CHAPTER 3

RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter discusses the research methodology adopted for the study. It begins with a discussion of the methodological concerns of prior research on the variables involved in this study. This is followed by a detailed explanation of the data collection procedures, sampling, key informants, and research instruments. The later part of the chapter focuses on Structural Equation Modelling (SEM), presenting a detailed explanation of the SEM procedures and tools utilised in the study.

3.1 PHILOSOPHICAL PERSPECTIVE OF THE RESEARCH

There are two philosophical approaches to the development of research: positivism and phenomenology. Positivism remains the dominant epistemological orientation of the management discipline despite recently being criticised for its inherent limitations (Johnson & Duberley, 2000). Positivism is based on the belief that empiricism, as an inductive accumulation of observations, will establish scientific laws. Therefore, studies based on positivism use objective means to measure the subject under study, rather than using subjective inferences such as those derived from sensation, reflection, or intuition (Easterby-Smith, 1991). Positivists believe that by complying with scientific principles in the research process, the resultant law of social science could be applied to predict future behaviour.

From the positivist perspective, the aim of management research is to generate laws which govern the ways in which organisations operate. The generation of these laws will enable management to become more scientific-oriented, and hence, using factual evidence, managers should be better able to predict and control their environments. As believed by Comte (1853), only positive social science could have access to factual and certain knowledge which could be used to reform societal behaviour (Johnson & Duberley, 2000). Positivists believe that evidence from empirical-based research will lead to the discovery of laws in a causal and predictive form, which will enable human intervention to alter social conditions to achieve desired outcomes.

The positivist approach in management studies is generally associated with quantitative methods (Johnson & Duberley, 2000). Many researchers have believed that in order for knowledge of organisational phenomena to be expanded, research should be based on quantitative data from large-scale studies (Blau & Scott, 1963; Daft, 1980). This approach requires the development of replicable data collection techniques and careful attention to sampling in order to ensure generalisability of the propositions that will generate greater insight and have greater power of prediction (Pugh, 1983). The dominance of quantitative approaches in management research provides an incentive to academicians to develop sophisticated statistical analysis tools to support empirical research.

This research embraces positivism as its epistemological orientation mainly because the positivist approach involves scientific processes which will strengthen the validity of the findings and, therefore, allow these to be accepted as a valuable

addition to the body of knowledge. Although positivism has been claimed to generate narrow-focused studies that do not reflect the true complex situation (Pfeffer, 1995), the development of sophisticated statistical techniques such as Structural Equation Modelling (SEM), facilitates the analysis of complex research frameworks which involve direct and mediating relationships. Moreover, the use of the positivist approach will also extend the use of the findings, such that they can function as a decision-making element in predictive situations. The concern to establish relationships based on data and logic, supported the necessity of empirical analysis based on a cross-sectional survey research design as used in this study.

3.2 RESEARCH DESIGN

The selection of an appropriate research design depends on the specific purpose of the study. The main reason for proposing a blueprint or a detailed plan of how information is to be sourced and processed, is to guide and verify the research process (Cooper & Emory, 1995). By selecting an appropriate research design, the researcher is assisted in planning, synthesising, and guiding research procedures. The selection of a research design is an important aspect in the improvement of empirical research and theory building in organisation studies (Grunow, 1995). The research design will not only determine the ability of the findings to address the research questions, but it will also determine the extent of robustness of the research process. Hence, research design is considered as a tool for method selection that will improve the formulation of research questions and theoretical references.

Research design can be classified into two categories; exploratory and conclusive (Malhotra, 1999). The purpose of exploratory research is to comprehend the nature of the situation, whereas conclusive research or causal research (Zikmund, 2000) explains the relationship between the investigated factors through hypothesis testing. This study employed a conclusive or causal design with the aim of establishing the relationship between prospector strategic orientation and explorative learning, taking into account the mediation effect of combinative capabilities in determining performance.

3.3 METHODOLOGICAL CONCERNS OF PREVIOUS RESEARCH

Researchers have used the Miles and Snow (1978) typology to study strategic behaviour in a wide variety of organisations and industries (Shortell & Zajac, 1990). Since its formulation, substantial empirical research has been devoted to confirm the classification within this strategic typology, and due to the exhaustive and extensive studies in this respect, this strategic classification has been generally accepted in the management and marketing literature (Conant et al., 1990; Song & Xie, 2000; Walker et al., 2003) and has successfully embraced the test of time and place (Hambrick, 2003; Song et al., 2008). Not only has the typology been evident across industry (e.g. Lyles et al., 1993; Wang, 2008), but some empirical studies have also found the significance of this typology using single industry settings (e.g. Davig, 1986; Smith et al., 1989).

As summarised in Table 3.1, the majority of studies on the Miles and Snow (1978) typology have used primary data and mailed questionnaires to address their respective research issues. Although interviews have also been used in some studies, the major purpose of these has been to identify the strategic orientation of the companies. In terms of industry setting, the manufacturing industry seems to have been the most popular since the variation of strategies was more evident in this large industry (e.g. Davig, 1986; Dvir et al., 1993; Laugen et al., 2006; Smith et al., 1989). The use of a single industry setting in this study, allows for the exclusion of the moderating role of the environment which has been proven to have an impact on the findings in strategy research (Hambrick, 1982; Miller, 1988).

Table 3.1
Operationalisation of Miles and Snow (1978) Typology: Approaches, Strengths and Limitations

Measurement approach	Measurement description	Strengths	Limitations
1a. Self-typing	Respondents are asked to classify their organisations as defender, prospector, analyser, or reactor based on paragraph descriptions of the four strategic types.	• Easy to complete and interpret • All four types can be captured • Useful with large samples	• Single-item scale • Over-simplification of archetypes-paragraph descriptions of the strategic archetypes capture only two or three of the 11 adaptive cycle dimension constructs
1b. Self-typing, complemented by investigator-specified decision rules	Multi-item, close-ended scale: The overall degrees to which a firm's strategy conform to the archetypes are inferred based on multi-item(Likert type) scales developed to measure each of the four strategy types	• Multi-item scale and interpret • All four types captured • Useful with large samples	• Simplification of archetypes-however scale items do not capture all of the 11 adaptive cycle dimensions • Scale inconsistencies – number of items varies by strategic types (nine for defenders, eight for prospectors, seven for analysers and four for reactors)

Table 3.1, continued

Measurement approach	Measurement description	Strengths	Limitations
2. Objective indicators	Percentage of sales derived from new products. Interval measure transformed into ordinal measure	• Useful with large samples • Easy to interpret	• Unidimensional conceptualisation of a multi-dimensional construct • Only prospectors and defenders can be identified using the proposed decision rule
3. External assessment	Expert panel assessment ang typing	• Impartial assessments • All four types capable of being captured • Potentially useful with large samples	• Time consuming • Expert must be identified and their involvement secured • A process by which classification decisions will be made must be developed
4. Investigator inference	Investigator inference based on interviews with company executives	• All four types captured • In-depth analysis • Multiple measurement approaches	• Time consuming • Usefulness restricted to small samples

Source: Conant et al., 1990

A major concern in using the Miles and Snow (1978) strategic typology is the method of determining whether the company is a defender, prospector, or analyser. As presented in Table 3.1, previous approaches to the classification of strategic orientation can be divided into four major groups, these being: self-typing, objective indicators, external assessment, and investigator inference (Conant et al., 1990; Snow & Hambrick, 1980). Generally, among these four, the self-typing approach has been acknowledged as an acceptable method in assessing strategic orientation and has been frequently used in strategy research (Dess & Davis, 1984; Huber & Power, 1985; Snow & Hambrick, 1980). However, self-typing using the paragraph approach as employed in a number of past studies, has revealed a tendency to over-simplify the multi-dimensionality of the typology (Conant et al., 1990). Hence, self-typing

that is based on multiple indicators is gaining popularity in assessing strategic orientation in large samples due to its wholesomeness (Conant et al., 1990) in capturing the three types of strategic orientation as classified by Miles and Snow (1978).

