD is the *t*-test of the hypotheses and it reports the statistical significance (probability) of the chi-square when data fit the Rasch model (Winsteps, 2006). As suggested by Linacre (2005) and Azrilah (1996), this study fulfil the following fit statistic range:

a) Outfit Mean Square: 0.5 < MNSQ value < 1.5

b) Outfit Z-Standard: -2 < ZSTD value < +2

c) Point Measure Correlation: 0.4 < PTMEA CORR value < 0.8

2.8.4.11 Principal-Component Analysis (PCA) of Residuals

In the common factor analysis, the aimed is to optimise commonalities, maximization, rotation and obliqueness to give the possible factor structure with the factor loadings interpreted as correlations with latent factor. In Rasch analysis, the principal component analysis is undertaken on residuals (Bond & Fox, 2007). Residual are parts of the data not explained by Rasch model. High correlations of residuals for two items indicates that they may not locally independent due to both incorporate some other dimension. Hence the purpose of PCA of residuals in Rasch analysis is to explain variance but not to construct variables. (Winsteps, 2006). Therefore, in the conventional factor analysis, the analysis is based on positive loading while in the PCA of residuals, interpretation is based in the contrast between positive and negative loadings.

2.9 Summary

This chapter provides an analysis of literature review from past research. Numerous studies have been reviewed pertaining to definitions and evolution of innovation, issues on innovation, innovation process, innovation outcome, firm performance and innovation antecedents. The literature is conducted with the objective to identify the significant of the study, concept, variables, important findings and to develop the conceptual framework. The chapter then, continued with the underpinning theories.

CHAPTER 3

THEORETICAL FRAMEWORK

3.0 Introduction

The objective of conceptual framework is to define the study concept and explain the relationships among variables. This chapter discusses the conceptual framework that focuses on the relationship between the six variables: Leadership, Managerial Levers, Business Process, Innovation Process, Innovation Outcome and Firm Performance. Discussions also include previous findings with regards to relationship between innovation and firm performance.

3.1 Conceptual Framework

Following to the problem statement, research questions, research objectives and literature review, this section presents conceptual framework. The conceptual framework provides foundation and also hypotheses for this study. It stems from the theoretical framework indicating the relationship between variables that become the basis of the research problem (Kumar, 2011). Based on the literature review discussed in Chapter 2, figure 3.1 illustrates the theoretical association for this study.

There are three antecedent variables, one independent variable, one mediating variable and one dependent variable identified for the study. Antecedent variables are leadership, managerial levers and business processes. Innovation process is the independent variable, innovation outcome is the mediating variable and firm performance is the dependent variable. In this study, innovation outcome mediates the relationship between innovation process and firm performance. The mediating variable is created when a third variable or construct intervenes between two other related constructs (Hair et al., 2010). According to the source, most application of mediation is to explain why a relationship between two constructs exists and this will assist in elucidating the influence of independent variable on dependent variable.

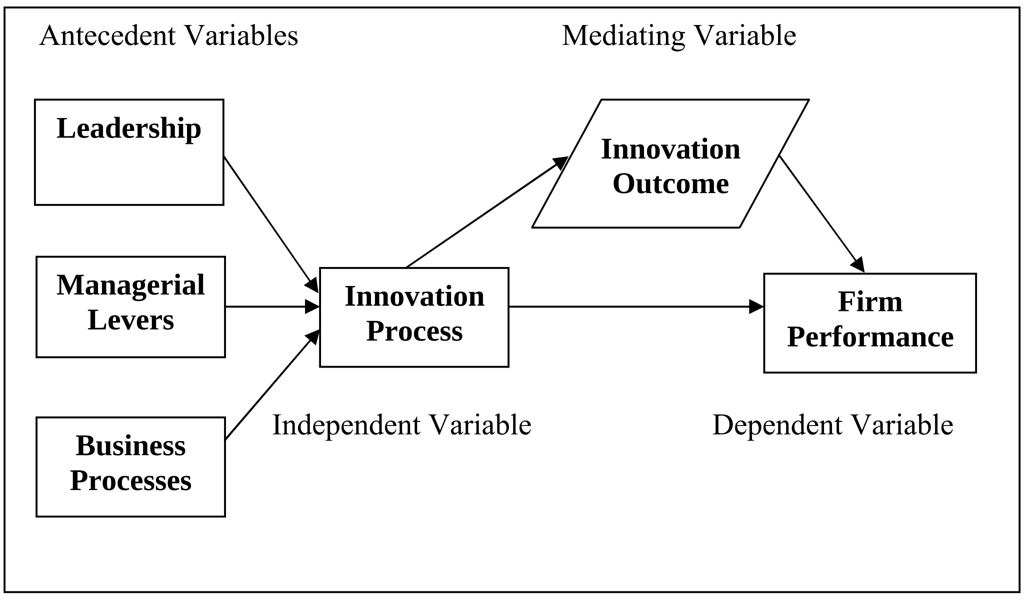

Figure 3.1
Conceptual Framework of the Study

Based on the above conceptual framework, there are six relationships that can be emphasised and also the level of innovation implementation. These relationships are listed as follows:

i. The relationship between leadership and innovation process.
ii. The relationship between managerial levers and innovation process.

iii. The relationship between business processes and innovation process.

iv. The relationship between innovation process and innovation outcome.

v. The relationship between innovation process and firm performance.

vi. The relationship between innovation outcome and firm performance.

3.2. Testable Statement

Hypothesis refers to assumptions or an idea about phenomenon, relationship or situation which become basis of an inquiry (Kumar, 2011). It is a form of testable statement from a relational basis between two or more variables (Sekaran & Bougie, 2010). Accordingly, this section describes the development of testable statement to examine the relationship between the antecedents, independent variables, mediating variable and dependent variable. Testable statement is put forward based on the theoretical framework, findings and arguments revealed from previous studies and the item response theory. The following discussions are listed below:

3.2.1 The level of relationship between leadership and innovation process

Leadership plays a vital role in nurturing innovation in organisation. Adegoke Oke, Munshi and Walumbwa (2009), found the influence of leadership is different according to innovation process. Innovation process involved discrete stages required different skill of leader and thus, transformational leadership style is suitable and related to affect innovation process when it stimulated creative idea in the earlier stage while the transactional leadership style appropriate in the implementation stage of innovation process (A. Oke et al., 2009). Through innovation processs, leadership promote team innovation in expression of ideas, innovative behaviour and decision process and this indirectly cause charismatic leader to positively influnce innovation (Paulsen, Maldonado, Callan, & Ayoko, 2009).

Similarly, Gumusluoğlu and Ilsev (2009), has found that transformational leadership has significant positive influence on the organisational innovation through the external support in the form of technical and financial. As organisational innovation is a tendency of organisation to develop new or improved product and bringing it to market, it is considered to involve innovation process. Thus, emperically this has also related to innovation process (Gumusluoğlu & Ilsev, 2009). Strategic variables such as knowledge and organisational learning has influence leaders to confont with innovation and thus the findings of García-Morales, Lloréns-Montes, and Verdú-Jover (2008), has supported that transformational leadership is associated with innovation.

In other study by Jung, Chow and Wu (2003), it is found that leadership of top managers enhanced organisational innovation directly and indirectly through creative organisational culture. Leadership is also found strongly positive to innovation subbodinates low in organisational-based-self esteem (Rank, Nelson, Allen, & Xian, 2009). Besides, leaders influence on innovative employee behaviour has stimulated innovation process and thus leadership has significant association with innovativeness (Krause, 2004; Lee, 2008). According to Mazutis and Crossan (2008) and (Talke, Salomo, & Rost, 2010), the upper echelon theory emphasised leadership traits are important determinant to organisation orientation such as innovation. Since this study also aims to investigate the level of leadership performed lead to innovation process, therefore the testable statement is as follows:

H1a: There is relationship between leadership and innovation process.

H1b: The higher the ability of organisation to perform leadership, the better their innovation process.

3.2.2 The level of relationship between managerial levers and innovation process

Managerial levers is a basic structure which is important to organisation in enhancing efficiency and also facilitates innovation. In this study, researcher focused on five managerial levers: strategy, structure, resource allocation, organisational learning and knowledge management tool and culture. Past research have indicated the relationship between managerial levers and innovation process and this is explained in the following discussions.

A case study has found that strategies engaged in an organisation has improved the effectiveness of innovation process (creation of ideas, development of innovations, utilisation, review and improvement) (Pan, 2010). Strategies were developed for innovation management at organisational level, enhance understanding on innovation process, provide explicit organisational construct and manage firm’s micro and macro environment (Pan, 2010). Innovation vary across firm together with different strategic orientation (Blumentritt & Danis, 2006). Evidence has produced that different strategic orientation between defenders, analysers and prospectors fitted with firm's innovation effort (Blumentritt & Danis, 2006).

Firm's organisational structure design may contribute to its organisational innovation capability (Daugherty et al., 2011). Decentralisation structure which involved business operational decision is significantly related to innovation process (idea generation) (Daugherty et al., 2011). Organisation with a formal structure can accelerate the positive effect on innovation process when it interact with the organisational learning process in the organisation because the formalisation tend to make employees focus more on the dynamic change of their job (Wei et al., 2011).

In a study of technological innovation capabilities impact on innovation performance, resource allocation showed a relationship with the percentage of sales income due to technological improved products and new products (Lau et al., 2010). Altough the findings did not show directly the relationship with innovation process but indirectly it is actually related to innovation process because resourse contributed to innovation capabilities in the organisation (Lau et al., 2010). Similarly the resource allocation from managerial, financial and technological commitment was found to be sinificantly related to innovation capability and managerial resource is found significant and futher influence strategic performance (Richey, Genchev, & Dauherty, 2005).

Both organisational learning and knowledge management is important levers to the innovation process. Jime´nez-Jimenez, Vall, and Hernandez-Espallardo (2008) found that organisational learning have a positive impact on innovation through knowledge acquisition, information distribution, information interpretation and organisational memory and this findings confirmed organisational learning is antecedents of innovation. The foundation of organisational learning has recognised the effect of top manager's bottom up learning on the exploitative innovation activities (Wei et al., 2011). As for the knowledge management, a study found that knowledge creation and knowledge sharing is positively related to the development of new products, technology and administrative system (Chen et al., 2010).

A study on character of knowledge integration and its role in the innovation processes affect knowledge management and this enable to understand innovation process in an organisation (Hislop, 2003) The organisational knowledge base was highly distributed in nature and attention to the type of relevent knowledge involved, its characteristics, its location and its mechanism in sharing, integrating and communicating. These has found to affect the dynamic of innovation process and social interaction (Hislop, 2003).

Culture stimulated innovation and creativity. It also affects the extent it to which creative solutions are encouraged, supported and implemented (Kenny & Reedy, 2006). Within organisation, it is found that organisation mission and R&D aspects are related to the innovation process in the form of idea generation, development of idea into useable concept and the successful application of the concept (Kenny & Reedy, 2006). The effects of learning culture has explained the difference in the level of innovation in organisation (Maria & Watkins, 2003). Findings by Naranjo-Valencia, Jime´nez-Jime´nez and Sanz-Valle (2011), has supported the relationship between organisational culture and innovation orientation particularly the innovation strategy of the firm (Naranjo-Valencia et al., 2011). The above discussions have put forward the relationship between managerial levers and innovation from previous findings. In this study, resource based view and dynamic capability theory further explains the contribution of managerial levers as valuable resources. While the item reponse theory applies to the ability level of managerial levers implemented lead to innovation process. Given the aforemention evidences, the testable statement:

H1c: There is relationship between managerial levers and innovation innovation process.

H1d: The higher the ability of organisation to perform managerial levers, the better their innovation process.

3.2.3 The level of relationship between business processes and innovation process

The significance influence of business processes in organisation were explained by previous research were discussed in Chapter Two (Antonucci & Goeke, 2011; Elzinga et al., 1995; Lewis et al., 2007). Although the relationship between business process and innovation process were not specifically highlighted, it is one of the stages in the design process innovation (Lewis et al., 2007). It is seen as a strategic and operational for improvement in organisation (Henriksen & Andersen, 2010). In addition, from the resource based view, business processes is path dependent process for firm to develop its capabilities (Ray et al., 2004). Business processes are found directly affected on the product and service innovation (Ganesh & Marvin, 2005). Therefore, the relationship of business processes and innovation process and the ability level of its implementation is hypothesize as follows:

H1e: There is relationship between business processes and innovation process.

H1f: The higher the ability of organisation to perform business processes, the better the innovation process

3.2.4 The level of relationship between innovation process and innovation outcome

Review from previous literature indicates that not many studies investigate the relationship between innovation process and innovation outcome**.** Innovation process and innovation outcome are related practically because a robust organisation practices a well defined and systematic innovation process as compared to brittle organisation (Desouza et al., 2009). Firms can benefit from innovation process such as ideation capabilities for continuous innovation (Björk et al., 2010). Conceptually, the stages in innovation process would produce output such as new product, process, patent or organisational learning which bring cumulative effect to organisation (Narvekar & Jain, 2006). Besides, innovation process also affects innovation outcome in terms of short and long term market success (Enzing et al., 2011).Innovation process become the one of the significant factor in determining business innovation success (Guimaraes, 2011). Thus, based on these literatures, the testable statement to investigate the relationship of innovation process and innovation outcome is as follows:

H2a: There is relationship between inovation process and innovation innovation outcome.

H2b: The higher the ability of organisation to perform innovation process, the better the innovation outcome.

3.2.5 The level of relationship between innovation process and firm performance

Innovation process is showed as a process of transformation from innovative input to innovative output and the efficiency of this stage determine the extent of innovation activities in the organisation (Kemp et al., 2003). Indeed, evidences from previous studies have agreed that the implementation of innovation in an organisation will involve innovation process and eventually affect firm performance (Enzing et al., 2011; Pullen et al., 2009; Rosenbusch et al., 2010; Terziovski, 2010). The innovation process is different between the new and improved product and this effects the firm’s short term and long term performance (Enzing et al., 2011).

Analysis on relationship between innovation and firm performance in the SME firms have indicated that the firm has benefited from innovation process if the development of innovation is managed diligently (Rosenbusch et al., 2010). Innovation process is forseen in the form of innovation process input and innovation process output and it is found to have an overall impact on performance. The result from the findings have indicated both innovation process input and output have a positive relationship on performance (Rosenbusch, et al., (2010). Innovation process is drived by several factors to boost performance (Terziovski, 2010). When innovation culture and strategy is aligned throug out the innovation process , it is found that there is a positive relationship between strategy and formal structure of organisation and performance where the final effect has improved firm performance (Terziovski, 2010). Besides, innovation process is a part of internal characteristic (formalisation, marketing and R&D intergration) of a firm that affect firm performance and it is found that a formal practice of innovation process create a strong performance of innovating firm (Pullen et al., 2009). Therefore, this study proposed a testable statement as follows:

H3a: There is relationship between innovation process and firm performance.

H3b: *The higher the ability of organisation to perform innovation process, the better their firm performance*.

3.2.6 The level of relationship between innovation outcome and firm firm performance

This study defines innovation outcome as the achievement of organisation innovativeness which includes product and process innovation that leads into new creation, novelty and is significant towards achieving firm performance. Different authors such as (Phromket & Ussahawanitchakit, 2009), (Gunday et al., 2011) and (Salomo et al., 2008) have empirically argued that innovation outcome affect organisational performance. In Camison and Lopez (2010), they empirically establish that manufacturing flexibility encouraged product, process and organisational innovation to lead improvement in firm performance.

Innovation is explored in terms of speed and magnitude has linked to organisational performance (financial and non-financial measures) (Shanti Gopalakrishnan, 2000). Both are considered the outcome of innovation since speed reflects the firm to adopt a product or process relative to competitor while magnitude is refers to the number of innovations that organisation adopted which produce benefit to performance (Shanti Gopalakrishnan, 2000). The study of Mok Kim Man (2009b), indicated that there is a significant relationship between innovativeness and performance for the SMEs in manufacturing sector. Innovativeness is related to performance by lowering cost, change in product design, cycle time and product variety and also organisation restructured (Man, 2009b). It is noted that the change in product design is the strongest determinant to SMEs performance (Man, 2009b).

New product development is a source of competitive advantage and thus the higher degree of product newness, give positive impact on firm performance (Salomo et al., 2008). Despite the direct positive impact there is also study showing that other factors that interacted this positive relationship. Seokin, Hyounseung and Joonsik, (2009), have proved that the actual relationship between product, process innovation and firm performance is influenced by fitness of product (functionality) and process (connection of components of the value chain) that need to be considered to project the positive relationship between innovation outcome and performance.

Innovation outcome captured innovation performance in the form of number of innovations, speed, level of newness and level of adopting innovation to be the first in the market (Prajogo, 2006). This finding has covered both, product and process innovation and it has high correlation with business performance in manufacturing and also service firm (Prajogo, 2006). Innovation types (product innovation, process innovation and marketing innovation) have positive impacts on firm performance through innovative performance (Gunday et al., 2011). Since innovation outcome involved the achievement of innovation goal related to product, process, idea, new production process, new structure or administrative system, it is found to have strong influence to export performance which also supports the relationship towards firm performance (Phromket & Ussahawanitchakit, 2009).

The results of the empirical research on innovation implementation has indicated a significant impact of the innovation outcome as the determinant of firm performance (Camison & Lopez, 2010; Hult et al., 2004; Medina & Rufı´n, 2009). Given the above evidences and arguments to support the relationship between innovation outcome and firm performance, this study proposed the following testable statements:

H4a: There is relationship between innovation outcome and firm performance.

H4b: The higher the ability of organisation to perform innovation outcome, the better their firm performance.

Innovation outcome is the effect from the innovation process (Gunday et al., 2011; Salomo et al., 2008). The innovation implementation is obvious when role of innovation outcome is identified between innovation process and organisation performance (Crossan & Apaydin, 2010) and (Laforet, 2011). This study propose that the firm performance can only be assessed (increase or decrease or improve or not) with innovation process only after they could generate innovation outcome. Therefore, this study argues that innovation outcome mediates the relationship between innovation process and firm performance.

H5a: Innovation outcome mediates the relationship between innovation process and firm performance.

H5b: The higher the ability of organisation to perform innovation process, innovation outcome and firm performance, the role of innovation outcome is established.

3.3 Summary

To summarise, this chapter has discussed the conceptual research framework of the study. There are six components depicted in the framework and each of the components was discussed extensively to establish the six direct relationships (between independent variables and dependent variable) and one indirect relationship (between mediating variable and dependent variable). This chapter has also pointed seven testable statements with regards to the level of innovation implementation. Following to this chapter is Chapter 4 which extensively discusses the methodology of the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.0 Introduction

This chapter discusses the research methodology which will be explained through four major sections. The first section explains the research design. The second section explains on sampling and data collection. The third section describes the operational definitions and measurements of instruments and finally section four will describe the approach on data analysis.

4.1 Research Design

According to Kumar (2011), research design is a procedure plan to indicate how the research process will be undertaken, structured and arranged so that it could finally answer the research questions. There are several steps involved in the research design for this study. It requires researcher to determine research process from the types of investigation proposed, data collection process, types of respondents, selection of respondents, data analysis and the how findings is presented.

The main objective of this study is to investigate the relationship on innovation process, innovation outcome and firm performance of the electrical and electronics industry in Malaysia. Parallel to this objective, the intention also includes investigating the ability level of innovation implementation in those particular organisations. In fulfilling the research objective, this study utilises several methods such as the probability sampling, discussion with the industry experts in charge in innovation in the manufacturing organisation and academicians. Extensive literature review from previous studies was conducted to identify problems and gaps. This type of research involves extensive preliminary works in order to understand the situation occurred before a model is developed and comprehensively investigated (Kumar, 2011; Sekaran & Bougie, 2010). Hence, this would be able to place the new area of knowledge particularly in the innovation management subject matter which is useful to the research community as well as practitioner.

Descriptive study attempts to describe a situation, problem, phenomenon or program or provide information about the living community or attitude towards an issue (Kumar, 2011). Thus, the goal of descriptive study is to provide the researcher a profile in describing relevant aspects of the phenomenon of interest from the perspective of individual, organisational and industry oriented (Sekaran & Bougie, 2010). On the other hand, hypothesis testing is used to explain the nature of certain relationship or establish differences among groups or the interdependence of two or more factors in a situation (Sekaran & Bougie, 2010).

Based on the above mentioned definitions, this study focuses on the descriptive study approach and hypothesis testing of testable relationships between the constructs. Descriptive study is undertaken in this study to understand the characteristics of innovation such as respondents profile and the engagement of innovation activities of the organisation. Furthermore, descriptive study will assist researcher to present this study in meaningful form in terms of systematically understand the situation, probe for further clarification and involve simple decisions (Sekaran & Bougie, 2010).

Since the objective of study investigates the relationship between innovation process, innovation outcome and firm performance and examine the level of innovation implementation, the testable statements have been used to describe the relationship between the study's variable.

4.1.1 Time dimension

This study uses the cross sectional design for the reason that data are gathered once, over a period of three month. In this case, data was collected one shot at one point of time purposely to answer research question (Sekaran & Bougie, 2010). Cross sectional design is preferable to longitudinal study due to the cost constraint and time element. Furthermore past studies on innovation and performance have used this sort of design (Calantone et al., 2002; Gunday et al., 2011; Jin et al., 2004; Prajogo, 2006; Salomo et al., 2008).

4.1.2 Unit of Analysis

The study focuses on electrical and electronics manufacturing firms in Malaysia. In this context, unit of analysis selected is organisation (company) where data was collected from the targeted respondent from the Chief Executive Officer, top management and executives level involved in implementing innovation. They were chosen since their role involved direct or indirectly in the innovation activities of their organisation. Moreover, with their knowledge, skill and experience, their perceptions are more valid. The respondents are required to answer an in depth questionnaires with regards to innovation.

4.2 Sampling Method

Sample is a subset or some part or larger population whose properties are studied to gain information about the whole (Zikmund, Babin, Carr, & Griffin, 2010). Therefore, this study uses sampling method as the process to make inference about the whole population. The target population for this study is organisations involved in producing electrical and electronics manufacturing firms in Malaysia. The main objective of sampling is to generalise from the sample to target population. The more representative the sample, the more confident the researcher can be that the results can be generalised to the target population. The advantage of using sample for this study is that (a) accurate information about population can be obtained quickly; (b) as a medium to search, explore, enhance knowledge and measure respondent in various areas such as perceptions, behaviours, personality traits, satisfaction and others; (c) fieldwork and data tabulation is closely supervised (Cochran, 1977; Zikmund et al., 2010).

The study employs probability sampling in which every member of the population will have equal chance of being included in the sample (Kumar, 2011; Zikmund et al., 2010). Simple random sample is used as the technique due to the best known probability sample (Zikmund et al., 2010). This technique is considered fair way, unbiased random selection and a representative sample.

The sampling frame for this study is based from Federation of Malaysian Manufacturers (FMM) Industries Directory 2012. From this directory, the population of electrical and electronics industry is represented by 863 manufacturing firms. The population for this study involved electrical and electronics sub-sector that comprise of: 1) machinery and equipment not elsewhere classified; 2) office, accounting and computing machinery; 3) electrical, machinery and apparatus not elsewhere classified and 4) radio television and communication equipment and apparatus. According to scientific calculation provided by Krejcie and Morgan 1970, with given population of 864, the sample size required is 234. Therefore 234 electronic and electrical companies were randomly selected from Federation of Malaysian Manufacturers 2012 Directory. The respondents were Chief Executive Officer (CEO), top management or executive level of the companies (Sekaran & Bougie, 2010). Therefore, 234 respondents are randomly selected from the FMM directory list to participate in this study.

4.3 Data Collection

There are various techniques of data collection such as self administered questionnaire (mail survey), e-mail surveys, face-to-face interview and telephone interview (Zikmund et al., 2010). This study uses the self administered questionnaire (mail survey) as the main technique for data collection. The questionnaire forms attached with cover letter, terms and definitions of the research and return self-addressed envolopes were posted to the identified repondents. The purpose of conducting this research is also included in the cover letter. Questionnaire has several advantages in this study in terms of (a) technique is relatively inexpensive as compared to interviews, saves time, human and financial resources; (b) offers greater anonymity; (c) increases the likelihood to obtain acurate information (Kumar, 2011).

4.4 Development of Instruments

Since questionnaire is used as medium for data collection, the instruments for each variables is guided by the literature review from previous studies with the conceptual framework used as the basic approach. In addition, the instruments developed must meet with the research objective as well as being able to be anwered by the targeted respondents. Initially, these items are verified by the industry experts and academicians. This procedure would avoid the issue of unclear questions, double barrelled questions, mistakes in wording and technical terms (Kumar, 2011). This is important so that every part of the items developed are used as measures in the analysis. The questionnaire prepared comprised the following items:

1) Background information on respondents, company profile and their innovation activities.
2) Questions with regards to leadership, managerial levers and business processes that promote the innovation process in the organisation.
3) Questions regarding innovation process as the medium of implementing innovation in the organisation.
4) Questions that indicates innovation outcome as a result of implementing innovation in the organisation.
5) Questions that reflect the firm performance of the participating companies for this study.

4.4.1 Operational Definition of Constructs

Operational definition describes what the variables are and how they are measured in research (Zikmund et al., 2010). Variables need to be operationalized and develop into definitions, concepts, dimensions, elements and measures (Sekaran & Bougie, 2010). At this stage, operational definition for each construct is important because if the construct is incorrectly defined, it will affect the validity of their measures (Sekaran & Bougie, 2010). Based on rigorous literature review from Chapter 2, this study has established a list of operational definitions which used to measure the antecedent variables, innovation process, innovation outcome and firm performance.

In line with the conceptual framework in Chapter 3, the dependent variable (endogenous) is firm performance , the independent variable is innovation process (exogenous), innovation outcome is mediating variable and andtecedent variable are leadership, managerial levers and business process. Since these variables involved resepondents attitudinal and perceptions, an interval scale is utilised (Sekaran & Bougie, 2010). This interval scale consist of 6 point numerical rating scale indicating range of point 1 to point 6 from strongly disagree to strongly agree.

In this study, interval scale is preferred since it is able to capture information about differences in quantities of a concept (Zikmund et al., 2010). Futhermore , interval scale can support statistical statements such as mean, standard deviation, correlation and regression (Cramer & Howitt, 2004). The 6 point rating scale is used to avoid the tendency of respondent in giving neutral feedback instead would motivate respondents to either provide positive or negative response and fulfiled the optimal length for bipolar scales (Fabrigar & Ebel-Lam, 2007). Being the most widely method used for questionnaire data collection, rating scale is reliable with well-read written format (Weller & Romney, 1988). Due to various dimension used to explain the variables, rating scales would allow researcher to use scales that anchored with agreement and disagreement degrees of the same concept of bipolar adjectives (Weller & Romney, 1988). The interval rating scale approach is also applicable with the measuring attributes developed by Item Response Theory (Parker, 2007). The following sections describe the details of each construct for dependent variable, independent variable, antecedents, and mediating variable.

4.4.1.1 Dependent Variable - Firm Performance

Firm performance can be viewed from objective and subjective measures. Information on firm performance measures are based from a variety of sources extract from past studies as mentioned in Chapter 2. For this study, firm performance is referred to five subjective measures that include return on investment, market share, sales, profitability and productivity. Subjective measures are used as the technique which also were used in the past studies (Li et al., 2010),(Akgun et al., 2009; Gunday et al., 2011) and (Prajogo, 2006).

In order to measure firm's performance, the researcher adopted several measures from Li, Zhou, and Si,(2010) Gunday, et al., (2011), Akgun, Keskin and Byrne (2009) and (Seokin et al., 2009). These measures specify the firm's performance for the last three years to be the perceived average performance. Furthermore this three year period is also used in the previous studies such as (Rhee et al., 2010) and

(Bolinao, 2009). The meaures were chosen because it can widen the innovation outcome of the firm's activities and application in a given period.

Respondents are required to answer questions on firm performance through a 6-point rating scale. Respondents also need to give rating to all dimensions in comparison to the competitors (Akgun et al., 2009). Although this approach could bring the possibility of biasness, but this could recover the issue of getting information which firm reluctant to disclose on exact performance records and the unwillingness of sharing objective performance data (Gunday et al., 2011). Table 4.1 shows the details of five items for the firm performance construct.

Table 4.1
Measures of Firm Performance

Dimensions	**No.**	**Items**	**Cronbach's alpha**	**Source (Adopt)**
Firm Performance	1.	Your company achieved better return on investment (ROI) than the competitor for the last three years.	0.91	Li, Zhou, and Si,(2010) Gunday, et al., (2011) and Akgun, Keskin Byrne (2009) and Seokin et al. (2009)
	2.	Your company achieved better market share than the competitor for the last three years.	0.91	
	3.	Your company achieved better sales than the competitor for the last three years.	0.93	
	4.	Your company achieved better profitability than the competitor for the last three years.	0.88	
	5.	Your company achieved better productivity per individual employee for the last three years.	0.83	

4.4.1.2 Independent Variable – Innovation Process

Innovation process is dynamic activities which is crucial to the innovation implementation (Bernstein & Singh, 2008; Desouza et al., 2009; Marques & Monteiro-Barata, 2006; Mudrak et al., 2005; Nieto, 2004), There are six dimensions representing innovation process for this study. As discussed in Chapter 2, dimensions comprise of: (1) idea generation; (2) idea mobilisation; (3) advocacy and screening; (4) experimentation; (5) commercialisation and (6) diffusion and implementation. This study used a 6 point rating scale from strongly disagree to strongly agree to measure the ability of respondents to implement the innovation process items. There are a total of 29 questions related to innovation process sub-dimensions.

a) Idea generation

Innovation is earlier sourced from new idea generated either internally (employees) or externally (customers, business partners, academia, government and competitors). These ideas were established through redefinition of concepts, changes in processes, new components or new development of service (Desouza et al., 2009). Table 4.2 indicates items under idea generation.

Table 4.2
Measures of Idea Generation

Dimensions	**No.**	**Items**	**Rasch Reliability Coefficient**	**Source (Adopt)**
Idea generation	1.	In our company, there are guidelines and processes establish to standardise stages of idea generation.	0.74	Adapt from Desouza, et al., (2009)
	2.	In our company, an idea is properly defined.	0.74	

Table 4.2 *Continued*

Dimensions	No.	Items	Rasch Reliability Coefficient	Source (Adopt)
	3.	In our company, procedures are defined to evaluate sources of idea.	0.74	

b) Idea mobilisation

This activity refers to the movement of ideas when there are conditions such as modification of product, processes, service or frameworks. In this stage idea must be well treated and shared across organisation so that it could suit the organisation settings. Idea mobilisation could alter business models, service or products for applicable use (Desouza et al., 2009). Table 4.3 indicates the idea mobilisation items that were asked over the respondents.

Table 4.3
Measures of Idea Mobilisation

Dimensions	No.	Items	Rasch Reliability Coefficient	Source
Idea mobilisation	1.	In our company, idea sources are connected across departments, geography and authority ranks.	0.74	Adapt from Desouza, et al., (2009)
	2.	In our company, idea sources are focused on the most likely or useful areas for the organisation.	0.74	
	3.	In our company, reward and recognition systems show value in both generation and mobilisation.	0.74	

Table 4.3 *Continued*

Dimensions	No.	Items	Rasch Reliability Coefficient	Source
	4.	In our company, accountability for recognizing and mobilizing ideas is specified.	0.74	
	5.	In our company, idea generators and those involved with mobilisation interact with stakeholders.	0.74	

c) Advocacy and screening

This process covers evaluation of potential opportunities for ideas within a particular organisation's context. Ideas need to be evaluated to make sure that it is worth for implementation. Both advocacy and screening must do simultaneously during the refinement stage of innovation process. This stage is crucial for adoption new practices or new product development. Both action assist in making ideas more explicit and communicable. This is important because ideas with high probability of success are the needed in the stage of innovation process (Desouza et al., 2009). Table 4.4 indicates items for advocacy and screening.

Table 4.4
Measures of Advocacy and Screening

Dimensions	No.	Items	Rasch Reliability Coefficient	Source
Advocacy and Screening	1.	In our company, organisational and customer considerations are clear to advocates.	0.74	Adapt from Desouza, et al., (2009)
	2.	In our company, possible ideas are broadly communicated.	0.74	

Table 4.4 *Continued*

Dimensions	No.	Items	Rasch Reliability Coefficient	Source
	4.	In our company, dedicated advocate roles exist, and/or reward systems are standardised to reward advocates.	0.74	
	5.	In our company, standards for evaluation are articulated and communicated across organisation.	0.74	
	6.	In our company, idea is evaluated as transparent as possible.	0.74	

d) Experimentation

Experimentation is needed to test the suitability of an idea for particular organisation at a particular time. It is an iterative process of development. Thus, it might be continuous or occurred in fits and starts depending on the advocates, screening and resources. This process must be conduct internally for business model, strategy or business changes however for the case of product development and consumer respond testing; experimentation could be implemented externally through outsourced (Desouza et al., 2009). Table 4.5 indicates questions related to experimentation.

Table 4.5
Measures of Experimentation

Dimensions	No.	Items	Rasch Reliability Coefficient	Source
Experimentation	1.	In our company, resources are in place for experimentation.	0.90	Adapt from Desouza, et al., (2009)

Table 4.5 *Continued*

Dimensions	No.	Items	Rasch Reliability Coefficient	Source
	2.	In our company, process is defined and authorized.	0.90	
	3.	In our company, a variety of avenues exist to experiment, some of which involved external parties.	0.90	
	4.	In our company, technology is utilised and invested in.	0.90	
	5.	In our company, failure is of the process, not an end point.	0.90	

e) Commercialisation

Commercialisation focuses upon the potential impact of an idea. It clarifies how and when ideas can be used by people other than the group that developed them, through data or prototypes from the experimentation process to reveal tangible benefits. Possible ideas are taken to create internal or external market value, within which value can be expressed or shared in a logical manner. Therefore, commercialisation establishes the specifications of an idea and the output in terms of a product or service or a combination of the two (Desouza et al., 2009). Table 4.6 indicates questions with regards to commercialisation.

Table 4.6
Measures of Commercialisation

Dimensions	**No.**	**Items**	**Rasch Reliability Coefficient**	**Source**
Commercialisation	1.	In our company, distinctions are drawn between immediately useful and ideas needing refinement or market changes.	0.90	Adapt from Desouza, et al., (2009)
	2.	In our company, benefits are articulated and documented.	0.90	
	3.	In our company, commercialisation is controlled and objective driven.	0.90	
	4.	In our company, market response feedback is given to experimenters.	0.90	

f) Diffusion and Implementation

Diffusion is the process of acceptance for a new innovation, while implementation is the process of setting up the structures, maintenance and resources to let the innovation to develop and be operated or produced. Organisational members need to actively engage in this stage. At the end of the stage of innovation process, the application of the innovation should be accomplished and turn the innovation into a product or service. Diffusion process needs an open culture and/or strong support all the way through the organisation. (Desouza et al., 2009). Table 4.7 indicates questions related to diffusion and implementation.

Table 4.7
Measures of Diffusion and Implementation

Dimensions	No.	Items	Rasch Item Reliability Index	Source
Diffusion and Implementation	1.	In our company, the whole organisation is targeted.	0.90	Adapt from Desouza, et al., (2009)
	2.	In our company, existing initiatives are incorporated.	0.90	
	3.	In our company, realistic objective are established.	0.90	
	4.	In our company, dialogue is emphasised with all stakeholders	0.90	
	5.	In our company, older, duplicative processes are eliminated.	0.90	
	6.	In our company, social network are utilised.	0.90	
	7.	In our company, technology is used to communicate.	0.90	

4.4.1.3 Mediating Variable – Innovation Outcome

Innovation outcome is the mediating variable which is theoretically extracted to measure its influence on the relationship between innovation process and firm performance. Based on positions of many authors discussed in Chapter two: (Phromket & Ussahawanitchakit, 2009), (Stock & Zacharias, 2011), (Laforet, 2011), (Terziovski, 2010), (Paladino, 2008), (Prajogo, 2006), (Calantone et al., 2002), (Akgun et al., 2009), (Seokin et al., 2009), (Sung et al., 2011) and (Pla-Barber & Alegre, 2007), innovation outcome can be defined as the achievement of organisation innovativeness which include product and process innovation that leads into new creation, novelty and significant towards achieving firm performance.

The following section would describe the dimesions and items to measure this variable. The 6 point rating scale (from strongly disagree to strongly agree) is applied to measure the ability of respondents to respond on innovation outcome. There are two sub-dimensions under innovation outcome: a) product innovation and b) process innovation. A total of 18 questions related to innovation process sub-dimensions were utilised in this study. The following section depicts the specific dimension and operational definitions:

(a) Product innovation

Product innovation is an activity including creation of new markets and (or) customers, and development of new product or improvement of pre-existing product to raise market share (Seokin et al., 2009). A new product of a firm encompass three concepts: newness, value and frequency (Stock & Zacharias, 2011). Newness refers to the degree of difference between company's product program and existing alternatives, value is known as meaningfulness, usefulness, utility or advantage and frequency of new product introduced in the market (Stock & Zacharias, 2011). Table 4.8 indicates product innovation questions:

Table 4.8
Measures of Product Innovation

Dimensions	No.	Items	Cronbach's alpha	Source (Adopt)
Product Innovation	1.	The products of our company are new.	0.87	(Stock & Zacharias, 2011) (Akgun et al., 2009) (Prajogo, 2006) (Seokin et al., 2009)
	2.	The products of our company are inventive.	0.87	
	3.	Our product focused on quality improvement.	0.78	
	4.	Our product focused on product design improvement.	0.85	
	5.	The products of our company differ significantly in terms of newness from existing product of competitors.	0.82	
	6.	The newly develop products our company solve the problem of our customer.	0.94	
	7.	The newly develop products our company lead to significant cost saving for our customers.	0.94	
	8	The newly develop products our company deliver high benefits for our customers.	0.94	
	9.	Our company has introduced more novel new products during the last 3 years than our strongest competitors.	0.92	
	10.	Our company continually introduces innovative products into the market.	0.92	

(b) Process Innovation

Process innovation is an activity that improves or transforms processes used for production or provision of service (Seokin et al., 2009). Table 4.9 indicates that process innovation items.

Table 4.9
Measures of Process Innovation

Dimensions	No.	Items	Alpha Value	Source (Adopt)
Process Innovation	1.	Our company is focused on improving work methods and process management.	0.70	(Seokin et al., 2009), (Akgun et al., 2009), (Prajogo, 2006), (Calantone et al., 2002)
	2.	Our company is focused on improving cost control.	0.70	
	3.	Our company constantly improving our business process.	0.78	
	4.	Our company is focused on technological competitiveness.	0.80	
	5.	Our company is focused on newness of technology.	0.86	
	6.	Our company is focused on the rate of changes in processes.	0.80	
	7.	Our company seeks new ways to do things.	0.89	
	8.	Our company is creative in its methods of operation.	0.89	

4.4.1.4 Antecedents Variables

Leadership, Managerial Levers and Business Processess are three variables that are used as the antecedents to innovation process for this study. The following sections describes in detail their dimensions and items measured.

a) Leadership

Literature review from past studies showed that the leadership factor is important antecendent that contribute to the success of innovation implementation (Barsh et al., 2008), (McMillan, 2010), (Bel, 2010), (Bossink, 2004a), (Carneiro, 2008)and (Jansen et al., 2009). Guided from these literatures, the definition of leadership for this study is innovative leadership comprises of abilities, skills and competencies that appropriate to contribute creatively, strategically and effective to enable innovation process at the firm level. Items have used the 6 point rating scale (from strongly disagree to strongly agree) to measure the ability of respondents to respond leadership. This is shown in Table 4.10.