Table 3.2
Industry Setting of Past Research on Miles and Snow (1978) Strategic Typology

Author	Sample and Industry	Data collection method	Group Extraction
Hrebiniak & Snow (1980)	247 managers in 4 industries	Mail questionnaire, secondary data	Self-typing - paragraph approach
Hambrick (1982)	20 organisations from 3 industries	Interviews, secondary data	External assessment
Meyer (1982)	3 hospitals	Interviews, secondary data	Investigator inference
Hambrick (1983)	850 PIMS firms in growth and maturity	Secondary data	Investigator inference
Hawes & Crittenden (1984)	181 retailing firms	Mail questionnaire	Self-typing using multiple indicators - Likert scale
Barrett & Windham (1984)	16 hospitals	Interviews	Investigator inference
Slocum et al. (1985)	499 salesperson in 2 companies	Interviews	Investigator inference
Davig (1986)	Apparel, foundry, fabricated metal products	Mail questionnaire	Self-typing - paragraph approach
Zahra (1987)	66 hospitals	Mail questionnaire	Self-typing - paragraph approach
Chaganti & Sambharya (1987)	79 executives in 3 tobacco firms	Secondary data	Investigator inference
Segev (1987)	85 Israeli industrial enterprises	Mail questionnaire	Self-typing - paragraph approach
McDaniel & Kolari (1987)	310 banks	Mail questionnaire	Self-typing - paragraph approach
Simons (1987)	76 Canadian firms	Interviews, mail questionnaire	External assessment
Ruekert & Walker (1987)	3 divisions in a large company.	Mail questionnaire	Self-typing - paragraph approach
Odom & Boxx (1988)	188 churches	Mail questionnaire	Self-typing - paragraph approach
Smith et al. (1989)	70 electronic firms	Mail questionnaire	Self-typing using multiple indicators
Usidken et al. (1989)	24 construction firms	Interviews	Self-typing - paragraph approach
Shortell & Zajac (1990)	574 hospitals	Mail questionnaire, secondary data	Self-typing using multiple indicators - Likert scale
Conant et al. (1990)	406 health maintenance organisations	Mail questionnaire	Self-typing using multiple indicators

Table 3.2, continued

Author	Sample and Industry	Data collection method	Group Extraction
Dvir et al. (1993)	Electronics and computer industry	Mail questionnaire	Self-typing - paragraph approach
Parnell & Wright (1993)	Catalogue and mail order houses	Mail questionnaire and secondary data	Self-typing using multiple indicators
Beekun & Ginn (1993)	109 hospitals	Mail questionnaire	Self-typing using multiple indicators - Likert scale
Thomas & Ramaswamy (1996)	83 Fortune 500 companies	Mail questionnaire	Investigator inference – objective measures
Aragon Correa (1998)	112 Spanish firms	Mail questionnaire	Self-typing using multiple indicators- - Likert scale
Woodside et al. (1999)	93 Finnish enterprises in multi-industry	Mail questionnaire	Self-typing using multiple indicators
Gimenenz (2000)	150 Brazilian small firms	Mail questionnaire	Self-typing using multiple indicators
Peng et al. (2004)	201 manufacturing companies in China	Mail questionnaire	Self-typing using multiple indicators - Likert scale
Moore (2005)	101 retail organisations	Mail questionnaire	Self-typing using multiple indicators - Likert scale
Olson et al. (2005)	228 manufacturing and services organisations	Mail questionnaire	Self-typing - paragraph approach
Parnell & Hershey (2005)	415 US and Mexican companies	Mail questionnaire	Self-typing using multiple indicators - Likert scale
Laugen et al. (2006)	55 medium and large manufacturing companies	Mail questionnaire	Investigator inference
Jusoh et al. (2006)	120 Malaysian manufacturing firms	Mail questionnaire	Self-typing using multiple indicators
Andrew et al. (2006)	119 English local authorities	Mail questionnaire	Self-typing - paragraph approach - Likert scale
Pleshko (2007)	125 credit unions in Florida	Mail questionnaire	Self-typing - paragraph approach
Lo & Wang (2007)	2 manufacturing industries in Taiwan	Mail questionnaire	Self-typing - paragraph approach - Likert scale
Song et al. (2008)	Firms in US, Japan and China	Mail questionnaire	Self-typing using multiple indicators
Wang (2008)	1,500 medium and large UK companies	Mail questionnaire	Self-typing - paragraph approach

In strategy research, the focus has usually been directed to change in performance as the result of strategy implementation (e.g. Davig, 1986; Gimenez, 2000; Hambrick, 1983; Miles and Cameron, 1982; Parnell & Wright, 1993; Snow & Hrebiniak, 1980). Most of the studies have proposed that proper implementation of variant strategies

will lead to positive performance depending on situational and configurational concerns. Both financial and non-financial measures have been employed to assess performance in strategy research. Among the financial measures that have been adopted are return on asset, mean revenue growth (Parnell & Wright, 1993), profitability, cashflow (Hambrick, 1983), turnover growth (Gimenez, 2000), and profit growth (Davig, 1986). On the other hand, non-financial measures have been measured based on market share gains, capital intensity, employee productivity (Hambrick, 1983), number of new products, and innovation (Shortell & Zajac, 1990).

In organisational learning research, studies that attempt to explicate the dynamics of explorative and exploitative learning are still limited in number and in terms of the issues they address. Since the inception of this idea by March (1991), a number of research studies have been concerned with understanding the nature of this concept (e.g. Kang et al., 2007; Keil et al., 2004; Liu, 2006). The majority have concluded that both were required simultaneously to develop competitive advantage (Auh & Menguc, 2005; Clegg, 1999; Levinthal & March, 1993; Liu, 2006; March, 1991). This conclusion has ignited the interest of subsequent researchers to explore antecedents and outcomes of exploration and exploitation (e.g. McGrath, 2001; Volberda et al., 2001). However, despite the overwhelming literature on exploration-exploitation, a systematic empirical inquiry is still absent (Sidhu et al., 2007), and this has made the comparison of previous findings difficult due to different definitions and indicators that are used to explore the idea of exploration-exploitation.

As illustrated in Table 3.3, the majority of previous studies have taken a quantitative approach in exploring the issues of exploration and exploitation; either using survey (e.g. Auh & Menguc, 2005; Geiger & Makri, 2006; Sidhu et al., 2007) or longitudinal secondary data (e.g. Beckham, 2006; Lavie & Rosenkopf, 2006; Vanhaverbeke et al., 2004). Case study has also been a popular method in respect of explorative and exploitative learning (e.g. Gilsing & Nooteboom, 2006; Lee et al., 2007; Lunnan & Barth, 2003). And another approach that has been used to explicate this concept is simulation (e.g. Miller et al., 2006; Rodan, 2005;).

Table 3.3
Dimensions of Explorative Learning in Previous Studies

Studies	Learning approach	Method	Measurement for learning
Bierly & Chakrabarti (1996)	Exploration, exploitation	Survey	Breath of innovation
Van Duesen & Mueller (1999)	Exploration, exploitation	Survey	Newness of members
Clegg (1999)	Exploration, exploitation	Case study	Innovation
McNamara & Fuller (1999)	Exploration, exploitation	Case study	Information search
McGrath (2001)	Exploration	Survey	Degrees of newness in project
Rosenkopf & Nerkar (2001)	Exploration, exploitation	Survey	Boundary spanning search behaviour
Douglas & Judge (2001)	Exploration	Survey	Information search
Katila & Ahuja (2002)	Exploitation	Survey	Search behaviour
Sidhu et al. (2003)	Exploration	Survey	Information acquisition
Lee et al. (2003)	Exploration, exploitation	Simulation	Information acquisition (technology)
Nerkar (2003)	Exploration	Survey	Innovation
Lunnan & Barth (2003)	Exploration, exploitation	Case study	Team involvement
Garcia et al. (2003)	Exploration, exploitation	Simulation	Innovation
Siggelkow & Levinthal (2003)	Exploration	Simulation	Information acquisition
Kyriakopoulos & Moorman (2004)	Exploration, exploitation	Survey	Innovation
Vanhaverbeke et al. (2004)	Exploration, exploitation	Longitudinal secondary data	Innovation (patent)
Sidhu et al. (2004)	Exploration, exploitation	Survey	Information acquisition
He & Wong (2004)	Exploration, exploitation	Survey	Innovation
Holmqvist (2004)	Exploration, exploitation	Case study	Innovation
Linnarson & Werr (2004)	Exploration	Case study	Innovation
Auh & Menguc (2005)	Exploration, exploitation	Survey	Innovation
Rodan (2005)	Exploration, exploitation	Simulation	Experimentation

Table 3.3, continued

Studies	Learning approach	Method	Measurement for learning
Gima (2005)	Exploration, exploitation	Survey	Experimentation
Jansen et al. (2006)	Exploration, exploitation	Survey	Innovation
Geiger & Makri (2006)	Exploration, exploitation	Survey	Innovation (patent)
Perretti & Negro (2006)	Exploration	Simulation	Newness of team members
Beckham (2006)	Exploration, exploitation	Longitudinal secondary data	Information acquisition
Gilsing & Nooteboom (2006)	Exploration, exploitation	Case study	Innovation
Wadhwa & Kotha (2006)	Exploration	Survey	Innovation (patent)
Miller et al. (2006)	Exploration, exploitation	Simulation	Information search
Siggelkow & Rivkin (2006)	Exploration	Simulation	Information search
Lavie & Rosenkopf (2006)	Exploration, exploitation	Secondary data	Information acquisition
Sidhu et al. (2007)	Exploration, exploitation	Survey	Information acquisition
Lee et al. (2007)	Exploration, exploitation	Case study	Innovation

Based on prior studies, there are two conceptions of explorative and exploitative learning. The majority of these studies have adopted March's (1991) description of exploration and exploitation as two ends of a uni-dimensional scale, whilst the others regarded explorative and exploitative learning as two distinct dimensions of learning behaviour (Bierly & Daly, 2001; He & Wong, 2004; Katila & Ahuja, 2002). In terms of the operationalisation of the measurement, previous studies have suggested a diversity of mechanisms to measure exploration and exploitation. Since learning is associated with innovation, many studies have used number of patents registered (Geiger & Makri, 2006; Katila & Ahuja, 2002; Nerkar, 2003; Vanhaverbeke et al., 2004), product innovation (Kyriakopoulos & Moorman, 2004; Taylor & Greve, 2006), radical innovation (Gima, 2005), and breadth and depth of innovation (Bierly & Chakrabarti, 1996) as measures of explorative learning. Other measurements have included technological and organisational boundary spanning in search behaviour (Katila & Ahuja, 2002; Sidhu et al., 2003, 2004; Rosenkopf & Nerker, 2001), the extent of newness of business development projects (McGrath, 2001), and the

diversity of members in a project (Perretti & Negro, 2006; Van Duesen & Mueller, 1999).

The use of innovation and number of patents to measure exploration posed a problem, firstly due to the reason that not all innovations are patentable, and not all patentable inventions are patented (Sidhu et al., 2007). It is obvious that not all firms can afford to file patents and some innovations may not be exclusive enough to be patented. Moreover, the incidence of patenting varies across sectors making cross-industry comparison difficult and superficial (Nerkar, 2003). The inconsistency in the definition of innovation has also posed a problem in respect of accepting innovation as a measurement of exploration. Sometimes innovation has been considered synonymously as exploration (as in radical innovation) and sometimes, as an outcome of exploration (as in new product innovation, new product development).

Without the establishment of sound measures, conclusive discussion on factors affecting exploration and exploitation impedes cross-sectional hypothesis-testing in different industry settings (Sidhu et al., 2004; Sidhu et al., 2007). Although studies by Sidhu et al. (2004, 2007) attempt to establish the measurement of exploration-exploitation based on information search, the possibility of other dimensions such as experimentation being included is still theoretically justifiable. It is even suggested by Sidhu et al. (2004) that the instrument they developed based on boundary spanning search behaviour should be further extended to cover additional construct facets.

In addition to the scant attention given to measurement issues, hypothesis-testing in exploration-exploitation research has mainly focused on the direct relationship between the two, and its antecedents or outcomes (e.g. Geiger & Makri, 2006; Katila & Ahuja, 2002; Sidhu et al., 2003, 2007; Vanhaverbeke et al., 2004). Substantial numbers of research studies have been devoted to exploring the structural requirements of organisations in encouraging exploration-exploitation learning (e.g. Douglas & Judge, 2001; Gima, 2005; He & Wong, 2004; Jansen et al., 2006; Vanhaverbeke et al., 2004) and this provides only a piece-meal understanding of this learning approach. What is lacking and less reported in the literature is the contingency perspective of organisational learning that offers an explanation of the effectiveness of explorative learning under different contextual conditions (Auh & Menguc, 2005).

In a number of studies, moderating variables have also been included in hypothesis-testing. Environment is one of the most common moderating variables in exploration-exploitation studies (Jansen et al., 2006; Sidhu et al., 2007) due to the belief that different dynamism levels have significant impact on the outcome of exploration and exploitation. Besides the environment, other variables that have been included in the analysis as moderating variables are competitive intensity (Auh & Menguc, 2005; He & Wong, 2004), inter-functional and control mechanisms (Douglas & Judge, 2001; Gima, 2005), absorptive capacity (Keil et al., 2004), and organisational form (Benner & Tushman, 2003).

The dearth in the literature that addresses the importance of learning in the strategy–performance relationship provides a basis to explore its mediating role in

performance determination. Although a substantial number of studies have addressed the configurational and situational requirements, their scope has only managed to provide a piece-meal understanding by exploring direct relationships in the context of prospector strategic orientation and performance. What is still lacking is a comprehensive analysis that relates strategic orientation and performance by taking into consideration the mediation effects of internal variables, especially factors related to learning (Wang, 2008). Whilst recent studies have explored the relationship between strategy and explorative learning (e.g. Auh & Menguc, 2005; Sidhu et al., 2004), these studies have not attempted to confirm the mediating role of both constructs that measures organisational mechanism and learning approach to explain variation in performance. Therefore, using a contingency perspective, this study fills the gap by offering explanations of the importance and effectiveness of explorative learning under specific contextual condition. This study intends to show the importance of internal factors, namely combinative capabilities and explorative learning in the relationship between strategy and performance, and how both factors mediates this relationship. By incorporating strategic, learning and structural elements, this study attempts to provide a comprehensive understanding of the relationship from the perspective of strategic management and organisational learning.

3.4 RESEARCH DESIGN AND JUSTIFICATIONS

The integrated research framework proposed in this study requires a large sample in order to make some degree of generalisation in the findings, and survey design is

known to be the best method for studying and describing large populations (Davis & Cosenza, 1993). Survey research is a method of gathering data from respondents that is assumed to be representative of the population, and the instrument used is composed of structured or open-ended items. The main advantage of using the questionnaire survey is the ability to pool information from a large sample over a relatively short period of time. Despite criticisms that the survey approach artificially forces respondents to form opinions, is unable to tap into conflicting views, and elicits unconscious biases within each respondent, it is still a popular method for studying and predicting behaviour (Dillman, 1991). Furthermore, a questionnaire especially in the form of a mailed survey, offers a more practical and cost effective method of data collection (Emory & Cooper, 1991).

Besides efficiency and cost effective qualities, the main advantage of survey design is its applicability in examining causal processes, and developing and testing explanations for particular relationships or social patterns (Hakim, 1994). The effectiveness of this approach is further facilitated and extended by the development of complex and sophisticated analysis techniques available in academia. The joint qualities of method and statistical techniques allow for a more comprehensive analysis of the research problem, especially in testing the mediation effect and assessing the overall fitness of the research model. This strengthens the findings by providing statistically-justified conclusions, rather than inferring from multiple linear regression output (Henley, Shook & Peterson, 2006).

Another advantage of survey design is that the measurement used can be replicated in different settings, or repeated in the same context at a different time (Hakim,

1994). Since most of the instruments applied are extracted from other mailed questionnaire surveys (e.g. Conant et al., 1990; Jarwoski & Kohli, 1993; Sidhu et al., 2004), it is therefore justified and practical to use the same approach to suit to the characteristics of these instruments. The repeated use of the measurements in different settings allows refinement of the measurement and increases the reliability of the scale for use in future studies (Camison, 2004).