Table 4.10
Measures of Leadership

Dimensions	**No.**	**Items**	**Rasch Item Reliability Index**	**Source**
Leadership	1.	The innovative leadership has inspired employee in terms of excitement and commitment.	0.90	(Bel, 2010)
	2.	The innovative leadership encourages new ideas to be flourish in the organisation.	0.90	
	3.	The innovative leadership motivate employee to be involved in a new and challenging project.	0.90	
	4.	The innovative leadership encourage employee to be confidence.	0.90	
	5.	The innovative leadership promotes creativity in a balance way.	0.90	
	6.	The innovative leadership manages linkages internally to ensure innovation related activities in the organisation are strategically alligned and coordinated.	0.90	

Table 4.10 *Continued*

Dimensions	No.	Items	Rasch Item Reliability Index	Source
	7.	The innovative leadership manages linkages externally in order to bring external perspective inside, tap into ideas, resources and co-innovation with partner organisations for new solution or systems.	0.90	
	8.	The innovative leadership provide contingent reward for innovative effort and innovative result.	0.90	

b) Managerial Levers

Managerial levers are catalysts which drive innovation process towards producing innovation outcome. Based on the literature review discussed in Chapter 2, managerial levers have theoretically extracted as the one of the antecedents for this study due to its role that maximise efficiency, adapting changes and facilitate organisation in achieving success (Chad, 2010; Crittenden & Crittenden, 2008; Leibold et al., 2004). In this study, there are five main sub-dimensions for managerial levers: (1) strategy, (2) structure, (3) resource allocation, (4) knowledge management and organisational learning and (5) culture. The following sections depict each dimension and operational definitions. Items are measured with 6 point rating scale. The following describes each of the managerial levers with their item measures:

(a) Strategy

Strategy is a continous management activities needed to overcome managerial challenge such as innovation (Blumentritt & Danis, 2006; Drejer, 2006; Li et al., 2010). In this study, researcher adopted 8 items by Terziovski (2010) to measure strategy that is listed in Table 4.11.

Table 4.11
Measures of Managerial Levers - Strategy

Dimensions	**No.**	**Items**	**Cronbach's alpha**	**Source (Adopt)**
Strategy	1.	The organisation's vision and mission includes a reference to innovation.	0.87	(Terziovski, 2010)
	2.	Innovation strategy has helped the organisation to achieve strategic goals.	0.87	
	3.	Improving administrative routines is seen as part of our innovation strategy.	0.87	
	4.	Internal cooperation is an important part of innovation strategy implementation.	0.87	
	5.	Customer satisfaction is part of our innovation strategy.	0.87	
	6.	Improving product or service quality is one of our key objectives of innovation strategy.	0.87	
	7.	Formulating innovation strategy increases employee skills.	0.87	
	8.	Improving employee commitment, morale, or both is part of our innovation strategy monitoring.	0.87	

(b) Structure

Structure is one of the identified lever discussed from literature review. Structure is needed to manage innovation efficiently and it relates with various parts of organisation (Smith et al., 2008). In this study, researcher adopted 7 items by Stock and Zacharias(2011) and Terziovski (2010) to measure its operational definitions that is listed in Table 4.12.

Table 4.12
Measures of Managerial Levers - Structure

Dimensions	No.	Items	Cronbach's alpha	Source (Adopt)
Structure	1.	In our company, we have specific units for the generation of innovations.	0.91	(Stock & Zacharias, 2011), (Terziovski, 2010)
	2.	It is clearly regulated who is responsible for innovations.	0.91	
	3.	In our company, people know who is in charge of innovations.	0.91	
	4.	The units responsible for innovation have sufficient resources for the generation of innovations.	0.91	
	5.	The units responsible for innovation have sufficient competencies for the introduction or generation of innovation.	0.91	
	7.	Our employees formally monitor developments in new technologies.	0.82	
	8.	Employees document and use failures as opportunities to learn.	0.82	

(c) Resource Allocation

Resource allocation is utilised through technological, human and financial resources to drive innovation process (Lau et al., 2010). This study adopted 5 items from (Lau et al., 2010) to measure its operational definition. The following Table 4.13 listed the items.

Table 4.13
Measures of Managerial Levers – Resource Alloacation

Dimensions	No.	Items	Cronbach's alpha	Source (Adopt)
Resource Allocation	1.	Our company plans human resource in phases for innovation activity.	0.95	(Lau et al., 2010)
	2.	Our company can select appropriate personnel in each functional department in innovation process.	0.96	
	3.	Our company can provide steady capital supplement in innovation activity.	0.96	
	4.	Our company fully uses external technologies.	0.96	
	5.	Our company adapts its technology level to changes in external environment.	0.96	

(d) Knowledge Management and Organisational Learning

Both knowledge management and organisational learning are also important managerial levers contributed to this study. Importance of these levers were discussed at length in previous studies such as (Chen et al., 2010), (Huang & Li, 2009), (Phromket & Ussahawanitchakit, 2009),(Jime´nez-Jimenez et al., 2008). In this research, the knowledge management and organisational learning are about the creation, sharing establishment, integration and the application of this components into the innovation process (Huang & Li, 2009; Phromket & Ussahawanitchakit, 2009). Thus this study has adopted 10 items from (Huang & Li, 2009), (Phromket & Ussahawanitchakit, 2009) and (Ar & Baki, 2011) to measure the dimensions as shown in Table 4.14.

Table 4.14
Measures of Managerial Levers - Knowledge Management and Organisational Learning

Dimensions	**No.**	**Items**	**Cronbach's alpha**	**Source (Adopt)**
Knowledge Management and Organisational Learning	1.	Knowledge is obtained from customers.	0.92	(Huang & Li, 2009), (Phromket & Ussahawanitchakit, 2009), (Ar & Baki, 2011)
	2.	Knowledge is obtained from partners.	0.92	
	3.	Knowledge is obtained from employees.	0.92	
	4.	Knowledge is shared between supervisors and subordinates.	0.86	
	5.	Knowledge is shared across the units.	0.86	
	6.	Our company affectively manages different sources and types of knowledge.	0.92	
	7.	Our company utilises knowledge into practical use.	0.92	
	8.	Our company has a comprehensive program for employee learning.	0.86	
	9.	Our company has an organisation-wide training and development process, including career path planning, for all our employees.	0.88	
	10.	Our managers agree that our organisation's ability to learn is the key to our competitive advantage.	0.82	

(e) Culture

Culture is a shared vision that promotes innovation (Adams et al., 2006). Numerous studies from the literature have showed the impact of culture on innovation (Martins & Terblanche, 2003), (Stock & Zacharias, 2011),(Valencia et al., 2010) and (Ahmed, 1998). For this study, researcher adopted 4 items to measure its operational definitions as showed in Table 4.15.

Table 4.15
Measures of Managerial Levers - Culture

Dimensions	No.	Items	Cronbach's alpha	Source (Adopt)
Culture	1.	Our culture rewards behaviour that relates to creativity and innovation.	0.71	(Terziovski, 2010), (Stock & Zacharias, 2011)
	2.	In our company, we are very open towards innovations (e.g. related to products and/or processes.	0.91	
	3.	In our company, we expect the new value-adding products and services are detected and developed permanently.	0.91	
	4.	In our company, we appreciate unconventional ideas (especially if they come from customer).	0.91	

c) Business Processes

In Chapter 2, business processes are defined as a set of connected activities between people and process which drive innovation process into creating innovation outcome. As a structured activities, business process is used to improve basic and major elements of organisation operation (Elzinga et al., 1995). The use of business processes in this study is significant to the organisation objectives, increased in efficiency and leads to innovation (Armistead et al., 1999; Ganesh & Marvin, 2005; Ray et al., 2004).This study will adopt measures used by Yu-Yuan(2006), through two dimensions: Process Alignment and People Involvement. Each dimension listed several items as listed in Table 4.16 and 4.17. Items are also measured by 6 point rating scale.

Table 4.16
Measures of Business Processes – Process Alignment

Dimensions	**No.**	**Items**	**Cronbach's alpha**	**Source (Adopt)**
Process Alignment	1.	Horizontal structure alignment has made frequent use of process team.	0.70	Yu-Yuan (2006)
	2.	Horizontal structure alignment has made cross-functional teams have more authority in making daily decisions than departmental managers.	0.70	
	3.	Horizontal structure alignment has made well practice horizontal communication.	0.70	
	4.	Horizontal structure alignment has made a flat organisational structure.	0.70	
	5.	Horizontal structure alignment has made managerial task to front line staff delegated.	0.70	
	6.	Technology enabled business processes to perform well.	0.70	
	7.	Amount of data shared by employees increasing		
	8.	IT important to improvement of business processes	0.73	
	9.	Well integrated IT systems across functional units.	0.73	

Table 4.16 *Continued*

Dimensions	**No.**	**Items**	**Cronbach's alpha**	**Source (Adopt)**
	10.	Core processes important input into strategic plan.	0.79	
	11.	Operational improvements had direct impact on ability to compete.	0.79	
	12.	Strategic planning process actually encourages information sharing and cross functional cooperation	0.79	

Table 4.17

Measures of Business Processes – People Involvement

Dimensions	**No.**	**Items**	**Cronbach's alpha**	**Source (Adopt)**
People Involvement	1.	Our executive has received adequate training in managing core processes.	0.85	Yu-Yuan (2006)
	2.	Our executive has sufficient knowledge on how to manage core processes.	0.85	
	3.	Our executive expressly recognises the need to identify core processes.	0.85	
	4.	Our executive allocates adequate resources to improve core processes.	0.85	
	5.	Our executive actively communicates to employees on how best to manage core processes.	0.85	
	6.	Our employees increasing involvement in the way their work is planned.	0.70	
	7.	Our employees increasing autonomy in making decisions that affect work.	0.70	
	8.	Our employees are given necessary resources to fix problems they encounter.	0.70	
	9.	Our employees are encouraged to fix problem they encounter.	0.70	
	10.	Our employees interacting more with external customers.	0.70	

4.4.2 Instruments Validity and Reliability

This study entails in measuring the respondents perceptions towards the items constructed from the questionnaire. Therefore, the outcome of study depended on the findings from the survey form. Nevertheless, instruments are prone to measurement errors and this would affect accuracy and quality of the findings (Kumar, 2011). Therefore, as a normal procedure in research process, study needs to establish the issue of validity and reliability to ascertain the quality of end result (Rajah & Asokkumar, 2009; Sekaran & Bougie, 2010). Most of the instruments applied in the study were adopted from previous studies. Those items were identified to be reliable due to the value of their Cronbach alpha between 0.7 to 0.9. Since the value is considered good and stable (Kimberlin & Winterstein, 2008), the instruments are applied and the reliability is also acceptable when using the Rasch approach. According to Rasch, reliability is the index of reproducibility and in this study, it is applied on item reliability index (0.90) and person reliability index (0.98). This concept is similar to the traditional Cronbach alpha. As this study utilised the Rasch measurement analysis, the approach is parallel to the physical measurement processes. The concept of validity in Rasch concerned about constructs to be accurate, precise, linear measures and unidimensionality (Linacre, 2004). According to Bond and Fox (2007), the unidimensionality principle requires analysis to focus on one attribute or dimension at a time.

Validity is the ability of an instrument to measure what it intends to measure (Kumar, 2011) In this study, validity issue would assist researcher to measure empirically and adequately the meaning of the concept that has been developed in the conceptual framework. This study involved two types of validity. First is order validity which is similar to the content validity. Second is the fit validity which is to measure the construct validity (Wright & Stone, 1999).

The content validity has embarked on two processes. First, the items listed in the questionnaire were selected from a wide-ranging review of literatures and were evaluated by academicians and panel of experts who are specialize in the field of innovation. An interview session was conducted with the experts from four companies to ensure the face validity for instruments. In addition, this task is also important to ensure that items are adequate and represent of the innovation concept. Second, a pilot study was conducted on 32 participating electrical and electronics companies. The objective is to test the effectiveness of the research methodology, reliability and validity of the measurements. The order validity and fit validity according to Rasch concept is further explained in Chapter 5.

Consequently, the concept of reliability is applied in this study to show the consistency and stability of the research instruments (Kumar, 2011). In the classical theory, reliability is important to establish internal consistency for the instruments. Hence, Cronbach's coefficient alpha is used to measure reliability with the coefficient value of 0.7 and above would be considered acceptable level (Zikmund et al., 2010). Nevertheless, in the Rasch measurement model, the reliability is still based on Cronbach alpha (KR20) with provision of reliability for person and items. Reliability indices according to Rasch measurement model has assisted researcher to determine whether there are adequate items spread along the logit ruler of the variable map and also adequate spread of ability among the persons (respondents)

(Bond & Fox, 2007). With high item reliability, this would give an indicative that items constructed would be consistent as inferences (Bond & Fox, 2007). The item and person reliability will be explained further in Chapter 5.

4.5 Data Analysis

Data analysis for this study involved the descriptive analysis, correlation measures and the percentage on probability of success according to Rasch measurement model.

4.5.1 Descriptive Analysis

The main purpose of using data display techniques is to make the findings easy, clear to understand and to provide comprehensive informatioan in effective way (Kumar, 2011). Therefore, descriptive analysis is used in this study with the objective to transform the raw data into summary format, to analyse and display the quantitative data. Descriptive analysis were discussed according to respondent profile, company profile and innovation activities. The information and data collected were analysed through a simple matrix table and pie charts. Respondents and organization profile are recorded in absolute number and percentage. The aim of descriptive analysis is for researcher to get the demographic profiling and provides an acceptance level of responses. The elaboration of descriptive analysis is discussed further in Chapter 5.

4.5.2 Correlation Analysis of Measures

According to Zikmund, et al., (2010) the most popular technique for indicating the relationship between two variables is correlation analysis. The objective is to further understand the natural relationship among variables, the direction and the significance of bivariate relationship which is tested with a *t*-test and p-value. In the Rasch analysis, correlation has been carry out through the linear function graph and item characteristic curve. With this plotted graph and item characteristic curve, analysis is done through graphical presentation to assess the relationship, direction and significant between variables of the study. The significant of the correlation was indicated by the fit statictics of mean square Z-standard $\pm$ 2 logit within the confidence level of 95% (Bond & Fox, 2007). Since the Rasch measurement model requires data to fit with model, the correlation between variables is significant when it falls within the Z-standard range.

The above discussions has showed the direct relationship between two variables. Having from the theoretical framework on the present of mediator role, the study need to analyse simultenously several independent variables towards dependent variable. In the common research analysis it involved multivariate statistical analysis (Zikmund et al., 2010). As for the indirect relationship through the mediating variable, analysis in this study was performed by the calculation of probability of success for each item of the variables concerned. Data analysis will be further discuss in Chapter 5.

4.5.3 Probablity of Success

The probability of success refers to probability of an event which can be described as the following (Azrilah, 1996):

Probability of success of an event = Ability of a person – Difficulty of an item

Therefore, for this study, the probability of success depends on the difference between the ability of the respondent of the organisation and the difficulty of the items (questionnaire). A company having a greater ability than other company should have greater probability of answering any item of the type in question. The probability of success is reported through percentage level of the company ability involved in the study. As mentioned by (Bond & Fox, 2007; Zubairi & Kassim, 2006), there are several basic concept in Rasch are used for data analysis particularly in this study:

a) Logit is the unit measurement in Rasch model used to transform raw scores obtained from the rating scale to log odd ratios. This logit scale is an interval scale which the unit between location in the variable map that have a consistent value.
b) Estimates of item difficulty calculated from the total number of persons in the sample that succeeded on the item.
c) Estimates of person ability calculated from the total of items to which person responded successfully in the sample.
d) Average difficulty of items is set at 0 logit.
e) Probability of success for any person on an item in Rasch model routinely sets at 50 percent chance of passing.

Table 4.18 lists summarise various techniques of data analysis are used in this study include: simple tabulation table, summary statistics form Rasch output table, person-item distribution map (variable map), linear graph function and item characteristic curve. These analysis tools were utilised to achieve the research objectives as well as to assess the research hypotheses and testable statements. A software package: Winsteps 3.69 is used to analyse the research data.

Table 4.18
Research Objectives, Research Hypothesis and Types of Data Analysis

No.	**Research Objectives**	**Research Hypothesis / Testable Statement**	**Data Analysis**
RO1	To investigate the relationship exists between antecedents represented by leadership, managerial levers and business processes with innovation process in the electrical and electronics companies.	H1a: There is relationship between leadership and innovation process.	Correlation between item measures from the linear graph function and item characteristic curve
		H1b: The higher the ability of organisation to perform leadership, the better their innovation process.	Probability of success in perfoming items according to ability of respondents and difficulty of items measured.
		H1c: There is relationship between managerial levers and innovation process.	Correlation between item measures from the linear graph function and item characteristic curve.
		H1d: The higher the ability of organisation to perform managerial levers, the better their innovation process.	Probability of success in perfoming items according to ability of respondents and difficulty of items measured.
		H1e: There is relationship between business processes and innovation process.	Correlation between item measures from the linear graph function and item characteristic curve
		H1f: The higher the ability of organisation to perform business processes, the better their innovation process.	Probability of success in perfoming items according to ability of respondents and difficulty of items measured.
RO2	To investigate if any relationship exists between innovation process and innovation outcome	H2a: There is relationship between innovation process and innovation innovation outcome.	Correlation between item measures from the linear graph function and item characteristic curve

Table 4.18 *Continued*

No.	Research Objectives	Research Hypothesis / Testable Statement	Data Analysis
		H2b: The higher the ability of organisation to perform innovation process the better their innovation outcome.	Probability of success in perfoming items according to ability of respondents and difficulty of items measured.
RO3	To investigate if any relationship exists between innovation process and firm performance.	H3a: There is relationship between innovation process and firm performance.	Correlation between item measures from the linear graph function and item characteristic curve
		H3b: The higher the ability of organisation to perform innovation process the better their firm performance.	Probability of success in perfoming items according to ability of respondents and difficulty of items measured
RO4	To investigate if any relationship exists between innovation outcome and firm performance	H4a: There is relationship between innovation outcome and firm performance.	Correlation between item measures from the linear graph function and item characteristic curve
		H4b: The higher the ability of organisation to perform innovation outcome outcome the better their firm performance.	Probability of success in perfoming items according to ability of respondents and difficulty of items measured
RO5	To investigate whether innovation outcome mediate the relationship between innovation process and firm performance.	H5a: Innovation outcome mediates the relationship between innovation process and firm performance.	Correlation analysis between item measures, probability of success in performing items and mediator analysis
		H5b: The higher the ability of organisation to perform innovation process, innovation outcome and firm performance, the role of innovation outcome as mediator is established	Probability of success in perfoming items according to ability of respondents and difficulty of items measured.

4.6 Summary

This chapter describes the research methodology of the study. Research is classified as descriptive study and data collection was conducted through the mail survey method. The respondents from electrical and electronics manufacturing company were selected randomly from the population. Rigorous literature review on innovation was conducted in providing the basis for conceptual framework. Six variables with their operational definitions were developed. The questionnaire instruments and content were validated by panel of experts and feedback from pilot study. Five research objectives and fourtheen testable statements have been developed to test the relationship among the listed variables. With the adoption Item Response Theory (IRT), this study utilises the Rasch Model for data analysis. Subsequently, Chapter 5 focuses on the findings and discussions.

CHAPTER 5

FINDINGS AND ANALYSIS

5.0 Introduction

This chapter aims to explain the findings of study. It covers a detailed analysis, discussions and interpretation of data collected from respondents via returned questionnaire. Findings are divided into several sections. Section 5.1 illustrates the sample of study. Section 5.2 illustrates the respondents profile which focuses on demographic aspect of respondents and participating companies. Subsequently followed by Section 5.3, testing the goodness of fit and result o study. Section 5.4 is the summary of the chapter.

5.1 Sample of study

The population of this study is focused on 863 electrical and electronics companies in Malaysia. The sampling frame was obtained from the annual listing of Malaysian industries for year 2012 Federation of Malaysian Manufacturers Directory (FMM, 2012) . Based on sample size determination suggested by Krejcie and Morgan as cited in Sekaran and Bougie (2010), a sample of 234 electrical and electronics companies were randomly selected in undertaking this study. Questionnaires were mailed out together with the cover letter and self-address envelope. The process of data collection was carried out within three months and initiatives such as e-mail and follow-up call were use to improve the feedback. At the end of the data collection period, a total of 61 pieces are accepted which were usable for this study. Although the sample size required is 234, the response is based on 61companies which is accepted within the Rasch requirements. The sample size according to Rasch is important in the sense that the sample obtained from the data collection must be stable in item calibrations (Linacre, 1994). Although in principle, the large sample size provides a more stable result, the Rasch model has suggested four types of minimum sample size range as the rule of thumb for item calibration. This is reasonable in providing stable sample size and maintain a useful level of measurement stability (Linacre, 1994).

- Type 1: Item calibration stable within $\pm$ 1 logit with confidence level 95%, minimum sample size range is between 16 - 36
- Type 2: Item calibration stable within $\pm$ 1 logit with confidence level 99%, minimum sample size range is between 27- 61
- Type 3: Item calibration stable within $\pm$ 1/2 logit with confidence level 95%, minimum sample size range is between 64 - 144
- Type 4: Item calibration stable within $\pm$ 1/2 logit with confidence level 99%, minimum sample size range is between 108 - 243

Therefore, although the recommended sample size for this study is 234, the valid response from 61 respondents have fulfil the second level of sample size range Rasch model requirements of confident level that items are in stable calibration within $\pm$ 1 logit (Azrilah, 1996). Furthermore, all items are fit according Rasch fit statistics criteria and this study has comply the polytomies data type for having more than 10 observations per category rating scale (Linacre, 2002). Besides fulfilling the Rasch requirements, the 26 percent response rate is reasonable for this kind of industry study as achieved by previous scholars such as Quek Eng and Yusof (2003), 24 percent; Bakar and Ahmad (2010), 20 percent and Mat and Razak (2011), 24.2 percent.

5.2 Respondents Profile

In meeting the data collection requirements, this study presents the descriptive statistics to indicate whether the responses are in the satisfactory level. For this study, the demographic segment is focuses on the respondent's profile, company profile, and the innovation activities. There are 61 companies involved which produced the electrical and electronics products and components. All responses are tabulated in the form of data and information is keyed-in according to specified coding in the table matrix type. Table 5.1 summarised codes of respondent profile. The following describes the demographic segment:

xxxA1A2A3A4A5B2B3B4B5B6C1C2C3C4C5C6C7C8C9 where;

xxx - refers to the number of respondents involved starts from C01.

A1 - refers to the position of the respondents which categorized as follows;

1 Chief Executive Officer

2 General Manager

3 Director

4 Senior Manager

A2 – refers to the age of respondents, where

1 Between 25 and 35 years

2 Between 36 and 45 years

3 Between 46 and 55 years

A3 – refers to the qualification of respondent's, where

1 School certificate / SPM and STPM

2 Diploma

3 Degree

4 Postgraduate Degree

A4 – refers to respondent's working experience, where

1 Less than 5 years

2 Between 5 and 10 years

3 Between 10 and 20 years

4 Above 20 years

A5 – refers to respondent's involvement in research and development (R&D) or any innovation activities, where

1 Yes

2 No

B2 – refers to the size of organisation according to the number of employees (definition is based on SME), where

1 Less than 50 employees (Small)

2 51 – 150 employees (Medium)

3 Above 151 employees (Large)

B3 – refers to the organisation ownership; where

1 Foreign

2 Malaysian

3 Joint Venture

B4 – refers to the type of electrical and electronics manufacturing sub-sector according to FMM Directory

1 Machinery and equipment not elsewhere classified

2 Office, accounting and computing machinery

3 Electrical, machinery and apparatus not elsewhere classified

4 Radio television and communication equipment and apparatus

B5 – is the average sales per year for the last three years

1 Between RM100,000 – RM500,000

2 Between RM 501,000 – RM 1 million

3 Between RM 1.1 million – RM 5 million

4 Between RM 5.1 million – RM 10 million

5 Above RM10 million

B6 – is the average profit per year for the last three years

1 Between RM100,000 – RM500,000

2 Between RM 501,000 – RM 1 million

3 Between RM 1.1 million – RM 5 million

4 Between RM 5.1 million – RM 10 million

5 Above RM10 million

C1 – refers to the introduction of new or enhancement of existing product for the last three years.

1 Yes

2 No

C2 – refers to the list of ideas for the new product development program (including improvement and introduction) where act as counter that determine the source of ideas.

( ) Customers

( ) Marketing and sales people

( ) The Competitors

( ) Middle Managers

( ) Suppliers

( ) Operatives

( ) Others (please specify)

C3 – refers to the introduction of new or improved methods of manufacturing for the last three years.

1 Yes

2 No

C4 – refers to the introduction of new or improved methods of manufacturing for the last three years.

( ) Replacement of existing machinery

( ) Re-organisation of process flow

( ) Re-organisation of workforce (e.g. increase and reduction)

( ) Re-scheduling of production workload

( ) Installation of equipment resulting in a higher level of automation

( ) Installation of equipment resulting in increased manufacturing flexibility

( ) Training leading to enhanced skills of operatives

( ) Improved system for stock control

C5 - refers to the list of ideas for process improvement program (including improvement and introduction) where act as counter that determine the source of ideas.

( ) Customers

( ) Marketing and sales people

( ) The Competitors

( ) Middle Managers

( ) Suppliers

( ) Operatives

( ) Others (please specify)

C6 – refers to in-house R&D undertaken in the organisation to increase the stock of knowledge and its use to create new and improved products and processes (including software development).

1 Yes

2 No

C7 – refers to external R&D activities which is similar activities as above but perform by other companies, public or private research organisation of purchased by the organisation.

1 Yes

2 No

C8 - refers to acquisition of other external knowledge such as purchase or licensing patent and non-patented invention and other types of knowledge from other organisation.

1 Yes

2 No

C9 – refers to internal and external training for personnel for new or improved products and processes.

1 Yes

2 No

Table 5.1
Summary of Respondents Profile

x	x	x	A1	A2	A3	A4	A5	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	C7	C8	C9
C	0	1	4	3	2	3	1	3	1	3	5	5	1	3	1	6	5	1	2	2	1
C	0	2	4	3	3	4	1	3	1	2	4	3	1	1	1	3	2	1	2	2	1
C	0	3	1	1	3	1	1	2	2	1	5	3	1	2	2	3	1	1	2	2	1
C	0	4	1	3	4	4	1	2	2	3	4	3	1	1	1	4	1	1	1	1	1
C	0	5	4	2	4	3	1	3	1	4	5	5	1	2	1	3	2	1	1	1	1
C	0	6	3	2	3	4	1	3	1	4	5	5	1	4	1	3	3	1	1	1	1
C	0	7	4	1	3	1	2	3	1	3	3	1	2	2	1	6	2	1	2	1	1
C	0	8	4	3	4	4	2	3	1	3	1	5	2	4	1	7	4	2	2	2	1
C	0	9	4	2	4	3	2	3	1	4	5	4	1	1	1	7	1	1	1	1	1
C	1	0	2	3	4	4	2	3	2	3	4	1	1	1	1	2	1	2	2	2	1
C	1	1	4	2	3	3	1	3	3	4	5	4	1	5	1	8	3	1	1	1	1
C	1	2	4	2	4	4	1	3	1	1	5	5	1	6	1	8	4	1	2	2	1
C	1	3	2	3	4	4	1	3	2	3	1	4	2	1	1	4	2	2	2	2	1
C	1	4	3	3	4	4	1	3	2	3	5	5	1	4	1	1	3	1	1	1	1
C	1	5	1	3	3	3	1	2	2	3	5	5	1	1	1	7	4	1	2	1	1
C	1	6	3	3	1	4	2	3	2	3	5	2	2	1	1	5	1	1	2	2	1
C	1	7	4	1	4	3	2	1	1	3	5	3	2	1	2	1	1	2	2	2	2
C	1	8	1	3	3	4	2	2	2	1	5	5	1	1	1	1	1	2	2	2	1
C	1	9	1	2	2	3	1	2	2	2	4	3	1	1	1	2	1	1	1	1	1
C	2	0	1	3	3	4	1	2	2	3	4	4	1	1	1	3	1	1	1	1	1
C	2	1	2	3	3	4	1	2	3	3	5	4	1	7	1	4	7	1	2	1	1
C	2	2	2	2	4	4	2	3	1	4	5	5	1	1	1	4	3	1	1	2	1
C	2	3	4	2	3	2	2	3	1	2	5	5	1	7	1	5	4	1	2	2	1
C	2	4	4	2	3	3	2	1	2	3	4	2	1	2	1	1	1	1	2	2	1
C	2	5	1	2	4	3	1	2	2	3	5	1	1	4	1	1	2	1	2	2	2
C	2	6	4	2	3	3	2	3	1	2	5	5	1	4	1	4	3	1	2	1	1
C	2	7	4	1	1	2	2	3	2	1	5	5	1	1	1	1	1	2	2	2	1
C	2	8	4	2	3	4	1	1	2	1	1	1	1	1	1	5	1	1	1	1	1
C	2	9	4	2	3	4	2	1	2	1	3	1	1	1	1	3	1	1	1	2	1
C	3	0	4	2	3	3	1	3	2	1	5	3	1	1	1	4	1	1	1	2	1
C	3	1	4	2	4	3	1	3	2	1	5	1	1	2	1	5	3	1	1	1	1
C	3	2	4	3	4	4	2	3	3	3	5	5	1	1	1	8	1	2	2	2	1
C	3	3	4	1	3	2	1	3	3	3	2	2	1	1	1	1	1	2	2	2	1

Table 5.1 *Continued*

x	x	x	A1	A2	A3	A4	A5	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	C7	C8	C9
C	3	4	4	2	3	4	2	3	1	3	5	4	2	1	1	3	2	2	2	2	1
C	3	5	4	3	4	4	1	3	1	4	4	4	1	1	1	5	2	1	1	2	1
C	3	6	4	3	4	4	1	3	1	4	3	1	1	3	1	4	2	1	1	1	1
C	3	7	4	1	3	3	1	2	1	4	5	4	1	1	1	1	1	2	2	2	1
C	3	8	4	1	3	1	2	2	2	3	3	2	1	1	1	4	3	2	2	2	2
C	3	9	1	3	4	4	1	2	3	1	5	3	1	3	1	3	2	1	2	2	2
C	4	0	4	1	3	2	1	3	3	3	5	5	1	1	1	1	1	2	2	2	1
C	4	1	4	1	3	2	2	1	2	3	3	1	1	2	1	4	1	2	2	1	1
C	4	2	3	2	1	3	1	1	2	3	4	1	1	3	1	8	3	1	2	2	1
C	4	3	4	2	3	3	1	3	1	4	5	4	1	5	1	1	1	1	2	2	1
C	4	4	4	1	3	2	2	3	2	3	5	5	1	5	1	8	4	1	1	1	1
C	4	5	4	3	4	3	2	2	2	3	5	4	1	3	2	3	3	1	2	2	2
C	4	6	4	2	4	3	1	1	2	3	3	1	2	1	1	3	2	2	1	2	1
C	4	7	4	1	4	2	1	2	2	4	3	1	1	1	1	1	2	1	2	2	1
C	4	8	2	3	4	4	2	3	2	3	5	4	1	7	1	5	3	1	1	2	1
C	4	9	4	2	4	4	2	2	1	3	5	5	1	1	1	6	1	1	2	2	1
C	5	0	4	3	1	4	2	2	3	3	5	4	2	3	1	2	2	2	2	1	1
C	5	1	4	3	4	3	2	3	1	4	5	5	1	2	1	8	3	1	1	1	1
C	5	2	4	3	4	4	2	2	2	3	4	1	2	1	1	6	4	2	2	2	2
C	5	3	4	2	4	3	1	3	2	3	5	3	1	5	1	4	5	1	1	2	1
C	5	4	2	3	4	4	2	2	2	3	5	3	1	3	1	5	3	2	2	2	1
C	5	5	4	1	3	2	1	1	2	3	4	2	1	4	1	3	3	1	1	2	1
C	5	6	2	3	4	4	1	1	2	3	5	2	1	2	1	8	2	1	2	2	1
C	5	7	4	3	2	4	1	3	2	1	5	5	1	7	1	3	7	1	1	1	1
C	5	8	4	1	3	2	2	1	2	4	1	1	1	1	1	1	1	1	1	1	1
C	5	9	4	1	3	1	2	1	2	3	2	2	1	1	1	2	1	1	1	2	1
C	6	0	2	3	4	3	2	3	2	3	5	4	2	1	1	2	1	1	2	2	1
C	6	1	4	1	3	2	2	1	2	4	4	3	2	2	1	3	3	2	2	2	1

Based on the above table, coding A1 represents the designated position of the respondents from the participating electrical and electronics companies. This is further showed by Table 5.2 where majority of the respondents (67 percent) are senior managers from the production, engineering and R&D department. The subsequent categories of the position are held by chief executive officer (13 percent), general manager (13 percent) and technical director (7 percent).

Table 5.2
Respondents Profile According to Designated Position

Respondent Position	**Frequency (n=61)**	**Percentage (%)**
Chief Executive Officer	8	13
General Manager	8	13
Technical Director	4	7
Senior Manager	41	67

The age of the respondent is represented by code A2. Table 5.3 indicated that 41 percent of the respondents were in the range between 46 and 55 years old. While 34 percent were in the range between 36 and 45 years old and 25 percent represents between 25 and 35 years old.

Table 5.3
Respondents Profile According to Age

Respondent Age	**Frequency (n=61)**	**Percentage (%)**
Between 25 and 35 years	15	25
Between 36 and 45 years	21	34
Between 46 and 55 years	25	41

Respondents' qualification is showed by code A3. Based on Table 5.4, a total of 88 percent respondents are qualified with degree and postgraduate degree while the remainders were the diploma (5 percent) and school certificate/ SPM and STPM (7 percent) holder.

Table 5.4
Respondents Profile According to Qualification

Respondent Qualification	**Frequency (n=61)**	**Percentage (%)**
School certificate / SPM and STPM	4	7
Diploma	3	5
Degree	27	44
Postgraduate Degree	27	44

As mention in the earlier section, code A4 represents the length of respondent's working experience. In Table 5.5, it is found that 44 percent respondents with above 20 years of working experience. This is followed by category between 10 and 20 years (33 percent); 16 percent with 5 to 10 years of experience and the least is 7 percent with less than 5 years of working experience.

Table 5.5
Respondents Profile According to Working Experience

Respondent Working Experience	Frequency (n=61)	Percentage (%)
Less than 5 years	4	7
Between 5 and 10 years	10	16
Between 10 and 20 years	20	33
Above 20 years	27	44

In terms of the respondent's involvement in the R&D or any innovation activities (Code A5), about 52 percent have involved while 48 percent did not involve directly. This is shown in Table 5.6. This is also in-line with explanation regarding that those who involved directly were the implementers' i.e. senior managers and technical director from R&D department, production, engineering and design. Senior position such as chief executive officer and general managers were the top management who manage and administer the whole organisation.

Table 5.6
Respondents Profile According to Involvement in R&D and Innovation Activities

Respondent Involved in R&D or innovation activities	Frequency (n=61)	Percentage (%)
Yes	32	52
No	29	48

The following discussion describes the respondents profile in terms of their company demographic information. The size of the electrical and electronics companies is based on the number of employees (Code B2). Definition on the size of organisation is referred according to the SME definition which is established by Small Medium Industries Development (SME Corp). As shown in Figure 5.1, a total of 52 percent of the companies have more than 151 employees which represents the large category. The second category contributes 28 percent of the respondents are companies with 51 to 150 employees (medium size) and the remainder is 20 percent of companies which have less than 50 employees (small size).

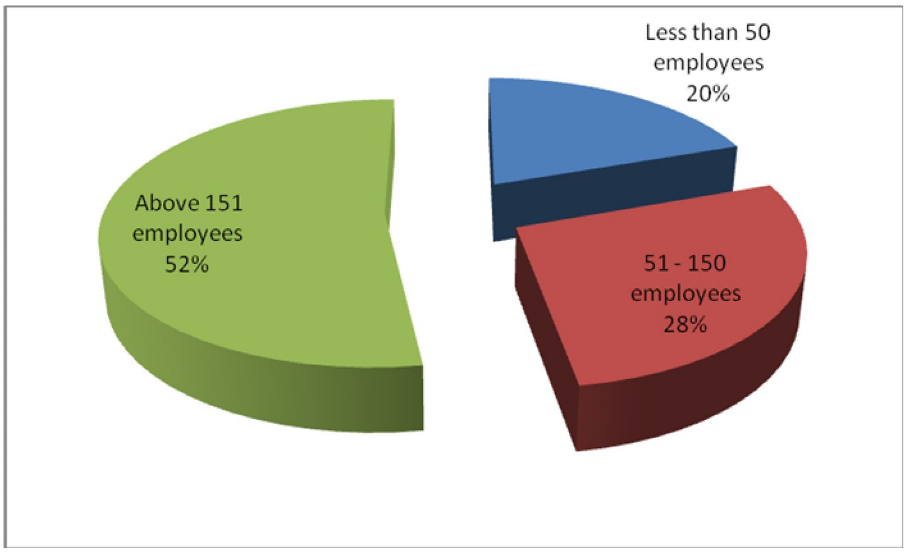

Figure 5.1
Respondents According to Number of Employees (Organisation Size)

This study is also further categorises the electrical and electronics companies according to percentage of ownership between foreign, local or joint-venture type. This information is key-in as code B3. In Figure 5.2, the finding indicates 35 companies (57 percent) are Malaysian, 19 companies (31 percent) are foreign and 7 companies (12 perncent) are the join-venture.

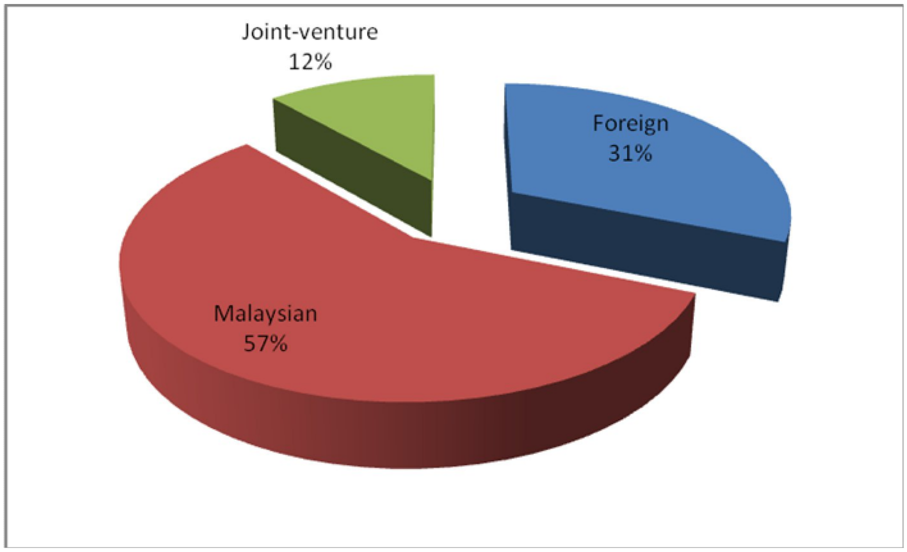

Figure 5.2
Respondents According to Ownership of Organisation

The electrical and electronics companies are also divided into four sub-sectors and information are coded as B4. This is in-line with the sub-sector definition provided by the Federation of Malaysian Manufacturers. Detail results of this categorisation are shown in Figure 5.3. Based on the findings, majority of the companies (56 percent) are the electrical, machinery and apparatus not classified elsewhere. While the second contributor is radio television and communication equipment and apparatus sub-sector (21 percent), third contributor is machinery and equipment not elsewhere classified sub-sector (16 percent) and the smallest category is reponded by the office, accounting and computing machinery sub-sector (7 percent). Therefore, it is noted that majority of the responded companies are dominated by the electrical sub-sectors as compared to electronic sub-sectors.