Finally, this design also offers a more practical and feasible means to gain access to organisations. Although in-depth interviews, observation, and case study provide greater insight into the research issues, these methods require intensive fieldwork from the researcher and commitment and co-operation from the respondents. Besides, in the current competitive business environment, business strategies and internal resources are considered confidential and often denied from public scrutiny. Therefore the mailed questionnaire is the most appropriate strategy since it requires minimum involvement from the organisation. Furthermore, the mailed questionnaire is more suitable as a means to contact respondents, such as top corporate executives, who might otherwise be inaccessible since their importance in their organisations and accompany busy schedules means they are often difficult to reach (Cooper & Schindler, 2000). The nature of this study, which asks respondents to form opinions on business strategy and organisational performance, requires answers from top executives. Thus, the use of a mailed questionnaire is the most practical and effective vehicle for gathering information from this type of respondent. Furthermore, the extensive use of mailed questionnaires in previous strategy (e.g. Laugen et al., 2006; Olson et al., 2005; Parnell & Hershey, 2005), and organisational learning research

(e.g. Geiger & Makri, 2006; Sidhu et al., 2004) justifies the adoption of this method in this study.

3.4.1 Sampling

The sample was developed from the Federation of Malaysian Manufacturing (FMM) database in 2005 which has a listing of 2,132 registered companies. The focus of the study was on manufacturing due to its contribution to the Malaysian Gross Domestic Product (GDP), and coincidentally, this industry has the most complete database thereby providing greater potential in respect of coverage by a questionnaire survey, and hence a greater possibility of getting sufficient respondents for the purpose of empirical analysis. Furthermore, the size and composition of companies in the manufacturing industry provides enough variation for analysis. This is supported by Levinthal (1997), who suggests that considerable diversity of organisational forms is still plausible in a single industry setting due to the interaction effects prevailing in the industry. Another desirable feature of using a single industry setting is the provision of control over market and environmental peculiarities (Conant et al., 1990). In addition, Olson et al., (2005) suggested that focus on a single large industry not only provides a similar context for the respondents, but that the response can still be broad enough for the result to be generalised. In this study, all manufacturing companies listed in the FMM 2005, and that were classified according to International Standard Industrial Classification (ISIC) Codes, were included in the sample, which ranged across Peninsular Malaysia, Sabah and Sarawak.

In order to assess learning interactions and performance, only firms with more than 50 full-time employees and that had been in operation for at least five years were included in the final list of manufacturing companies to be used as the sample. The choice of 50 employees and above classifies these companies in the medium and large-sized category as defined by the Small and Medium Industry Development Corporation (SMIDEC). Based on this requirement, a total of 1,550 firms were included in the sample.

The focus on larger firms was due to the fact that they were expected to have in place, the finance, people, and routines to implement more complex competitive effort than smaller companies (Haveman, 1993). Although firm size did not appear to have any relation to performance, studies have found that larger firms exhibit more prospective characteristics than smaller firms (Davig, 1986; Gimenez, 2000). Furthermore, research on slack resources and innovation has shown that organisations with sufficient slack resources tend to have a greater risk-taking attitude (Singh, 1986) and experimental orientation (Bourgeios, 1981, Geiger & Cashen, 2002; Geiger & Makri, 2006). Moreover, organisational learning is found to be more crucial in larger firms (Schildt, Maula & Keil, 2005; Wang, 2008), according to the argument that larger firms require extensive scanning to update information, resources, and capabilities in lieu of competition. This is supported by a study by Sidhu et al. (2007) that concluded monetary and human resources were found to be positively related to exploration orientation. In terms of age, it was found that age and size influenced firm growth (Carroll & Hannan, 2000) since older firms have increased cumulative experience that enhances innovation (Sorenson & Stuart, 2000).

In choosing key informants, this study employed the sampling strategy advocated by Seidler (1974) that suggested the selection of the same kind of key informants in all of the sampled companies. This exercise was believed to reduce bias resulting from the use of perceptual measures that depend highly on the characteristics of key informants. Therefore, the questionnaire was specifically addressed to the Chief Executive Officer (CEO) or Managing Director (MD). According to Westphal and Frederickson (2001), top management personnel have a significant impact on strategic directions which are influenced by their personal philosophy and personality (Kotey & Meredith, 1997). Strategic literature has acknowledged the validity of the CEO or MD in measuring strategic configurations since he/she has overall knowledge especially in terms of strategic direction and overall performance of the firm (e.g. Aragon Correa, 1998; Conant et al., 1990; Goll, Johnson & Rasheed, 2007; Hambrick, 1981; Shortell & Zajac, 1990; Sidhu et al., 2004; Snow & Hrebiniak, 1980). This is further supported by the strategy literature that regards the top management team as suitable respondents for the measurement of organisational constructs (Conant et al., 1990). Although the multiple informant approach is generally preferable, due to time and resource constraints, the single informant approach allows for larger number of firms to be surveyed.

3.4.2 Research Instrument Design

For the purpose of hypotheses testing in this study, multi-item scales were adopted from previous studies for the measurement of the constructs. Although most of the constructs have already been used and validated in prior studies in organisational strategy (e.g. Aragon Correa, 1998; Conant et al., 1990; Gimenez, 2000; Jusoh et al.,

2006), organisational learning (e.g. Sidhu et al., 2004, 2007), and also organisational design (Caruna, Pitt & Berthon, 1998; Rapert & Wren, 1998; Tuominen, Rajala & Moller, 2000), a thorough literature review helped in the selection and refinement of each item, to form a meaningful measure for each constructs.

As it has often been claimed that the five-point Likert scale under-estimates extreme positions (Albaum, 1997), each item was based on a six-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. This practice was believed to eliminate potential bias stemming from respondents' reluctance to choose an extreme position, in favour of providing a socially-acceptable answer that would allow them to appear more normal and helpful. Hence, this study employed a six-point Likert scale (without a mid-point) in order to reduce social desirability bias without changing the direction of opinion (Garland, 1991). By doing this, the researcher prevented respondents from resorting to a neutral default option (Amabile et al., 1996).

The questionnaire was divided into five sections (Appendix 1). As summarised in Table 3.4, Section A measured the prospector strategic orientation of the company. This was followed by Section B that measured the extent of the prevailing combinative capabilities in the company. Section C measured the level of explorative learning prevalent in the company, and Section D measured the performance of the company based on the perception of the CEO/MD. Finally, section E presented demographic-related questions to gauge the background of the company such as industry, export orientation, years of operation, and number of employees.

Table 3.4
Questionnaire Design

Section	Measurement	Number of items
Section A	Prospector strategic orientation	18
Section B	Combinative capabilities	23
Section C	Explorative learning	18
Section D	Performance	14
Section E	Demographic	6

In this study, prospector strategic orientation was measured using a uni-dimensional scale that measured the extent of the strategic inclination based on 18 items. The respondents were required to indicate their position on the six-point semantic scale based on two extreme positions. Although the questions were grouped together and the instruction explained what the items were attempting to measure, the items were jumbled up in terms of the dimension of strategies in the prospector strategic orientation.

Combinative capabilities were measured using 23 items in Section B. This was followed by 18 items to measure explorative learning. Both combinative capabilities and explorative learning employed a six-point Likert scale ranging from 'strongly disagree' to 'strongly agree' without a mid-point. Performance in Section D was measured using 14 items where the respondents were required to indicate their position on a five point Likert scale ranging from 'far inferior' to 'far superior' when compared to the last three years' performance, and to their competitors' performance.

The questionnaire was presented in English since English is widely used in Malaysian firms. Furthermore, since the target respondents consisted of the CEO or MD of the company, the use of the English language did not pose a problem to them in respect of their understanding. In fact, there was no comment or other indication of any language problem in the pilot testing. Secondly, by using the English language, the researcher ensured that the originality of the questions in terms of meaning and intent as used in other studies, was maintained.

3.4.2.1 Prospector Strategic Orientation

Four broad approaches for identifying and measuring strategies as mentioned by Snow and Hambrick (1980) have been utilised in the operationalisation of the Miles and Snow (1978) categorisation. In the self-typing approach, respondents are asked to classify their organisations as defender, prospector, and analyser, based on paragraph description of the three strategic types. Objective indicators involved transforming the interval measure of performance data such as percentage of sales derived from new products into an ordinal measure. Another approach has been the use of external assessment whereby experts are consulted to classify firms according to the typology. Besides soliciting expert opinion, firms can also be classified using investigator inference based on interviews with company executives.

Among the four approaches, paragraph approach has been widely employed (Conant et al., 1990), but this approach has limited content validity because of its tendency to over-simplify the multi-dimensionality of the archetype constructs. Based on the work of Snow and Hrebeniak (1980) paragraph descriptions of the strategic

archetypes, Conant *et al* (1990) developed a comprehensive measure using an 11-item scale, and this scale has been extensively used to measure strategic orientation in many recent studies (e.g. Gimenez, 2000; Jusoh et al., 2006; Parnell & Wright, 1993; Song et al., 2008; Woodside et al., 1999).

Based on the notion that firms pursue different degrees of prospector strategic orientation, this study employed a semantic scale approach in assessing prospective strategy. Such an approach to determining strategic orientation has been widely used and accepted in strategy research and is gaining popularity in studies on the Miles and Snow (1978) typology (e.g. Gatignon & Xuereb, 1997; Aragon Correa, 1998; Moore, 2005; Parnell & Hershey, 2005; Andrew et al., 2006). As summarised in Table 3.5, the semantic scale measurements used in this study were developed based on the work of Conant et al. (1990) and Covin and Slevin (1989) on entrepreneurial (8 items), engineering (5 items), and administrative (5 items) dimensions. Many studies (e.g. Jusoh et al., 2006; Parnell & Wright, 1993; Song et al., 2008; Woodside et al., 1999) have employed these measurements in classifying strategic orientation. Besides, the similarities in terms of research setting and the nature of the respondents, justified the application of this scale in this study.

Table 3.5
Measurement Development for Prospector Strategic Orientation

Q	Author	Original Measure	Measure used in this study
A1	Conant et al. (1990)	In comparison with other organisations, the services which we provide to our members are best characterised as : Services which are well focused, relatively stable and consistently-defined throughout the organisation and marketplace. Services which are innovative, continually changing and broader in nature throughout the organisation and marketplace.	My company's product lines are narrow throughout the marketplace. My company's product lines are broader in nature throughout the marketplace.
A2	Covin & Slevin (1989)	In dealing with competitors, my firm … Is very seldom the first business to introduce new products/services, administrative techniques, operating technologies, etc Is very often the first business to introduce new products/services, administrative techniques, operating technologies etc	My company is very seldom the first to introduce new products. My company is very often the first to introduce new products.
A3	Conant et al. (1990)	One of the most important goals in this organisation, in comparison to other organisations, is our dedication and commitment to Keep costs under control. Insure that the people, resources and equipment required to develop new services and new markets are available and accessible.	My company's success depends on maintaining high level of efficiency. My company's success depends on our ability to innovate frequently.
A4	Conant et al. (1990)	In comparison with other organisations, the services which we provide to our members are best characterised as: Services which are well focused, relatively stable and	My company's products are relatively stable throughout the marketplace. My company's products are innovative and continually changing throughout the marketplace.

Table 3.5, continued

Q	Author	Original Measure	Measure used in this study
		consistently-defined throughout the organisation and marketplace. Services which are innovative, continually changing and broader in nature throughout the organisation and marketplace.	
A5	Covin & Slevin (1989)	In dealing with competitors, my firm … Is very seldom the first business to introduce new products/services, administrative techniques, operating technologies etc Is very often the first business to introduce new products/services, administrative techniques, operating technologies etc	My company is often the pioneer of new technologies. My company is very seldom the first to introduce new technologies.
A6	Covin & Slevin (1989)	When confronted with decision-making situations involving uncertainty, my firm Typically adopts a bold, aggressive posture in order to maximise the probability of exploiting potential opportunities. Typically adopts a cautious, 'wait-and-see' posture in order to minimise the probability of making costly decisions.	My company adopts a bold, aggressive posture in order to maximise the probability of exploiting potential opportunities. My company adopts a cautious, 'wait-and-see' posture in order to minimise the probability of making costly decisions.
A7	Conant et al. (1990)	In comparison to other organisations, the increase or losses in demand which we have experienced are due most probably to : Our practice of concentrating on more fully developing those markets which we currently serve Our practice of aggressively entering into new markets with new types of service offerings and programs	My company concentrates more on fully developing those markets that we currently serve. My company is aggressively entering into new markets with new products.

Table 3.5, continued

Q	Author	Original Measure	Measure used in this study
A8	Covin & Slevin (1989)	In general, the top managers of my firm favour … A strong emphasis on the marketing of tried and true products or services. A strong emphasis on R&D, technological leadership and innovation.	In general, my company favours a strong emphasis on the marketing of established products. In general, my company emphasises on R&D to continuously market new and innovative products.
A9	Conant et al. (1990)	The amount of time my organisation spends on monitoring changes and trends in the marketplace can best be described as : We really don't spend much time monitoring the marketplace We are continuously monitoring the marketplace	My company occasionally monitors changes and trends in the marketplace. My company continuously monitors changes and trends in the marketplace.
A10	Covin & Slevin (1989)	In dealing with competitors, my firm … Typically responds to actions which competitors initiate. Typically initiate actions which competitors then respond to.	My company usually responds to actions that are initiated by competitors. My company usually initiates actions that will be responded to by competitors.
A11	Covin & Slevin (1989)	In dealing with competitors, my firm … Typically seeks to avoid competitive clashes, preferring a 'live and let live' posture. Typically adopts a very competitive, 'undo the competitors' posture.	My company seeks to avoid competitive clashes by maintaining existing product or market. My company adopts a very competitive, 'undo the competitors' posture.
A12	Covin & Slevin (1989)	*Changes in product or service lines have been mostly of a minor nature.* Changes in product or service lines have usually been quite dramatic.	Changes in product lines have been mostly of a minor nature. Changes in product lines have usually been quite dramatic.

Table 3.5, continued

Q	Author	Original Measure	Measure used in this study
A13	Conant et al. (1990)	More so than any other organisations, our management staff tends to concentrate on: Maintaining a secure financial position through cost and quality control measures. Developing new services and expanding into new markets or market segments.	My company emphasises maintaining the production of standardised products to reduce cost. My company emphasises continuous improvement of products to secure a long-term competitive advantage.
A14	Covin & Slevin (1989)	In general top managers of my firm have A strong proclivity for low-risk projects (with normal and certain rates of return). A strong proclivity for high-risk projects (with chances of very high returns).	My company has a strong tendency to go for low-risk projects (with normal and certain rates of return). My company has a strong tendency to go for high-risk projects (with chances of very high returns).
A15	Covin & Slevin (1989)	In general, the top managers of my firm believe that Owing to the nature of the environment, it is best to explore it gradually via timid, incremental behaviour. Owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm's objectives.	Owing to the nature of the environment, my company believes that it is best to explore gradually and incrementally. Owing to the nature of the environment, my company believes that bold, wide-ranging acts are necessary to achieve the company's objectives.
A16	Conant et al. (1990)	In contrast to other organisations, the competencies (skills) which our managerial employees possess can best be characterised as : Specialised: their skills are concentrated into one, or a few, specific areas. Are able to consistently develop new services and new markets.	One thing that protects my company's competitive position is that we are able to consistently penetrate existing markets with a limited number of products. One thing that protects my company's competitive position is that we are able to consistently develop new products and new markets.

Table 3.5, continued

Q	Author	Original Measure	Measure used in this study
A17	Conant et al. (1990)	In contrast to other organisations, my organisation has an image in the marketplace as an organisation which: Offers fewer, selective services which are high in quality Has a reputation for being innovative and creative	My company has an image in the marketplace as a company that offers fewer, selected products. My company has an image in the marketplace as a company that frequently offers innovative and new products.
A18	Conant et al. (1990)	In contrast to many other organisations, my organisation prepares for the future by: Identifying those problems which, if solved, will maintain and then improve our current service offerings and market position. Identifying trends and opportunities in the market place which can result in the creation of service offerings or programs which are new to the HMO industry or which reach new markets.	My company prepares for the future by identifying those problems, which if solved, will maintain and then improve our current products and market position. My company prepares for the future by identifying trends and opportunities in the market place, which can result in the creation of new products or reach new markets.

3.4.2.2 Combinative Capabilities

This study defined combinative capabilities according to the definition prescribed by Van den Bosch et al. (1999) that classified combinative capabilities into three categories: system capabilities, coordination capabilities, and socialisation capabilities. Since scant attention has been given to this concept, a generally accepted measurement was still elusive. Jansen et al. (2005) proposed that system capabilities should be measured by formalisation, coordination capabilities by participation (Ruekert & Walker, 1987), and socialisation capabilities by

connectedness. Based on this, measurements by several authors in different studies were adopted and extended to measure combinative capabilities in this study.