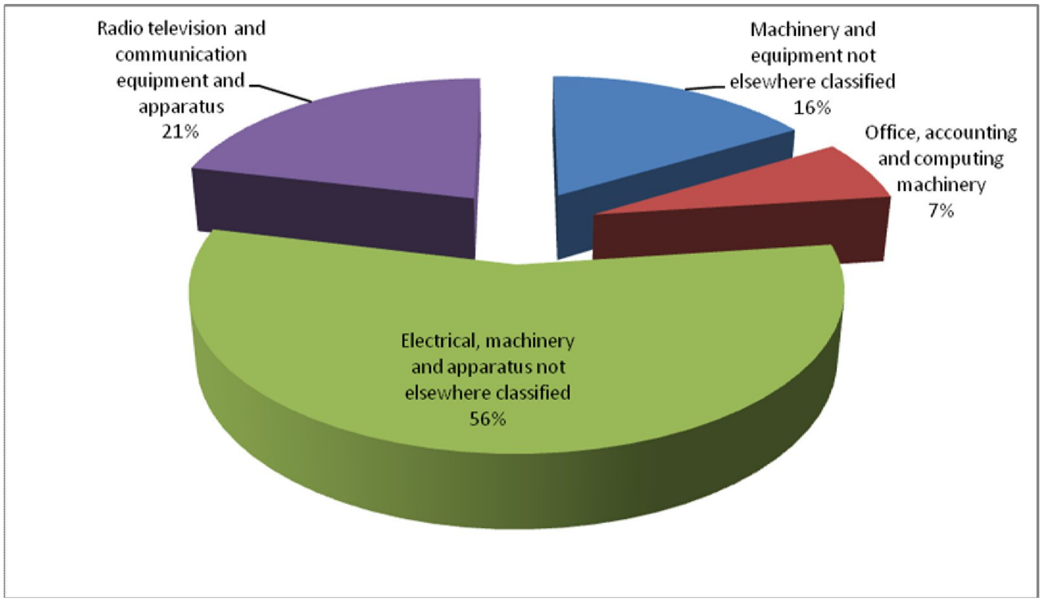

Figure 5.3
Respondents According to Electrical & Electronics Sub-sector

Another important questions posted to the respondents are the average sales per year (code B5) and average profit per year (code B6). Figure 5.4 indicates 61 percent of the companies earned above RM 10 million sales a year. About 18 percent of the companies earned between RM 5.1 million to RM 10 million, 11 percent earned between RM 1.1 million to RM 5 million per year and the balance are 3 percent companies with RM501,00 to RM 1 million and 7 percent companies with the least category of sales between RM100,000 to RM500,00 per year.

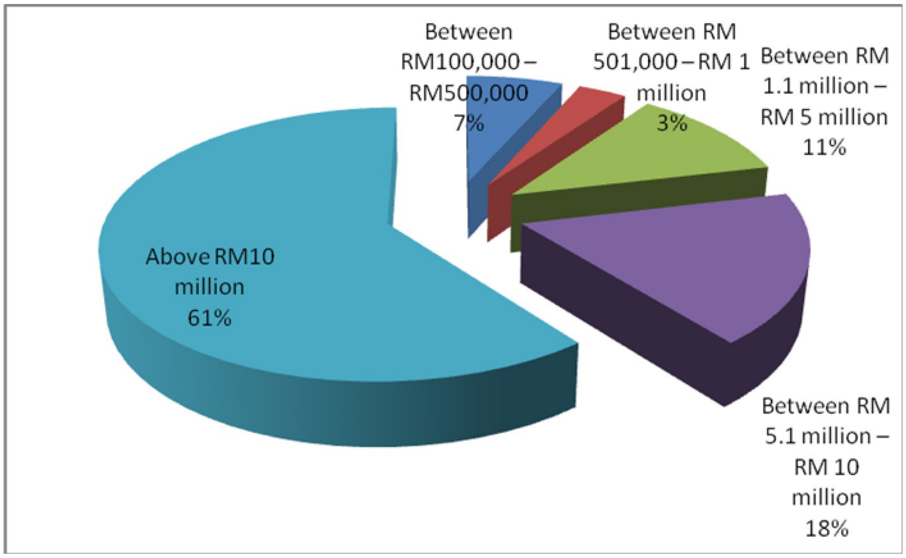

Figure 5.4
Respondents According to Sales Per Year

Consequently, in figure 5.5, the responded companies are assesed in terms of profit per year. From a total of 61 companies, 30 percent manage to make a yearly profit above RM10 million, 21 percent of the companies earned between RM5.1 million to RM10 million and 16 percent of the companies achieved between RM1.1 million to RM5 million profit per year. The remaining two category are 12 percent for those who achieved RM501,000 to RM1 million and 21 percent of the companies managed to achieve yearly profit between RM100,000 to RM500,000.

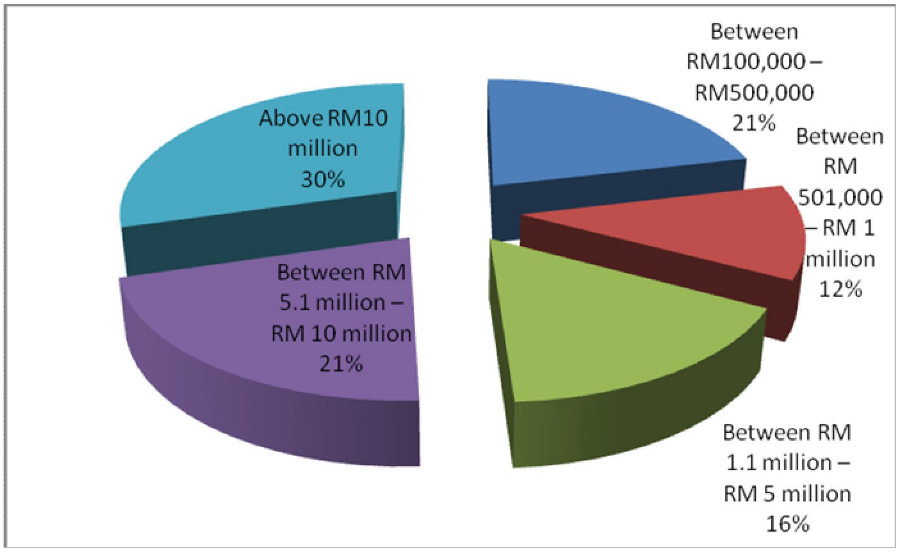

Figure 5.5
Respondents According to Profit Per Year

Questions with regards to product and process innovation is important for this study as this would relate to the innovation outcome which is one of the main variable identified in the theoretical framework. Table 5.7 indicates that 82 percent (50 companies) have introduced new or enhancement of existing product while 18 percent (11 companies) did not produced new product during the last three years.

Table 5.7
Respondents According to New Product Introduction

New product introduction in the organisation	Frequency (n=61)	Percentage (%)
Yes	50	52
No	11	18

The introduction of new product from innovation activities was initialy based on ideas contributed from various sources such as board of directors, customers, marketing and sales employees, competitors, middle managers, suppliers and operatives. Figure 5.6 illustrates the details. It is found that majority (49 percent) of the companies rely on only one source of ideas. About 15 percent generated ideas from two sources. Another 11 percent of the companies have three sources for ideas while the only small number of electrical and electronics companies utilise ideas from more than three sources: 10 percent with four sources, 6 percent with five sources, 2 percent with six sources and 7 percent with seven sources of ideas.

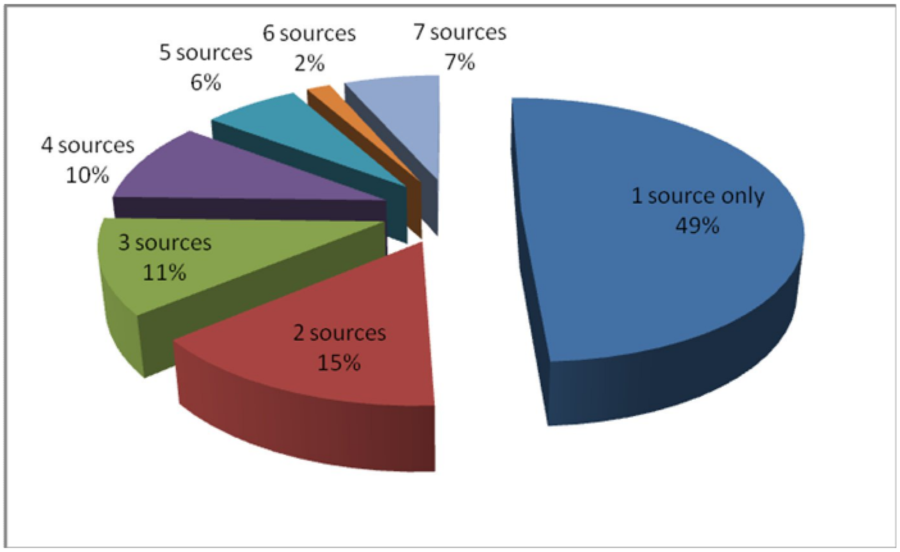

Figure 5.6
Sources of Ideas for Product Innovation in Electrical & Electronics Companies

Similarly, the innovation activity includes the process innovation as a result from introduction of new or improved method of manufacturing when producing goods and services. This question is represented by code C3. As shown in Table 5.8, from a total of 61 electrical and electronics companies, 95 percent (58 companies) have introduce new method from innovation activities while only 3 companies (5 percent) did not have any new methods for the last three years in operation. Furthermore, this study also found that the process innovation is slightly higher than product innovation when comparison made between Table 5.7 and Table 5.8.

Table 5.8
Respondents According to New Process Introduction

New process introduction in the organisation	Frequency (n=61)	Percentage (%)
Yes	58	95
No	3	5

Respondents were asked about what type of changes and how many of those changes have been establish for the new method (process innovation) in their companies. There are eight type of changes identified for this study as shown in Figure 5.7. These include replacement of exiting machinery, re-organisation of process flow, workforce, re-scheduling of production workload, installation of equipment resulting in a higher level of automation, installation of equipment resulting in increased manufacturing flexibility, enhanced skills of operatives and improved system for stock control. Findings indicate that 20 percent introduced one type of changes, 8 percent with 2 types of changes and 21 percent with three types of changes. The balance of them used more than three types of changes: 16 percent for four types, 12 percent for five types, 7 percent for six to seven types, 5 percent for seven types and 11 percent for eight types of changes.

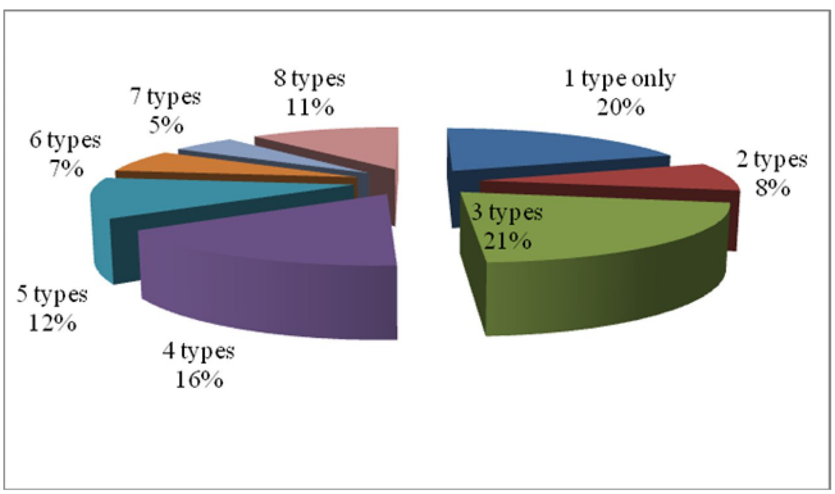

Figure 5.7
Type of Changes for Process Innovation in Electrical & Electronics Companies

The ideas for process improvement initially came from multiple sources similar as in product innovation. Figure 5.8 shows that 40 percent of the companies were only rely on one source of idea and 21 percent rely on two sources of ideas. The remaining of electrical and electronics companies utilised more than two sources of ideas: 23 percent (3 sources), 10 percent (4 sources), 3 percent (5 sources), 3 percent (7 sources).

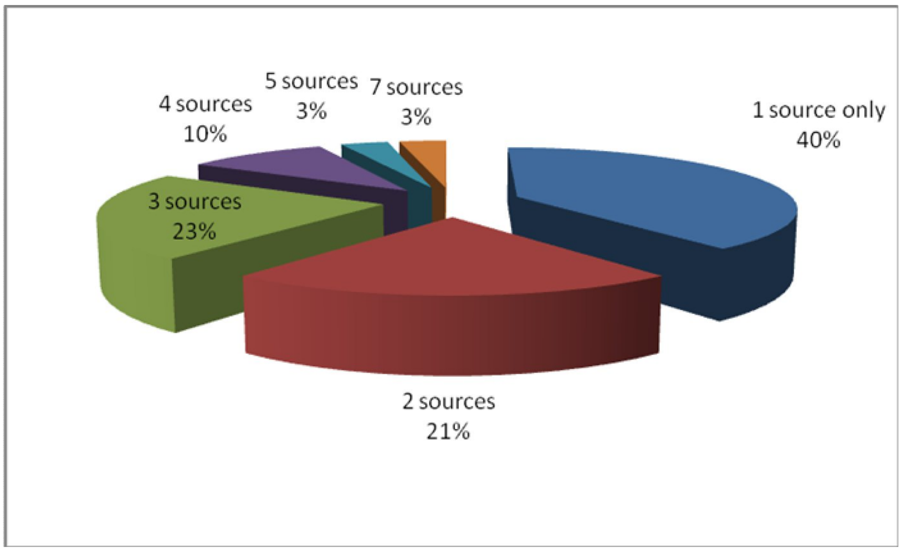

Figure 5.8
Sources of Ideas for Process Innovation in Electrical & Electronics Companies

The concluding questions of this section cover the engagement of innovation activities in their company for the last three years. Based on the previous explaination, these activities are key-in as C6 (In-house R&D), C7 (External R&D), C8 (Aquisition of other external knowledge) and C9 (Internal and external training). Table 5.9 indicates that 70 percent of the companies have undertaken an in-house R&D and 90 percent are doing well with the internal and external training for personnel for the new product and process innovation. It is noted that 8 companies represent the small size, 12 medium size companies and 24 is the large size companies. As for the internal and external training, there was 11 small size companies, 12 for medium size and 32 for the large size. However, the figure is quite low for innovation activities that involved external R&D outside their organisation that involved research and aquisition of external knowledge such as patent and non-patented invention. As mention in the above table, only 39 percent of the companies engaged in erternal R&D activities and 34 percent of the companies involved in aquisition of external knowledge. There were only 6 small sizes, 3 medium sizes and 15 large sizes involved in external R & D activities. The portion is also small for acquisition of other external knowledge where 3 companies are the small size, 6 companies medium size and 12 companies the large size.

Table 5.9
Respondents According to Engagement of Innovation Activities

Innovation Activities	**Category**	**Frequency (n=61)**	**Percentage (%)**
In-house R&D	Yes	43	70
	No	18	30
External R&D	Yes	24	39
	No	37	61
Acquisition of other external	Yes	21	34
knowledge	No	40	66
Internal and external training	Yes	55	90
	No	6	10

5.3 Goodness of Fit

A common data analysis measurement model requires an acceptable goodness-of-fit and specific evidence of construct validity where it shows how well the specified model fits the data (Hair et al., 2010). Similar to this approach, application of the Rasch Model demands researcher to establish the goodness-of-fit however, instead of model fits the data, it needs to show how well the data fits the model (Bond & Fox, 2007). In this context the data have to fulfil principle to test whether data is measured on a linear interval scale particularly in a cumulative response process (Azrilah, 1996). Some common essential aspects of Rasch analysis are used such as its internal consistency through the Polytomous Model (PRM) fit statistics and the Person Separation Index for the reliability of the scale (Bond & Fox, 2007). Before analysis goodness-of-fit is undertaken, some requirements are needed especially data cleaning, screening and diagnostic of the rating scale used in this study.

5.3.1 Data Cleaning and Screening

Following the data collection, the first stage is to screen the data in order to detect the error in coding, inputs and missing data. The Winsteps 3.6 software manages to obtain the missing data and output from this software is shown in Table 5.10. In this table, the category label refers to six response points of rating scale from 1 to 6. Each of the items is tabulated in the form of frequency of respondents on the categories. It is found that the total results reported are 7076 with 116 items from 61 respondents. The software has indentified 5 missing data which accounted for 0.07 % from the overall data.

It is noted that there are also no error in data entry found in the category score. According to Rasch approach, data missing at random have minimal impact, do not bias on estimated measures and also can be accommodate through Winsteps software (Linacre, 2006). Since the missing data is minimal which under 10 percent, it can be ignored because the allowances for missing data are inherent in the technique used (Hair et al., 2010). Therefore, data collected from this study considered clean and it is ready for the next stage analysis.

Table 5.10
Frequency of Responses

Category Label	Category Score	Observed Count	Percentage (%)
1	1	52	1
2	2	302	4
3	3	1113	16
4	4	2179	31
5	5	2546	36
6	6	879	12
Missing		**5**	**0**

5.3.2 Rating Scale Diagnostic According to Rasch Model

This study applies the interval scale with an ascending order. The interval scale enables the responses to be placed at a unit of measurement that allows the responses to be place at equal distance of the variable (Kumar, 2011). An interval scale with 6 point rating scale is applied where respondents indicate their agreement or disagreement on each statements that represented the variable of the study. The following is the 6 point rating scale:

Strongly Disagree 1-------2------ 3------ 4 ------ 5------ 6 **Strongly Agree**

As mentioned in Chapter 4, rating scale is most common research tool to show the evaluation of instruments and psychological test (Tatum, 1998). Rating scale is also a defined format that communicates between respondents and the questionaire in the form of shared language of specified options (Lopez, 1995). It is crucial to determine that the rating scale is acceptable because in reality they are only raw scores and respondents rating choices are not equal (Tatum, 1998). Since the rating scale applied in this study is interval type, hence it has the properties of an ordinal scale with arbitrary starting and terminating point (Kumar, 2011). Therefore, a constructive analysis of rating scale is needed so that data could represent a useful meaning from the repondents (Lopez, 1995).

According to Rasch measurement model, this issue can be solved by ‘Rasch Logit Ruler’, where the responses with regards to agreement or disagreement can be expressed as logarithm of the odd probabilistic value (Azrilah, 1996). As showed in Figure 5.9, responses can be created with equal interval separation between log odd units on the logit unit measurement ruler (Azrilah, 1996). Hence the logit unit has described the respondents measured attribute or ability for this study.

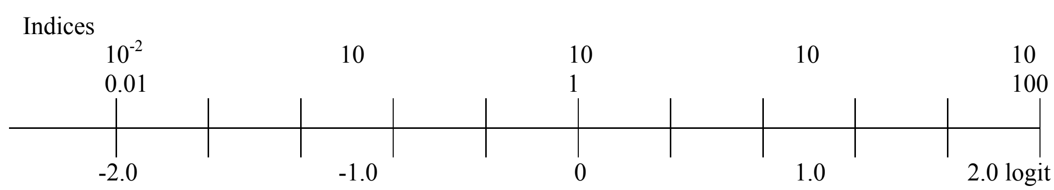

Figure 5.9
Log odds unit ruler

Consequently, the next process is to ensure on whether the 6 point rating scale used in this study operated according to proper function. As suggested by Linacre (2002) this study uses some basic guidelines and the visual method to produce the rating scale that qualified the optimal number of response categories. The basic guidelines adopted in this study are observed count, observed average and structure calibration.

From table 5.11, the observed count for each rating category is found to be more than 10 observations which fulfil the minimal number of response per category (Bond &

Fox, 2007).The observed average shows that higher rating category producing higher logit measures. Hence, the average measures advance monotonically with category (Linacre, 2002). At the structure calibration column, it is noted that the thresholds has increase at least by 1.07 logits (2.61 logit – 1.54 logit) and but not more than 5 logits. For rating scale which is more than 3 point category rating scale, this means that it has achieved a good calibration that will not degrade the rating scale as intended measures (Linacre, 2002)

Table 5.11
Summary of Category Structure

Category Label	**Category Score**	**Observed Count**	**Percentage (%)**	**Observed Average**	**Structure Calibration**
1	1	52	1	-.05	NONE
2	2	302	4	0.51	-2.61
3	3	1113	16	-0.01	-1.54
4	4	2179	31	0.87	-0.19
5	5	2546	36	1.70	1.12
6	6	879	12	2.67	3.22

The visual method is shown through the probability curves. This curve refers to probability of endorsing a given rating scale for every difference between agreeability and endorsability (Bond & Fox, 2007). Figure 5.10 illustrates the probability curves for 6 category rating scale. It is noted that each category has distinct peak and indicates most probable response category of some portion of the measured variable. Therefore, from the above discussions with regards to basic guidelines and visual display, it is suffice to acknowledge that this 6 point rating scale is accepted for this study.

```
P      -+-----+-----+-----+-----+-----+-----+-----+-----+-----+-
R  1.0 +                                                       +
O      |                                                       |
B      |                                                       |
A      |                                                     66|
B   .8 +1                                                  66  +
I      | 1                                                6    |
L      |  11                                             6     |
I      |    1                                          66      |
T   .6 +     1                               55       6        +
Y      |      1                           555  555   6         |
    .5 +       1                         5        556          +
O      |        12222    33333   44444455          65          |
F   .4 +       221   2233     3*4     544         6  55        +
       |     22   1   322     4 3    5   4       6     5       |
R      |   22      133   2  44   3  5     4    66       55     |
E      |  2        31     2*      3*       44 6           5    |
S   .2 +22        3  1    4 2     5 3        *             55  +
P      |        33    1 44   2  55   33    66 44             55|
O      |      33      4*1     **2      3366     444            |
N      |  3333     444   11**5   222 66663333      4444        |
S   .0 +*******************66**********************************+
E      -+-----+-----+-----+-----+-----+-----+-----+-----+-----+-
       -4    -3    -2    -1     0     1     2     3     4     5
        Person [MINUS] Item MEASURE
```

Figure 5.10
Category Probabilities: Modes-Structure Measures at Intersections

5.3.3 Reliability

Before further interpreting the data, items for each of the variable used in the study must be inspected for validity and reliability. This is shown via summary statistics for items and persons in Table 5.12. Summary is based on a total of 7071 data points were analysed with yield of log likelihood Chi-Square of 15939.63 with 6891 degree of freedom (d.f.) at p=0.0000.

Table 5.12
Summary of 61 Measured Person

	Total Score	Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	503.5	115.9	1.19	0.12	1.02	-0.50	1.01	-0.6
S.D	76.0	0.6	1.11	0.01	0.56	3.9	0.54	3.8
Max	641.0	116.0	3.62	0.17	2.70	9.0	2.79	9.4
Min	307.0	111.0	-1.31	0.11	0.28	-8.4	0.28	-8.4

Separation 7.98
Person Reliability 0.98

Cronbach Alpha (KR-20) Person Raw Score Reliability = 0.99

According to Linacre (1997) reliability is the index of relative reproducibility and this is applied on item reliability index and person reliability index. Reliability according to Rasch is similar concept to the traditional reliability of cronbach alpha i.e., to measure the internal consistency. Table 5.12 revealed that the Cronbach Alpha value was 0.99 which indicates very high reliability in measuring the interaction between respondents and items in the respective dimensions: Leadership (LD), Managerial Levers (ML), Business Processes (BP), Innovation Process (IP), Innovation Outcome (IO) and Firm Performance (FR).

The person reliability is also high at 0.98 indicates it is high tendency replicability of person if this sample of persons were given a similar set of items that measured same construct (Bond & Fox, 2007). This has provided confidence in the ability of estimates and inquiry that some person score higher and some score lower which establish consistency. Item separation index of 7.98 indicates that person can be separated into eight ability strata.

Table 5.13
Summary of 116 Measured Item

	Total Score	**Count**	**Measure**	**Model Error**	**Infit**		**Outfit**	
					MNSQ	**ZSTD**	**MNSQ**	**ZSTD**
Mean	264.8	61.0	0.00	0.17	1.00	-0.1	1.01	-0.1
S.D	20.3	0.2	0.57	0.01	0.33	1.7	0.34	1.8
Max	315.0	61.0	1.24	0.20	2.46	6.0	2.46	6.0
Min	217.0	60.0	-1.59	0.15	0.51	-3.3	0.52	-3.2

Separation 3.04
Item Reliability 0.90

Table 5.13 indicates the item reliability index of 0.90 which is also high. In this context, when items are given to another sample of the same group it could be replicable. This also means that the items are stable and sufficient for some items are difficult and some are easier to response and thus have established consistency. Item separation index of 3.04 indicates that items can be separated into three difficulty strata. Comparison between person ability and item difficulty is measured from the length of the logit ruler. It is noted that measures for item ruler length from Table 5.13 is 2.83 logit (1.24 + 1.59) against person ruler of 4.93 logit (3.62+1.31) in Table 5.12. This gives an overall overview that person ability spread over 4.93 logit whilst the item difficulty measured is shorter. Therefore, it shows that for this study, respondents are able to respond to most of the items. In summary, the reliability for both indexes has provided a line of inquiry and finally this will be meaningful inference for researcher in undertaking the analysis before further analyse the fit statistics.

5.3.4 Validity and Fit Statistics

Validity is a fundamental concept for a variable and this will determine the accuray of intended concept for a study (Wright & Stone, 1999; Zikmund et al., 2010). In the traditional statistical method, there are three types of validity: content validity, criterion validity and construct validity. This similar concept is also applicable in Rasch however from different perspective. According to Rasch analysis, successful realisation of a variable results from its real representation in data. Therefore, two types of validity measured for this study are the order validity and the fit validity (Wright & Stone, 1999). The item order validity covers the content and constructs validity as in the common statistics. In this context, validity is derived from difficulty order of items that define the variable meaning (content and construct validity) while the ability order of person responded determine the variable utility. This means that it fulfil the criterion validity.

The fit validity is a quantitative validity which is diagnosed by fit statistics (Bond & Fox, 2007). The fit statistics provide a guide to the measurement process by detecting a situation on the lack of fit and too good fit. Fit statistics are important since Rasch requires that a complete analysis must show the evaluation of how well the data fits the essential specification. The lack of fit will identify inconsistency between our aim and the results and too good fit discovers doubtful situation (too good to be true) (Wright & Stone, 1999).

Analysis through fit statistics will show the extent to which data can be used to construct measures. In this context, fit statistics will monitor the responses of persons and items and be the quality control technique in validating the responses (Wright & Stone, 1999). In evaluating fit statistics for this study, data must fulfil three criteria: point measure correlation (PTMEA CORR), outfit mean square (MNSQ) and outfit Z-standard (ZSTD) (Bond & Fox, 2007) and (Azrilah, 1996).

Point measure correlation refers to correlation between observations in the data and measures of items or persons. The outfit mean square means an outlier-sensitive fit with regards to items and persons responses. This indicator shows the amount of distortion in measuring instruments. The standardise fit statistics of ZSTD are t-test of the hypothesis to show the significance of data to fit with the Rasch model (Azrilah, 1996). The ranges of these criteria are as follows:

a) Point measure correlation: 0.4 < PTMEA CORR value < 0.80

b) Outfit mean square: 0.5 < MNSQ value < 1.5

c) Outfit Z-standard: -2 < ZSTD value < +2

Based on the above criteria, six variables (leadership, managerial levers, business processes, innovation process, innovation outcome and firm performance) used in the study will be scrutinized according to the accepted range. When fit is within the guidelines of the study, data will fulfil the fundamental requirement for measurement (Wright & Stone, 1999).

5.3.4.1 Leadership

Leadership is the first dimension that correspond to the antecedents of innovation in this study. There are 8 items identified which focus on abilities, skills and competencies that appropriate for undertaking innovation process. Table 5.14 describes the overall findings with regards to leadership.

Table 5.14

Descriptive Statistics for Leadership

	Item		
	Measure	**Outfit**	
		MNSQ	**Zstd**
Mean	-0.41	0.99	0.0
Standard Deviation	0.21	0.15	0.8
Maximum	-0.20	1.23	1.32
Minimum	-0.77	0.78	-1.2
Separation	0.59		
Reliability	0.53		

The value for item mean with of the organisations with regards to leadership is -0.41 logit with a standard deviation of 0.21 logit. Items are located between the minimum value of -0.77 logit and maximum value of -0.20 logit. The value of outfit ZSTD is located between -1.2 logit and 1.32 logit, within the acceptance area of 95 % confidence interval. As mention earlier, the quality data need to fulfil Rasch requirements fit, through three criteria: PTMEA CORR, Outfit MNSQ and Outfit ZSTD (Azrilah, 1996; Bond & Fox, 2007). Based on Figure 5.11, all leadership items are within the acceptance level of 95% confidence interval. From the figure, Group Characteristic Curve (GCC) is the ogive-shape plot of probabilities of a correct response for leadership items. Table 5.15 provide the details of the item measures.

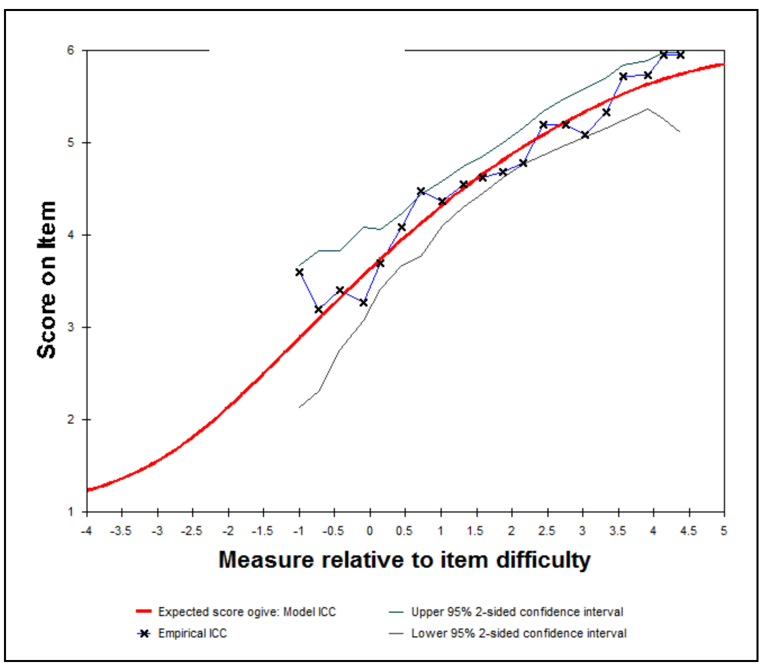

Figure 5.11
GCC Graph for Leadership

Table 5.15
Leadership – Item Measures

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
LD7	-0.20	0.90	-0.5	0.61
LD8	-0.23	1.07	0.5	0.60
LD6	-0.37	0.79	-1.2	0.69
LD1	-0.46	1.03	0.2	0.65
LD2	-0.61	0.78	-1.2	0.70
LD5	-0.61	1.12	0.7	0.52
LD4	-0.74	1.03	0.2	0.54
LD3	-0.77	1.23	1.3	0.59

Based on Table 5.15, all items for leadership have met the three criterias of fit. The value of oufit MNSQ is between 0.50 and 1.50. The value of outfit ZSTD is within the range of -2 and 2. The items also satisfy the point measure correlation with values above 0.40 and less tha 0.80. Therefore, there will be no deletion for the unfit items. Items for leadership are fit for analysis and 8 items are maintain for this study. All items have negative logit values and it it clear indication that these items are easy items which located on the lower end continumm in the person-item variable map.

5.3.4.2 Managerial Levers

The managerial levers is the second dimension of antecedent variables. This dimension is represented by five sub-dimension that include strategy, structure, resource allocation, knowledge management and organisational learning and culture. Therefore, there are a total of 34 items that described this variable.

Table 5.16
Descriptive Statistics for Managerial Levers

	Item		
	Measure	**Outfit**	
		MNSQ	**Zstd**
Mean	0.00	1.15	0.7
Standard Deviation	0.73	0.30	1.5
Maximum	1.24	2.14	5.0
Minimum	-1.59	0.68	-2.0
Separation	3.84		
Reliability	0.94		

Table 5.16 indicates the examination of three fit criteria for managerial levers. It is noted that minimum and maximum outfit MNSQ value is between 0.68 logit and 2.14 logit while outfit ZSTD value is between -2.0 logit and 5.0 logit. Both indicators are beyond the fit criteria where some items are located outside the 95% confidence interval. Figure 5.12 shows the misfit items through GCC (Bond & Fox, 2007). As shown in Table 5.17, there are 5 items from 34 items did not qualified for quality data criteria. Therefore, these items are misfits and it is suggested for deletion to improve analysis on the items (Green & Frantom, 2002). From table 5.17 items that need to be deleted are ML9, ML10, ML11, ML19 and ML22.

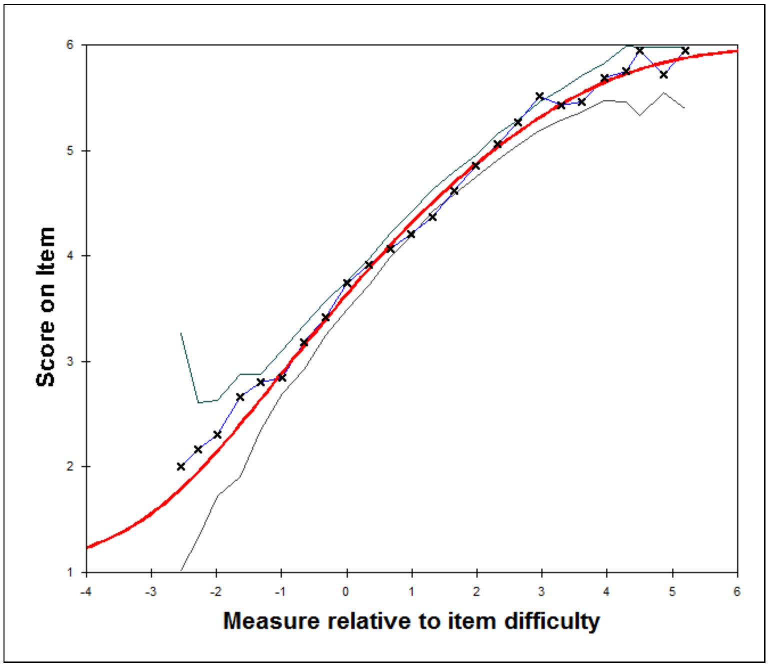

Figure 5.12
GCC Graph for Managerial Levers

Table 5.17
Misfits Items of Managerial Levers

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
ML19	1.24	2.14	5.0	0.31
ML10	1.07	1.65	3.2	0.57
ML9	1.05	1.43	2.2	0.59
ML11	0.78	1.64	3.1	0.56
ML22	0.16	1.75	3.5	0.48

After the 5 items have deleted, Table 5.18 below indicates that outfit MNSQ for the items have improved and located between 0.74 logit and 1.43 logit. Similarly to outfit ZSTD, the value is in the range between -1.6 logit to 2.0 logit. However, the separation and item reliability slightly reduced as compared to the previous Table 5.16.

Table 5.18
Descriptive Statistics for Managerial Levers After Deletion

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	-0.04	1.10	0.5
Standard Deviation	0.71	0.19	1.0
Maximum	1.09	1.43	2.0
Minimum	-1.56	0.74	-1.6
Separation	3.64		
Reliability	0.93		

5.3.4.3 Business Processes

Business processes is the third dimension of this study. It refers to a set of connected activities between people and process involved which will drive innovation process of an organisation. There are two sub-dimensions involved: process alignment and people involvement. The sub-dimensions are represented by 22 items.

Table 5.19
Descriptive Statistics for Businesses Processes

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	-0.02	0.79	-1.3
Standard Deviation	0.41	0.20	1.3
Maximum	0.61	1.45	2.3
Minimum	-0.87	0.52	-3.2
Separation	2.21		
Reliability	0.83		

Table 5.19 indicates that the outfit MNSQ value for business processes items have met the specified range within 0.52 logit and 1.45 logit. This dimension however, failed to fulfil the outfit ZSTD criteria. It is noted that the ZSTD value is more than ± 2. Further investigation is needed to check on the items which are unfit to the meet the model condition. From the GCC graph (Figure 5.13), it was found that there are items that placed outside the 95% confidence level and there were 5 misfits items identified from Table 5.20. These items are represented by BP 22, BP5, BP2, BP16, and BP15. Although the misfit items are in the range of 0.40 logit to 0.80 logit in terms of point measure correlation, most of the ZSTD values are less than -2.0. Therefore these items are over fit while the fit statistics are too low to meet the Rasch model's expectation (Bond & Fox, 2007). After reviewing the misfit items, the decision was to delete 5 from 22 items of the business processes dimensions.

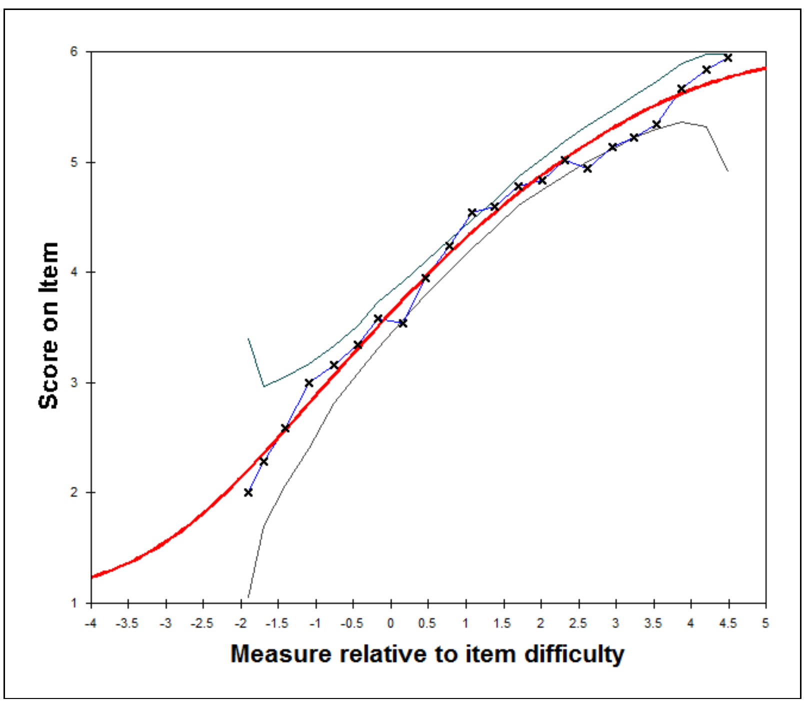

Figure 5.13
GCC Graph for Business Processes

Table 5.20

Misfits Items of Business Processes

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
BP22	0.61	1.45	2.3	0.48
BP5	0.40	0.52	-3.2	0.75
BP2	0.37	0.58	-2.7	0.75
BP16	0.11	0.58	-2.7	0.73
BP15	-0.11	0.59	-2.7	0.73

The following Table 5.21 below, provides the new result for business processes dimension after deletion treatment on 5 misfit items. Both MNSQ and ZSTD are in the specified range of fit statistics and there is also a small improvement in terms of item separation from 2.21 logit to 2.27 logit and item reliability increased from 0.83 logit to 0.84 logit.