As system capabilities are reflected in the degree of formal systems prevailing in the firm, the operationalisation of this construct was based on the organisational mechanism associated with formalisation as used in studies by Covin and Slevin (1989) and Lee and Choi (2003). As illustrated in Table 3.6, the operationalisation of coordination capabilities was based on items that measured training, skills (Nieto & Quevedo, 2005) and inter-functional coordination (Narver & Slater, 1990). Finally, socialisation capabilities were represented by connectedness and inter-departmental communication (Jaworski & Kohli, 1993) which measured the extent to which individuals in organisational units were networked to various levels of the hierarchy. Several streams of research have suggested that inter-departmental connectedness facilitates interaction and exchange of information, and eventually the actual utilisation of the information (Jaworski & Kohli, 1993; Deshpande & Zaltman, 1982).

Table 3.6
Measurement Development for Combinative Capabilities

Q	Author	Original Measure	Measure used in this study
B1	Covin & Slevin (1989)	Our organisation has a strong insistence on a uniform managerial style throughout the firm.	Strong insistence on a uniform managerial style is applied throughout the company.
B2	Covin & Slevin (1989)	Our organisation has strong emphasis on holding fast to tied and true management principles despite any changes in business conditions.	Strong emphasis is given on holding fast to tried and true management principles despite any changes in business conditions.

Table 3.6, continued

Q	Author	Original Measure	Measure used in this study
B3	Jaworski & Kohli (1993)	There is ample opportunity for informal 'hall talk' among individuals from different departments in this business unit.	Employees have ample opportunity for informal discussions with individuals from different departments.
B4	Nieto & Quevedo (2005)	Most of our staff are highly skilled and qualified.	Most of our employees are highly skilled and qualified.
B5	Covin & Slevin (1989)	A strong emphasis always on getting personnel to follow the formally laid down procedures.	Strong emphasis on always getting employees to adhere to formal procedures.
B6	Jaworski & Kohli (1993)	In this business unit, it is easy to talk with virtually anyone you need to, regardless of rank or position.	It is easy to talk with virtually anyone you need to, regardless of rank or position.
B7	Jaworski & Kohli (1993)	Managers here discourage employees from discussing work-related matters with those who are not their immediate superiors or subordinates.	Employees are discouraged from discussing work-related matters with those who are not their immediate superiors or subordinates.
B8	Narver & Slater (1990)	Information shared among functions	Information is shared among employees in different departments.
B9	Covin & Slevin (1989)	Tight formal control of most operations by means of sophisticated control and information systems.	Tight formal control of most operations by using sophisticated control and information systems.
B10	Nieto & Quevedo (2005)	The firm has staff with a wide range of training and educational backgrounds.	Having a workforce with diverse educational backgrounds is critical to our value-creation activities.
B11	Jaworski & Kohli (1993)	In this business unit, employees from different departments feel comfortable calling each other when the need arises.	Employees from different departments feel comfortable to communicate with each other when the need arises.
B12	Covin & Slevin (1989)	Strong emphasis always on getting personnel to follow the formally laid-down procedures.	Most activities are well-defined by their formal job description.
B13	Jaworski & Kohli (1993)	Junior managers in my department can easily schedule meetings with junior managers in other departments.	Managers in any department can easily schedule meetings with managers from other departments.
B14	Lee & Choi (2003)	Members can ignore the rules and reach informal agreements to handle some situations.	To handle some situations, decisions may not follow standard operating procedures. (R)

Table 3.6, continued

Q	Author	Original Measure	Measure used in this study
B15	Nieto & Quevedo (2005)	The level of coordination between the various activities carried out in our firm is very high.	The level of coordination between various activities carried out in this company is very high.
B16	Jaworski & Kohli (1993)	Communications from one department to another are expected to be routed through 'proper channels'.	Employees have proper channels to communicate with other departments.
B17	Lee & Choi (2003)	If employees wish to make their own decisions, they are quickly referred to a policy manual.	If employees wish to make their own decisions, they are quickly referred to a policy manual.
B18	Nieto & Quevedo (2005)	We encourage diversity in people and ideas within our company.	Diversity of ideas is encouraged.
B19	Nieto & Quevedo (2005)	The firm has staff with a wide range of training and educational backgrounds	Most of our employees possess broad and diverse skills that allow them to be deployed across many areas or functions.
B20	Jaworski & Kohli (1993)	People around here are quite accessible to those in other departments.	People around here are quite accessible to those in other departments.
B21	Narver & Slater (1990)	All functions contribute to customer value.	All departments contribute to the implementation of projects that increase customer value.
B22	Narver & Slater (1990)	Share resources with other business units.	Resources are shared among functional units.
B23	Narver & Slater (1990)	Functional integration in strategy.	Projects are often assigned to a team that involves employees from different departments.

3.4.2.3 Explorative Learning

Although many attempts have been made to explicate issues related to learning constructs, many aspects of organisational learning were still elusive and ill-defined and that this shortfall warranted systematic research in organisational learning (Daft & Huber, 1987; Sidhu et al., 2005). Without developing measures that operationalise

basic learning concepts, systematic research on organisational learning is unlikely to progress far. Furthermore, the conceptual contribution on explorative learning has not being sufficiently embraced by empirical work (Sidhu et al., 2004). Although some empirical studies have enriched the understanding in explorative learning (e.g. McGrath, 2001; Volberda et al., 2001), they have still fallen short in identifying the dimensions of explorative learning (Sidhu et al., 2007).

Studies on the measurement of the exploration and exploitation constructs have been focused on non-local and local information searches (Rosenkopf & Nerkar, 2001; Sidhu et al., 2004; Sidhu et al., 2007). These studies have suggested that particularly in the case of explorative learning, a well-developed acquisition capability is required to identify new emergent opportunities as well as assimilation qualities in order to understand and diffuse newly-found knowledge.

According to Zahra and George (2002), information acquisition is associated with a firm's capabilities to identify and acquire externally-generated knowledge that is critical to that firm's operation. A firm's exposure to knowledge within its environment will influence decision-making and the development of future capabilities (March & Simon, 1993). This assertion is further supported by Van Wijk et al. (2001) who suggested that the breadth and depth of knowledge exposure positively influenced a firm's tendency to explore new and related knowledge. In other words, firms with well-developed capabilities for information acquisition are likely to be more adept at continually revamping their knowledge stocks by spotting trends in their external environment and internalising knowledge (Zahra & George,

2002). Being responsive to the external environment, firms can reconfigure their resource base in time to capture emerging strategic opportunities.

Recent studies have described exploration and exploitation based on internal and external boundary spanning whereby new knowledge can be acquired within firms through local searches, and through the integration of knowledge from other organisations. Consequently, a more focused measure was introduced by Sidhu et al. (2004, 2007) to measure exploration and exploitation based on three-dimensional boundary spanning concentrating on supply, demand and geographic space.

Due to the absence of a generally accepted measure of exploration orientation, experimentation was integrated in this study as another dimension in explorative learning besides also using the information acquisition dimension based on the work of Sidhu et al. (2004). This attempt will enrich the scant literature on exploration orientation measurement and allow the development of a more comprehensive measurement of explorative learning. Moreover, since experimentation involves making choices when the outcomes are unpredictable (Rodan, 2005), it captures such things as risk-taking, variation, and innovation (March, 1998) that is often mentioned in explaining exploration. Although some studies have argued that unconstrained experimentation may lead to a competency trap (Liu, 2006; Rodan, 2005), in a changing world, insufficient experimentation will have severe consequences. Since explorative learning is associated with variation, a higher rate of experimentation will increase the variation in beliefs among individuals in a system (Rodan, 2005). Therefore, exploration in this study was measured by information acquisition and experimentation. As illustrated in Table 3.7, works from Yeung et al. (1999) were

compiled to measure experimentation, and measurements used by Sidhu et al. (2004) were used to measure information acquisition.

Table 3.7
Measurement Development for Explorative Learning

Q	Author	Original Measure	Measure used in this study
C1	Sidhu et al. (2004)	We are knowledgeable about all the important opportunities in the geographic areas in which we operate.	We are knowledgeable about all the important opportunities in the geographic areas in which we operate.
C2	Sidhu et al. (2004)	We are well aware of technological and technical developments within our industry.	We are well aware of technological and technical developments within our industry.
C3	Yeung et al. (1999)	We constantly seek new ideas, even before old ones are fully implemented.	We constantly search for new ideas, even before old ones are fully implemented.
C4	Self-developed		We make a point to try many of the innovative ideas that are proposed in the company.
C5	Yeung et al. (1999)	Good ideas tend to disappear if not in regular use.	Good ideas are usually captured through the company's corporate memory.
C6	Sidhu et al. (2004)	Our information gathering efforts cover all industries that employ the sort of technology that we use.	Our information gathering efforts cover all industries that employ the sort of technology that we use.
C7	Sidhu et al. (2004)	We acquire little information on opportunities to employ our existing production facilities in new product domains. (R)	We acquire little information on opportunities to employ our existing production facilities in new product domains. (R)
C8	Yeung et al. (1999)	This firm promotes experimentation and innovation as a way of improving the work processes.	Although procedures have been established, experimentation and innovation are still encouraged as a way to improve work processes.
C9	Yeung et al. (1999)	We constantly seek for new ways to do work.	Efforts toward improvement focus more on looking for a new system.
C10	Yeung et al. (1999)	Experiences and ideas provided by external sources (advisors, customers, training firms, etc) are considered a useful instrument for this firm's learning.	Experiences and ideas provided by external sources (advisors, customers, consultants) are considered useful instruments for learning.

Table 3.7, continued

Q	Author	Original Measure	Measure used in this study
C11	Sidhu et al. (2004)	In our company, there is close surveillance of advancements in process and product technologies in the supplier industries.	There is close surveillance of advancements in process and product technologies in the supplier industries.
C12	Self-developed		Most of the work is assigned to teams according to their expertise.
C13	Yeung et al. (1999)	We work to ensure that all employees can recognise or discover the information that they need to perform their job.	All employees have access to more information than the minimum required to perform their job.
C14	Sidhu et al. (2004)	We closely follow the activities of companies in our industrial sector but operating outside our geographic area.	We closely follow the activities of companies in our industrial sector but operating outside our geographic area.
C15	Yeung et al. (1999)	We work to ensure that employees are directly exposed to variation and complexity of the environment.	We work to ensure that employees are directly exposed to variation and complexity of the environment.
C16	Yeung et al. (1999)	We try a lot of new ideas, even at the risk of implementing them before they are fully articulated.	We try a lot of new ideas, even at the risk of implementing them before they are fully articulated.
C17	Sidhu et al. (2004)	We closely monitor companies not active in our product area, but having skills and know how comparable to ours.	We closely monitor companies not active in our product area, but having skills and know how comparable to ours.
C18	Yeung et al. (1999)	We seem to be always trying new ideas before exhaustively examining them in order to seize opportunities.	We seem to be always trying new ideas before exhaustively examining them in order to seize opportunities.

3.4.2.4 Performance

As proposed by Lee and Choi (2003), methods for measuring organisational performance in organisational learning can be categorised into four groups: financial measures, intellectual capital, tangible and intangible benefits, and balanced scorecard. Ittner and Lacker (1997) also suggested that overall perceived

performance should also include other financial and non-financial goals that are also important to organisations. Based on this, this study adopted a 14-item measure which was used to assess the overall performance of a firm in many studies (e.g. He & Wong, 2004; Powell, 1995; O'Cass & Ngo, 2007).

The measurement for performance was based on perceptual measure or self – reported items that was generally used to assess organisational performance and considered effective in comparing business units and industries (Drew, 1997). There were many precedents in the literature for obtaining performance information on a primary basis (e.g. Conant et al., 1990; Covin & Slevin, 1994; O'Cass & Ngo, 2007; Powell, 1995). The dominance of perceptual over objective measures in the literature is due to the reason that objective measures are often not available due to firm's reluctance to provide information which is considered confidential (Pelham & Wilson, 1996). Although there is inherent disadvantage in using perceptual measures for performance, studies have found strong correlation between perceptual and internal objective measures of performance (Dess & Robinson, 1984; Pearce, Freeman & Robinson, 1987) as well as secondary published data external to the organisations (Venkatraman & Ramanujan, 1986). Furthermore, the perceptual approach allows greater comparability across industries, with varying standards of acceptable performance (Douglas & Judge, 2001; Pelham & Wilson, 1996). In addition, a study by Morgan et al. (2004) found a strong correlation between objective performance data and subjective assessments of performance by key informants, which supports the validity of key informant perceptual data.

The measurements of performance in this study were categorised into three groups: financial, process innovation, and product innovation. For performance measurement, this study adopted a measurement design developed and validated by Deshpande, Jarley and Webster, (1993) and Drew (1997), whereby respondents were required to indicate how successful their firm was in terms of sales volume, profit, growth and market share, as compared to previous years, and as compared to competitors. As summarised in Table 3.8, financial performance measurements were adopted from Lee and Choi (2003), while innovative performance was measured following He and Wong (2004) by asking respondents to indicate how successful their organisation was in developing new products, opening new markets, and improving production processes.

Table 3.8
Measurement Development for Performance

Q	Author	Measure used in this study
E1	Lee & Choi (2003)	Sales volume
E2	Lee & Choi (2003)	Market share
E3	Lee & Choi (2003)	Profit
E4	Lee & Choi (2003)	Growth
E5	Lee & Choi (2003)	Return on assets
E6	Self-developed	Export (if applicable)
E7	He & Wong	Introduction of new products
E8	He & Wong	Improvement of existing product quality
E9	He & Wong	Extension of product range
E10	He & Wong	Improvement of production processes
E11	He & Wong	Reduction in production cost
E12	He & Wong	Improvement in yield or reduction in material consumption
E13	He & Wong	Capturing new markets
E14	He & Wong	Entering new technology fields

3.5 PILOT STUDY

A pilot study was conducted before the actual collection of the real data for this study. Such preparation is very important especially to identify the relevance of the items and also whether the items can be easily understood by the potential respondents, since any inability to understand items results in bias. In addition to checking the readability of the questions, pilot testing also provides an estimation of the time required to complete the questionnaire. However, it should be noted that the results generated from pilot testing are not for statistical purposes, and the responses from this exercise are not to be included in the analysis to generate research findings.

A pilot test was conducted among 20 companies in the manufacturing sectors in Malaysia. Besides answering the questionnaire, the respondents were also asked to give comments and suggestions for its improvement. Some of the relevant comments and suggestions, such as the need to clarify the instructions, and use of ambiguous words were then acted upon in order to improve the readability, and thereby contribute to respondents' understanding.

In terms of statistical analysis, a reliability test using Cronbach's coefficient alpha was used to establish the internal consistency of the measures (Nunnally, 1978). This is commonly applied in research and it is suggested that in the early stage of any research study, reliability in the range of 0.5 to 0.6 is considered acceptable. Table 3.9 illustrates the results of the reliability tests of the pilot study. The Cronbach's coefficient alpha for all variables ranged between 0.503 and 0.884 which was within the acceptable range of reliability for preliminary study (Kline, 1998). Thus, from

the analysis of the pilot study, the reliability assessment gave an initial indication of internal consistency of the items in measuring the variables in this study.

Table 3.9
Reliability Results of Pilot Testing

Variables	Number of items	Cronbach's Coefficient Alpha
Innovative	6	0.767
Competitive product	4	0.531
Aggressive	5	0.732
First mover	2	0.773
Coordination capabilities	7	0.578
Socialisation capabilities	3	0.503
System capabilities	7	0.501
Experimentation	11	0.716
Information acquisition	5	0.684
Financial	5	0.844
Product innovation	4	0.706
Process innovation	3	0.687

3.6 DATA ANALYSIS

In this study, Structural Equation Modelling (SEM) was utilised to test the proposed model since SEM offers a more comprehensive analysis that is able to answer the research questions of this study. Moreover, this technique can be applied in this study because the data collected has fulfilled the requirements of SEM in terms of sample size and treatment of missing values, and is able to meet the basic assumptions of SEM procedures, which require normality and the absence of multicollinearity.