Table 5.21

Descriptive Statistics for Business Processes After Deletion

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	0.01	0.84	-0.8
Standard Deviation	0.43	0.14	0.6
Maximum	0.71	1.10	0.6
Minimum	-0.81	0.67	-2.0
Separation	2.27		
Reliability	0.84		

5.3.4.4 Innovation Process

Innovation process is the fourth dimension of the study. It consists of activity which include six sub-dimensions: idea generation, idea mobilisation, advocacy and screening, experimentation, commercialisation and finally diffusion and implementation. Due to the list of activities, these sub-dimensions are represented by 29 items. Table 5.22 below indicates the descriptive statistics of the dimension.

Table 5.22
Descriptive Statistics for Innovation Process

	Item		
	Measure	**Outfit**	
		MNSQ	**Zstd**
Mean	0.28	0.90	-0.7
Standard Deviation	0.33	0.27	1.6
Maximum	0.71	1.56	2.8
Minimum	-0.58	0.53	-3.2
Separation	1.70		
Reliability	0.74		

The mean value for items under innovation process dimension is 0.28 logit with standard deviation of 0.33 logit. The minimum and maximum value for innovation process items are between -0.58 logit and 0.71 logit respectively and this shows that there are easy as well as difficult items with regards to innovation process. The separation index is at 1.70 logit while item reliability is only 0.74 logit. As for the fit statistics, Table 5.22 shows that the MNSQ value is more than 1.5 logit while ZSTD value is in between -3.2 logit and 2.8 logit. Hence, both indicators did not accomplish the fit criteria and this demand further inspection on each of the innovation process items for the misfit condition. Figure 5.14 shows the GCC graph of innovation process response function and data which deviate from the specified model. The details are further explored through the misfit items in Table 5.23.

It is found that two items (IP27 and IP18) have more MNSQ outfit of more than 1.5 logit and 7 items with ZSTD value between -3.1 and 2.8 logit. According to Azrilah (1996), MNSQ value that greater than 1.0 is considered as 'noise' and data is under fit the model while the ZSTD value less than 0.0 indicates too predictable. It is also noted that three of the items (IP22, IP19 and IP24) exceed more than 0.80 logit for point measure correlation. Due to the high value of ZSTD, the data would be lack of predictability(Azrilah, 1996). Hence these misfit items are decided to be deleted.

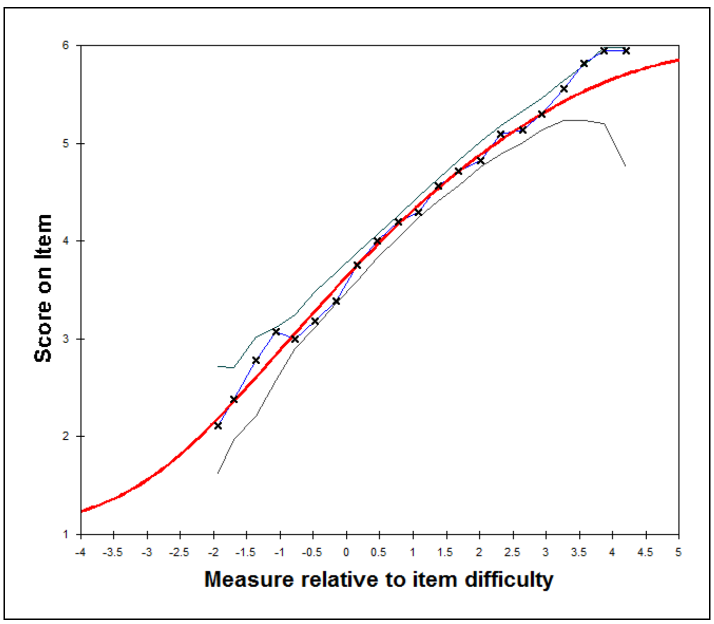

Figure 5.14
GCC Graph for Innovation Process

Table 5.23

Misfits Items of Innovation Process

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
IP20	0.40	0.63	-2.4	0.79
IP22	0.38	0.53	-3.1	0.81
IP10	0.32	0.61	-2.5	0.75
IP19	0.32	0.53	-3.2	0.84
IP27	0.32	1.56	2.8	0.48
IP18	0.11	1.45	2.3	0.54
1P24	-0.03	0.60	-2.6	0.82

Table 5.24

Descriptive Statistics for Innovation Process After Deletion

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	0.40	0.99	-0.1
Standard Deviation	0.40	0.22	1.2
Maximum	0.88	1.48	2.0
Minimum	-0.50	0.73	-1.6
Separation	2.04		
Reliability	0.81		

The items deletion have improved the analysis. Based on Table 5.24, after deletion, there are 22 items fit for innovation process dimension. The MNSQ value is in positioned between 0.73 logit and 1.48 logit while the ZSTD value range is between -1.6 logit to 2.0 logit. It is also noted that the separation measure improved to 1.99 logit and reliability increased from 0.74 logit to 0.81 logit.

5.3.4.5 Innovation Outcome

The fifth dimension is innovation outcome. This dimension refers to the achievement of organisation innovativeness which comprise product innovation and process innovation. It is represented by two sub-dimensions which consist of 18 items. Table 5.25 indicates the finding related to innovation outcome.

Table 5.25
Descriptive Statistics for Innovation Outcome

	Item		
	Measure	**Outfit**	
		MNSQ	**Zstd**
Mean	-0.31	1.12	0.40
Standard Deviation	0.53	0.48	2.2
Maximum	1.00	2.46	6.0
Minimum	-1.14	0.70	-1.8
Separation	2.64		
Reliability	0.87		

Table 5.25 above clearly indicates that the MNSQ Outfit value and ZSTD Outfit value are not meeting the quality control criteria for the fit statistics. Both indicators are highly beyond the specified logit of 1.5 logit for MNSQ value and 2.0 logit for the ZSTD. From figure 5.15, the GCC graph indicates that there is one misfit item located far from the 95% confidence level. Table 5.26 lists four misfit items: IO1, IO9, IO2 and IO10 which is potential for deletion. Due to high logit value of ZSTD, these items are deleted in order to ensure that data is fit to the specified model.

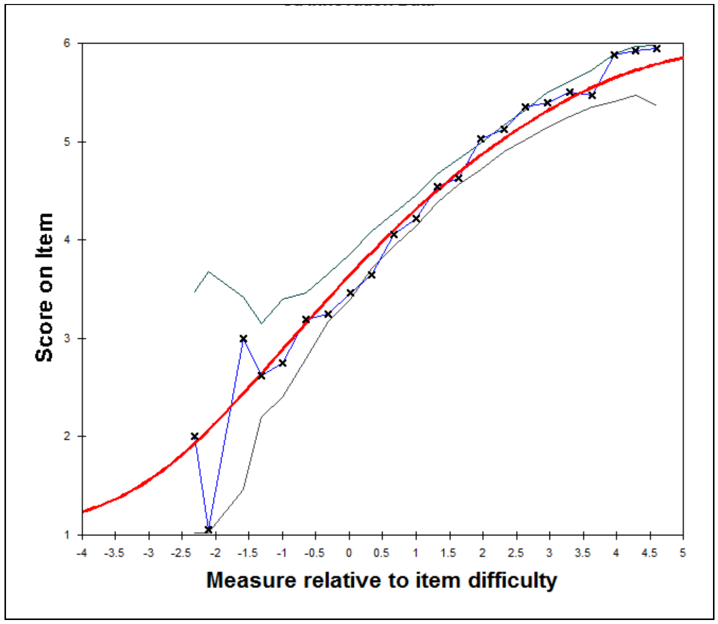

Figure 5.15
GCC Graph for Innovation Outcome

Table 5.26
Misfits Items of Innovation Outcome

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
IO1	1.00	2.46	6.0	0.43
IO9	0.32	1.90	4.1	0.53
IO2	0.16	1.42	2.2	0.68
IO10	0.00	1.98	4.4	0.56

Table 5.27 below shows the new result for innovation outcome with 14 measured items. The deletion task has improved the fit statistcs criteria. MNSQ Outfit value is between 0.70 logit and 1.37 logit while the ZSTD Outfit value is between -1.8 logit and 1.9 logit. Although the standard deviation value decreases from 0.53 to 0.41, the item separation and reliability have reduced to 1.94 and 0.79 respectively.

Table 5.27

Descriptive Statistics for Innovation Outcome After Deletion

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	-0.42	0.94	-0.3
Standard Deviation	0.41	0.17	0.9
Maximum	0.29	1.37	1.9
Minimum	-1.09	0.70	-1.8
Separation	1.94		
Reliability	0.79		

5.3.4.6 Firm Performance

Firm performance is the last dimension that need to be carry out handle for fit analysis. This dimension is related to measuring performance of this study. There are five items contributed to firm performance.

Table 5.28

Descriptive Statistics for Firm Performance

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	0.42	1.28	1.5
Standard Deviation	0.16	0.22	1.1
Maximum	0.63	1.55	2.7
Minimum	0.14	0.99	0.0
Separation	1.20		
Reliability	0.72		

Table 5.28 indicates the mean value for firm performance item is at 0.42 logit with standard deviation of 0.16 logit. The minimum value is 0.14 logit and maximum value for the item is at 0.63 logit. It also shows the value for MNSQ is between 0.99 logit and 1.55 logit and the ZSTD value is between 0.0 logit and 2.7 logit. The condition has created 'noise' that makes data underfit the model due to the MNSQ value greater than 1.0. As the ZSTD is greater than 2.0 logit, some items are located outside the 95% confidence level. Figure 5.16 potrays the misfit items far from the acceptance limit. As shown in Table 5.29, it is noted that two items failed to meet the specified Rasch criteria are item FR4 and FR2. Therefore it is decided to be deleted.

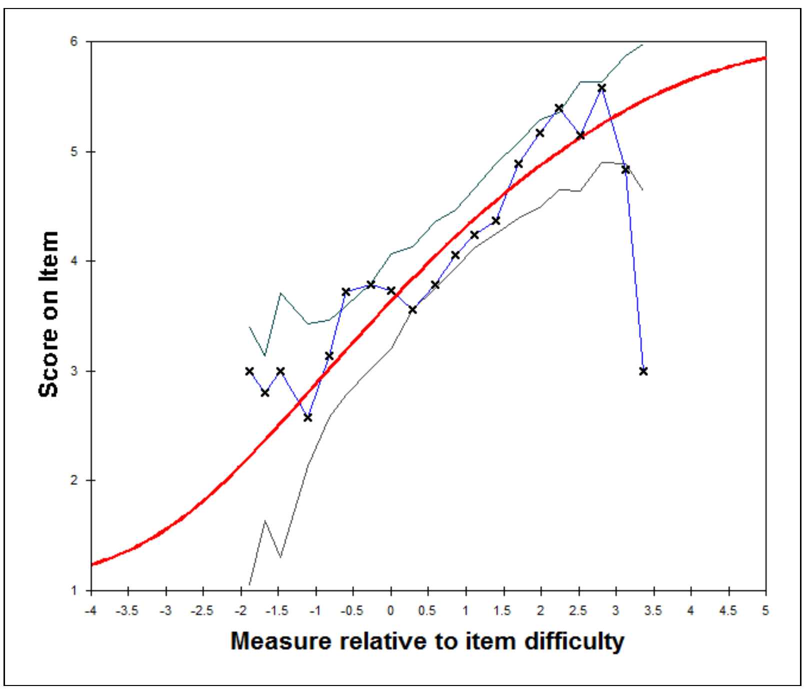

Figure 5.16
GCC Graph for Firm Performance

Table 5.29
Misfits Items of Firm Performance

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
FR4	0.64	1.55	2.7	0.53
FR2	0.14	1.42	2.2	0.57

Table 5.30 below, shows the new result for firm performance dimension after excluding misfit items. The standard deviation was small and it is reduced to 0.06 logit. The MNSQ Outfit is located within the specified range of 1.08 logit to 1.48 logit while ZSTD Oufit value is located between 0.5 logit to 2.0 logit. Therefore, the variable has achieved the Rasch fit criterias.

Table 5.30
Descriptive Statistics for Firm Performance After Deletion

	Item		
	Measure	Outfit	
		MNSQ	Zstd
Mean	0.59	1.28	0.8
Standard Deviation	0.06	0.20	0.9
Maximum	0.66	1.48	2.0
Minimum	0.52	1.08	0.5
Separation	1.25		
Reliability	0.74		

5.3.4.7 Summary of Items Fit

Following the data cleaning and fit statistics test, a total of earlier 116 items have been reduced to 93 items. Based from the six dimesions: leadership, managerial levers, business processes, innovation process, innovation outcome and firm performance, 23 items are indentified as misfit which did meet the Rasch quality criteria. Consequently, items were further screen to identify whether they are dependent each other which might measure similar meaning. The screening is assessed through output table of principle component analysis for high correlated item. Additional of one more item is identified and was deleted from the instrument. Therefore the final items used as measurement in answering research questions were 92 items. Table 5.31 below, summarised the final result and also comparison before and after the deletion process. Item reliability for this study improved to 0.91 logit after deletion as well as the seperation index increased from 3.04 to 3.09. The MNSQ value improved from the earlier range of 0.52 logit to 2.46 logit to the specified range of 0.67 logit to 1.50 logit. The ZSTD value is also improved from the range of -3.2 logit to 6.0 logit to the range of -2.0 logit to 2.0 logit. Therefore, all 92 items are located within the 95% confidence level and this is sufficient for the data to be fit to the Rash Model.

Table 5.31
Comparison of the Overall Result Before and After Deletion of Items

	116 Items (Before)			**92 Items (After)**		
		Outfit			**Outfit**	
	Measure	**MNSQ**	**Zstd**	**Measure**	**MNSQ**	**Zstd**
Mean	0.00	1.01	-0.1	0.00	1.00	-0.2
Standard Deviation	0.57	0.34	1.8	0.59	0.21	1.2
Maximum	1.24	2.46	6.0	1.09	1.50	2.0
Minimum	-1.59	0.52	-3.2	-1.56	0.67	-2.0
Separation	3.04			3.09		
Reliability	0.90			0.91		
Std error of item mean	0.05			0.06		

Accordingly, the following segment will answer the research questions of this study. Analysis will be based on 92 items representing the innovation instruments with 61 respondents from electrical and electronics companies.

5.3.5 Research Question 1

"RQ1: Is there any relationship between antecedents represented by leadership, managerial levers and business processes with innovation process?

The first research question stated above aims to identify whether there is any relationship between antecedent variables: leadership, managerial levers and business processes with innovation process. The tentative statements about this relationship as discussed in Chapter 3 are $H_{1a,}$ $H_{1b,}$ $H_{1c,}$ H_{1d} $H_{1e,}$ and H1f. This question is based on limited studies conducted on the three roles of antecedents and their relationship with innovation process. In addition, antecedent factors are useful in explaining the innovation implementation (Ar & Baki, 2011; Crossan & Apaydin, 2010).

According to the Rasch Model, relationship between variables ($H_{1a,}$ $_{H1c,}$ $H_{1e,)}$ can be explained in terms of fit statistics and how fit the data of the variables to the model. This study utilises the graph plot in order to explain the direction of the relationship. In the ordinary statistical analysis, Pearson Correlation Product Moment is used to measure the strength of variable relationship while in the Rasch Model the measured correlation between the items of the construct will be used (Linacre, 2005).

As for the level of ability between antecedents and innovation process ($H_{1b,}$ H_{1d} and $H_{1f)}$ discussions are highlighted according to the ability of electrical and electronics companies in performing the individual items of leadership, managerial levers and business processes in relation to innovation process. From the context of Rasch model, findings are analyse through the person-item map (variable map) and by calculating the probability of success in performing items for each variable related to the study.

The person-item map shows the relations between item difficulty estimates and person ability estimates (Bond & Fox, 2007). This map provides a visual display of simultaneous location of both item and persons that represents the construct being measured in this study (Englehard, 2013). Findings are discussed based on the key estimates focus on value of items mean, value of persons mean, the maximum and minimum logit value for both items and persons, the level of ability according to group and the level of difficulty of items responded. The following descriptions will elaborate the person-item map which later this approach will be used for each of the variables of the study to assess the ability of antecedents, the level of implementation of the responding companies as well as to address the other subsequent research questions.

Table 5.32 below, tabulates the score in terms of logit value for persons. The table lists the ability level of 61 respondents representing the electrical and electronics companies for 92 items. From this table, measures are arranged according to descending order from the highest to the lowest ability in performing the items. The 61 respondents representing the electrical and electronics companies are coded by specific codes. The higher the logit value causes the higher company's ability to perform the items. The mean value for person is positioned at 1.45 logit. The maximum value is 4.33 logit which is represented by C02433413124311132122 1 while minimum value is -1.21 logit is corresponding to C52434422234121164222 2.

Table 5.32
Person Measure Order

Person	Measure (logit)	Person	Measure (logit)
C024334131243111321221	4.33	C251243122351141121222	1.53
C014323131355131651221	3.79	C274112232155111112221	1.45
C124244131155161841221	3.65	C404132133355111112221	1.37
C284234112111111511111	3.59	C304233132153111411121	1.34
C234232231255171541221	3.3	C244233212342121111221	1.28
C574324132155171371111	3.06	C414132212331121412211	1.24
C514343231455121831111	3	C074131231331221621211	1.13
C444132232355151841111	2.97	C504314223354231222211	1.11
C151333122355111741211	2.92	C364344131431131421111	1
C264233231255141431211	2.89	C454343222354132331222	1
C054243131455121321111	2.64	C464243112331211322121	1
C063234131455141331111	2.59	C584132212411111111111	0.98
C191223122243111211111	2.42	C554132112342141331121	0.97
C434233131454151111221	2.39	C494244221355111611221	0.88
C334132133322111112221	2.28	C132344132314211422221	0.72
C084344231315241742221	2.21	C534243132353151451121	0.6
C041344122343111411111	2.12	C562344112352121821221	0.56
C391344123153131321222	2.1	C542344222353131532221	0.53
C201334122344111311111	1.9	C181334222155111112221	0.44
C094243231454111711111	1.86	C354344131444111521121	0.44
C423213112341131831221	1.84	C344234231354211322221	0.19
C143344132355141131111	1.73	C482344232354171531121	0.11
C314243132151121531111	1.73	C594131222322111211121	0.08
C114233133454151831111	1.65	C602343232354211211221	-0.09
C474142122431111121221	1.65	C384131222332111432222	-0.14
C374133121454111112221	1.63	C102344232341111212221	-0.17
C031131122153122311221	1.59	C174143211353212112222	-0.36
C222244231455111431121	1.59	C294234212131111311121	-0.44
C163314232352211511221	1.57	C614132212443221332221	-0.51
C212334123354171471211	1.53	C324344233355111812221	-1.06
		C524344222341211642222	-1.21

The respondents of this study are divided into three groups. The first group which is classified as high ability is a group of persons who located above the person mean value of 1.45 logit. Hence, about 51 percent (31 respondents) have high abilities to perform the items listed in the questionnaire. Moderate is the second group where their locations are between the mean item value and the mean person value. The moderate group is contributing to 36 percent (22 respondents). The third group is labelled as poor where their locations are below the item mean value. There are 8 respondents who located below than 0.00 logit from the item mean.

Graphically, the three types of respondents are shown in Figure 5.17 below. Given the same logit scale, both persons (respondents) and items are measured on the same logit ruler on the variable map. The right hand side of the map measures the item difficulty level. The items are represented by leadership (LD), managerial levers (ML), business processes (BP), innovation process (IP), innovation outcome (IO) and firm performance (FR). The higher the location, items are more difficult as compared to the lower location which showed items are easier. On the left hand side, the logit ruler measures the person ability level from the high ability on the top of the map to the lower side which indicates the low ability level. The person ability level for each company is represented by the codes range from C014323131355131651221 to C61413221244322133222. Hence, it is noted that the high ability companies located on the upper side of the map, the middle location are those with moderate ability and at the lower side of the map are those with poor level ability.

```
                         Person - MAP – Item
                        <high ability>|<difficult>
 5                                    +
                                      |
                                      |
                                      |
                                C024  |
                                      |
 4   High ability                     +
                                C014 T|
                           C124 C284  |
                                      |
                                C234  |
                                      |
 3                C151 C444 C514 C574  +
                                C264  |
                           C054 C063 S|
                                C191  |
                           C334 C434  |
                      C041 C084 C391  |
 2                                    +
                      C094 C201 C423  |
  C031 C114 C143 C222 C314 C374 C474  |                    Person  mean = 1.45 logit
                 C163 C212 C251 C274 M|
                      C244 C304 C404  |
                      C074 C414 C504  |T ML
 1          C364 C454 C464 C554 C584  +  ML ML
                                C494  |  IP IP IP IP ML ML ML
                           C132 C534  |S BP BP FR FR IP IP IP IP IP IP ML
                 C181 C354 C542 C562  |  FR IP IP
  Moderate                            |  BP BP BP BP IO IP ML ML
                           C344 C482 S|  BP BP IO IP IP IP ML ML ML ML
 0                              C594  +M BP BP IO IP ML ML ML
  Item mean = 0.00  logit 02 C384 C602  |  BP IO IO IO IP IP IP LD LD ML ML
                                C174  |  BP BP IO LD LD ML ML ML ML
                           C294 C614  |  BP BP BP IO IP LD LD ML
                                      |S IO IO LD LD ML ML ML
                                      |  BP IO IO
-1                              C324 T+  IO
   Poor                         C524  |T IO ML
                                      |
                                      |  ML ML
                                      |
                                      |
-2                                    +
                        <low ability>|<easy>
```

Figure 5.17

Person-Item Map for 92 overall items

The division of three groups are considered good as suggested by Fisher (2007) and Englehard (2013) since it has been used when applying Rasch Model in the social and behavioural science. In this context, at the first step, item mean for 92 items is set at 0.00 logit. Nevertherless the value of item mean will vary according to the level of items difficulty for each individual variable discussed.

5.3.5.1 The relationship between leadership and innovation process

As disscussed in the previous chapter, leadership is focuses on items that comprise the abilities, skills and competencies that contribute innovatively and strategicaly to the innovation process. Leadership is one of the significant factor to the innovation implementation and also predictor to innovation performance (Barsh et al., 2008). The leadership role assists in innovation activities when it has the potential to activate people in idea generation process (Ven, 1986).

The leadership approach from their style, skill and abilities must complement the whole process of innovation (McMillan, 2010). Eisenbeiss et al. (2008) and Bossink (2004a) in their studies indicated that both transactional and transformational style of leadership are important in cooperating skills and abilities to confront with innovation. Innovative leadership role inspires people to generate idea, provide vision and strategy in driving innovation into organisation (Crossan & Apaydin, 2010).

The descriptive statistics with regard to the relationship between leadership and innovation process are shown in Table 5.33. As mentioned earlier, this description is to clarify the testable statement of H_{1a}. All measures were tabulated in the form of logits value. This task is undertaken through Winsteps 3.6 software that convert the raw score of the rating scale into logits value.

Table 5.33
Summary Statistics for Leadership and Innovation Process

	Measure Item	Outfit	
	logit	MNSQ	Zstd
Mean	0.18	0.99	0.0
Standard Deviation	0.51	0.20	1.1
Maximum	0.88	1.48	2.0
Minimum	-0.70	0.73	-1.6
Separation	2.69		
Reliability	0.88		

Based on Table 5.33 above, mean value for items are set to 0.00 logit. The mean value for leadership item is 0.18 logit. This indicates that most of the leadership items are easy items and this means that leadership is easily performed by the organisation under this study. The minimum logit is -0.70 while the maximum logit is 0.88. Although it is easy items, the range between the minimum and maximum indicates the spreads of difficulty level for leadership in the variable map.

As disscused earlier, the relationship between leadership and innovation process is examined through three criteria of Rasch fit statistics: outfit mean square (MNSQ), outfit Z-standard (ZSTD) and point measure correlation (PTMEA CORR). The oufit MNSQ is between 0.73 logit and 1.48 logit and the value for ZSTD is between -1.6 logit and 2.0 logit. The result shows that this construct is fit within the specified range and hence, it fits the model. As shown in Figure 5.18, data are located within the ±2 ZSTD value.

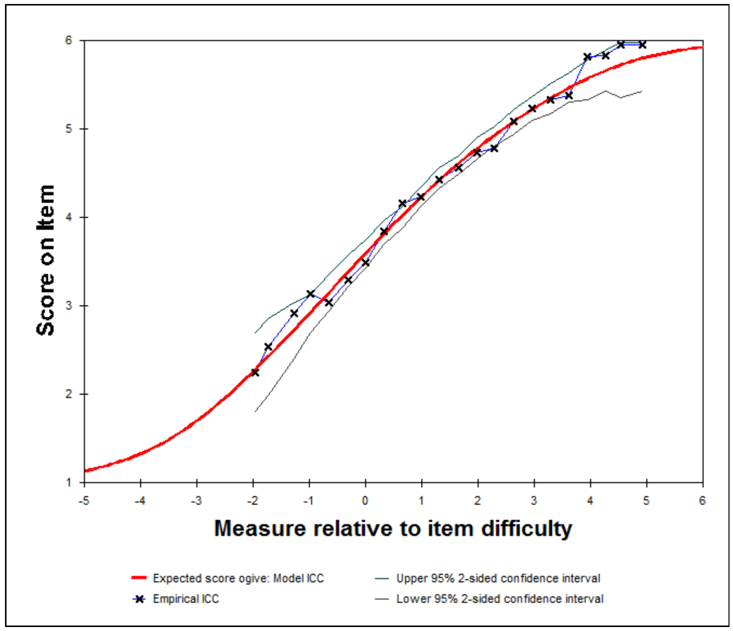

Figure 5.18
GCC Graph for Leadership and Innovation Process

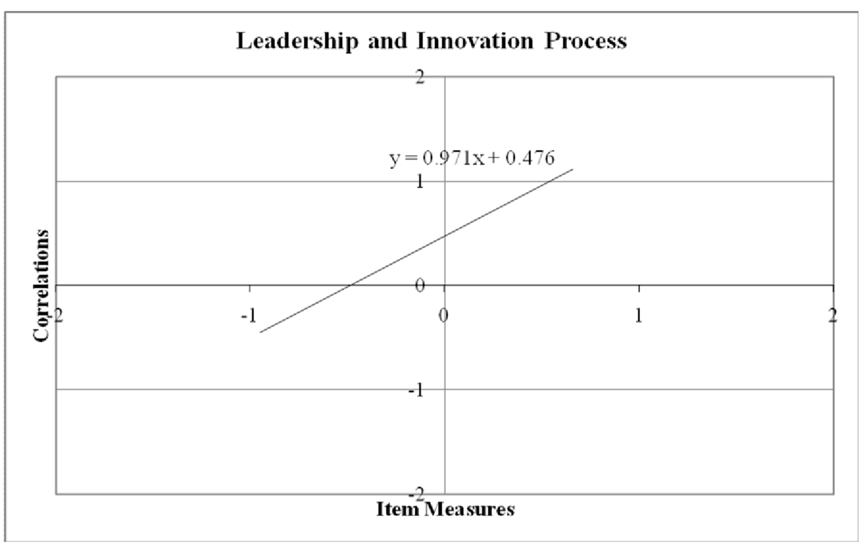

Figure 5.19
The Relationship between Leadership and Innovation Process

The relationship between the two variable as shown above via Figure 5.19. It is noted that the diagram shows a positive relationship between items measured. A positive item correlation with a slope of 0.971 logit. This correlation is significant within the confidence interval of 95%. Square root of the MNSQ is used to measure the strength of the relationship. The average for MNSQ for leadership items is 0.99 logit and the square root of MNSQ is 0.99 logit. Hence, it can be productive for measurement as the range fall witihin 0.5 to 1.5 logit (Azrilah, 1996). Subsequently, the discussion is further elaborates to address the issue on the ability level between leadership and innovation process in the electrical and electronics companies. This is referring to testable statement of $H_{1b.}$

5.3.5.2 The ability level between leadership and innovation process

Leadership is one of important antecedents that determine the success of innovation process implementation. There are 8 items representing innovative leadership construct which focus on skill, ability and competency traits. As mention earlier, discussions will be based on the mean value, maximum and minimum logit for persons and items through the variable map.

The variable map in Figure 5.20 provides a picture of various responses from the companies by placing the difficulty level of the leadership items on the same measurement scale as the ability level of the respondents. The left side shows respondents and the right side shows the leadership items. Items on the right side of the map are distributed from most difficult at the top to the least difficult at the bottom. The mean, maximum and minimum logit for persons and items are portrayed in the map.

From the map, about 87 percent (53 electrical and electronic companies) located above the maximum item measures of -0.09 logit. It indicates that these companies do not facing difficulty in undertaking the leadership issues. Persons that score above person mean of 1.45 logit are those who have high ability in performing leadership items. There are a total of 31 companies in this category which comprise of 19 large companies with more than 151 employees, 10 medium size companies (51 – 150 employees) and 2 small size companies (less than 50 employees). The moderate group located between item mean (-0.41 logit) and person mean (1.45 logit) is represented by 26 companies with 12 companies under the large size, 7 companies is medium size and 7 companies is the small size. The third group with poor abilities is represented by 4 companies that located below the item mean (-0.41 logit).

It is noted that 4 items are difficult for the low ability companies to perform include L1, L6, L7 and L8. These items are related to inspiration of innovative leadership towards commitment, managing for internal linkage for innovation related activities, managing for external linkage such as external perspective such as ideas and resources inside organisation and innovative leadership to provide reward for innovation effort. Although most of the companies are able to perform all the leadership items, there are two companies: C32434423335511181 2221 and C52434422234121164 2222 perceived that all items are difficult and these companies are located at the lowest continuum of the variable map.

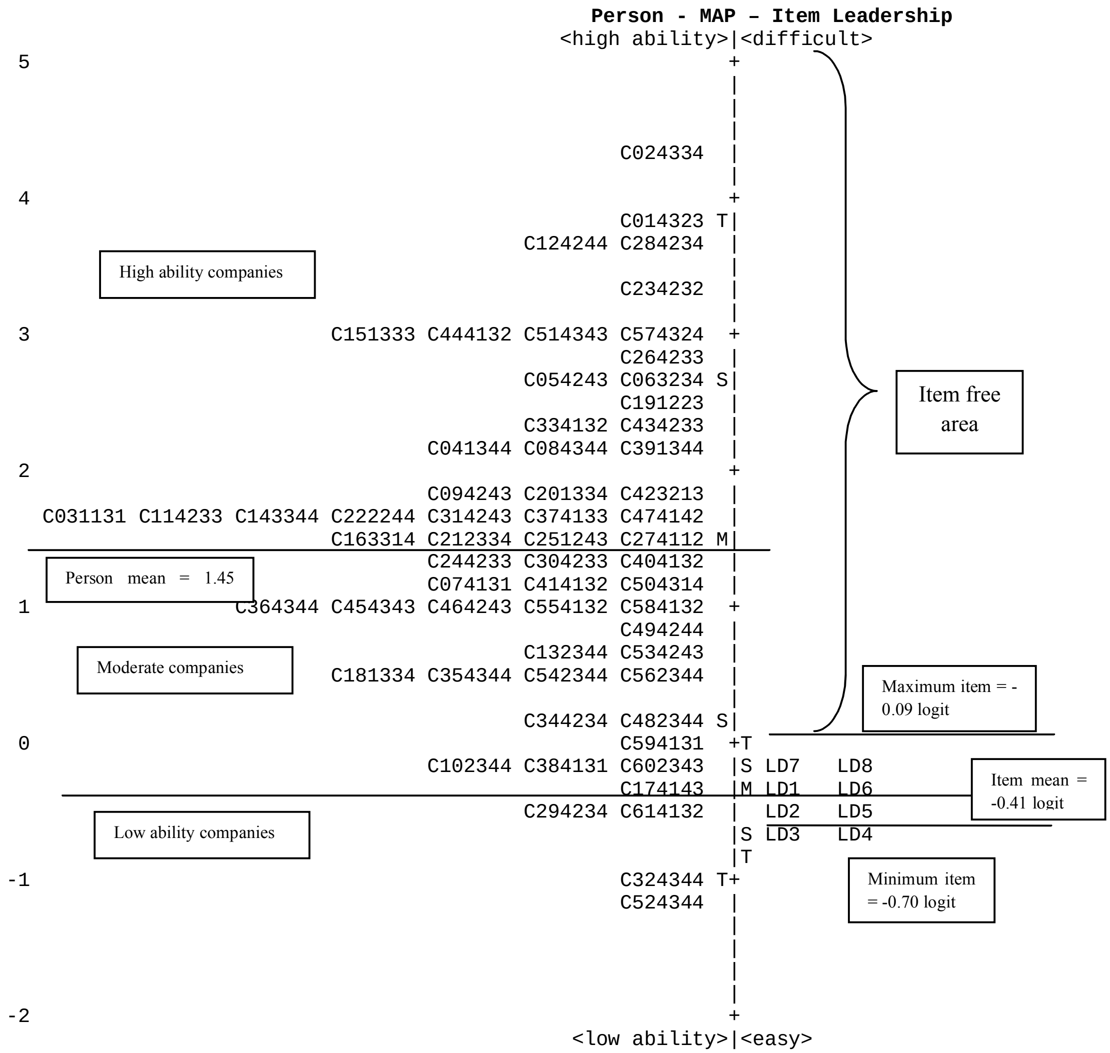

Figure 5.20
Person-Item Map for Leadership

The level of leadership implementation is further inspected by its probability of success in performing leadership items. Table 5.34 below indicates the probability of success for 61 electrical and electronics companies to implement 8 leadership items. It is noted that there are 7 companies scored below than 50 percent chance to achieve some of the leadership items. For instance, the lowest probability value is 0.25. This percentage was contributed by company C5243442223412116422222 which has only 25% chance to achieve LD7 and LD8.

The low ability company need to improve on on external linkage management so that it innovative leadership could bring in the external perspective, tap into ideas and resources into the innovation process. In addition, this company also need to reward innovation effort to boost innovation in the organisation. However, based on the overall probablity scores, it can be concluded that 8 leadership items are not difficult to be implemented by the responded companies and this is indicated through item free area in the variable map. This is also due to the item mean value which located at -0.41 logit, the lower side of the variable map is considered as easy and common to most of the electrical and electronics companies.

Table 5.34

The Probability of Success - Leadership

Person	Measure (logit)	Probability LD1	LD2	LD3	LD4	LD5	LD6	LD7	LD8
C024334131243111321221	4.33	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
C014323131355131651221	3.79	0.98	0.99	0.99	0.99	0.99	0.98	0.98	0.98
C124244131155161841221	3.65	0.98	0.98	0.99	0.99	0.98	0.98	0.98	0.98
C284234112111111511111	3.59	0.98	0.98	0.99	0.99	0.98	0.98	0.98	0.98
C234232231255171541221	3.3	0.98	0.98	0.98	0.98	0.98	0.97	0.97	0.97
C574324132155171371111	3.06	0.97	0.97	0.98	0.98	0.97	0.97	0.96	0.96
C514343231455121831111	3	0.97	0.97	0.98	0.98	0.97	0.96	0.96	0.96
C444132232355151841111	2.97	0.97	0.97	0.98	0.97	0.97	0.96	0.96	0.96
C151333122355111741211	2.92	0.96	0.97	0.97	0.97	0.97	0.96	0.95	0.95
C264233231255141431211	2.89	0.96	0.97	0.97	0.97	0.97	0.96	0.95	0.95
C054243131455121321111	2.64	0.95	0.96	0.97	0.96	0.96	0.95	0.94	0.94
C063234131455141331111	2.59	0.95	0.96	0.96	0.96	0.96	0.95	0.94	0.94
C191223122243111211111	2.42	0.94	0.95	0.96	0.96	0.95	0.94	0.92	0.93
C434233131454151111221	2.39	0.94	0.95	0.96	0.96	0.95	0.94	0.92	0.92
C334132133322111112221	2.28	0.93	0.94	0.95	0.95	0.94	0.93	0.91	0.92
C084344231315241742221	2.21	0.93	0.94	0.95	0.95	0.94	0.92	0.91	0.91
C041344122343111411111	2.12	0.92	0.93	0.94	0.94	0.93	0.92	0.90	0.90
C391344123153131321222	2.1	0.92	0.93	0.94	0.94	0.93	0.92	0.90	0.90
C201334122344111311111	1.9	0.91	0.92	0.93	0.93	0.92	0.90	0.88	0.88
C094243231454111711111	1.86	0.90	0.92	0.93	0.93	0.92	0.89	0.88	0.88
C423213112341131831221	1.84	0.90	0.91	0.93	0.92	0.91	0.89	0.87	0.88
C143344132355141131111	1.73	0.89	0.91	0.92	0.92	0.91	0.88	0.86	0.86
C314243132151121531111	1.73	0.89	0.91	0.92	0.92	0.91	0.88	0.86	0.86
C114233133454151831111	1.65	0.88	0.90	0.91	0.91	0.90	0.87	0.85	0.85
C474142122431111121221	1.65	0.88	0.90	0.91	0.91	0.90	0.87	0.85	0.85
C374133121454111112221	1.63	0.88	0.90	0.91	0.91	0.90	0.87	0.85	0.85
C031131122153122311221	1.59	0.88	0.89	0.91	0.91	0.89	0.87	0.84	0.85
C222244231455111431121	1.59	0.88	0.89	0.91	0.91	0.89	0.87	0.84	0.85
C163314232352211511221	1.57	0.87	0.89	0.91	0.90	0.89	0.86	0.84	0.84
C212334123354171471211	1.53	0.87	0.89	0.90	0.90	0.89	0.86	0.83	0.84
C251243122351141121222	1.53	0.87	0.89	0.90	0.90	0.89	0.86	0.83	0.84

Table 5.34 *Continued*

Person	Measure (logit)	Probability LD1	LD2	LD3	LD4	LD5	LD6	LD7	LD8
C27411223215511111222 1	1.45	0.86	0.88	0.90	0.89	0.88	0.85	0.82	0.83
C40413213335511111222 1	1.37	0.85	0.87	0.89	0.88	0.87	0.84	0.81	0.82
C30423313215311141112 1	1.34	0.85	0.87	0.88	0.88	0.87	0.83	0.81	0.81
C24423321234212111122 1	1.28	0.84	0.86	0.88	0.88	0.86	0.83	0.80	0.80
C41413221233112141221 1	1.24	0.83	0.85	0.87	0.87	0.85	0.82	0.79	0.80
C07413123133122162121 1	1.13	0.82	0.84	0.86	0.86	0.84	0.80	0.77	0.78
C50431422335423122221 1	1.11	0.81	0.84	0.86	0.86	0.84	0.80	0.77	0.77
C36434413143113142111 1	1	0.80	0.82	0.85	0.84	0.82	0.78	0.75	0.75
C45434322235413233122 2	1	0.80	0.82	0.85	0.84	0.82	0.78	0.75	0.75
C46424311233121132212 1	1	0.80	0.82	0.85	0.84	0.82	0.78	0.75	0.75
C58413221241111111111 1	0.98	0.79	0.82	0.84	0.84	0.82	0.78	0.74	0.75
C55413211234214133112 1	0.97	0.79	0.82	0.84	0.84	0.82	0.78	0.74	0.75
C49424422135511161122 1	0.88	0.78	0.80	0.83	0.82	0.80	0.76	0.73	0.73
C13234413231421142222 1	0.72	0.75	0.78	0.81	0.80	0.78	0.73	0.69	0.70
C53424313235315145112 1	0.6	0.73	0.76	0.79	0.78	0.76	0.71	0.67	0.67
C56234411235212182122 1	0.56	0.72	0.75	0.78	0.77	0.75	0.70	0.66	0.66
C54234422235313153222 1	0.53	0.71	0.74	0.77	0.77	0.74	0.69	0.65	0.66
C18133422215511111222 1	0.44	0.69	0.73	0.76	0.75	0.73	0.67	0.63	0.64
C35434413144411152112 1	0.44	0.69	0.73	0.76	0.75	0.73	0.67	0.63	0.64
C34423423135421132222 1	0.19	0.64	0.67	0.71	0.70	0.67	0.62	0.57	0.58
C48234423235417153112 1	0.11	0.62	0.65	0.69	0.69	0.65	0.60	0.55	0.56
C59413122232211121112 1	0.08	0.61	0.65	0.69	0.68	0.65	0.59	0.54	0.55
C60234323235421121122 1	-0.09	0.57	0.61	0.65	0.64	0.61	0.55	0.50	0.51
C38413122233211143222 2	-0.14	0.56	0.60	0.64	0.63	0.60	0.53	0.49	0.50
C10234423234111121222 1	-0.17	0.55	0.59	0.63	0.62	0.59	0.53	0.48	0.49
C17414321135321211222 2	-0.36	0.50	0.54	0.58	0.58	0.54	0.48	0.43	0.44
C29423421213111131112 1	-0.44	0.48	0.52	0.56	0.56	0.52	0.46	0.41	0.42
C61413221244322133222 1	-0.51	0.47	0.50	0.55	0.54	0.50	0.44	0.40	0.40
C32434423335511181222 1	-1.06	0.33	0.37	0.41	0.40	0.37	0.31	0.27	0.28
C52434422234121164222 2	-1.21	0.30	0.34	0.38	0.37	0.34	0.28	0.25	0.25

The ability level is also measured on the items between leadership and innovation process. This is shown through the probability of success of the items. By using the logit score for each person responded, mean item value for leadership and innovation process (0.18 logit) into the probability formula, table 5.35 tabulates the probability of success performed by 61 companies. There are 50 companies which have more than 50 percent chances of implementing both leadership and innovation process items. The tabulation shows that the high ability companies have probability of success score 79 percent and above. The ability levels for moderate companies have probability of success between 50 to 78 percent. While the poor ability companies only managed to achieve less than 50 percent. Therefore, it can be concluded that the higher the ability of a company to implement innovative leadership, the higher the probability of success in performing innovation process. This has support the testable statement of $H_{1b.}$

Table 5.35
Probability of Success for Leadership (LD) and Innovation Process (IP)

Person	**Measure (logit)**	**Mean LD & IP**	**Probability**
C024334131243111321221	4.33	0.18	0.98
C014323131355131651221	3.79	0.18	0.97
C124244131155161841221	3.65	0.18	0.97
C284234112111111511111	3.59	0.18	0.97
C234232231255171541221	3.3	0.18	0.96
C574324132155171371111	3.06	0.18	0.95
C514343231455121831111	3	0.18	0.94
C444132232355151841111	2.97	0.18	0.94
C151333122355111741211	2.92	0.18	0.94
C264233231255141431211	2.89	0.18	0.94
C054243131455121321111	2.64	0.18	0.92
C063234131455141331111	2.59	0.18	0.92
C191223122243111211111	2.42	0.18	0.90
C434233131454151111221	2.39	0.18	0.90

Table 5.35 *Continued*

Person	Measure (logit)	Mean LD & IP	Probability
C3341321333221111112221	2.28	0.18	0.89
C0843442313152417422221	2.21	0.18	0.88
C0413441223431114111111	2.12	0.18	0.87
C3913441231531313212222	2.1	0.18	0.87
C2013341223441113111111	1.9	0.18	0.85
C0942432314541117111111	1.86	0.18	0.84
C4232131123411318312221	1.84	0.18	0.84
C1433441323551411311111	1.73	0.18	0.82
C3142431321511215311111	1.73	0.18	0.82
C1142331334541518311111	1.65	0.18	0.81
C4741421224311111212221	1.65	0.18	0.81
C3741331214541111112221	1.63	0.18	0.81
C0311311221531223111221	1.59	0.18	0.80
C2222442314551114311121	1.59	0.18	0.80
C1633142323522115111221	1.57	0.18	0.80
C2123341233541714712111	1.53	0.18	0.79
C2512431223511411212222	1.53	0.18	0.79
C2741122321551111112221	1.45	0.18	0.78
C4041321333551111112221	1.37	0.18	0.77
C3042331321531114111121	1.34	0.18	0.76
C2442332123421211111221	1.28	0.18	0.75
C4141322123311214122111	1.24	0.18	0.74
C0741312313312216212111	1.13	0.18	0.72
C5043142233542312222111	1.11	0.18	0.72
C3643441314311314211111	1	0.18	0.69
C4543432223541323312222	1	0.18	0.69
C4642431123312113221211	1	0.18	0.69
C5841322124111111111111	0.98	0.18	0.69
C5541321123421413311211	0.97	0.18	0.69
C4942442213551116112211	0.88	0.18	0.67
C1323441323142114222211	0.72	0.18	0.63
C5342431323531514511211	0.6	0.18	0.60
C5623441123521218212211	0.56	0.18	0.59

Table 5.35 *Continued*

Person	Measure (logit)	Mean LD & IP	Probability
C542344222353131532221	0.53	0.18	0.59
C181334222155111112221	0.44	0.18	0.56
C354344131444111521121	0.44	0.18	0.56
C344234231354211322221	0.19	0.18	0.50
C482344232354171531121	0.11	0.18	0.48
C594131222322111211121	0.08	0.18	0.48
C602343232354211211221	-0.09	0.18	0.43
C384131222332111432222	-0.14	0.18	0.42
C102344232341111212221	-0.17	0.18	0.41
C174143211353212112222	-0.36	0.18	0.37
C294234212131111311121	-0.44	0.18	0.35
C614132212443221332221	-0.51	0.18	0.33
C324344233355111812221	-1.06	0.18	0.22
C524344222341211642222	-1.21	0.18	0.20

5.3.5.3 The relationship between managerial levers and innovation process

The managerial levers dimension comprise of strategy, structure, resource allocation, knowledge management and organisational learning and culture. Similar to earlier discussions, the relationship between managerial levers and innovation process is measured through fit statistic and the graph from scatterplot. As mentioned in Chapter 3, the testable statement is H_{1c} and $H_{1d.}$

Table 5.36
Summary Statistics for Managerial Levers and Innovation Process

	Measure Item	Outfit	
	logit	MNSQ	Zstd
Mean	0.15	1.06	0.3
Standard Deviation	0.64	0.21	1.1
Maximum	1.09	1.48	1.8
Minimum	-1.56	0.73	-2.0
Separation	3.33		
Reliability	0.93		

Table 5.36 indicates the mean value for managerial levers and innovation process through the operation of ISELECT is 0.15 logit. The value indicates that most of the items are easy due to its location to adjacent 0.00 logit of the set up mean value. Altough the value for item mean is small, the minimum and maximum value is positioned to be a the range of -1.56 to 1.09 logit respectively. This negative value shows that item is located at the lower continum of the variable map where managerial levers are familiar practices applied by the electrical and electronics companies. The maximum value of 1.09 logit is the highest score among other items. On the variable map, it is located in the upper side of the continumm.

The highest item logit of 1.09 is represented by item ML14 while the lowest item logit of -1.56 is represented by item ML6. Item ML14 is the related to the extent company formally monitor development in new technologies. This indicates that some of the companies considered this practice are quite difficult. Item ML6 is related to the extent on whether improving product or service quality is one of our key objectives of innovation strategy for organisation. The finding revealed that this type of objective is very common to the companies. Data for this dimension is fit since the outfit MNSQ is between 0.73 logit to 1.48 logit.

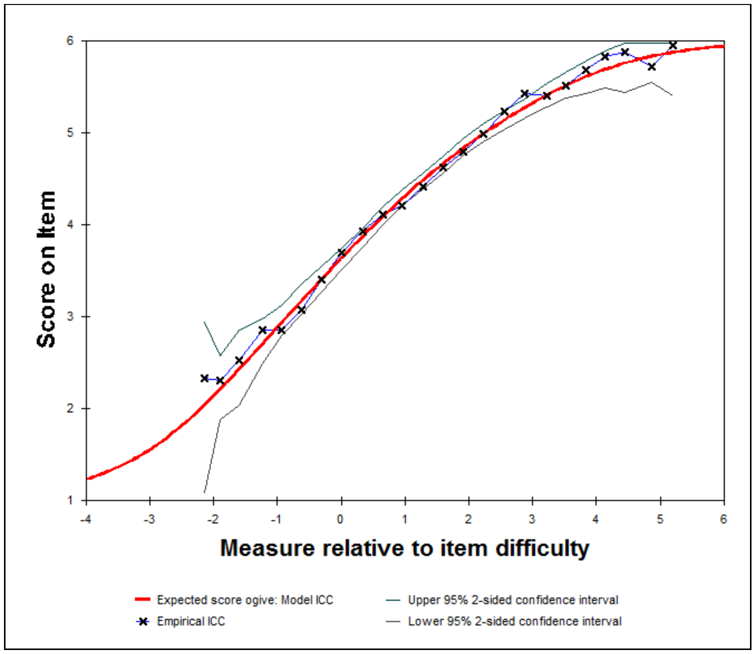

Figure 5.21
GCC Graph for Managerial Levers and Innovation Process

Based on Figure 5.21 above, all items are also within the +2 ZSTD values and graphically are within the 95% confidence level. The relationship between managerial levers and innovation process is showed through a linear graph function. From Figure 5.22, it is noted that correlation between these items portrayed a positive relationship with a slope of 0.962 logit. In terms of mean MNSQ, the value is 1.06 and the square root of MNSQ is also 1.00 logit. Hence this dimension is acceptable measurement.

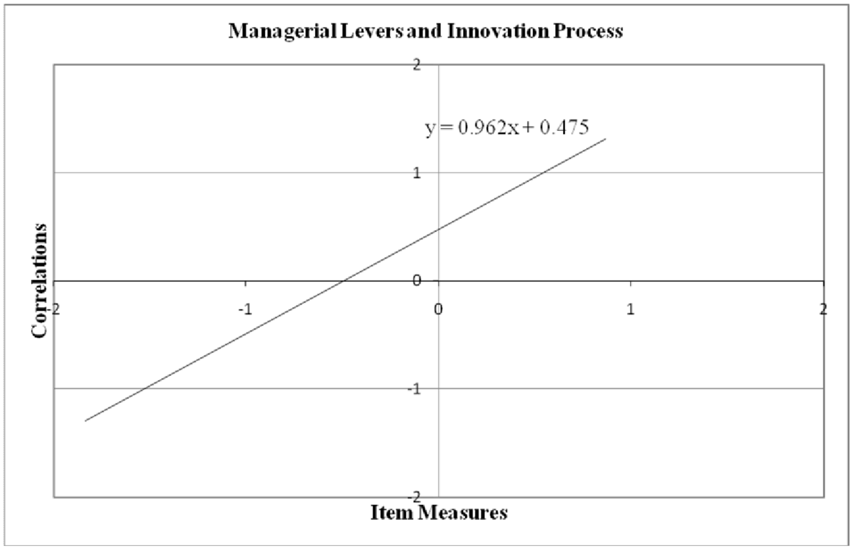

Figure 5.22
The Relationship between Managerial Levers and Innovation Process

5.3.5.4 The ability level between managerial levers and innovation process

The managerial levers antecedent have crucial role in implementing innovation process of an organisation. With 29 items, this construct represents a set of activity which covers five major elements: strategy, structure, resource allocation, knowledge management and organisational learning and culture.

The mean score for managerial levers is -0.04 logit. The maximum and minimum positions are 1.09 logit and -1.56 logit respectively. The variable map in Figure 5.23 shows that 51 percent of the electrical and electronic companies located above mean person 1.45 logit are classified as companies with high ability level. Hence, 31 companies perceived all managerial levers are easy item to be implemented. About 36 percent of the companies are the moderate group which located between item mean value and person mean value. These 22 companies range from 10 organisations for large size, 6 organisations each for the medium and small size. Since they are classified in the moderate category, items that located above its mean can be classified as difficult. From the variable map, there are 16 items identified comprise of ML12, ML16, ML20, ML15, ML26, ML21, ML13, ML17, ML23, ML28, ML3, ML14, ML18, ML29, ML33 and ML31. Most of the issues related are difficult for companies in terms of:

a) To improve administrative routines as a part of organisation's innovation strategy
b) Units that responsible for innovation have sufficient resources for the generation of innovations
c) Units responsible for innovation have sufficient competencies for the introduction or generation of innovation
d) Employees formally monitor developments in new technologies
e) Employees use failures as opportunities to learn
f) Human resource plan for innovation activity
g) Selection of appropriate personnel in each functional department in innovation process.
h) Provision of steady capital supplement in innovation activity
i) To adapt its technology level to changes in external environment
j) To obtain knowledge from customers
k) To obtain knowledge from employees
l) To affectively manages different sources and types of knowledge
m) To have a comprehensive program for employee learning
n) Culture to rewards behaviour that related to creativity and innovation
o) Expectation on the new value-adding products and services are detected and developed permanently.

As for the third category, there are 8 companies classified as low ability level in performing the managerial levers items. As mention in the earlier discussions, those companies positioned below the item mean value. Table 5.37 below tabulates the probability of success for 61 electrical and electronics companies in implementing items of managerial levers. From this table, 23 companies have probability of success below than 50 percent to implement item ML14 which is related to structure that formally monitor developments of new technology. Some of the low ability companies have between 10 to 20 percent chances of success in implementing managerial levers items. For instance, C52434422234121164222 has only 9 percent chances of success to implement item ML14 and 17 percent chances to implement item ML15. Nevertherless, most of the companies have higher success in managerial levers items particularly ML4, ML5, ML6, ML7 and ML8. This is due to the easy items which spread from-0.70 logit to -1.56 logit.

In order to examine the level of the relationship between managerial levers on innovation process, calculation is based on the the company's probability of chances in performing the items . This will elaborate the testable statement of $H_{1d.}$ The item mean value for this dimension is 0.15 logit. Table 5.38 shows the probability of success of performing managerial levers and innovation process. Calculations are based on the logit score for each person responded, mean item value for managerial levers and innovation process into the probability formula. Overall, there are 51 companies achieved more than 50 percent probability of success of performing the dimension. The scores show that the high ability companies have probability of success more that 79 percent to perform items in leadership and innovation process. The ability for moderate companies have probability of success between 51 to 79 percent while the poor ability companies only managed to achieve less than 49 percent. Therefore, this is also indicates that the higher the ability level to implement managerial levers, the higher the innovation process of the participating companies of this study.

```
                              Person - MAP - Item
                            <high ability>|<difficult>
 5                                        +
                                          |
                                          |
                                          |
                                    C0243 |
                                          |
 4                                        +
                                    C0143 T|
                               C1242 C2842 |
                                          |
                                    C2342 |
                                          |
 3                   C1513 C4441 C5143 C5743  +
                                    C2642 |
                               C0542 C0632 S|
                                    C1912 |
                               C3341 C4342 |
                          C0413 C0843 C3913 |
 2                                        +
                          C0942 C2013 C4232 |
  C0311 C1142 C1433 C2222 C3142 C3741 C4741 |
                     C1633 C2123 C2512 C2741 M|        Maximum item = 1.09 logit
                          C2442 C3042 C4041  |T
                          C0741 C4141 C5043  +  ML14
 1              C3643 C4543 C4642 C5541 C5841  +  ML12  ML13
                                    C4942 |  ML16  ML17  ML18
                               C1323 C5342 |S ML20
                     C1813 C3543 C5423 C5623 |
                                          |  ML15  ML23
                               C3442 C4823 S|  ML26  ML28  ML29  ML31   Item mean = -0.04 logit
 0                                  C5941  +M ML21  ML3   ML33
                          C1023 C3841 C6023 |  ML25  ML34
                                    C1741 |  ML1   ML24  ML27  ML32
                               C2942 C6141 |  ML2
                                          |S ML30  ML7   ML8
                                          |
-1                                  C3243 T+
                                    C5243 |  ML4        Minimum item =- -1.56 logit
                                          |
                                          |T ML5   ML6
                                          |
                                          |
-2                                        +
                             <low ability>|<easy>
```

Figure 5.23
Person-Item Map for Managerial Levers

Table 5.37

The Probability of Success – Managerial Levers

		Probability													
Person	**Measure (logit)**	**ML1**	**ML2**	**ML3**	**ML4**	**ML5**	**ML6**	**ML7**	**ML8**	**ML12**	**ML13**	**ML14**	**ML15**	**ML16**	**ML17**
C364344131431131421111	1	0.80	0.82	0.74	0.90	0.93	0.93	0.84				0.48	0.66	0.52	0.54
C454343222354132331222	1	0.80	0.82	0.74	0.90	0.93	0.93	0.84				0.48	0.66	0.52	0.54
C464243112331211322121	1	0.80	0.82	0.74	0.90	0.93	0.93	0.84	0.85	0.50	0.51	0.48	0.66	0.52	0.54
C584132212411111111111	0.98	0.79	0.81	0.74	0.90	0.92	0.93	0.83	0.84	0.49	0.50	0.47	0.65	0.52	0.53
C554132112342141331121	0.97	0.79	0.81	0.74	0.89	0.92	0.93	0.83	0.84	0.49	0.50	0.47	0.65	0.52	0.53
C494244221355111611221	0.88	0.78	0.80	0.72	0.89	0.92	0.92	0.82	0.83	0.47	0.48	0.45	0.63	0.50	0.51
C132344132314211422221	0.72	0.75	0.77	0.69	0.87	0.90	0.91	0.79	0.81	0.43	0.44	0.41	0.59	0.46	0.47
C534243132353151451121	0.6	0.73	0.75	0.66	0.85	0.89	0.90	0.77	0.79	0.40	0.41	0.38	0.56	0.43	0.44
C562344112352121821221	0.56	0.72	0.74	0.65	0.85	0.89	0.89	0.77	0.78	0.39	0.40	0.37	0.55	0.42	0.43
C542344222353131532221	0.53	0.71	0.74	0.64	0.85	0.89	0.89	0.76	0.77	0.38	0.39	0.36	0.54	0.41	0.42
C181334222155111112221	0.44	0.69	0.72	0.62	0.83	0.88	0.88	0.74	0.76	0.36	0.37	0.34	0.52	0.39	0.40
C354344131444111521121	0.44	0.69	0.72	0.62	0.83	0.88	0.88	0.74	0.76	0.36	0.37	0.34	0.52	0.39	0.40
C344234231354211322221	0.19	0.64	0.67	0.56	0.80	0.85	0.85	0.69	0.71	0.31	0.32	0.29	0.46	0.33	0.34
C482344232354171531121	0.11	0.62	0.65	0.54	0.78	0.84	0.84	0.68	0.69	0.29	0.30	0.27	0.44	0.31	0.32
C594131222322111211121	0.08	0.61	0.64	0.53	0.78	0.83	0.84	0.67	0.69	0.28	0.29	0.27	0.43	0.31	0.32
C602343232354211211221	-0.09	0.57	0.60	0.49	0.75	0.81	0.81	0.63	0.65	0.25	0.26	0.24	0.39	0.27	0.28
C384131222332111432222	-0.14	0.56	0.59	0.48	0.74	0.80	0.81	0.62	0.64	0.24	0.25	0.23	0.38	0.26	0.27
C102344232341111212221	-0.17	0.55	0.58	0.47	0.73	0.79	0.80	0.61	0.63	0.24	0.24	0.22	0.37	0.26	0.27
C174143211353212112222	-0.36	0.50	0.53	0.43	0.69	0.76	0.77	0.57	0.58	0.20	0.21	0.19	0.33	0.22	0.23
C294234212131111311121	-0.44	0.48	0.51	0.41	0.67	0.75	0.75	0.55	0.56	0.19	0.20	0.18	0.31	0.21	0.22
C614132212443221332221	-0.51	0.47	0.50	0.39	0.66	0.73	0.74	0.53	0.55	0.18	0.19	0.17	0.30	0.20	0.20
C324344233355111812221	-1.06	0.33	0.36	0.27	0.53	0.61	0.62	0.39	0.41	0.11	0.12	0.10	0.20	0.12	0.13
C524344222341211642222	-1.21	0.30	0.33	0.24	0.49	0.58	0.59	0.36	0.38	0.10	0.10	0.09	0.17	0.11	0.11

Table 5.37 Continued

Person	Measure (logit)	Probability														
		ML18	ML20	ML21	ML23	ML24	ML25	ML26	ML27	ML28	ML29	ML30	ML31	ML32	ML33	ML34
C3643441314311314211111	1	0.52	0.58	0.73	0.66	0.80	0.76	0.71	0.78	0.70	0.71	0.85	0.70	0.80	0.74	0.76
C45434322235413233 1222	1	0.52	0.58	0.73	0.66	0.80	0.76	0.71	0.78	0.70	0.71	0.85	0.70	0.80	0.74	0.76
C4642431123312113221 21	1	0.52	0.58	0.73	0.66	0.80	0.76	0.71	0.78	0.70	0.71	0.85	0.70	0.80	0.74	0.76
C5841322124111111111111	0.98	0.52	0.57	0.73	0.65	0.80	0.76	0.71	0.78	0.70	0.70	0.85	0.70	0.80	0.74	0.76
C5541321123421413311 21	0.97	0.52	0.57	0.73	0.65	0.80	0.75	0.71	0.78	0.69	0.70	0.85	0.69	0.80	0.74	0.75
C4942442213551116112 21	0.88	0.50	0.55	0.71	0.63	0.78	0.74	0.69	0.76	0.67	0.68	0.83	0.67	0.78	0.72	0.74
C1323441323142114222 21	0.72	0.46	0.51	0.67	0.59	0.75	0.70	0.65	0.73	0.64	0.65	0.81	0.64	0.75	0.69	0.70
C5342431323531514511 21	0.6	0.43	0.48	0.65	0.56	0.73	0.68	0.62	0.71	0.61	0.62	0.79	0.61	0.73	0.66	0.68
C5623441123521218212 21	0.56	0.42	0.47	0.64	0.55	0.72	0.67	0.62	0.70	0.60	0.61	0.79	0.60	0.72	0.65	0.67
C5423442223531315322 21	0.53	0.41	0.46	0.63	0.54	0.72	0.66	0.61	0.69	0.59	0.60	0.78	0.59	0.72	0.64	0.66
C1813342221551111122 21	0.44	0.39	0.44	0.61	0.52	0.70	0.64	0.59	0.67	0.57	0.58	0.76	0.57	0.70	0.62	0.64
C3543441314441115211 21	0.44	0.39	0.44	0.61	0.52	0.70	0.64	0.59	0.67	0.57	0.58	0.76	0.57	0.70	0.62	0.64
C3442342313542113222 21	0.19	0.33	0.38	0.55	0.46	0.64	0.58	0.52	0.62	0.51	0.52	0.72	0.51	0.64	0.56	0.58
C4823442323541715311 21	0.11	0.31	0.36	0.53	0.44	0.62	0.56	0.50	0.60	0.49	0.50	0.70	0.49	0.62	0.54	0.56
C5941312223222111211121	0.08	0.31	0.35	0.52	0.43	0.62	0.56	0.50	0.59	0.48	0.49	0.69	0.48	0.62	0.53	0.56
C6023432323542112112 21	-0.09	0.27	0.31	0.48	0.39	0.58	0.51	0.46	0.55	0.44	0.45	0.66	0.44	0.58	0.49	0.51
C3841312223321114322 22	-0.14	0.26	0.30	0.47	0.38	0.56	0.50	0.44	0.53	0.43	0.44	0.65	0.43	0.56	0.48	0.50
C1023442323411112122 21	-0.17	0.26	0.30	0.46	0.37	0.56	0.50	0.44	0.53	0.42	0.43	0.64	0.42	0.56	0.47	0.50
C1741432113532121122 22	-0.36	0.22	0.26	0.41	0.33	0.51	0.45	0.39	0.48	0.38	0.38	0.59	0.38	0.51	0.43	0.45
C2942342121311113111 21	-0.44	0.21	0.24	0.39	0.31	0.49	0.43	0.37	0.46	0.36	0.36	0.57	0.36	0.49	0.41	0.43
C6141322124432213322 21	-0.51	0.20	0.23	0.38	0.30	0.47	0.41	0.35	0.44	0.34	0.35	0.56	0.34	0.47	0.39	0.41
C3243442333551118122 21	-1.06	0.12	0.15	0.26	0.20	0.34	0.29	0.24	0.31	0.23	0.24	0.42	0.23	0.34	0.27	0.29
C5243442223412116422 22	-1.21	0.11	0.13	0.23	0.17	0.31	0.26	0.21	0.28	0.20	0.21	0.38	0.20	0.31	0.24	0.26

Table 5.38

Probability of Success for Managerial Levers (ML) and Innovation Process (IP)

Person	Logit measure	Mean ML & IP	Probability
C02433413124311132122 1	4.33	0.15	0.98
C01432313135513165122 1	3.79	0.15	0.97
C12424413115516184122 1	3.65	0.15	0.97
C28423411211111151111 1	3.59	0.15	0.97
C23423223125517154122 1	3.3	0.15	0.96
C57432413215517137111 1	3.06	0.15	0.95
C51434323145512183111 1	3	0.15	0.95
C44413223235515184111 1	2.97	0.15	0.94
C15133312235511174121 1	2.92	0.15	0.94
C26423323125514143121 1	2.89	0.15	0.94
C05424313145512132111 1	2.64	0.15	0.92
C06323413145514133111 1	2.59	0.15	0.92
C19122312224311121111 1	2.42	0.15	0.91
C43423313145415111122 1	2.39	0.15	0.90
C33413213332211111222 1	2.28	0.15	0.89
C08434423131524174222 1	2.21	0.15	0.89
C04134412234311141111 1	2.12	0.15	0.88
C39134412315313132122 2	2.1	0.15	0.88
C20133412234411131111 1	1.9	0.15	0.85
C09424323145411171111 1	1.86	0.15	0.85
C42321311234113183122 1	1.84	0.15	0.84
C14334413235514113111 1	1.73	0.15	0.83
C31424313215112153111 1	1.73	0.15	0.83
C11423313345415183111 1	1.65	0.15	0.82
C47414212243111112122 1	1.65	0.15	0.82
C37413312145411111222 1	1.63	0.15	0.81
C03113112215312231122 1	1.59	0.15	0.81
C22224423145511143112 1	1.59	0.15	0.81
C16331423235221151122 1	1.57	0.15	0.81
C21233412335417147121 1	1.53	0.15	0.80
C25124312235114112122 2	1.53	0.15	0.80

Table 5.38 *Continued*

Person	Logit measure	Mean ML & IP	Probability
C274112232155111112221	1.45	0.15	0.79
C404132133355111112221	1.37	0.15	0.77
C304233132153111411121	1.34	0.15	0.77
C244233212342121111221	1.28	0.15	0.76
C414132212331121412211	1.24	0.15	0.75
C074131231331221621211	1.13	0.15	0.73
C504314223354231222211	1.11	0.15	0.72
C364344131431131421111	1	0.15	0.70
C454343222354132331222	1	0.15	0.70
C464243112331211322121	1	0.15	0.70
C584132212411111111111	0.98	0.15	0.70
C554132112342141331121	0.97	0.15	0.69
C494244221355111611221	0.88	0.15	0.67
C132344132314211422221	0.72	0.15	0.64
C534243132353151451121	0.6	0.15	0.61
C562344112352121821221	0.56	0.15	0.60
C542344222353131532221	0.53	0.15	0.59
C181334222155111112221	0.44	0.15	0.57
C354344131444111521121	0.44	0.15	0.57
C344234231354211322221	0.19	0.15	0.51
C482344232354171531121	0.11	0.15	0.49
C594131222322111211121	0.08	0.15	0.48
C602343232354211211221	-0.09	0.15	0.44
C384131222332111432222	-0.14	0.15	0.43
C102344232341111212221	-0.17	0.15	0.42
C174143211353212112222	-0.36	0.15	0.38
C294234212131111311121	-0.44	0.15	0.36
C614132212443221332221	-0.51	0.15	0.34
C324344233355111812221	-1.06	0.15	0.23
C524344222341211642222	-1.21	0.15	0.20

5.3.5.5 The relationship between business processes and innovation process

Table 5.39
Summary Statistics for Business Processes and Innovation Process

	Measure Item logit	Outfit MNSQ	Outfit Zstd
Mean	0.22	0.93	-0.5
Standard Deviation	0.46	0.20	1.1
Maximum	0.88	1.48	2.0
Minimum	-0.81	0.67	-2.0
Separation	2.42		
Reliability	0.85		

Business Processes is the third antecedent to be examined for this study. The relationship between business processes and innovation process is also discussed in the context of fit statistics and the scatter plot of a linear graph. The testable statement for this relationship is H_{1e}. Based on table 5.39, the mean value for this item is reported at 0.22 logit. Many items are spread around the mean. Therefore, it indicates that on average, most of the items are slightly above mean but still easy and applied into the companies. The highest score is 0.88 logit while the minimum score is at -0.81 logit. The negative logit which is represented by BP8 is related to the extent that IT is important in improving the business process. This is the easiest item and common to the companies.

On the other hand, item IP8 and IP11 scored 0.88 logit, are considered difficult for the comapny. IP8 is refering to the extent of interaction between idea generators and stakeholder while IP11 is referring to the extent of dedicated advocate role and reward systems are standardised in the organisation. The value for Outfit MNSQ is within the range of 0.67 logit to 1.48 logit which give the indication as fit to the model. The ZSTD is also within the specified range of $\pm$ 2 and it is located within 95% of confidence level. As shown in GCC graph, from Figure 5.24, items with regards to business processes and innovation process are plotted almost near to the expected line.

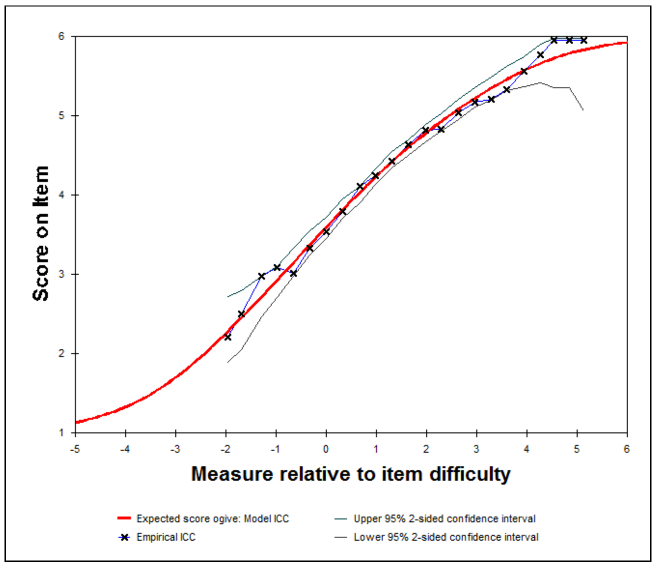

Figure 5.24
GCC Graph for Business Processes and Innovation Process

When the data is considered fit to the Rasch requirements, the relationship of the dimension is further examined through the linear graph function as shown in Figure 5.25. It is noted that the correlation between business processes and innovation process is a positive relationship with slope of 0.968 logit. Therefore, there is a positive relationship between business processes and innovation process and it is singificant within the 95% confidence interval. The MNSQ mean is 0.93 logit and the square-root of MNSQ is 0.96 logit shows to be productive measurement.

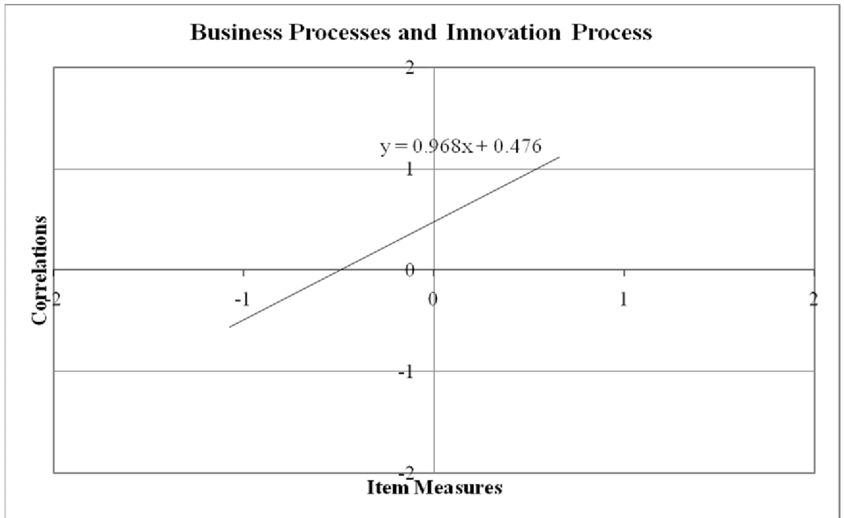

Figure 5.25
The Relationship Between Business Processes and Innovation Process

5.3.5.6 The ability level between business processes and innovation process

There are 17 items designated for business processes. This variable is explained by two sub-dimensions: process alignment and people involvement. The mean score for business processes is 0.22 logit. The maximum and minimum positions are 0.88 logit and –0.81 logit respectively. The variable map in figure 5.26 shows that 31 companies of the electrical and electronics companies located above mean person 1.45 logit are classified as high abilities. About 19 of the companies are the moderate group which located between item mean value and person mean value. Therefore these companies' perceived items that located above its mean can be classified as difficult.

From the variable map, there are 8 items identified comprise of BP1, BP3, BP4, BP13, BP17, BP18, BP19 and BP20. Most of the issues that considered difficult are for related to:

a) Horizontal structure alignment has made frequent use of process team
b) Horizontal structure alignment has made well practice horizontal communication
c) Horizontal structure alignment has made a flat organisational structure
d) Executive has received adequate training in managing core processes
e) Executive actively communicates to employees on how best to manage core processes
f) Employees increasing involvement in the way their work is planned
g) Employees increasing autonomy in making decisions that affect work
h) Employees are given necessary resources to fix problem together

The low ability companies are represented by 11 organisations which placed below the item mean. These companies found that all items are difficult exclude item BP8 i.e. the importance of IT in improving business processes. Nevertheless, there are 2 companies have low ability to perform item BP8 at -0.81 logit due to their position is lower than the item position. These two organisations are located at -1.07 logit and -1.22 logit.

Table 5.40 below tabulates the probability of success for all respondents of the companies in implementing items under business processes. From this figure, 16 companies have probability of success below than 50 percent to implement items under business processes particularly items related to flat organisational structure and the autonomy of making decisions. There are also 17 companies that have less than 50 percent chances to perform items BP4 and BP19. These companies are lacking in terms of flexiblity in process alignment and lack of autonomy in decision making.

The ability of companies is further explored through the relationship between business process and innovation process. This will explained the testable statement of H_{1f}. Table 5.41 shows the probability of success performing items business processes and innovation process. Calculations are based on the logit score for each person responded, mean item for business processes and innovation process (0.22 logit) into the probability formula. The table shows that high ability companies have probability of success more than 77 percent to perform items of business processes and innovation process. The moderate ability companies have probability of success between 55to 77 percent while the poor ability companies only managed to achieve less than 49 percent. Therefore, the higher the ability of a company the higher the probability of success in performing those items whiles the lower ability will perform low probability of success. The high probability in performing business processes contributes to high probability in innovation process.

Based on the above findings, it is noted that the leadership, managerial levers and business processes are important antecedents in implementing innovation process. As mentioned earlier, their item mean value indicate that this three dimensions are easy items which is applicable to the participating organisation. Nevertheless the success rate of performing these items depended on the ability of the company and the difficulty level. In addition, the high probability scores in implementing leadership, managerial levers and business processes have contributed to high ability implementation towards innovation process.

```
                                   Person - MAP – Item Business Processes
                                 <high ability>|<difficult>
 5                                             +
                                               |
                                               |
                                               |
                                       C0243   |
                                               |
 4                                             +
                                       C0143 T|
                                 C1242 C2842   |
                                               |
                                       C2342   |
                                               |
 3                   C1513 C4441 C5143 C5743   +
                                       C2642   |
                                 C0542 C0632 S|
                                       C1912   |
                                 C3341 C4342   |
                           C0413 C0843 C3913   |
 2                                             +
                           C0942 C2013 C4232   |
   C0311 C1142 C1433 C2222 C3142 C3741 C4741   |
                     C1633 C2123 C2512 C2741 M|
                           C2442 C3042 C4041   |
                           C0741 C4141 C5043   |
 1             C3643 C4543 C4642 C5541 C5841   +
                                       C4942   |T
                                 C1323 C5342   |  BP19  BP4
                     C1813 C3543 C5423 C5623   |S
                                               |  BP1   BP17  BP18  BP3
                                 C3442 C4823 S|  BP13  BP20
 0                                     C5941   +M BP14  BP7
                           C1023 C3841 C6023   |  BP21
                                       C1741   |  BP10  BP9
                                 C2942 C6141   |S BP11  BP12  BP6
                                               |
                                               |T BP8
-1                                     C3243 T+
                                       C5243   |
                                               |
                                               |
                                               |
                                               |
-2                                             +
                                  <low ability>|<easy>
```

Person mean = 1.45 logit

Maximum item = 0.88 logit

Item mean = 0.22 logit

Minimum item =- 0.81 logit

Figure 5.26

Person-Item Map for Business Processes

Table 5.40

Probability of Success for Business Processes

Person	Measure (logit)	Probability BP1	BP3	BP4	BP6	BP7	BP8	BP9	BP10	BP11	BP12	BP 13	BP14	BP17	BP18	BP19	BP20	BP21
C132344132314211422221	0.72	0.60	0.58	0.50	0.78	0.68	0.82	0.73	0.74	0.77	0.78	0.62	0.67	0.59	0.61	0.51	0.62	0.70
C534243132353151451121	0.6	0.57	0.55	0.47	0.76	0.65	0.80	0.71	0.71	0.75	0.76	0.59	0.64	0.56	0.58	0.48	0.59	0.67
C562344112352121821221	0.56	0.56	0.54	0.46	0.75	0.64	0.80	0.70	0.70	0.74	0.75	0.58	0.63	0.55	0.57	0.47	0.58	0.66
C542344222353131532221	0.53	0.55	0.53	0.46	0.74	0.64	0.79	0.69	0.70	0.74	0.74	0.57	0.62	0.54	0.57	0.46	0.57	0.66
C181334222155111112221	0.44	0.53	0.51	0.43	0.73	0.62	0.78	0.67	0.68	0.72	0.73	0.55	0.60	0.52	0.54	0.44	0.55	0.64
C354344131444111521121	0.44	0.53	0.51	0.43	0.73	0.62	0.78	0.67	0.68	0.72	0.73	0.55	0.60	0.52	0.54	0.44	0.55	0.64
C344234231354211322221	0.19	0.47	0.45	0.37	0.67	0.55	0.73	0.62	0.62	0.67	0.67	0.49	0.54	0.46	0.48	0.38	0.49	0.58
C482344232354171531121	0.11	0.45	0.43	0.35	0.65	0.53	0.72	0.60	0.60	0.65	0.65	0.47	0.52	0.44	0.46	0.36	0.47	0.56
C594131222322111211121	0.08	0.44	0.42	0.35	0.65	0.53	0.71	0.59	0.60	0.64	0.65	0.46	0.51	0.43	0.46	0.35	0.46	0.55
C602343232354211211221	-0.09	0.40	0.38	0.31	0.61	0.49	0.67	0.55	0.55	0.60	0.61	0.42	0.47	0.39	0.41	0.31	0.42	0.51
C384131222332111432222	-0.14	0.39	0.37	0.30	0.60	0.47	0.66	0.53	0.54	0.59	0.60	0.41	0.46	0.38	0.40	0.30	0.41	0.50
C102344232341111212221	-0.17	0.38	0.36	0.29	0.59	0.47	0.65	0.53	0.53	0.58	0.59	0.40	0.45	0.37	0.39	0.30	0.40	0.49
C174143211353212112222	-0.36	0.34	0.32	0.26	0.54	0.42	0.61	0.48	0.49	0.53	0.54	0.35	0.40	0.33	0.35	0.26	0.35	0.44
C294234212131111311121	-0.44	0.32	0.30	0.24	0.52	0.40	0.59	0.46	0.47	0.51	0.52	0.34	0.38	0.31	0.33	0.24	0.34	0.42
C614132212443221332221	-0.51	0.30	0.29	0.23	0.50	0.38	0.57	0.44	0.45	0.50	0.50	0.32	0.37	0.30	0.32	0.23	0.32	0.40
C324344233355111812221	-1.06	0.20	0.19	0.15	0.37	0.26	0.44	0.31	0.32	0.36	0.37	0.21	0.25	0.20	0.21	0.15	0.21	0.28
C524344222341211642222	-1.21	0.18	0.17	0.13	0.34	0.24	0.40	0.28	0.29	0.33	0.34	0.19	0.22	0.17	0.19	0.13	0.19	0.25

Table 5.41

Probability of Success for Business Processes (BP) and Innovation Process (IP)

Person	Logit measure	Mean BP & IP	Probability
C024334131243111321221	4.33	0.22	0.98
C014323131355131651221	3.79	0.22	0.97
C124244131155161841221	3.65	0.22	0.97
C284234112111111511111	3.59	0.22	0.97
C234232231255171541221	3.3	0.22	0.96
C574324132155171371111	3.06	0.22	0.94
C514343231455121831111	3	0.22	0.94
C444132232355151841111	2.97	0.22	0.94
C151333122355111741211	2.92	0.22	0.94
C264233231255141431211	2.89	0.22	0.94
C054243131455121321111	2.64	0.22	0.92
C063234131455141331111	2.59	0.22	0.91
C191223122243111211111	2.42	0.22	0.90
C434233131454151111221	2.39	0.22	0.90
C334132133322111112221	2.28	0.22	0.89
C084344231315241742221	2.21	0.22	0.88
C041344122343111411111	2.12	0.22	0.87
C391344123153131321222	2.1	0.22	0.87
C201334122344111311111	1.9	0.22	0.84
C094243231454111711111	1.86	0.22	0.84
C423213112341131831221	1.84	0.22	0.83
C143344132355141131111	1.73	0.22	0.82
C314243132151121531111	1.73	0.22	0.82
C114233133454151831111	1.65	0.22	0.81
C474142122431111121221	1.65	0.22	0.81
C374133121454111112221	1.63	0.22	0.80
C031131122153122311221	1.59	0.22	0.80
C222244231455111431121	1.59	0.22	0.80
C163314232352211511221	1.57	0.22	0.79
C212334123354171471211	1.53	0.22	0.79

Table 5.41 *Continued*

Person	Logit measure	Mean BP & IP	Probability
C251243122351141121222	1.53	0.22	0.79
C274112232155111112221	1.45	0.22	0.77
C404132133355111112221	1.37	0.22	0.76
C304233132153111411121	1.34	0.22	0.75
C244233212342121111221	1.28	0.22	0.74
C414132212331121412211	1.24	0.22	0.73
C074131231331221621211	1.13	0.22	0.71
C504314223354231222211	1.11	0.22	0.71
C364344131431131421111	1	0.22	0.69
C454343222354132331222	1	0.22	0.69
C464243112331211322121	1	0.22	0.69
C584132212411111111111	0.98	0.22	0.68
C554132112342141331121	0.97	0.22	0.68
C494244221355111611221	0.88	0.22	0.66
C132344132314211422221	0.72	0.22	0.62
C534243132353151451121	0.6	0.22	0.59
C562344112352121821221	0.56	0.22	0.58
C542344222353131532221	0.53	0.22	0.58
C181334222155111112221	0.44	0.22	0.55
C354344131444111521121	0.44	0.22	0.55
C344234231354211322221	0.19	0.22	0.49
C482344232354171531121	0.11	0.22	0.47
C594131222322111211121	0.08	0.22	0.47
C602343232354211211221	-0.09	0.22	0.42
C384131222332111432222	-0.14	0.22	0.41
C102344232341111212221	-0.17	0.22	0.40
C174143211353212112222	-0.36	0.22	0.36
C294234212131111311121	-0.44	0.22	0.34
C614132212443221332221	-0.51	0.22	0.33
C324344233355111812221	-1.06	0.22	0.22
C524344222341211642222	-1.21	0.22	0.19

5.3.5.7 Summary

The above findings are to respond the first research objective in determining the relationship between the antecedents (leadership, managerial levers and business processes) and innovation process for 61 respodents from electrical and electronics manufacturing companies in Malaysia. In achieving this objective, analysis is based on fit statistics, the mean MNSQ value, square-root of MNSQ and simple linear function. The results indicates that all three dimensions to have a positive relationship with innovation process and has supported testable statement H1a, H1c and H1e. The findings have supported the previous studies such as (Chang et al., 2011) and (Garcı´a-Morales et al., 2006). As for the testable statements H1b, H1d and H1f the ability level between antecedents and innovation process is achieved through its probability of success in implementing those items. In general, most of the items for these dimensions are common practices that being implemented in participating companies. However, it is still depending on the company ability level. Therefore, the higher the ability to implement these antecedents so that the better their innovation process in the respective companies.

5.3.6 Research Question 2

"RQ2: Is there any relationship between innovation process and innovation outcome?

The second research question is aimed to determine on whether is there any relationship exist between innovation process and innovation outcome. The testable statement is H_{2a}. Both variable are important in determining the success of innovation in the organisation (Guimaraes, 2011). Based on 61 respondents from the electrical and electronic companies, analysis of the relationship as indicated in Table 5.42.

5.3.6.1 The relationship between innovation process and innovation outcome

Table 5.42
Summary Statistics for Innovation Process and Innovation Outcome

	Measure Item	**Outfit**	
	logit	**MNSQ**	**Zstd**
Mean	0.07	0.97	-0.2
Standard Deviation	0.57	0.20	1.0
Maximum	0.88	1.48	1.8
Minimum	-1.09	0.70	-2.0
Item Reliability	0.90		
Separation Index	3.00		

The item reliability is at 0.90 logit and separation index 3.00 logit indicates that the variables have fulfiled the good rating of quality criteria (Azrilah, 1996). The mean value for the item is reported at 0.07 logit. This gives an indicative that items are easy whereby all items are adjacent to 0.00 logit item mean that has been set up earlier. The minimum and maximum for this item is at -1.09 and 0.88 respectively. The fit statistic for MNSQ is between 0.70 logit and 1.48 logit while the ZSTD is between -2.0 logit to 1.8 logit. Therefore items are fit to the specified model in explaining the relationship.

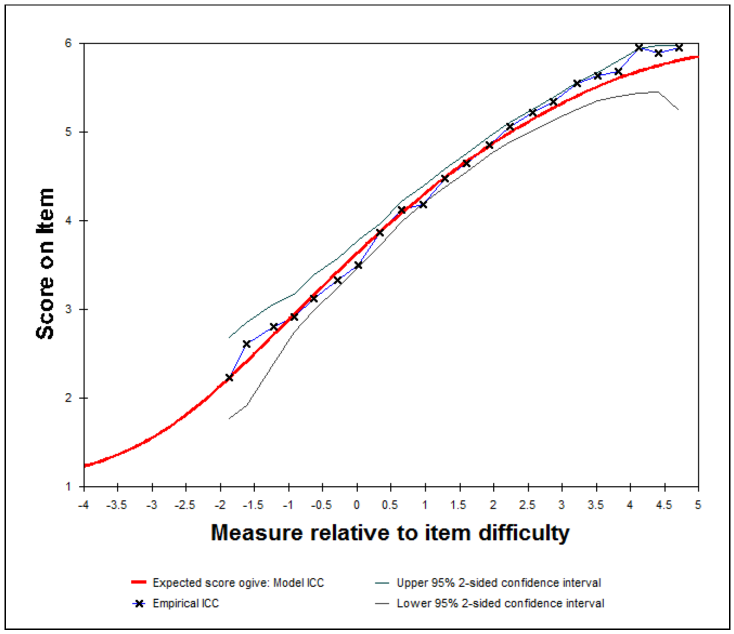

Figure 5.27
GCC Graph for Innovation Process and Innovation Outcome

As shown in Figure 5.27 above, items are plotted between accepted level of $\pm$ 2 ZSTD and this relationship is within 95% of confidence level. The linear function graph in Figure 5.28 below shows that this relationship is a positive relationship with the a slope of 0.965 logit for the items. The mean value for MNSQ is reported at 0.97 logit while square-root for MNSQ is 0.98 logit, which closer to 1.00.

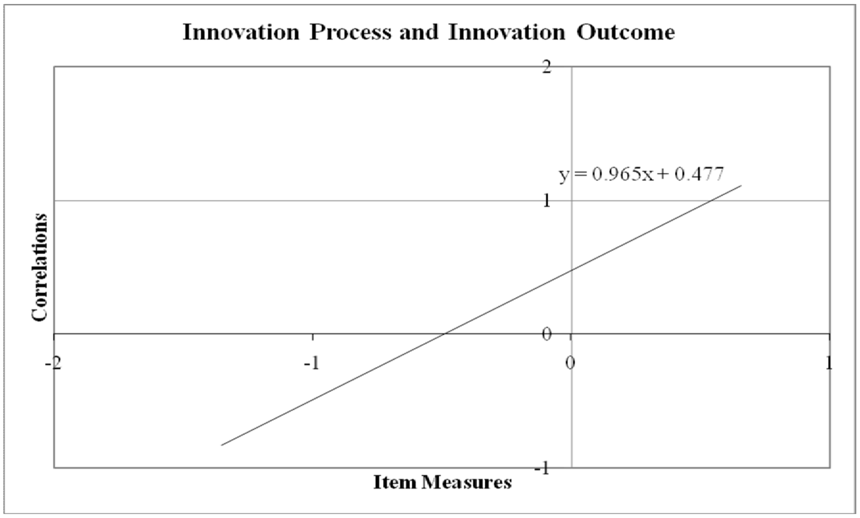

Figure 5.28
The Relationship between Innovation Process and Innovation Outcome

5.3.6.2 The ability level between innovation process and innovation outcome

Innovation process is important as implementation tool of innovation in the organisation. The dimension involves a series of activity which include idea generation, idea mobilisation, advocacy, screening, experimentation, commercialisation, diffusion and implementation. As for this study, there are 21 items representing the dimension.

Similar to the previous discussions, the following describes the ability level of the respondents in performing innovation process items. Figure 5.29 below show the variable map between 61 electrical and electronics companies and the items under innovation process. The mean score for innovation process is 0.40 logit. The maximum and minimum positions are 0.88 logit and –0.50 logit respectively. The person mean value is at 1.45 logit. The 31 respondents are still classified as high ability level since their locations are above person mean of 1.45 logit. Hence, the free item area shows that all items are very easy for the companies to apply in their respective organisations. About 19 of the companies are the moderate group which located between item mean value and person mean value. Therefore these companies' perceived items that located above the mean can be classified as difficult. From the person-item map, there are 12 items identified comprise of IP1, IP3, IP4, IP6, IP7, IP8, IP11, IP12, IP13, IP14, IP16 and IP28. Most of the issues that are difficult related to:

a) Idea generation process in terms of guideline and evaluation on the sources of idea.
b) Idea mobilisation – the connection of idea sources across departments, geography and authority ranks
c) Accountability, reward and recognition systems show value in both idea generation and idea mobilisation
d) Interaction of ideas with stakeholders
e) Idea screening process such as standards, evaluation and transperancy across organisation
f) Resources for experimentation
g) Variety of avenues to experiment, some of which might involved external parties
h) Utilisation of social network.

Organisations which located below the item mean value of 0.40 logit are those with low abilities to implement innovation process. This group is represented by 11 companies. For the lowest achievers such as C3243442333551118l2221 and C52434422234121164222, all items of innovation process are considered very difficult as compared to others due to their postion at -1.06 and -1.21 logit respectively. Their position is far lower than the mean item 0.40 logit and even lower than the minimum item of IP29 (the use of technology for communication) at 0.49 logit. It is noted that factors that might contribute to their low abilities are due to the lack of idea generation, do not involved in internal and external R&D activities and there is no activity that engage external knowledge with regards to innovation.

```
                          Person - MAP – Item
                        <high ability>|<difficult>
 5                                    +
                                      |
                                      |
                                      |
                                C024  |
                                      |
 4                                    +
                                C014 T|
                           C124 C284  |
                                      |
                                C234  |
                                      |
 3                C151 C444 C514 C574 +
                                C264  |
                           C054 C063 S|
                                C191  |
                           C334 C434  |
                      C041 C084 C391  |
 2                                    +
                      C094 C201 C423  |
   C031 C114 C143 C222 C314 C374 C474 |
                  C163 C212 C251 C274 M|
                      C244 C304 C404  |
 Person mean = 1.45 logit
                      C074 C414 C504  |T                     Maximum item = 0.88 logit
 1           C364 C454 C464 C554 C584 +
                                C494  |S IP11 IP3  IP7  IP8
                           C132 C534  |  IP12 IP14 IP16 IP28 IP4  IP6
                  C181 C354 C542 C562 |  IP1  IP13
                                      |M IP5
                           C344 C482 S|  IP15 IP26 IP9       Item mean = 0.40 logit
 0                              C594  +S IP21
                      C102 C384 C602  |  IP17 IP23 IP25
                                C174  |T
                           C294 C614  |  IP29
                                      |
                                      |                   Minimum item  = -0.50 logit
-1                              C324 T+
                                C524  |
                                      |
                                      |
                                      |
                                      |
-2                                    +
                         <low ability>|<easy>
```

Figure 5.29
Person-Item Map for Innovation Process

The relationship between the ability level and difficulty of innovation process items are also showed through the probability formula. Based on each person logit score, Table 5.43 below tabulates the probability of success in the electrical and electronics companies in implementing 21 innovation process items. The table show some of the 17 companies which have probability of success below than 50 percent to implement items under innovation process particularly items related to the activities in idea generation, mobilisation, screening and experimentation.

In this context, high numbers of companies which have low probability of success are among the high as compared to other dimension such as leadership, managerial levers, business processes and innovation outcome. Therefore, companies perceived innovation process as difficult stage when implementing the innovation in their routine activities. Nevertheless, there are also items with high percentage probability of success such as IP9, IP17 and IP21 which related to organisation and customer consideration in the screening process, utilisation of technology invested and objective towards commercialisation.

The ability of companies is further explored through the relationship between innovation process and innovation outcome. The testable statement is H_{2b}. Table 5.44 shows the probability of success performing items innovation process and innovation outcome. Calculations are based on the logit score for each person responded, mean item for innovation process and innovation outcome (0.07 logit) into the probability formula. In general, there are 52 companies achieved more than 50 percent probability of success in performing this relationship. From the table, it shows that higher ability companies have probability of success more than 80 percent to perform items of innovation process and innovation outcome. The moderate ability companies have probability of success between 50 to 80 percent while the poor ability companies only managed to achieve less than 50 percent. Therefore, the higher the ability of a company, the higher the probability of success in performing innovation process which gives higher innovation outcome. While the lower ability companies perform low probability of success in innovation process as well as innovation outcome.

Table 5.43

Probability of Success for Innovation Process items

Person	Measure (logit)	Probaility IP1	IP3	IP4	IP5	IP6	IP7	IP8	IP9	IP11	IP12	IP13	IP14	IP15	IP16	IP17	IP21	IP23	IP25	IP26	IP28	IP29
C494244221355111611221	0.88	0.58	0.53	0.53	0.62	0.53	0.51	0.50	0.69	0.50	0.57	0.60	0.54	0.69	0.53	0.74	0.69	0.73	0.74	0.67	0.57	0.80
C132344132314211422221	0.72	0.54	0.49	0.50	0.58	0.50	0.48	0.46	0.65	0.46	0.53	0.56	0.50	0.65	0.50	0.70	0.66	0.69	0.71	0.63	0.53	0.77
C534243132353151451121	0.6	0.51	0.46	0.47	0.55	0.47	0.45	0.43	0.62	0.43	0.50	0.53	0.47	0.62	0.47	0.68	0.63	0.67	0.69	0.60	0.50	0.75
C562344112352121821221	0.56	0.50	0.45	0.46	0.54	0.46	0.44	0.42	0.62	0.42	0.49	0.52	0.46	0.62	0.46	0.67	0.62	0.66	0.68	0.59	0.49	0.74
C542344222353131532221	0.53	0.50	0.44	0.45	0.53	0.45	0.43	0.41	0.61	0.41	0.48	0.51	0.46	0.61	0.45	0.66	0.62	0.65	0.67	0.59	0.48	0.74
C181334222155111112221	0.44	0.47	0.42	0.43	0.51	0.43	0.41	0.39	0.59	0.39	0.46	0.49	0.43	0.59	0.43	0.64	0.59	0.63	0.65	0.56	0.46	0.72
C354344131444111521121	0.44	0.47	0.42	0.43	0.51	0.43	0.41	0.39	0.59	0.39	0.46	0.49	0.43	0.59	0.43	0.64	0.59	0.63	0.65	0.56	0.46	0.72
C344234231354211322221	0.19	0.41	0.36	0.37	0.45	0.37	0.35	0.33	0.52	0.33	0.40	0.43	0.37	0.52	0.37	0.58	0.53	0.57	0.59	0.50	0.40	0.67
C482344232354171531121	0.11	0.39	0.34	0.35	0.43	0.35	0.33	0.32	0.50	0.32	0.38	0.41	0.35	0.50	0.35	0.56	0.51	0.55	0.57	0.48	0.38	0.65
C594131222322111211121	0.08	0.38	0.33	0.34	0.42	0.34	0.32	0.31	0.50	0.31	0.37	0.40	0.35	0.50	0.34	0.56	0.50	0.54	0.56	0.48	0.37	0.64
C602343232354211211221	-0.09	0.35	0.30	0.30	0.38	0.30	0.29	0.27	0.46	0.27	0.33	0.36	0.31	0.46	0.30	0.51	0.46	0.50	0.52	0.43	0.33	0.60
C384131222332111432222	-0.14	0.33	0.29	0.29	0.37	0.29	0.28	0.27	0.44	0.27	0.32	0.35	0.30	0.44	0.29	0.50	0.45	0.49	0.51	0.42	0.32	0.59
C102344232341111212221	-0.17	0.33	0.28	0.29	0.36	0.29	0.27	0.26	0.44	0.26	0.32	0.34	0.29	0.44	0.29	0.50	0.44	0.48	0.50	0.41	0.32	0.58
C174143211353212112222	-0.36	0.29	0.24	0.25	0.32	0.25	0.24	0.22	0.39	0.22	0.28	0.30	0.26	0.39	0.25	0.45	0.40	0.43	0.46	0.37	0.28	0.53
C294234212131111311121	-0.44	0.27	0.23	0.24	0.30	0.24	0.22	0.21	0.37	0.21	0.26	0.28	0.24	0.37	0.24	0.43	0.38	0.41	0.44	0.35	0.26	0.51
C614132212443221332221	-0.51	0.26	0.22	0.22	0.28	0.22	0.21	0.20	0.35	0.20	0.25	0.27	0.23	0.35	0.22	0.41	0.36	0.40	0.42	0.33	0.25	0.50
C324344233355111812221	-1.06	0.17	0.14	0.14	0.19	0.14	0.13	0.13	0.24	0.13	0.16	0.18	0.15	0.24	0.14	0.29	0.25	0.27	0.29	0.22	0.16	0.36
C524344222341211642222	-1.21	0.15	0.12	0.12	0.17	0.12	0.12	0.11	0.21	0.11	0.14	0.15	0.13	0.21	0.12	0.26	0.22	0.25	0.26	0.20	0.14	0.33

Table 5.44

Probability of Success for Innovation Process (IP) and Innovation Outcome (IO)

Person	Logit measure	Mean IP & IO	Probability
C02433413124311132122l	4.33	0.07	0.99
C01432313135513165122l	3.79	0.07	0.98
C12424413115516184122l	3.65	0.07	0.97
C28423411211111151111l	3.59	0.07	0.97
C23423223125517154122l	3.3	0.07	0.96
C57432413215517137111l	3.06	0.07	0.95
C51434323145512183111l	3	0.07	0.95
C44413223235515184111l	2.97	0.07	0.95
C15133312235511174121l	2.92	0.07	0.95
C26423323125514143121l	2.89	0.07	0.94
C05424313145512132111l	2.64	0.07	0.93
C06323413145514133111l	2.59	0.07	0.93
C19122312224311121111l	2.42	0.07	0.91
C43423313145415111122l	2.39	0.07	0.91
C33413213332211111222l	2.28	0.07	0.90
C08434423131524174222l	2.21	0.07	0.89
C04134412234311141111l	2.12	0.07	0.89
C391344123153131321222	2.1	0.07	0.88
C20133412234411131111l	1.9	0.07	0.86
C09424323145411171111l	1.86	0.07	0.86
C42321311234113183122l	1.84	0.07	0.85
C14334413235514113111l	1.73	0.07	0.84
C31424313215112153111l	1.73	0.07	0.84
C11423313345415183111l	1.65	0.07	0.83
C47414212243111112122l	1.65	0.07	0.83
C37413312145411111222l	1.63	0.07	0.83
C03113112215312231122l	1.59	0.07	0.82
C22224423145511143112l	1.59	0.07	0.82
C16331423235221151122l	1.57	0.07	0.82
C21233412335417147121l	1.53	0.07	0.81

Table 5.44 *Continued*

Person	Logit measure	Mean IP & IO	Probability
C251243122351141121222	1.53	0.07	0.81
C274112232155111112221	1.45	0.07	0.80
C404132133355111112221	1.37	0.07	0.79
C304233132153111411121	1.34	0.07	0.78
C244233212342121111221	1.28	0.07	0.77
C414132212331121412211	1.24	0.07	0.76
C074131231331221621211	1.13	0.07	0.74
C504314223354231222211	1.11	0.07	0.74
C364344131431131421111	1	0.07	0.72
C454343222354132331222	1	0.07	0.72
C464243112331211322121	1	0.07	0.72
C584132212411111111111	0.98	0.07	0.71
C554132112342141331121	0.97	0.07	0.71
C494244221355111611221	0.88	0.07	0.69
C132344132314211422221	0.72	0.07	0.66
C534243132353151451121	0.6	0.07	0.63
C562344112352121821221	0.56	0.07	0.62
C542344222353131532221	0.53	0.07	0.61
C181334222155111112221	0.44	0.07	0.59
C354344131444111521121	0.44	0.07	0.59
C344234231354211322221	0.19	0.07	0.53
C482344232354171531121	0.11	0.07	0.51
C594131222322111211121	0.08	0.07	0.50
C602343232354211211221	-0.09	0.07	0.46
C384131222332111432222	-0.14	0.07	0.45
C102344232341111212221	-0.17	0.07	0.44
C174143211353212112222	-0.36	0.07	0.39
C294234212131111311121	-0.44	0.07	0.38
C614132212443221332221	-0.51	0.07	0.36
C324344233355111812221	-1.06	0.07	0.24
C524344222341211642222	-1.21	0.07	0.22

5.3.7 Research Question 3

"RQ3: Is there any relationship between innovation process and firm performance?

The third research question is aimed to determine on whether is there any relationship exist between innovation process and firm performance. The testable statement is H_{3a}. Based on table 5.45, the summary statistics for the two variables shows a separation index of 1.90 and item reliability of 0.78 and it can be considered as fair rating instrument quality criteria as mentioned by Azrilah (1996). The mean value for the item is reported at 0.42 logit. Therefore it shows that items are are located slightly above 0.00 logit mean. The minimum and maximum for this item is at -0.50 and 0.88 respectively. The fit statistic for MNSQ is between 0.73 logit and 1.39 logit while the ZSTD is between -2.0 to 2.0 logit. Therefore items are fit to the specified model in explaining the relationship.

5.3.7.1 The relationship between innovation process and firm performance

Table 5.45
Summary Statistics for Innovation Process and Firm Performance

	Measure Item	**Outfit**	
	logit	**MNSQ**	**Zstd**
Mean	0.42	0.94	0.1
Standard Deviation	0.38	0.24	1.2
Maximum	0.88	1.39	2.0
Minimum	-0.50	0.73	-2.0
Item Reliability	0.78		
Separation Index	1.90		

As shown in Figure 5.30 below, items are plotted between accepted level of ± 2 ZSTD and this relationship is within 95% of confidence level. The linear function graph in Figure 5.31 below shows that this relationship is a positive relationship with the a slope of 0.972 logit for the items. The mean value for MNSQ is reported at 0.94 logit while square-root for MNSQ is 0.972 logit, which closer to 1.00. The positive relationship is proven to be exist since the value of MNSQ closer to 1.0 has little distortion to the measurement analysis.

This finding has improve the inconsistencies in previous studies conducted by Rosenbusch et al. (2010) and (Marques & Monteiro-Barata, 2006). In addition, finding has assist to explain the details of innovation process through its positive relationship between its dimension and firm performance. Therefore, this study enhances the qualitative study conducted earlier by Desouza et al. (2009) and also adding up on empirical finding with regards to innovation process as claimed by Hobday (2005).

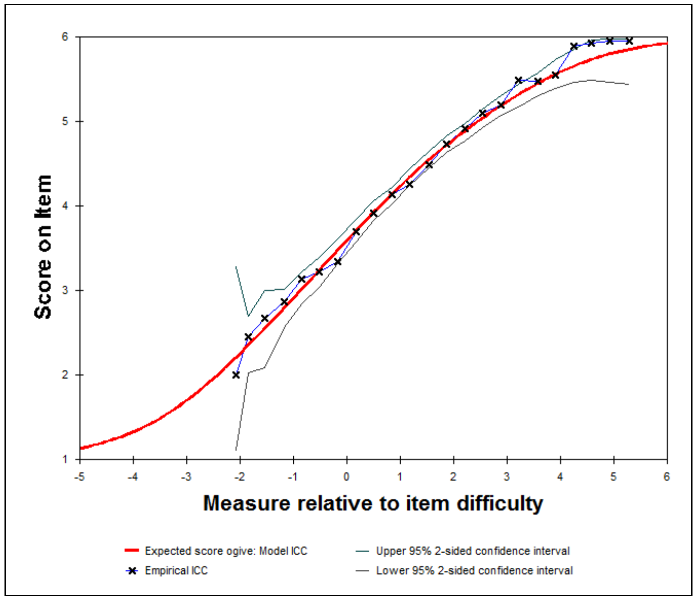

Figure 5.30
GCC Graph for Innovation Process and Firm Performance

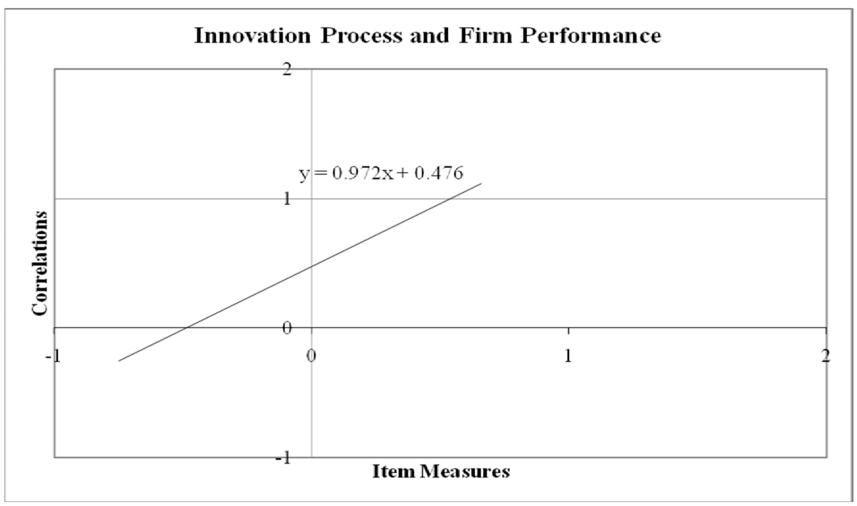

Figure 5.31
The Relationship between Innovation Process and Firm Performance

5.3.7.2 The ability level between innovation process and firm performance

The ability of company is further explored through the probability of success for relationship between innovation process and firm performance. The testable statement for this relationship is H_{3b}. Calculations are based on the logit score for each person, mean item value for innovation process and firm performance (0.42 logit). Table 5.46 shows that the high ability companies have probability of success more than 74 percent to perform items of innovation process and firm performance. This also applies to the moderate ability companies which have probability of success between 50 to 72 percent while the poor ability companies only managed to achieve less than 50 percent for relationship items between innovation process and firm performance. Therefore, the higher the ability of a company, the higher the probability of success in performing innovation process and firm performance as compared to the low ability company. The clarification regarding this relationship will be further explained in the following section when comparing simultaneously with the three other relationships as showed in Table 5.52.

Table 5.46
Probability of Success for Innovation Process (IP) and Firm Performance (FR)

Person	Person (logit)	Probability IP & FR
C024334131243111321221	4.33	0.98
C014323131355131651221	3.79	0.97
C124244131155161841221	3.65	0.96
C284234112111111511111	3.59	0.96
C234232231255171541221	3.3	0.95
C574324132155171371111	3.06	0.93
C514343231455121831111	3	0.93
C151333122355111741211	2.97	0.93
C444132232355151841111	2.92	0.92
C264233231255141431211	2.89	0.92
C054243131455121321111	2.64	0.90
C063234131455141331111	2.59	0.90
C191223122243111211111	2.42	0.88
C434233131454151111221	2.39	0.88
C334132133322111112221	2.28	0.87
C084344231315241742221	2.21	0.86
C041344122343111411111	2.12	0.85
C391344123153131321222	2.1	0.84

Table 5.46 *Continued*

Person	Person (logit)	Probability IP & FR
C094243231454111711111	1.9	0.81
C201334122344111311111	1.86	0.81
C423213112341131831221	1.84	0.81
C314243132151121531111	1.73	0.79
C143344132355141131111	1.73	0.79
C114233133454151831111	1.65	0.77
C374133121454111112221	1.65	0.77
C474142122431111121221	1.63	0.77
C222244231455111431121	1.59	0.76
C031131122153122311221	1.59	0.76
C163314232352211511221	1.57	0.76
C212334123354171471211	1.53	0.75
C251243122351141121222	1.53	0.75
C274112232155111112221	1.45	0.74
C404132133355111112221	1.37	0.72
C304233132153111411121	1.34	0.72
C244233212342121111221	1.28	0.70
C414132212331121412211	1.24	0.69
C074131231331221621211	1.13	0.67
C504314223354231222211	1.11	0.67
C364344131431131421111	1	0.64
C454343222354132331222	1	0.64
C464243112331211322121	1	0.64
C584132212411111111111	0.98	0.64
C554132112342141331121	0.97	0.63
C494244221355111611221	0.88	0.61
C132344132314211422221	0.72	0.57
C534243132353151451121	0.6	0.54
C562344112352121821221	0.56	0.53
C542344222353131532221	0.53	0.53
C354344131444111521121	0.44	0.50
C181334222155111112221	0.44	0.50
C482344232354171531121	0.19	0.44
C344234231354211322221	0.11	0.42
C594131222322111211121	0.08	0.42
C602343232354211211221	-0.09	0.38
C384131222332111432222	-0.14	0.36
C102344232341111212221	-0.17	0.36
C174143211353212112222	-0.36	0.31
C294234212131111311121	-0.44	0.30
C614132212443221332221	-0.51	0.28
C324344233355111812221	-1.06	0.19
C524344222341211642222	-1.21	0.16

5.3.8 Research Question 4

"RQ4: Is there any relationship between innovation outcome and firm performance?

The fourth research question is aimed to determine on whether is there any relationship exist between innovation outcome and firm performance. The testable statement for this relationship is H_{4a}. Based on Table 5.47, the summary statistics for the two variables shows a separation index of 2.71 logit and item reliability of 0.88. The mean value for the item is reported at -0.24 logit. It shows that items are easly applied to the electrical and electronics companies. The minimum and maximum for this item is at -1.09 logit and 0.66 logit respectively. The fit statistic for MNSQ is between 0.70 and 1.39 logit while the Z standard is between -1.8 to 2.0 logit. Therefore data are fit to describe the relationship.

5.3.8.1 The relationship between innovation outcome and firm performance

Table 5.47
Summary Statistics for Innovation Outcome and Firm Performance

	Measure Item	**Outfit**	
	logit	**MNSQ**	**Zstd**
Mean	-0.24	0.93	-0.40
Standard Deviation	0.54	0.22	1.0
Maximum	0.66	1.39	2.0
Minimum	-1.09	0.70	-1.8
Item Reliability	0.88		
Separation Index	2.71		

As shown in Figure 5.32 below, items are plotted between accepted level of $\pm$ 2 ZSTD and this relationship is within 95% of confidence level. The linear function graph in Figure 5.33 below shows that this relationship is a positive relationship with the a slope of 0.964 logit for the items. The mean value for MNSQ is reported at 0.93 logit while square-root for MNSQ is 0.96 logit, which is closer to 1.00. This relationship is also significant positive relationship within 95% of confidence interval. The finding has supported arguments by Neely et al. (2001) who stress the importance of relationship between innovation outcome and firm performance.

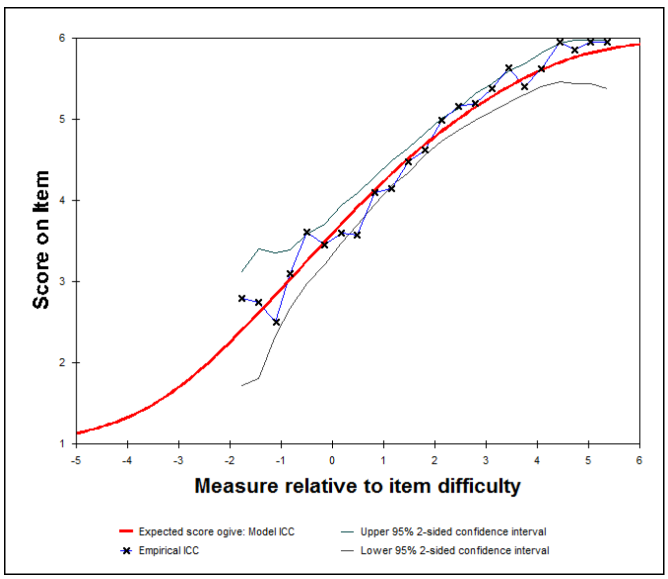

Figure 5.32
GCC Graph for Innovation Outcome and Firm Performance

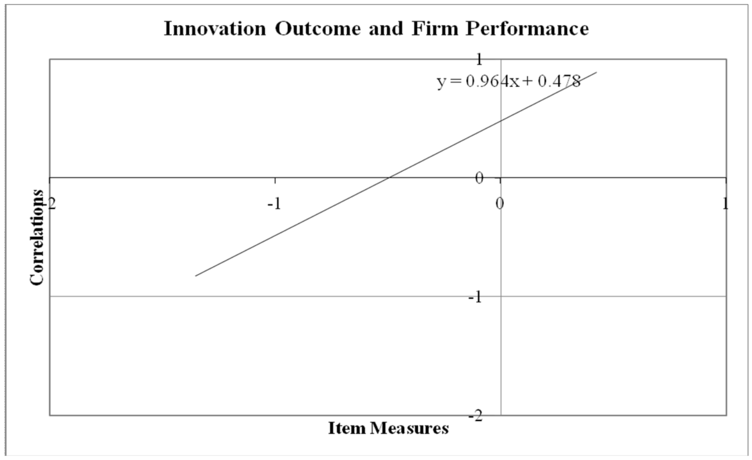

Figure 5.33
The Relationship between Innovation Outcome and Firm Performance

5.3.8.2 The ability level between innovation outcome and firm performance

Innovation outcome in this study is the achievement of the organisation as a result of innovation implementation. Since it describes on what kind of innovation generated, the items established are related to product innovation and process innovation. In addressing outcome of innovation, companies need to respond to 14 items.

The ability to perform this variable is presented through the person-item map and the use of probability calculation. Figure 5.34 below show the variable map between 61 electrical and electronics companies and the items under innovation process. The mean score for innovation outcome is -0.42 logit. Maximum item is at 0.29 logit and minimum item located at -1.09 logit. This means that innovation outcome items are easy and applied in most of the responded companies.

Items that are below the mean value are easy as compared to item located above the mean of -0.42 logit. Based on the person mean 1.45 logit, it is still 31 companies have high abilities to perform innovation outcome which is the first group as mentioned earlier. As shown through the free item area, all items are very easy for the high achievers. Since innovation outcome is easy to perform as compared to innovation process, the difference can be noted for the moderate group level. In performing the innovation outcome items and there are 26 companies fall under this category. Nevertheless, these companies still confront with difficulties in performing items such as IO5, IO6, IO7, IO8, IO15, IO16 and IO18. These items are related to:

a) The significant diference of product innovation in terms of newness from existing product of competitors
b) Products that solve the customer problem
c) Products that lead to significant cost saving for customers
d) Products that deliver high benefits to customers
e) The newness of technology
f) The rate of changes in processes
g) Creative in methods of operation

In the context of innovation outcome, only 4 companies fall under the low ability category. These companies are C29423421213111131 1121, C614132212443221332221, C614132212443221332221 and C52434422234121 1642222 where all were placed at the negative logit value, lower than the item mean of -0.42 logit. As for these companies, all innovation outcome items are difficult and therefore this would later affect their probability of success.

```
                    Person - MAP – Item
                  <high ability>|<difficult>
 5                              +
                                |
                                |
                                |
                         C02433 |
                                |
 4                              +
                       C01432 T|
                C12424 C28423  |
                                |
                         C23423 |
                                |
 3    C15133 C44413 C51434 C57432  +
                         C26423  |
                  C05424 C06323 S|
                         C19122  |
                  C33413 C43423  |
           C04134 C08434 C39134  |
 2                              +
           C09424 C20133 C42321  |
 C03113 C11423 C14334 C22224 C31424 C37413 C47414  |
    C16331 C21233 C25124 C27411 M|
           C24423 C30423 C40413  |
           C07413 C41413 C50431  |
 1   C36434 C45434 C46424 C55413 C58413  +
                         C49424  |
                  C13234 C53424  |
    C18133 C35434 C54234 C56234  |
                                 |T IO5
                  C34423 C48234 S|  IO6
 0                       C59413  +S IO15
           C10234 C38413 C60234  |  IO16  IO7   IO8
                         C17414  |  IO18
                  C29423 C61413  |M IO4
                                 |  IO14  IO3
                                 |S IO11  IO17
-1                       C32434 T+  IO13
                         C52434  |T IO12
                                 |
                                 |
                                 |
                                 |
-2                               +
                   <low ability>|<easy>
```

Person mean = 1.45 logit

Maximum item = 0.29 logit

Item mean = -0.42 logit

Minimum item -1.09 logit

Figure 5.34

Person-Item Map for Innovation Outcome

The relationship between the ability and difficulty of innovation outcome items are also showed through the probability formula. Based on each person logit score, Table 5.48 below tabulates the probability of success for all respondents in the electrical and electronics companies in implementing 14 items. From the total, 11 companies have probability of success below than 50 percent in implementing items such as IO5, IO6, IO7 and IO15. Their chances to attempt to the newness of the product and focus towards newness in technology are low which is less than 30 percent.

Nevertheless, due to the most items are easy to the respondents, it is noted that 93 percent (57 companies) have succeeded in getting more than 50 percent chances in probability of success of performing innovation outcome. Item IO12 is the most performed by all 60 companies except for company C524344222341211642222. From the findings, it is noted that the electrical and electronics companies are more focused on process innovation outcome which is limited to improve the cost control.

The ability level of company is further explored through the probability of success for relationship between innovation outcome and firm performance. The testable statement for this relationship is H_{4b}. Based on the mean item value for innovation outcome and firm performance (-0.24 logit), Table 5.49 shows that there are 56 companies have probability of success more than 50 percent to perform items of innovation outcome and firm performance. However, the high ability companies group performed more than 84 percent in relationship between innovation outcome and firm performance. This also applies to the moderate ability companies which have probability of success between 52 to 83 percent while there are 5 poor ability companies only managed to achieve less than 50 percent for relationship items between innovation process and firm performance. Therefore, the higher the ability of a company, the higher the probability of success in performing innovation outcome and firm performance as compared to the low ability company. The clarification regarding this relationship will be further explained in the following section when comparing simultaneously with the three other relationship between variables: innovation process and innovation outcome, innovation outcome and firm performance and innovation process and firm performance.

Table 5.48
Probability of Success for Innovation Outcome items

Person	Measure (logit)	IO3	IO4	IO5	IO6	IO7	IO8	IO11	IO12	IO13	IO14	IO15	IO16	IO17	IO18
							Probability								
C0243341312431113 21221	4.33	0.99	0.99	0.98	0.98	0.99	0.99	0.99	1.00	1.00	0.99	0.99	0.99	0.99	0.99
C01432313135513165 1221	3.79	0.99	0.99	0.97	0.97	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.98	0.99	0.98
C12424413115516184 1221	3.65	0.99	0.98	0.97	0.97	0.98	0.98	0.99	0.99	0.99	0.99	0.97	0.98	0.99	0.98
C28423411211111151 1111	3.59	0.99	0.98	0.96	0.97	0.98	0.98	0.99	0.99	0.99	0.99	0.97	0.98	0.99	0.98
C23423223125517154 1221	3.3	0.98	0.98	0.95	0.96	0.97	0.97	0.98	0.99	0.99	0.98	0.96	0.97	0.98	0.98
C57432413215517137 1111	3.06	0.98	0.97	0.94	0.95	0.96	0.96	0.98	0.98	0.98	0.98	0.96	0.96	0.98	0.97
C51434323145512183 1111	3	0.98	0.97	0.94	0.95	0.96	0.96	0.98	0.98	0.98	0.97	0.95	0.96	0.98	0.97
C44413223235515184 1111	2.97	0.97	0.97	0.94	0.94	0.96	0.96	0.98	0.98	0.98	0.97	0.95	0.96	0.98	0.97
C15133312235511174 1211	2.92	0.97	0.97	0.93	0.94	0.96	0.96	0.98	0.98	0.98	0.97	0.95	0.96	0.98	0.96
C26423323125514143 1211	2.89	0.97	0.97	0.93	0.94	0.95	0.96	0.97	0.98	0.98	0.97	0.95	0.96	0.98	0.96
C05424313145512132 1111	2.64	0.96	0.96	0.91	0.92	0.94	0.95	0.97	0.98	0.97	0.96	0.93	0.95	0.97	0.95
C06323413145514133 1111	2.59	0.96	0.95	0.91	0.92	0.94	0.94	0.97	0.98	0.97	0.96	0.93	0.94	0.97	0.95
C19122312224311121 1111	2.42	0.96	0.95	0.89	0.91	0.93	0.93	0.96	0.97	0.97	0.95	0.92	0.93	0.96	0.94
C43423313145415111 1221	2.39	0.96	0.94	0.89	0.90	0.93	0.93	0.96	0.97	0.97	0.95	0.92	0.93	0.96	0.94
C33413213332211111 2221	2.28	0.95	0.94	0.88	0.89	0.92	0.92	0.95	0.97	0.96	0.95	0.91	0.92	0.96	0.93
C08434423131524174 2221	2.21	0.95	0.93	0.87	0.89	0.91	0.92	0.95	0.96	0.96	0.94	0.90	0.92	0.95	0.93
C04134412234311141 1111	2.12	0.94	0.93	0.86	0.88	0.91	0.91	0.95	0.96	0.96	0.94	0.89	0.91	0.95	0.92
C39134412315313132 1222	2.1	0.94	0.93	0.86	0.88	0.90	0.91	0.95	0.96	0.96	0.94	0.89	0.91	0.95	0.92
C20133412234411131 1111	1.9	0.93	0.91	0.83	0.85	0.89	0.89	0.94	0.95	0.95	0.93	0.87	0.89	0.94	0.91

Table 5.48 *Continued*

Person	Measure (logit)	Probability													
		IO3	IO4	IO5	IO6	IO7	IO8	IO11	IO12	IO13	IO14	IO15	IO16	IO17	IO18
C09424323145411171111 1	1.86	0.93	0.91	0.83	0.85	0.88	0.89	0.93	0.95	0.94	0.92	0.87	0.89	0.94	0.90
C4232131123411318312 21	1.84	0.92	0.91	0.82	0.84	0.88	0.89	0.93	0.95	0.94	0.92	0.86	0.89	0.93	0.90
C143344132355141131111	1.73	0.92	0.90	0.81	0.83	0.87	0.87	0.92	0.94	0.94	0.91	0.85	0.87	0.93	0.89
C314243132151121531111	1.73	0.92	0.90	0.81	0.83	0.87	0.87	0.92	0.94	0.94	0.91	0.85	0.87	0.93	0.89
C114233133454151831111	1.65	0.91	0.89	0.80	0.82	0.86	0.87	0.92	0.94	0.93	0.91	0.84	0.87	0.92	0.88
C474142122431111121221	1.65	0.91	0.89	0.80	0.82	0.86	0.87	0.92	0.94	0.93	0.91	0.84	0.87	0.92	0.88
C374133121454111112221	1.63	0.91	0.89	0.79	0.81	0.86	0.86	0.92	0.94	0.93	0.91	0.84	0.86	0.92	0.88
C031131122153122311221	1.59	0.91	0.88	0.79	0.81	0.85	0.86	0.91	0.94	0.93	0.90	0.83	0.86	0.92	0.88
C222244231455111431121	1.59	0.91	0.88	0.79	0.81	0.85	0.86	0.91	0.94	0.93	0.90	0.83	0.86	0.92	0.88
C163314232352211511221	1.57	0.90	0.88	0.78	0.81	0.85	0.86	0.91	0.93	0.93	0.90	0.83	0.86	0.92	0.87
C212334123354171471211	1.53	0.90	0.88	0.78	0.80	0.84	0.85	0.91	0.93	0.92	0.90	0.82	0.85	0.91	0.87
C251243122351141121222	1.53	0.90	0.88	0.78	0.80	0.84	0.85	0.91	0.93	0.92	0.90	0.82	0.85	0.91	0.87
C274112232155111112221	1.45	0.89	0.87	0.76	0.79	0.83	0.84	0.90	0.93	0.92	0.89	0.81	0.84	0.91	0.86
C404132133355111112221	1.37	0.88	0.86	0.75	0.77	0.82	0.83	0.89	0.92	0.91	0.88	0.80	0.83	0.90	0.85
C304233132153111411121	1.34	0.88	0.86	0.74	0.77	0.82	0.82	0.89	0.92	0.91	0.88	0.79	0.82	0.90	0.85
C244233212342121111221	1.28	0.88	0.85	0.73	0.76	0.81	0.82	0.89	0.91	0.91	0.87	0.78	0.82	0.89	0.84
C414132212331121412211	1.24	0.87	0.84	0.72	0.75	0.80	0.81	0.88	0.91	0.90	0.87	0.78	0.81	0.89	0.83
C074131231331221621211	1.13	0.86	0.83	0.70	0.73	0.78	0.79	0.87	0.90	0.89	0.85	0.76	0.79	0.87	0.82
C504314223354231222211	1.11	0.86	0.82	0.69	0.72	0.78	0.79	0.87	0.90	0.89	0.85	0.75	0.79	0.87	0.81
C364344131431131421111	1	0.84	0.81	0.67	0.70	0.76	0.77	0.85	0.89	0.88	0.84	0.73	0.77	0.86	0.80
C454343222354132331222	1	0.84	0.81	0.67	0.70	0.76	0.77	0.85	0.89	0.88	0.84	0.73	0.77	0.86	0.80
C464243112331211322121	1	0.84	0.81	0.67	0.70	0.76	0.77	0.85	0.89	0.88	0.84	0.73	0.77	0.86	0.80

Table 5.48 *Continued*

Person	Measure (logit)	Probability													
		IO3	IO4	IO5	IO6	IO7	IO8	IO11	IO12	IO13	IO14	IO15	IO16	IO17	IO18
C58413221241111111111	0.98	0.84	0.81	0.67	0.70	0.76	0.77	0.85	0.89	0.88	0.83	0.73	0.77	0.86	0.79
C554132112342141331121	0.97	0.84	0.80	0.66	0.69	0.75	0.76	0.85	0.89	0.88	0.83	0.73	0.76	0.86	0.79
C494244221355111611221	0.88	0.82	0.79	0.64	0.67	0.74	0.75	0.84	0.88	0.87	0.82	0.71	0.75	0.84	0.78
C132344132314211422221	0.72	0.80	0.76	0.61	0.64	0.70	0.72	0.82	0.86	0.85	0.79	0.67	0.72	0.82	0.75
C534243132353151451121	0.6	0.78	0.74	0.58	0.61	0.68	0.69	0.80	0.84	0.83	0.77	0.65	0.69	0.80	0.73
C562344112352121821221	0.56	0.77	0.73	0.57	0.60	0.67	0.68	0.79	0.84	0.82	0.77	0.64	0.68	0.80	0.72
C542344222353131532221	0.53	0.77	0.73	0.56	0.59	0.66	0.68	0.79	0.83	0.82	0.76	0.63	0.68	0.79	0.71
C181334222155111112221	0.44	0.75	0.71	0.54	0.57	0.64	0.66	0.77	0.82	0.81	0.74	0.61	0.66	0.78	0.69
C354344131444111521121	0.44	0.75	0.71	0.54	0.57	0.64	0.66	0.77	0.82	0.81	0.74	0.61	0.66	0.78	0.69
C344234231354211322221	0.19	0.70	0.65	0.48	0.51	0.58	0.60	0.72	0.78	0.76	0.69	0.55	0.60	0.73	0.64
C482344232354171531121	0.11	0.69	0.63	0.46	0.49	0.56	0.58	0.71	0.77	0.75	0.68	0.53	0.58	0.72	0.62
C594131222322111211121	0.08	0.68	0.63	0.45	0.48	0.56	0.57	0.70	0.76	0.74	0.67	0.52	0.57	0.71	0.61
C602343232354211211221	-0.09	0.64	0.59	0.41	0.44	0.51	0.53	0.66	0.73	0.71	0.63	0.48	0.53	0.67	0.57
C384131222332111432222	-0.14	0.63	0.57	0.39	0.43	0.50	0.52	0.65	0.72	0.70	0.62	0.47	0.52	0.66	0.56
C102344232341111212221	-0.17	0.62	0.57	0.39	0.42	0.50	0.51	0.65	0.72	0.69	0.61	0.46	0.51	0.65	0.55
C174143211353212112222	-0.36	0.58	0.52	0.34	0.38	0.45	0.46	0.60	0.67	0.65	0.57	0.41	0.46	0.61	0.50
C294234212131111311121	-0.44	0.56	0.50	0.33	0.36	0.43	0.44	0.58	0.66	0.63	0.55	0.39	0.44	0.59	0.48
C614132212443221332221	-0.51	0.54	0.48	0.31	0.34	0.41	0.43	0.56	0.64	0.62	0.53	0.38	0.43	0.57	0.47
C324344233355111812221	-1.06	0.40	0.35	0.21	0.23	0.29	0.30	0.43	0.51	0.48	0.39	0.26	0.30	0.44	0.33
C524344222341211642222	-1.21	0.37	0.32	0.18	0.20	0.26	0.27	0.39	0.47	0.44	0.36	0.23	0.27	0.40	0.30

Table 5.49

Probability of Success for Innovation Outcome (IO) and Firm Performance (FR)

Person	Person (logit)	Probability IO and FR	Person	Person (logit)	Probability IO and FR
C02433413124311132l221	4.33	0.99	C27411223215511111222l	1.45	0.84
C01432313135513165l221	3.79	0.98	C40413213335511111222l	1.37	0.83
C12424413115516184l221	3.65	0.98	C30423313215311141112l	1.34	0.83
C28423411211111151111l	3.59	0.98	C24423321234212111122l	1.28	0.82
C23423223125517154l221	3.3	0.97	C41413221233112141221l	1.24	0.81
C57432413215517137l111	3.06	0.96	C07413123133122162121l	1.13	0.80
C51434323145512183l111	3	0.96	C50431422335423122221l	1.11	0.79
C15133312235511174l211	2.97	0.96	C36434413143113142111l	1	0.78
C44413223235515184l111	2.92	0.96	C45434322235413233122 2	1	0.78
C26423323125514143l211	2.89	0.96	C46424311233121132212l	1	0.78
C05424313145512132l111	2.64	0.95	C58413221241111111111l	0.98	0.77
C06323413145514133l111	2.59	0.94	C55413211234214133112l	0.97	0.77
C19122312224311121l111	2.42	0.93	C49424422135511161122l	0.88	0.75
C43423313145415111l221	2.39	0.93	C13234413231421142222l	0.72	0.72
C33413213332211111222l	2.28	0.93	C53424313235315145112l	0.6	0.70
C08434423131524174222l	2.21	0.92	C56234411235212182122l	0.56	0.69
C04134412234311141111l	2.12	0.91	C54234422235313153222l	0.53	0.68
C39134412315313132122 2	2.1	0.91	C35434413144411152112l	0.44	0.66
C09424323145411171111l	1.9	0.89	C18133422215511111222l	0.44	0.66
C20133412234411131111l	1.86	0.89	C48234423235417153112l	0.19	0.61
C42321311234113183122l	1.84	0.89	C34423423135421132222l	0.11	0.59
C31424313215112153111l	1.73	0.88	C59413122232211121112l	0.08	0.58
C14334413235514113111l	1.73	0.88	C60234323235421121122l	-0.09	0.54
C11423313345415183111l	1.65	0.87	C38413122233211143222 2	-0.14	0.52
C37413312145411111222l	1.65	0.87	C10234423234111121222l	-0.17	0.52
C47414212243111112122l	1.63	0.87	C17414321135321211222 2	-0.36	0.47
C22224423145511143112l	1.59	0.86	C29423421213111131112l	-0.44	0.45
C03113112215312231122l	1.59	0.86	C61413221244322133222l	-0.51	0.43
C16331423235221151122l	1.57	0.86	C32434423335511181222l	-1.06	0.31
C21233412335417147121l	1.53	0.85	C52434422234121164222 2	-1.21	0.27
C25124312235114112122 2	1.53	0.85			

5.3.9 Research Question 5

" RQ5: Does the innovation outcome mediate the relationship between innovation process and firm performance?

The fifth research question is aimed to determine on whether the innovation outcome mediate the relationship between innovation process and firm performance. The testable statements for this question are H_{5a} and H_{5b}. Before proceed to the mediator analysis, the following Table 5.50 provides the summary statistics in terms of fit criteria for relationship between innovation process, innovation outcome and firm performance. It shows a separation index of 2.97 logit and item reliability of 0.90. The mean value for the item is reported at 0.11 logit. This means that items are easy practiced in the electrical and electronics companies. The minimum and maximum for this item is at -1.09 logit and 0.88 logit respectively. The fit statistic for MNSQ is between 0.70 and 1.48 logit while the ZSTD is between -2.0 to 2.0 logit.

Table 5.50
Summary Statistics for Innovation Process, Innovation Outcome and Firm Performance

	Item Measure	**Outfit**	
	(logit)	**MNSQ**	**Zstd**
Mean	0.11	0.92	-0.04
Standard Deviation	0.57	0.19	1.1
Maximum	0.88	1.48	2.0
Minimum	-1.09	0.70	-2.0
Item Reliability	0.90		
Separation Index	2.97		

The following discussion is proceed with the innovation outcome role as mediating variable. According to Tabachnick and Fidell (2007), if there is a hypothetical sequence of three or more variables, the middle variable is considered as a mediator which leads the change to dependent variable. In this study, the innovation outcome is the intervening mechanism that provides the indirect effect between innovation process (independent variable) and firm performance (dependent variable).

In the normal regression analysis, Baron and Kenny (1986) mentioned that a mediating variable is confirmed when it fulfil three conditions: a significant relationship exist between the independent variable and dependent variable, a significant relationship exist between the independent variable and mediator and the relationship between independent variable and dependent variable reduced when mediator exist. The significant of these relationships are assessed through its *p*-value (Rucker, Preacher, Tormala, & Petty, 2011).

In this study, innovation outcome as mediating variable is guided by the theoretical gap identified from the literature review (Crossan & Apaydin, 2010). Therefore, rather than focuses on significant of the relationship as normally used in regression analysis and structural equation modelling, researcher is encourage to explore the indirect effect of the variable based on theoretical reason (Rucker et al., 2011). The approach on mediator role for this study is discussed from the context of Rasch analysis. Several procedures to confirm that innovation outcome mediates the relationship between innovation process and firm performance. The first approach is to compare the item mean value for:

a) Relationship between innovation process (IP) and innovation outcome (IO)

b) Relationship between innovation outcome (IO) and firm performance (FR)

c) Relationship between innovation process (IP) and firm performance (FR)

d) Relationship between innovation process (IP), innovation outcome (IO) and firm performance (FR).

The second approach is by referring to the linear function graph for those relationships and the third approach is by calculating the probability of success performing items for each relationship. By putting together the output and analysis from the previous discussions, Table 5.51 below summarises findings in order to confirm on innovation outcome as mediating variable. From the table, the direct relationship between innovation process and firm performance shows the mean value of 0.42 logit. The logit value is more than the other three: innovation process and innovation outcome (0.07 logit), innovation outcome and firm performance (-0.24 logit) and innovation process, innovation outcome and firm performance (0.11 logit).

Table 5.51
Summary of findings to confirm innovation outcome as mediating variable

Variable	**Mean (logit)**	**Number of company have more than 50% success**	**Average probability of success**
IP → IO (indirect effect)	0.07	52	0.75
IO → FR (indirect effect)	-0.24	56	0.79
IP → FR (direct effect)	0.42	48	0.69
IP → IO → FR	0.11	51	0.74

From the Rasch analysis, the difficulty level of 0.42 logit shows that items are more difficult as compared to others. With this difficulty level, it is noted that when there is direct relationship between innovation process and performance, the number of person probability of success with more than 50 percent chances performing the items is low (48 companies). On average, the percentange probability of success is only 69 percent. However, when there is indirect relationship established with innovation outcome as mediator between innovation process and firm performance, the difficulty level is low. Therefore, this has increased the number of companies which have more than 50 percent chances of success in implementing innovation. For instance the indirect relationship between innovation process and innovation outcome managed by 52 companies while the indirect relationship between innovation outcome and firm performance managed by 56 companies. Hence, it can be said that innovation outcome mediates relationship between innovation process and firm performance and this has also increase the probability of success in implementing innovation. As hypothesised earlier, the higher the ability of organisation to perform innovation process, innovation outcome and firm performance, the role of innovation outcome as mediator is established.

Similar to the normal concept of mediation proposed by Baron and Kenny (1986), the relationship for the direct and indirect variables for this study are significant for mediation analysis. Figure 5.35 below summarises the relationship between variables into the framework of the study and probability of success for each relationship. In Rasch analysis, the relationships which involved innovation process, innovation outcome and firm performance are all significant because they fall in 95% confident level and data fit to the model. Based on figure 5.35 on average, it is noted that the direct relationship between leadership and innovation process (0.73), managerial levers and innovation process (0.73) and between business process and innovation process (0.72). The indirect relationship between innovation process and innovation outcome (0.75) and indirect relationship between innovation outcome and firm performance (0.79) have reduce the probability of success when there is direct relationship between innovation process and firm performance (0.69). In this context, the innovation outcome function as a partial mediator since the direct relationship between innovation process and firm performance is reduced but not zero (Tabachnick & Fidell, 2007).

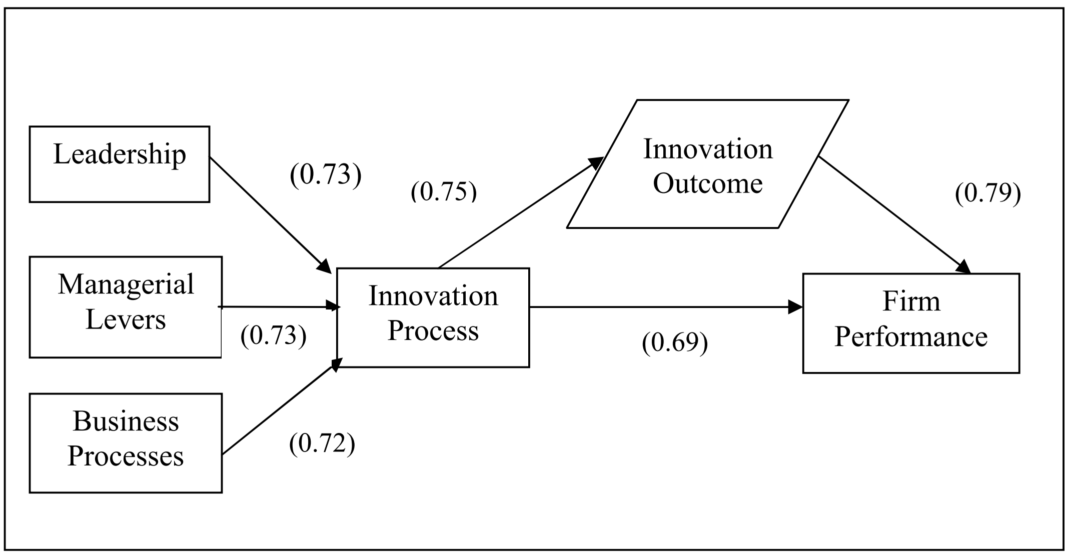

Figure 5.35
Framework of the Study and Probability of Success to Confirm Mediator Role

Based on this finding, it is clear that the result has assist to explain the innovation outcome role as conceptualise by Crossan and Apaydin (2010). As a result, this would also clarify the inconsisntency in the previous studies such as Sung et al. (2011) and Seokin et al. (2009).

5.3.9.1 The ability level of firm performance

This variable is used to evaluate the success of particular activity in an organisation. In this study, the effect of innovation activity that cover innovation process and innovation outcome will finally affect firm performance. There are 3 items representing firm performance that include productivity, sales and return on investment.

The ability to perform this item is discuss according to the ability of person and difficulty of item, probability of success for the item itself, probability of success relationship between innovation process and firm performance and probability of success relationship between innovation outcome and firm performance. Figure 5.36 below show the variable map between respondents and the items under firm performance. The mean score for firm performance is 0.59 logit. Maximum item is at 0.66 logit and minimum item located at 0.52 logit. It is noted all logit are in the positive value. This means that firm performance dimension is relatively the most difficult as compared to the antecedents, innovation process and innovation outcome. Therefore, there are some companies able to achieve the performance level and there are also some of them which are low performers.

As mentioned earlier, items that are below mean value is easy as compared to item located above the mean of 0.59 logit. Above the person mean of 1.45 logit are the high ability companies (31 organisations) which have performed well for all items as indicated via the free item area. In this context, the high ability companies were those companies than surpass the average level of performance for the latent variable measured in the study. These companies manage to answer almost all the questions of the study. Therefore measure the level of firm performance of those companies in implementing innovation. Since firm performance is slightly difficult item, the difference can be noted for the moderate group level and also the low ability group. In performing the firm performance items, there are 14 companies fall under moderate group and 16 companies representing the low abilities group. From the variable map there are 13 companies which performed lower than the items (FR1, FR3 and FR5) scores.

In terms of the probability of success in performing the firm performance items, a total of 16 companies have probability of success below than 50 percent. As shown in Table 5.52, some of the low ability companies chances are as low as less than 20 percent in achieving performance in sales, return on investment and productivity It is noted that the overall probability of success is more in the sales performance as compared to return on investment and productivity. This will be further explaining through probability success in performing the items under relationship between innovation process and firm performance and also between innovation outcome and firm performance.

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  3                               C4441322 C5143432 C5743241  +
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                                           C1912231 C4342331  |
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                                  C0413441 C0843442 C3913441  |
  2                                                           +
                                  C0942432 C2013341 C4232131  |
                         C1142331 C1433441 C3142431 C4741421  |
   C0311311 C1633142 C2123341 C2222442 C2512431 C3741331  |
                                           C2741122 C4041321 M|
Person  mean = 1.45  logit        C2442332 C3042331 C4141322  |     Maximum item = 0.66 logit
                                           C0741312 C5043142  |
  1         C3643441 C4543432 C4642431 C5541321 C5841322  +
                                                    C4942442  |
                                                    C1323441  |S FR1
                                  C5342431 C5423442 C5623441  |M FR3   FR5
                                           C1813342 C3543441  |T
                                                             S|
                                  C3442342 C4823442 C5941312  |       item mean= 0.59 logit
  0                                                           +
                                  C1023442 C3841312 C6023432  |     Minimum item = 0.52 logit
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                                           C1741432 C2942342  |
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Figure 5.36
Person-Item Map for Firm Performance

Table 5.52
Probability of Success for Firm Performance

Person	Measure (logit)	FR1	FR3	FR5
C024334131243111321221	4.33	0.98	0.98	0.98
C014323131355131651221	3.79	0.96	0.96	0.96
C124244131155161841221	3.65	0.95	0.96	0.95
C284234112111111511111	3.59	0.95	0.96	0.95
C234232231255171541221	3.3	0.93	0.94	0.94
C574324132155171371111	3.06	0.92	0.93	0.92
C514343231455121831111	3	0.91	0.92	0.92
C444132232355151841111	2.97	0.91	0.92	0.91
C151333122355111741211	2.92	0.91	0.92	0.91
C264233231255141431211	2.89	0.90	0.91	0.91
C054243131455121321111	2.64	0.88	0.89	0.88
C063234131455141331111	2.59	0.87	0.89	0.88
C191223122243111211111	2.42	0.85	0.87	0.86
C434233131454151111221	2.39	0.85	0.87	0.86
C334132133322111112221	2.28	0.83	0.85	0.84
C084344231315241742221	2.21	0.82	0.84	0.83
C041344122343111411111	2.12	0.81	0.83	0.82
C391344123153131321222	2.1	0.81	0.83	0.82
C201334122344111311111	1.9	0.78	0.80	0.79
C094243231454111711111	1.86	0.77	0.79	0.78
C423213112341131831221	1.84	0.76	0.79	0.78
C143344132355141131111	1.73	0.74	0.77	0.76
C314243132151121531111	1.73	0.74	0.77	0.76
C114233133454151831111	1.65	0.73	0.76	0.74
C474142122431111121221	1.65	0.73	0.76	0.74
C374133121454111112221	1.63	0.73	0.75	0.74
C031131122153122311221	1.59	0.72	0.74	0.73
C222244231455111431121	1.59	0.72	0.74	0.73
C163314232352211511221	1.57	0.71	0.74	0.73
C212334123354171471211	1.53	0.70	0.73	0.72
C251243122351141121222	1.53	0.70	0.73	0.72
C274112232155111112221	1.45	0.69	0.72	0.70
C404132133355111112221	1.37	0.67	0.70	0.68
C304233132153111411121	1.34	0.66	0.69	0.68
C244233212342121111221	1.28	0.65	0.68	0.66
C414132212331121412211	1.24	0.64	0.67	0.65
C074131231331221621211	1.13	0.62	0.65	0.63
C504314223354231222211	1.11	0.61	0.64	0.62
C364344131431131421111	1	0.58	0.62	0.60
C454343222354132331222	1	0.58	0.62	0.60
C464243112331211322121	1	0.58	0.62	0.60

Table 5.52 *Continued*

Person	Measure (logit)	FR1	FR3	FR5
C58413221241111111111	0.98	0.58	0.61	0.59
C55413211234214133 1121	0.97	0.58	0.61	0.59
C49424422135511161 1221	0.88	0.55	0.59	0.57
C13234413231421142 2221	0.72	0.51	0.55	0.53
C53424313235315145 1121	0.6	0.49	0.52	0.50
C56234411235212182 1221	0.56	0.48	0.51	0.49
C54234422235313153 2221	0.53	0.47	0.50	0.48
C18133422215511111 2221	0.44	0.45	0.48	0.46
C35434413144411152 1121	0.44	0.45	0.48	0.46
C34423423135421132 2221	0.19	0.38	0.42	0.40
C48234423235417153 1121	0.11	0.37	0.40	0.38
C59413122232211121 1121	0.08	0.36	0.39	0.37
C60234323235421121 1221	-0.09	0.32	0.35	0.33
C38413122233211143 2222	-0.14	0.31	0.34	0.32
C10234423234111121 2221	-0.17	0.30	0.33	0.32
C17414321135321211 2222	-0.36	0.27	0.29	0.28
C29423421213111131 1121	-0.44	0.25	0.28	0.26
C61413221244322133 2221	-0.51	0.24	0.26	0.25
C32434423335511181 2221	-1.06	0.15	0.17	0.16
C52434422234121164 2222	-1.21	0.13	0.15	0.14

As mentioned earlier, the ability of company is further explored through the probability of success for relationship between variables. Table 5.53 below indicates that both variables are put together to show the comparison of achieving the probability of success in performing firm performance.Calculations are based on the logit score for each person, mean item for innovation process and firm performance (0.42 logit) and also mean item for innovation outcome and firm performance (-0.24 logit) into the probability formula.

As for the items of innovation outcome and firm performance, the moderate ability companies have probability of success between 52 to 84 percent and the poor ability companies performed less than 52 percent.

The higher the ability of a company, the higher the probability of success in performing those items while the lower ability will perform low probability of success. In the context of performance, it can be said that the probability of success is higher in relationship between innovation outcome and firm performance than the probability of success in relationship between innovation process and firm performance. On the average, probability of success for a company to perform those items is 69 percent for innovation process and firm performance while 79 percent for innovation outcome and performance.

From table 5.53, the probability of success for relationship between innovation process and innovation outcome is inserted to show comparison between the three. The average probability of success is 75 percent. As mentioned earlier, this has provides an indication about the role of innovation outcome as mediating variable in the study framework. Based on item mean of 0.11 logit, probability of success is still higher with 74 percent as compared to the probability of performing items innovation process and firm performance (69 percent).

Table 5.53
Comparison Probability of Success for IP&IO, IP&FR, IO&FR and IP,IO & FR

Person	**Person (logit)**	**Probability IP & IO**	**Probability IP & FR**	**Probability IO and FR**	**Probability IP, IO &FR**
C024334131243111321221	4.33	0.99	0.98	0.99	0.99
C014323131355131651221	3.79	0.98	0.97	0.98	0.98
C124244131155161841221	3.65	0.97	0.96	0.98	0.97
C284234112111111511111	3.59	0.97	0.96	0.98	0.97
C234232231255171541221	3.3	0.96	0.95	0.97	0.96
C574324132155171371111	3.06	0.95	0.93	0.96	0.95
C514343231455121831111	3	0.95	0.93	0.96	0.95
C151333122355111741211	2.97	0.95	0.93	0.96	0.95
C444132232355151841111	2.92	0.95	0.92	0.96	0.94
C264233231255141431211	2.89	0.94	0.92	0.96	0.94
C054243131455121321111	2.64	0.93	0.90	0.95	0.93
C063234131455141331111	2.59	0.93	0.90	0.94	0.92

Table 5.53 *Continued*

Person	Person (logit)	Probability IP & IO	Probability IP & FR	Probability IO and FR	Probability IP, IO &FR
C264233231255141431211	2.89	0.94	0.92	0.96	0.94
C054243131455121321111	2.64	0.93	0.90	0.95	0.93
C063234131455141331111	2.59	0.93	0.90	0.94	0.92
C191223122243111211111	2.42	0.91	0.88	0.93	0.91
C434233131454151111221	2.39	0.91	0.88	0.93	0.91
C334132133322111112221	2.28	0.90	0.87	0.93	0.90
C084344231315241742221	2.21	0.89	0.86	0.92	0.89
C041344122343111411111	2.12	0.89	0.85	0.91	0.88
C391344123153131321222	2.1	0.88	0.84	0.91	0.88
C094243231454111711111	1.9	0.86	0.81	0.89	0.86
C201334122344111311111	1.86	0.86	0.81	0.89	0.85
C423213112341131831221	1.84	0.85	0.81	0.89	0.85
C314243132151121531111	1.73	0.84	0.79	0.88	0.83
C143344132355141131111	1.73	0.84	0.79	0.88	0.83
C114233133454151831111	1.65	0.83	0.77	0.87	0.82
C374133121454111112221	1.65	0.83	0.77	0.87	0.82
C474142122431111121221	1.63	0.83	0.77	0.87	0.82
C222244231455111431121	1.59	0.82	0.76	0.86	0.81
C031131122153122311221	1.59	0.82	0.76	0.86	0.81
C163314232352211511221	1.57	0.82	0.76	0.86	0.81
C212334123354171471211	1.53	0.81	0.75	0.85	0.81
C251243122351141121222	1.53	0.81	0.75	0.85	0.81
C274112232155111112221	1.45	0.80	0.74	0.84	0.79
C404132133355111112221	1.37	0.79	0.72	0.83	0.78
C304233132153111411121	1.34	0.78	0.72	0.83	0.77
C244233212342121111221	1.28	0.77	0.70	0.82	0.76
C414132212331121412211	1.24	0.76	0.69	0.81	0.76
C074131231331221621211	1.13	0.74	0.67	0.80	0.73
C504314223354231222211	1.11	0.74	0.67	0.79	0.73
C364344131431131421111	1	0.72	0.64	0.78	0.71
C454343222354132331222	1	0.72	0.64	0.78	0.71
C464243112331211322121	1	0.72	0.64	0.78	0.71
C584132212411111111111	0.98	0.71	0.64	0.77	0.70
C554132112342141331121	0.97	0.71	0.63	0.77	0.70
C494244221355111611221	0.88	0.69	0.61	0.75	0.68
C132344132314211422221	0.72	0.66	0.57	0.72	0.65
C534243132353151451121	0.6	0.63	0.54	0.70	0.62
C562344112352121821221	0.56	0.62	0.53	0.69	0.61
C542344222353131532221	0.53	0.61	0.53	0.68	0.60
C354344131444111521121	0.44	0.59	0.50	0.66	0.58
C181334222155111112221	0.44	0.59	0.50	0.66	0.58

Table 5.53 *Continued*

Person	Person (logit)	Probability IP & IO	Probability IP & FR	Probability IO and FR	Probability IP, IO &FR
C48234423235417153112 1	0.19	0.53	0.44	0.61	0.52
C34423423135421132222 1	0.11	0.51	0.42	0.59	0.50
C59413122232211121112 1	0.08	0.50	0.42	0.58	0.49
C60234323235421121122 1	-0.09	0.46	0.38	0.54	0.45
C38413122233211143222 2	-0.14	0.45	0.36	0.52	0.44
C10234423234111121222 1	-0.17	0.44	0.36	0.52	0.43
C17414321135321211222 2	-0.36	0.39	0.31	0.47	0.38
C29423421213111131112 1	-0.44	0.38	0.30	0.45	0.37
C61413221244322133222 1	-0.51	0.36	0.28	0.43	0.35
C32434423335511181222 1	-1.06	0.24	0.19	0.31	0.24
C52434422234121164222 2	-1.21	0.22	0.16	0.27	0.21
Average probability		**0.75**	**0.69**	**0.79**	**0.74**

5.4 Summary

This chapter explains the findings of the study. The study applies Rasch Model with Item Response Theory used as a basis of discussions. Analysis is produced from the Winstep 3.6 software. Findings have highlighted the relationship between the variables of the study and the level of innovation implementation in the electrical and electronics manufacturing industry. The relationship between variables include the relationship between each of the antecedents (leadership, managerial levers and business processes) and innovation process, relationship between innovation process and innovation outcome, relationship between innovation process and firm performance and finally relationship between innovation outcome and firm performance. It is reported that all relationships indicate positive relationships and the role of innovation outcome as mediating variable was established.

Observation from the mean (in logit value) for each item showed that all antecedents: leadership, managerial levers and business processes are being practiced in the electrical and electronics manufacturing companies. Business processes is found difficult item among the three antecedents. The higher ability to undertake leadership, managerial levers and business processes, the better the innovation process. Hence these antecedent constructs would facilitate the innovation process. In terms of innovation implementation, innovation process is perceived to be difficult item as compared to innovation outcome. Consequently, the levels of innovation implementations were discussed by calculating probability of success in performing the constructs and firm performance. The result reported that high ability organisation performed better than the low ability organisation in terms of performing all constructs in this study. The level of innovation implementation was established according to high ability companies, moderate companies and low ability companies. Therefore, given with higher ability, this would provide higher probability of success in implementing innovation. As a result, this would impact the innovation process, innovation outcome and finally would lead to higher firm performance.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.0 Introduction

Chapter 6 is the final chapter of the study. This chapter recapitulate the main points of the study through revisiting the research questions, research objectives and synopsis of findings. The discussions also include research contributions, limitations, recommendations and the conclusion of the study.

6.1 Overview of the study

The point of conducting this study has been the call for a better understanding on the innovation in organisation and also to examine the ability level of innovation implementation in the electrical and electronics manufacturing companies in Malaysia. In the field of innovation, it is noted that there were many studies conducted from various perspectives to denote its implementation, definitions, theoretical views, impacts, contributing factors and its relationship with firm performance. Nevertheless, there still are inconsistencies in the previous findings, relationship between variables is fragmented and it is also limited studies to capture the level of innovation implementation. These issues have been argued in Chapter 1. An intensive literature review was conducted on innovation widely issue encapsulating on firm performance, innovation antecedents, innovation process, innovation outcome as well as innovation issues in Malaysia. It was concluded from the literature review into research questions, research objectives and conceptual framework.

The first objective of this study is to investigate the relationship between antecedents (leadership, managerial levers and business processes) and innovation process. Based on the literature review, the leadership construct is based on items that related to the ability, skills and competency. The construct for managerial levers are strategy, structure, resource allocation, knowledge management and organisational learning and culture. The third antecedent which i.e. business processes is represented by two dimensions: process alignment and people involvement. The second objective of the study is to examine the relationship between innovation process and innovation outcome. This objective clarifies the arguments about the innovation implementation in the sense of how it works and what form it would be produced. The innovation process construct is represented by six dimensions: idea generation, idea mobilisation, advocacy and screening, experimentation, commercialisation, diffusion and implementation. The innovation outcome is represented by product innovation and process innovation.

Subsequently, the third research objective was to examine the direct relationship between innovation process and firm performance while the fourth objective was to examine the between innovation outcome and firm performance. Based on literature, the extent of innovation process and its influenced on firm performance was enhanced when innovation outcome functioned as a mediating variable. Hence, this has set to be the fifth objective of the study which is to investigate whether innovation outcome played a meditating role.

Following the defined objectives, the innovation concepts were further discussed in Chapter 2. In this chapter, the notion of study was discussed using selected theories as the underpinnings include Item Response Theory, Upper Echelon Theory, Resource Based View and Dynamic Capability Theory and Organisational Process Theory. The traditional perspectives about innovation were discussed at length focusing on its definitions and evolution, level of analysis, orientation, type of innovation and innovation issues on performance. The literature review was concluded with established definitions on innovation, innovation process, innovation outcome and firm performance which are relevant to the concept of study.

The theoretical discussion was further elaborated in Chapter 3 with a conceptual framework comprising of three parts; first describing the main elements of antecedents, second describing the implementation process and third describing the outcome on firm performance. Chapter 3 was concluded to establish six direct relationships between the antecedents , independent variable (innovation process) and dependent variable (firm performance) with innovation outcome as the mediating variable.

Following this chapter is Chapter 4 which is the outline for research methodology. A cross sectional research setting was chosen and study is classified as descriptive analysis, correlation measures and probability of success percentage via Rasch model analysis. In order to construct the operational definitions for each of the items, an intensive review was conducted and this has contributed to the development of 116 items used in the questionnaire survey. With the assistance from industry experts and academicians, instruments were further check for face validity and its relatedness with innovation subject matter. In addition, pilot study has been undertaken for the purpose testing the effectiveness of the research methodology. Based on the pilot study's feedback, the research process was continued through the survey method. Questionnaires were randomly distributed to the electrical and electronics manufacturing companies throughout Malaysia population list developed by the Federation of Malaysian Manufacturers (FMM) Industries Directory 2012. As for the unit of analysis, the top management executives or senior managerial level involved in implementing innovation were the respondents for the survey.

The Rasch approach for data collection and analysis were executed through the computer software Winsteps 3.69. This process is elaborated in Chapter 5. Requirement such as data screening, cleaning and diagnostic of the rating scale were used to ensure that data are fit for analysis. As mentioned previously, the prerequisite for Rasch model is the researcher must produce data that fits to the model. This approach is contrasting to the traditional method which requires factor loading and the dimension that produce the best fit line. Data for analysis must fulfil the three fit statistic criteria. As suggested by Bond and Fox (2007), data considered fit if the point measure correlation between 0.4 and 0.8 logit, outfit MNSQ is between 0.5 and 1.5 logit and the ZSTD value is between -2 to 2 logit with 95% confidence level.

Based on 61 respondents that went through the data cleaning process, 92 items were declared fit for the analysis. In Rasch, both item and person reliability were applied to the data whereby in the classical theory, the normal method is based on the Cranach alpha value. In this study, the item reliability is 0.91 logit and person reliability is 0.98 logit. This is in line with the rating scale for instrument quality criteria that emphasised reliability above 0.67 logit is considered fair while reliability exceed 0.94 logit is considered excellent (Fisher, 2007). Overall, the highest logit for person (respondents) is 4.33 logit while the highest logit for items is 1.09 logit. Since the person logit measure is above the item logit measure, this shows that respondents are satisfied with their innovation implementation on firm performance. The easiest item in the study is recorded at -1.56 logit and this item is referring to strategy in improving product or service quality which is under the managerial levers variable. This means that the item is considered common to all responding companies.

This overview is elaborated further with the issues that are related to the study. The first issue is to address the limitation of early studies about the relationship between antecedents and innovation process. In addition, investigation on this first research question is also to sought out the gap suggested by previous study (Crossan & Apaydin, 2010). The antecedent variables are leadership, managerial levers and business processes. Through the Rasch model analysis, the variables were identified fit to the model. The relationship between each of the antecedent variables and innovation process (independent variable) was determined by scatter plots and ZSTD value. Findings indicated that there is a positive relationship between each of the antecedent variables and independent variable with 95% confident interval. The positive finding supported the findings done earlier by Paulsen et al. (2009), Naranjo-Valencia et al. (2011) and also by (Lewis et al., 2007). Therefore, this has also supported the suggestion that the three types of antecedent should be together as determinants factor to drive innovation process (Crossan & Apaydin, 2010).

The second issue was to attend to the relationship between innovation process and innovation outcome. This issue is related to the how innovation works in the organisation. This is based on inconsistencies and limitation in previous studies related to the innovation role and the need to further understand both innovation process and innovation outcome (Quintane et al., 2011; Tushman et al., 2010). Innovation process is represented by six dimensions from idea generation process to implementation while innovation outcome is represented by product innovation and process innovation. Data that represent these variables are fit to the model. With the scatter plots and ZSTD value, the positive relationship between innovation process and innovation outcome was revealed.

The third issue was to address the relationship between innovation process and firm performance. Innovation process determines the innovation activity of an organisation. As mentioned in Chapter 1, findings from previous studies were also debatable (Enzing et al., 2011; Rosenbusch et al., 2010). Although there were studies conducted between innovation and performance but it has focused on innovation in general but not innovation process specifically. After the data for this two variables fit to the model, findings for this issue indicated that there is a positive relationship between innovation process and firm performance. Subsequently the fourth issue that addressing the relationship between innovation outcome and firm performance has found to have positive relationship. The fifth issue of the study has also managed to establish the role of innovation outcome as mediating variable. It is noted that from the second to the fifth issues, the study has support the arguments about the role innovation process and innovation outcome on performance by Crossan and Apaydin (2010).

The final issue for this study has sought to address the relationship between the level of ability to implement innovation and its influence on firm performance especially in the context of electrical and electronics industry. This is due to the lack of discourse in the previous studies by Ariffin and Figueiredo (2003) and Rasiah (2010). The Rasch model analysis has produced the result tabulated in the same Person-item map which to indicate the ability level of innovation implementation on firm performance. This variable map has ranked the person (respondents) ability level on the left hand side from the low ability at the bottom to the high ability level at the upper side of the map. Based on the output from Winsteps software, the level of innovation implementation on firm performance was measured through each of the mean (in logit value) as well probability of success in performing all items under the six variables involved in the study.

Findings have indicated the mean for each variable was reported as leadership (-0.41 logit), managerial levers (-0.04 logit) business processes (0.01 logit), innovation process (0.40 logit), innovation outcome and (-0.42 logit). It is noted that the mean for innovation process variable was observed to be the most difficult dimension to implement innovation in organisation. This is indeed has supported the findings by Desouza et al. (2009) about the importance of innovation process in order to differentiate between the excellent organisations and the weak organisation, those without the well defined innovation process.

The findings have also produce the level of innovation implementation according to three groups of companies that performed innovation according to excellent, moderate and poor. As a result, given with higher ability, this would provide higher probability of success in implementing innovation and this has finally affected the innovation process, innovation outcome and firm performance.

6.2 Theoretical implication of the study

This study has contributed towards two main streams. Firstly, the contribution towards innovation research in the sense of expanding the innovation concept, model, findings and literature. Second, is the application of the underpinning theories into the study.

6.2.1 Contribution towards innovation research

As mentioned in Chapter 2, the innovation research has been expanded since the introduction of innovation by Schumpeter in 1936 and from that point of time the research in this area became more flexible, lean and flat structure (Anderson et al., 2004). Although there were numerous findings and discussions on innovation from various perspectives, the concern on what, how and what kind of innovation is still fragmented and limited. Therefore, the main field of this study has aimed to contribute to the theory of understanding innovation in terms of developing concept, to describe and analyse the relationship between innovation antecedents, innovation process, innovation outcome and firm performance.

By studying the implementation of innovation in the organisation, in particular within the context of electrical and electronics industry, this study has provided insight into the scope of interest that innovation management addresses. As was argued in Chapter 2 and 3, the current innovation research is fragmented in explaining the determinants towards how do innovation being implemented in the organisation and the outcome of innovation that finally will affect firm performance. Instead of a variety of different meanings of innovation either being discussed as independent variable or dependent variable, this study has added the knowledge of understanding innovation implementation into three main aspects to improve the performance of organisation.

In this study, the three main aspects of innovation management discussed were antecedents (leadership, managerial levers and business processes), innovation process and innovation outcome. Through the establishment of conceptual framework, the study gives the innovation research a more thorough understanding of its implication on firm performance. It is noted that although the influence of innovation on firm performance depended on many factors, this study has revealed that positive relationship and connection between the antecedent factors i.e. leadership, managerial levers and business process, innovation process, innovation outcome and firm performance. The role of innovation outcome as mediator has also been established.

6.2.2 Contribution towards item response theory, upper echelon theory, and resource based view and dynamic capability theory and organisation process theory

This study has contributed wealth of theory. As mentioned in Chapter 2, there are three types of theory applied with the aimed to increase the understanding on innovation management into organisation. Item Response Theory (IRT), a modern theory is used as the fundamental underpinning theory. This theory is integrated with the upper echelon theory, resource based view and dynamic capability theory and organisation process theory. Upper Echelon Theory is a theory that explained the organisational strategic choice and performance level which is affected by managerial background and in this study it reflects the leadership.

This study is also underpinned by the Resource View and Dynamic Capability Theory to explore the managerial levers and business processes as antecedents to the innovation process. These represent both tangible and intangible resources which are able to integrate those antecedent factors leading towards firm performance (Wernefelt, 1984). With Dynamic Capability Theory applied in this study, this is also in line with innovation management in increasing competitive advantage. The Organisational Process Theory is applied to indicate the progression of innovation process to be implemented in the organisation.

The application of Item Response Theory in this study is used to support the data analysis methodology through the Rasch model. It is also an alternative to the common research method. It is noted that this theory is barely used in the innovation management research. Apart of being the underpinning theory and method of analysis, the theory contributed to support the practical issue of the study, to investigate the ability of organisation in the electrical and electronics industry in implementing innovation according to the antecedents, innovation process and innovation outcome.

With Rasch model, the respondents from participating organisations who performed innovation were measured according to their ability level and the difficulty of items under study. The responded companies were also divided into three levels of abilities in performing innovation: high, moderate and low. In line with the framework of the study, the level of performing innovation has affected the firm performance. Those companies which at the upper level abilities have improved firm performance while companies with low abilities were less performed. This finding is also extended the research conducted earlier that emphasised on level of implementing innovation in the electrical and electronics industry (Ariffin & Figueiredo, 2003; Rasiah, 2010).

The Rasch analysis contributed to attend the measurement issues particularly the rating scale applied in measuring the instruments. According to Tatum (1998), the common rating scales used in research did not have uniform structure or equal interval because measuring such items that involved attitudes, confidence or ability are not all the same point on the scale. Therefore, the Rasch model operates through Winsteps software able to alter the rated data into the logistic model in the logit form. Output from the model was calibrated into common unit so that the measures taken on antecedents, innovation process, innovation outcome and firm performance are measured in objective, stable and precise across sample of study (Tatum, 1998).

6.3 Managerial implication of the study

In adding together with the theoretical contributions, this study has offered new insights for practical innovation management to be applied in the organisation. From the perspective of organisation, the innovation is very vital and hence it would affect firm performance. The influence of innovation on firm performance depended on many factors. This study has portrayed innovation management into three major areas: the antecedents, innovation process and innovation outcome. These three represent the determinants, implementation and innovation result that would affect firm performance. The antecedents served as factors must precede innovation process. Organisation need to ensure that innovative leadership should be in position to guide and initiate innovation agenda. Managerial levers act as the catalyst and business processes are crucial to ensure that people factor (the employee of organisation) connected together with system established in the organisation. While innovation process would affect the extent of innovation implementation, innovation outcome is the end result of innovation.

A focus on performance goal should not only focus on the innovation result (product and processes) but firm should also focus on the innovation process. Innovation process has been revealed in the study as difficult task in undertaking innovation. This is showed through items relating to idea generation, idea mobilisation, advocacy and screening, experimentation and diffusion and implementation. Organisation need to improve innovation process by setting a systematic procedure to generate idea, mobilise idea across departments in the organisation and connected the ideas with the top management. Reward and recognition must be established in order to motivate idea generation process. On the experimentation issue, priority must be given to ensure resources to be in place.

Innovation outcome has emerged as the achievement in implementing innovation before organisation achieves their final goal on performance. In other words, this means that identification of innovation outcome in terms of product and process in the manufacturing sector is important particularly in the electrical and electronics industry. Above all, when organisation managed to identify the innovation process and innovation outcome, then is should practically relevant to transcend towards firm performance. Therefore through this process, it would benefit the managerial perspective through the followings:

a) Establish a systematic framework of innovation management and this could be applied at firm level.

b) Measuring the innovation impact according to organisation ability. This study has divides organisation according to three type ability level. They are the excellent, moderate and poor performer. This is based on their location on the variable map plotted side by side between ability and item difficulty and also the probability of success in performing the innovation constructs. In order to improve the ability level, organisation need to focus on items that are difficult however important to the innovation implementation and finally would achieved the performance goal.

c) Assist to identify the limitations in undertaking innovation, so that further improvement can be made. This can be executed through identifying the difficult items that are unable to achieve in order to decide on further improvements. For instance, organisation should focus to improve on difficult items under antecedents, innovation process and innovation outcome. Hence, by improving on these items, it is hope that organisation could improve their ability from the poor ability level to the excellent level as well as improving their firm performance.

d) Constructs established in this study could be used as indicator to evaluate the effectiveness of innovation implementation in the organisation. Since the electrical and electronics industry is one of the 12 potential sector identified in the National Key Economic Area, this innovation approach could be utilised to audit their innovation level as well as the contribution towards firm performance. Through innovation process and innovation outcome as the mechanism, this would also continually assist the organisation to push towards high value added manufacturing activities.

e) The segmentation according to three groups of organisation: excellent, moderate and poor would be used as indicator to profile the performance of electrical and electronics manufacturing. The profiling can also be derived from the innovation outcome perspective where companies are segmented according to product innovation and process innovation. This profiling benefits both the organisation and government agency such as Malaysia

Productivity Corporation which has been engaged in promoting productivity and quality through Innovative Creative Circle (ICC).

6.4 Limitations of the study

There are several limitations engaged in this study. The limitations include the following:

a) This study is limited to manufacturing of electrical and electronics industry. Therefore, findings cannot be generalized to other type of industries such as services, constructions or agriculture. The nature, characteristic and also culture of these industries are different as compared to the electrical and electronics.

b) Since this study involved a perception survey towards the implementation of innovation, it is a cross sectional type of study. The respondents for this study were from the senior executive and top managerial level. Therefore, it appears to be not possible to obtain information specifically about employee perceptions towards innovation.

c) Analysis of this study is focused only at the organisational level. Therefore a detail analysis on innovation cannot be comprehensive beyond other level of analysis such as individual, subunit level of the organisation and group level. Although the study applied to the organisation level, the innovation process is seen from the perspective of intra-industry and innovation process took place between industry innovations that include industry expenditure on R&D and stages of industry life cycle. This has excluded the extra industry focus where it emphasised the technological aspects.

d) Since the data collected were based on perceptions, direct comparison with the formal documents and company records could not be performed with the objective to verify with the actual data particularly the financial performance of the organisation.

6.5 Recommendation for future research

Considering the limitations that need to be taken into account, this study presents some recommendations for further research. The recommendations are listed as follows:

a) This study has focus on generic framework on innovation management applied in the organisation. Hence, this study could be extended to other type of industry such as automotive-based companies, plastics companies and food manufacturing companies. Although these companies are manufacturers by nature, it could be interesting to examine the innovation process, innovation outcome and their industry performance.

b) Instead of one level of unit analysis, this research could be enhanced into more than one level analysis such as team level and departmental or subunit analysis. Therefore, the perceptions towards innovation management on performance will be obtained from employees that directly involved in the innovation activities. Research at the departmental level such as R & D departments is associated with the innovation process and innovation outcome. Hence, the interaction between antecedents' factors and each level of the innovation process could be traced at the technology generation and adoption. This would encounter the process of getting information that involved external knowledge which is hardly captured from the present findings. In view of this justification, additional variable such as departments or business unit dimensions could be added into the framework.

c) The empirical analysis of this study represents only a cross section study where respondents responded the questionnaire on how they perceived the innovation process and innovation outcome has affected their firm performance. This means that it is a one off attempt perceptions on innovation. In order to examine the long term effect of the innovation implementation, a longitudinal study is proposed to assess the performance of electrical and electronics companies for a certain of period for researcher to analyse the pattern and impact of the innovation process and innovation outcome.

d) Of all the instruments, innovation process was found to be the most difficult items and this has affected the probability of success of performing the items in the respective electrical and electronics companies. Innovation process is one of the vital parts of innovation management and it would be benefit to the academician as well as the industrialist to conduct a case study merely on innovation process. A case study on innovation process would increase the understanding of innovation because it involved a distinct phases that involved all level from employees, middle managers and the top management of an organisation.

e) Most of the analysis of past innovation studies were based on the classical test theory. With the application of the Rasch model analysis into this study, it is noted that this model could be used to determine the quality of new innovation instruments for future research. Rasch analysis is also proposed to examine the different level of abilities between employees, team level or departments and this would adding to the data and information collected for innovation studies.

f) The future study should also take into account the actual data on firm performance such as productivity indicators of the company. In this context, it would be benefited if a study on the relationship between innovation outcome and productivity level to be conducted. The use of Rasch model would indicate the different ability of organisation performing innovation outcome and productivity level. This will lead to better clarification of the impact of innovation and productivity of electrical and electronics manufacturing companies in Malaysia.

6.6 Conclusion

The importance of innovation studies are rapidly recognised by previous scholars and the discourse about the subject matter were undertaken from various angle. One cannot deny that it is very important for organisation to innovate in order to be competitive and sustaining high performance. Therefore, the main objective of this study is to examine the relationship between innovation implementation and its impact on firm performance. The motivation to conduct this study is due to inconsistency of previous research on the theoretical role of innovation either as independent, dependent, moderator or mediator. There were also conflicting findings and studies are fragmented on whether innovation as a process or as an outcome. Furthermore there are also limited studies on the level of innovation implementation particularly in the context of electrical and electronics industry in Malaysia. In view of these gaps, this study has investigated further the innovation implementation from the perspective of antecedent factors, innovation process, innovation outcome and its impact on firm performance.

The literature reviews are conducted rigorously and this has facilitated researcher in providing the foundation to construct the conceptual framework and innovation instruments. The conceptual framework for this study translated the theoretical gaps into antecedent variables: leadership, managerial levers and business processes. The underpinning theories applied for this study are Item Response Theory, Upper Echelon Theory, Resources Based View and Dynamic Capability Theory and Organisation Process Theory. Following to data collection, the Rasch Model analysis is applied as the research methodology where analysis is based on probabilistic unidimensional model.

The conclusion of the study is enclosed with the findings for each of the research questions. The first part of the finding has revealed that three antecedent factors which influenced the innovation process: leadership, managerial levers and business processes are found to be positively related to the innovation process. Business processes has been identified with the highest mean compared to leadership and managerial levers. This has given an indicative that the business processes is perceived as difficult item as compared to leadership and managerial levers by the respondents. In this context, the people involvement and process alignment are two elements that are crucial to the innovation process of an organisation.

The second part of the finding has revealed the role of innovation process and innovation outcome. As mentioned in Chapter 5, the result indicated that there are positive relationship between innovation process and innovation outcome, between innovation process and firm performance and between innovation outcome and firm performance. This has also established the role of innovation outcome as mediating variable as hypothesized in the study. The empirical analysis of the study on those variables have described that innovation process must precede the innovation outcome and finally will affect the firm performance. Hence, this study has sought out the conflicting findings on innovation from the past research. Based on the findings, it is suffice to conclude that the extent of innovation implementation depended on the innovation process. This is due to its mean value which is highest among other variables. The indication is clear that innovation issue is all about the innovation process engaged in the respective organisation and they need to specifically identify between the innovation process and innovation outcome so that it would influence their firm performance.

The final part of the conclusion is raised from the investigation attempt on the ability level of innovation implementation. In this context, the application of modern test theory through the Rasch Model has instilled new approach in terms measurement issue as well as new methodology into this study. The extent of innovation implementation is assessed through three ability level of organisation on the six variables of the study. From the findings, this has lead to conclude that the higher the ability level of organisation to implement the antecedents (leadership, managerial levers and business processes), the higher the innovation process. Therefore, given with a higher innovation process, this will also gives a higher ability in performing the innovation outcome and finally would increase the firm performance. In conclusion, with the application of the variable map from Rasch model analysis, this study has provided a means of identification on innovation level in the organisation.

6.7 Summary

This chapter enfolds the study. It elucidates briefly by reviewing the research process involved from Chapter 1 to Chapter 5. Theoretical implications are described through the application of Item Response Theory which is new in this area of study as well as other related theory. The managerial implications were discussed from the perspective of practicality especially for its contribution towards innovation management in organisation. The ending part of this chapter has emphasised the limitations, avenue of further research and the conclusion of the study.

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APPENDIX A
(Cover Letter and Measuring Instrument via Questionnaire)

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SURVEY ON INNOVATION PROCESS, INNOVATION OUTCOME AND FIRM PERFORMANCE: A MALAYSIA ELECTRICAL AND ELECTRONICS (E&E) INDUSTRY STUDY

Dear Respected Respondent,

This survey aims to gather opinion and perceptions in order to better understand the relationship between innovation process, innovation outcome and firm performance in electrical and electronics (E&E) industry in Malaysia. The findings from this survey will provide vital information that can contribute to the development and to strengthen the current application of innovation process, innovation outcome and its impact on firm's performance in the E&E industry.

Therefore, we pledge you to spend your time answering this survey related to the innovation implementation in your organisation. Your support in answering the survey is very much appreciated and important to ensure the success of the study. Please endeavour to answer all questions as accurately as you can. There is no right or wrong answer. It is your opinion that is important to this study. The questionnaire and definition of terms are attached. Kindly send your response to the address using the attached return envelope. All research information collected is **strictly confidential and meant for academic purposes.**

Thank you very much for your time and cooperation. We greatly appreciate the help of your organisation and yourself in furthering the research endeavour.

Thank you,
Yours faithfully

QUESTIONNAIRE

SURVEY ON INNOVATION PROCESS, INNOVATION OUTCOME AND FIRM PERFORMANCE
A Malaysia Electrical and Electronics Industry Study

Research Leading to a PhD in Management Conducted by

SURIATI ZAINAL ABIDIN

Under the Supervision of

ASSOCIATE PROFESSOR DR. SANY SANURI
PROFESSOR RUSHAMI ZIEN BIN YUSOFF

COLLEGE OF BUSINESS
UNIVERSITI UTARA MALAYSIA

CONFIDENTIALITY

The views expressed in this questionnaire will be treated as confidential. Information indentifying the respondents and their organisations will not be disclosed under any circumstances

SECTION A: CONTACT PERSON

Please fill the following information below (please ticks (√) :

1. Your position: ____

2. Age:
   ( ) Between 25 and 35 years ( ) Between 36 and 45 years
   ( ) Between 46 and 55 years

3. Qualifications :
   ( ) School certificate/SPM and STPM ( ) Diploma
   ( ) Degree ( ) Postgraduate Degree

4. Number or years working experience:
   ( ) Less than 5 years
   ( ) Between 5 and 10 years
   ( ) Between 10 and 20 years
   ( ) Above 20 years

5. Do you involved in the research and development (R&D) or any innovation activities?
   ( ) Yes ( ) No

6. E-mail:____

SECTION B: COMPANY PROFILE

Please ticks (√) the most appropriate represent your organisation:

1. Name of company:____

2. The number of employees in the organisation:
   ( ) Less than 50 ( ) 51 – 150 employees ( ) Above 151 employees

3. Ownership of company in percentage:
   ( ) % Foreign (US, Japan, Britain, France, Germany and etc). Please specify________
   ( ) % Malaysian

4. What is the main industry or activity of your company?
   ____

5. Name of your products:
   ____

6. Average sales per year for the last 3 years.
   ( ) Between RM100,000 – RM500,000
   ( ) Between RM 501,000 – RM 1 million
   ( ) Between RM 1.1 million – RM 5 million

( ) Between RM 5.1 million – RM 10 million
( ) Above RM10 million

7. Average profit per year for the last 3 years.
   ( ) Between RM100, 000 – RM500,000
   ( ) Between RM 501,000 – RM 1 million
   ( ) Between RM 1.1 million – RM 5 million
   ( ) Between RM 5.1 million – RM 10 million
   ( ) Above RM10 million

SECTION C: INNOVATION ACTIVITIES

Please ticks (√) the most appropriate represent your organisation:

1. During the last 3 years, did your company introduce new or enhancement of existing product (exclude resale of new product purchased from other enterprise and changes of solely aesthetic nature)?
   ( ) Yes ( ) No

2. Ideas for product development programmes (including improvement and introduction) initially came from:
3. ( ) Members of the board of directors ( ) Middle managers
   ( ) Customers ( ) Suppliers
   ( ) Marketing and sales people ( ) Operatives
   ( ) The competitors ( ) Others (please specify)?______

4. During the last 3 years, did your company introduce new or improved methods of manufacturing or producing goods or services?
   ( ) Yes ( ) No

5. Which of these changes (from new or improved method) fall in the following category:
   ( ) Replacement of existing machinery
   ( ) Re-organisation of process flow
   ( ) Re-organisation of workforce (e.g. increase and reduction)
   ( ) Re-scheduling of production workload
   ( ) Installation of equipment resulting in a higher level of automation
   ( ) Installation of equipment resulting in increased manufacturing flexibility
   ( ) Training leading to enhanced skills of operatives
   ( ) Improved system for stock control

6. Ideas for these process improvement programmes (including improvement and introduction) initially came from:
   ( ) Members of the board of directors ( ) Middle managers
   ( ) Customers ( ) Suppliers
   ( ) Marketing and sales people ( ) Operatives
   ( ) The competitors ( ) Others (please specify)?_______

8. During the last 3 years, did your company engage in the following innovation activities:
   i. In-house R&D – Creative work undertaken within your enterprise to increase the stock of knowledge and its use to devise new and improved products and processes (including software development)

( ) Yes ( ) No

ii. Extramural R&D (External R&D activities) – Same activities as above but perform by other companies, public or private research organisation of purchased by your firm.
( ) Yes ( ) No

iii. Acquisition of other external knowledge such as purchase or licensing patent and non-patented invention and other types of knowledge from other organisation.
( ) Yes ( ) No

iv. Internal and external training for personnel for new or improved products and processes.
( ) Yes ( ) No

SECTION D: ANTECEDENTS OF INNOVATION (LEADERSHIP, MANAGERIAL LEVERS AND BUSINESS PROCESS)

Please indicate your agreement or disagreement with the following statements about your organisation leadership, managerial levers and business processes that promote innovation. Using the scale from 1 – 6, kindly circle your response.

Strongly Disagree 1-------2------ 3------ 4 ------ 5------ 6 **Strongly Agree**

LEADERSHIP							
No.	Statements	Scale					
1.	The innovative leadership has inspired employee in terms of excitement and commitment.	1	2	3	4	5	6
2.	The innovative leadership encourages new ideas to be flourish in the organisation.	1	2	3	4	5	6
3.	The innovative leadership motivate employee to be involved in a new and challenging project.	1	2	3	4	5	6
4.	The innovative leadership encourage employee to be confidence	1	2	3	4	5	6
5.	The innovative leadership promotes creativity in a balance way	1	2	3	4	5	6
6.	The innovative leadership manages linkages internally to ensure innovation related activities in the organisation are strategically alligned and coordinated.	1	2	3	4	5	6
7.	The innovative leadership manages linkages externally in order to bring external perspective inside, tap into ideas, resources and co-innovation with partner organisations for new solution or systems.	1	2	3	4	5	6
8.	The innovative leadership provide reward for innovative effort and innovative result.	1	2	3	4	5	6

MANAGERIAL LEVERS - STRATEGY							
No.	Statements	Scale					
1.	The organisation's vision and mission includes a reference to innovation.	1	2	3	4	5	6
2.	Innovation strategy has helped the organisation to achieve	1	2	3	4	5	6

MANAGERIAL LEVERS - STRATEGY							
	strategic goals.						
3.	Improving administrative routines is seen as part of our innovation strategy.	1	2	3	4	5	6
4.	Internal cooperation is an important part of innovation strategy implementation.	1	2	3	4	5	6
5.	Customer satisfaction is part of our innovation strategy	1	2	3	4	5	6
6.	Improving product or service quality is one of our key objectives of innovation strategy	1	2	3	4	5	6
7.	Formulating innovation strategy increases employee skills	1	2	3	4	5	6
8.	Improving employee commitment, morale, or both is part of our innovation strategy monitoring.	1	2	3	4	5	6

MANAGERIAL LEVERS - STRUCTURE							
No.	Statements	Scale					
1.	In our company, we have specific units for the generation of innovations.	1	2	3	4	5	6
2.	It is clearly regulated who is responsible for innovations	1	2	3	4	5	6
3.	In our company, people know who is in charge of innovations	1	2	3	4	5	6
4.	The units responsible for innovation have sufficient resources for the generation of innovations.	1	2	3	4	5	6
5.	The units responsible for innovation have sufficient competencies for the introduction or generation of innovation.	1	2	3	4	5	6
6.	Our employee formally monitor developments in new technologies	1	2	3	4	5	6
7.	Our employees use failures as opportunities to learn	1	2	3	4	5	6

MANAGERIAL LEVERS – RESOURCE ALLOCATION							
No.	Statements	Scale					
1.	Our company plan human resource in phase for innovation activity	1	2	3	4	5	6
2.	Our company can select appropriate personnel in each functional department in innovation process.	1	2	3	4	5	6
3.	Our company can provide steady capital supplement in innovation activity.	1	2	3	4	5	6
4.	Our company fully use external technologies	1	2	3	4	5	6
5.	Our company adapts its technology level to changes in external environment.	1	2	3	4	5	6

MANAGERIAL LEVERS – KNOWLEDGE MANAGEMENT AND ORGANISATIONAL LEARNING							
No.	Statements	Scale					
1.	Knowledge is obtained from customers	1	2	3	4	5	6
2.	Knowledge is obtained from partners	1	2	3	4	5	6
3.	Knowledge is obtained from employees	1	2	3	4	5	6
4.	Knowledge is shared between supervisors and subordinates	1	2	3	4	5	6
5.	Knowledge is shared across the units	1	2	3	4	5	6
6.	Our company affectively manages different sources and types of knowledge	1	2	3	4	5	6

MANAGERIAL LEVERS – KNOWLEDGE MANAGEMENT AND ORGANISATIONAL LEARNING							
7.	Our company utilises knowledge into practical use	1	2	3	4	5	6
8.	Our company have a comprehensive program for employee learning	1	2	3	4	5	6
9.	Our company have an organisation-wide training and development process, including career path planning, for all our employees	1	2	3	4	5	6
10.	Our managers agree that organisation's ability to learn is the key to our competitive advantage	1	2	3	4	5	6

MANAGERIAL LEVERS - CULTURE							
No.	Statements	Scale					
1.	Our culture rewards behaviour that relate to creativity and innovation	1	2	3	4	5	6
2.	In our company, we are very open toward innovations (e.g. related to products and/or processes	1	2	3	4	5	6
3.	In our company, we expect the new value-adding products and services are detected and developed permanently	1	2	3	4	5	6
4.	In our company, we appreciate unconventional ideas (especially if they come from customer)	1	2	3	4	5	6

BUSINESS PROCESSES – PROCESS ALIGNMENT							
No.	Statements	Scale					
1.	Horizontal structure alignment has made frequent use of process team	1	2	3	4	5	6
2.	Horizontal structure alignment has made cross-functional teams have more authority in making daily decisions than departmental managers.	1	2	3	4	5	6
3.	Horizontal structure alignment has made well practice horizontal communication	1	2	3	4	5	6
4.	Horizontal structure alignment has made a flat organisational structure	1	2	3	4	5	6
5.	Horizontal structure alignment has made managerial task to front line staff delegated	1	2	3	4	5	6
6.	Technology enabled business processes to perform well	1	2	3	4	5	6
7.	Amount of data shared by employees increasing	1	2	3	4	5	6
8.	IT important to improvement of business processes	1	2	3	4	5	6
9.	Well integrated IT systems across functional units	1	2	3	4	5	6
10.	Core processes important input into strategic plan	1	2	3	4	5	6
11.	Operational improvements had direct impact on ability to compete	1	2	3	4	5	6
12.	Strategic planning process actually encourages information sharing and cross functional cooperation	1	2	3	4	5	6

BUSINESS PROCESSES – – PEOPLE INVOLVEMENT							
No.	Statements	Scale					
1.	Our executive has received adequate training in managing core processes	1	2	3	4	5	6

2.	Our executive has sufficient knowledge on how to manage core processes	1	2	3	4	5	6
3.	Our executive expressly recognises the need to identify core processes	1	2	3	4	5	6
4.	Our executive allocates adequate resources to improve core processes	1	2	3	4	5	6
5.	Our executive actively communicates to employees on how best to manage core processes	1	2	3	4	5	6
6.	Our employees increasing involvement in the way their work is planned	1	2	3	4	5	6
7.	Our employees increasing autonomy in making decisions that affect work	1	2	3	4	5	6
8.	Our employees are given necessary resources to fix problems they encounter	1	2	3	4	5	6
9.	Our employees encouraged to fix problem they encounter	1	2	3	4	5	6
10.	Our employees interacting more with external customers	1	2	3	4	5	6

SECTION E: INNOVATION PROCESS

Using the scale of 1 – 6, please indicate your agreement or disagreement with the following statements about your organisation innovation process.

Strongly Disagree 1-------2------ 3------ 4 ------ 5------ 6 **Strongly Agree**

INNOVATION PROCESS – IDEA GENERATION							
No.	Statements	Scale					
1.	In our company, there are guidelines and processes establish to standardise stages of idea generation.	1	2	3	4	5	6
2.	In our company, an idea is properly defined.	1	2	3	4	5	6
3.	In our company, procedures are defined to evaluate sources of idea.	1	2	3	4	5	6

INNOVATION PROCESS – IDEA MOBILISATION							
No.	Statements	Scale					
1.	In our company, idea sources are connected across departments, geography and authority ranks.	1	2	3	4	5	6
2.	In our company, idea sources are focused on the most likely or useful areas for the organisation.	1	2	3	4	5	6
3.	In our company, reward and recognition systems show value in both generation and mobilisation	1	2	3	4	5	6
4.	In our company, accountability for recognizing and mobilizing ideas is specified.	1	2	3	4	5	6
5.	In our company, idea generators and those involved with mobilisation interact with stakeholders.	1	2	3	4	5	6

INNOVATION PROCESS – ADVOCACY AND SCREENING							
No.	Statements	Scale					
1.	In our company, organisational and customer considerations are clear to advocates.	1	2	3	4	5	6
2.	In our company, possible ideas are broadly communicated.	1	2	3	4	5	6
3.	In our company, dedicated advocate roles exist, and/or reward systems are standardised to reward advocates.	1	2	3	4	5	6
4.	In our company, standards for evaluation are articulated and communicated across organisation.	1	2	3	4	5	6
5.	In our company, idea is evaluated as transparent as possible.	1	2	3	4	5	6

INNOVATION PROCESS - EXPERIMENTATION							
No.	Statements	Scale					
1.	In our company, resources are in place for experimentation	1	2	3	4	5	6
2.	In our company, process is defined and authorized.	1	2	3	4	5	6
3.	In our company, a variety of avenues exist to experiment, some of which involved external parties	1	2	3	4	5	6
4.	In our company, technology is utilised and invested in.	1	2	3	4	5	6
5.	In our company, failure is of the process, not an end point.	1	2	3	4	5	6

INNOVATION PROCESS - COMMERCIALISATION							
No.	Statements	Scale					
1.	In our company, distinction are drawn between immediately useful and ideas needing refinement or market changes.	1	2	3	4	5	6
2.	In our company, benefits are articulated and documented.	1	2	3	4	5	6
3.	In our company, commercialisation is controlled and objective driven.	1	2	3	4	5	6
4.	In our company, market response feedback is given to experimenters	1	2	3	4	5	6

INNOVATION PROCESS – DIFUSSION AND IMPLEMENTATION							
No.	Statements	Scale					
1.	In our company, the whole organisation is targeted	1	2	3	4	5	6
2.	In our company, existing initiatives are incorporated.	1	2	3	4	5	6
3.	In our company, realistic objective are established	1	2	3	4	5	6
4.	In our company, dialogue is emphasised with all stakeholders	1	2	3	4	5	6
5.	In our company, older, duplicative processes are eliminated.	1	2	3	4	5	6
6.	In our company, social network are utilised.	1	2	3	4	5	6
7.	In our company, technology is used to communicate.	1	2	3	4	5	6

SECTION F: INNOVATION OUTCOME

Using the scale of 1 – 6, please indicate your agreement or disagreement with the following statements about organisation innovation outcome.

Strongly Disagree 1-------2------ 3------ 4 ------ 5------ 6 **Strongly Agree**

INNOVATION OUTCOME – PRODUCT INNOVATION							
No.	Statements	Scale					
1.	The products of our company are new.	1	2	3	4	5	6
2.	The products of our company are inventive	1	2	3	4	5	6
3.	The products of our company focused on quality improvement	1	2	3	4	5	6
4.	The products of our company focused on product design improvement	1	2	3	4	5	6
5.	The products of our company differ significantly in terms of newness from existing product of competitors.	1	2	3	4	5	6
6.	The newly develop products our company solve the problem of our customer	1	2	3	4	5	6
7.	The newly develop products our company lead to significant cost saving for our customers	1	2	3	4	5	6
8.	The newly develop products our company deliver high benefits for our customers	1	2	3	4	5	6
9.	Our company has introduced more new products during the last 3 years than our strongest competitors	1	2	3	4	5	6
10.	Our company continually introduces innovative products into the market	1	2	3	4	5	6

INNOVATION OUTCOME – PROCESS INNOVATION							
No.	Statements	Scale					
1.	Our company is focused on improving work methods and process management	1	2	3	4	5	6
2.	Our company is focused on improving cost control	1	2	3	4	5	6
3.	Our company are constantly improving our business process	1	2	3	4	5	6
4.	Our company is focused on technological competitiveness	1	2	3	4	5	6
5.	Our company is focused on the newness of technology	1	2	3	4	5	6
6.	Our company is focused on the rate of changes in processes	1	2	3	4	5	6
7.	Our company seeks new ways to do things	1	2	3	4	5	6
8.	Our company is creative in its methods of operation	1	2	3	4	5	6

SECTION G: FIRM PERFORMANCE

Using the scale of 1 – 6, please indicate your agreement or disagreement with the following statements about your organisation performance.

Strongly Disagree 1-------2------ 3------ 4 ------ 5------ 6 **Strongly Agree**

FIRM PERFORMANCE							
No.	Statements	Scale					
1.	Our company achieve better return on investment (ROI) than the competitor for the last three years.	1	2	3	4	5	6
2.	Our company achieve better market share than the competitor for the last three years.	1	2	3	4	5	6
3.	Our company achieve better sales than the competitor for the last three years.	1	2	3	4	5	6
4.	Our company achieve better profitability than the competitor for the last three years.	1	2	3	4	5	6
5.	Our company achieve better productivity per individual employee for the last three years.	1	2	3	4	5	6

THANK YOU FOR YOUR TIME AND EFFORT IN COMPLETING THIS QUESTIONNAIRE

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