3.6.1 Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) is an extension of the general linear model that allows a more comprehensive and simultaneous analysis of what is called 'a system of regression equations' (Nachtigall, Kroehne, Funke & Steyer, 2003). It combines the logic of confirmatory factor analysis, multiple regression, and path analysis, in the application of a single technique (Breckler, 1990). The distinctive quality of SEM is its ability to explain relationships between multiple dependent and independent variables simultaneously. Additionally, SEM also allows testing of multiple relationships concurrently; one variable can be treated as a dependent variable in one relationship, and an independent variable in another relationship within the same model. With this capacity, it allows the researcher to test the full scope of the hypothesised relationships using one comprehensive statistical approach rather than using multiple tools consecutively as has been the case in many prior research studies (Shook, Ketchen, Hult & Kacmar, 2004).

Variables in SEM are classified as latent and observed. Latent variables are unobserved variables that are not directly measured, but are assessed indirectly, based on the covariance of two or more measured (observed) variables (Hardy & Bryman, 2004). In other words, observed variables serve as indicators of the underlying construct that they are presumed to represent (Byrne, 2001). Since the core of the SEM analysis lies in the need to bridge the relationship between observed and latent variables, the careful selection of assessment measures is crucial (Kelloway, 1995).

The objective of SEM is to determine how well the hypothesised model fits the observed data. Specifically, the mechanics of this technique rely on the consistency of the hypothesised causal structure with the correlation and covariance matrix of the data being used (Breckler, 1990). However, in applied research, it is often difficult to determine the adequacy of structural equation models based on various measures as utilised in SEM. Different measures of model fit may yield conflicting conclusions about the extent to which the model actually matches the observed data (Engel, Moosbrugger & Muller, 2003). As explained later in this chapter, the use of a number of fit indices simultaneously will strengthen and validate the conclusion of the model fitness.

The interest in using SEM in strategy and management research is becoming increasingly prevalent because of its potential in testing multiple hypothesised relationships within the framework of an overall model. SEM allows testing of the full scope of hypothesised relationships within one statistical approach and this liberates the use of multiple approaches consecutively as in prior research (Shook et al., 2004). In other words, the features of SEM complement the increasing complexity and specificity of research questions in social and behavioural sciences generally, and in this study specifically. Moreover, the inclusion of the confirmatory factor analysis (CFA) component in the measurement model allows measurement error to be examined explicitly. In other words, SEM allows both hypothesis-testing and factor analysis to be accomplished in a single method. The following section discusses the rationale for applying SEM in this study and the statistical procedures involved in SEM.

3.6.2 Justification for Using SEM in this Study

The popularity of SEM has gained momentum across disciplines but such widespread acceptance should not be the prime reason for using SEM in any empirical study. Although SEM has been hailed as a powerful tool in multivariate analysis, the application should commensurate with the need and purpose of the study. In simple terms, if the research questions involve the testing of direct relationships, it is sufficient to use regression analysis using SPSS software. Hence, the application of this technique should be based on the complexity of the research framework that is translated into multiple research objectives involved in the study.

The main reason for using this statistical tool in this research is basically due to the research framework which involves mediating and dependence relationships. For instance, explorative learning mediates the relationship between prospector strategic orientation and performance, and in another situation, combinative capabilities play a mediating role in prospector strategic orientation and explorative learning relationship. In other words, explorative learning is a mediator in one relationship and a dependent variable in another relationship. The virtue of SEM in testing interaction effects among variables in a series of dependence relationships simultaneously, is the impetus for using this statistical tool.

Moreover, SEM has been advocated in complex studies because it can expand the explanatory ability by allowing model-testing in a single comprehensive method (Hair, Anderson, Tatham & Black, 1998). By using SEM, it will not only be possible for the statistical analysis to determine significance in direct and mediated

relationships as postulated in the hypotheses, but also for the measurement models and structural models to be confirmed. Thus, the powerful utility of SEM will extend the interpretation of the research findings and generate more comprehensive conclusions. This is further supported by the development of flexible and user-friendly computer software that facilitates the usage of these tools of statistical analysis. All in all, the robustness of this technique, in line with the objectives of this study, is the main driver for the application of this statistical tool. Analysis using SEM will address all the research questions presented in this study.

3.6.3 Meeting SEM Requirements and Assumptions

Being a powerful extension of the general linear model, SEM requires meeting several assumptions to ensure trustworthy results. Major concerns in SEM requirements are sample size, normality, and multicollinearity.

3.6.3.1 Sample Size Requirements

The appropriate number of samples in SEM depends on the distribution of the variables, size of the model, the number of indicator variables, the amount of missing data, the reliability of the variables, and the strength of the relationships among variables (Engel et al., 2003). Using an insufficient number of samples will result in convergence failures, improper solutions, and lowered accuracy of parameter estimates. As the data become more non-normal, larger samples are required (Lei & Lomax, 2005) to stabilise the results. Some scholars have proposed that using maximum likelihood (ML) estimation requires a sample size of between

150 to 200 multivariate normally distributed data (Boomsma & Hoogland, 2001; Hoelter, 1983). Kline (1998) and Hoelter (1993) suggested that a sample size of 200 and above is 'safe' in SEM analysis.

Another guideline to address the issue of sample size is to compare the ratio between the number of estimated parameters and the number of respondents. Generally, it is suggested that 15 cases per predictor is reasonable since this is the rule of thumb in ordinary least squares multiple regression analysis (Stevens, 2002). The minimum size was recommended by Bentler (1995) as being five times the number of free parameters in the model. However, it should be noted that for this lower bound requirement, the data must be normally distributed, and free from missing values and outliers. Moreover, taking into account the path coefficient between the measured variables and the residual term of variance estimate, minimally 15 cases are still required for each observed variable.

3.6.3.2 Normality in Data Distribution

Another requirement of SEM is that all variables, dependent and mediating, must be continuously distributed with normally-distributed residuals. In the case of multivariate analysis, multivariate normality is required, which means variables must be normal in the univariate sense and also in combinations. As compared to univariate normality, multivariate normality is more difficult to assess; however, it can be implied from an examination of univariate distribution through skewness and kurtosis (Kline, 1998). For the purpose of this study, both graphical and statistical analyses (in the form of skewness and kurtosis analysis) were employed.

3.6.3.3 The Absence of Multicollinearity

Multicollinearity is a measure of inter-correlations that exist between latent variables. The problem of multicollinearity is detected when inter-correlations among some variables are so high that certain mathematical procedures are either impossible or yield unstable results (Kline, 1998). Bivariate correlations can be examined to provide a preliminary indication of a problem relationship; usually a value exceeding 0.85 is indicative of multicollinearity (Kline, 1998). Another method is to examine the beta coefficient since if this has a high value, the presence of multicollinearity is indicated. As multicollinearity increases, standard errors associated with the coefficient estimators also increase and thereby result in low significance measures and wide confidence intervals (Berry & Feldman, 1985). This will produce a highly unstable regression result that will distort the overall findings of the research.

3.6.4 Exploratory and Confirmatory Factor Analysis

Before relationships between latent variables can be analysed, it is common practice to submit the inter-correlation matrix of indicators to be factor analysed in order to achieve a more meaningful interpretation (Gerbing & Hamilton, 1996). In exploratory factor analysis (EFA), without model specification, factors are automatically extracted and the solutions rotated to achieve a meaningful interpretation (Anderson & Gerbing, 1988).

The difference between EFA and confirmatory factor analysis (CFA) is that CFA requires model specification which is based on strong theory underlying the measurement model (Hurley, Scandura, Schriesheim, Brannick, Seers, Vandenberg, & Williams, 1997). It is suggested that CFA is actually an extension of EFA which is based on Maximum Likelihood (ML) estimation (Anderson & Gerbing, 1988). In order to perform CFA, a specification of the complete factor pattern including factor correlations is required. The argument for either using EFA or CFA has been vigorously discussed (Hurley et al., 1997). Both are considered important but most authors believe that EFA is more suitable in developing scales that fulfil the requirement of internal consistency (Gerbing & Hamilton, 1996). On the other hand, CFA is more appropriate in hypothesis-testing with well-developed underlying theory supporting the hypothesised relationship. Although this discussion on the comparative qualities gives an impression that the researcher must choose either one, many believe that both techniques are complementary to each other (Hurley et al., 1997) due to their unique strengths.

In this study, both procedures were performed taking into account their complementary contributions in confirming the resultant model. The use of EFA in exploring the dimensionality of the construct will be further enhanced by submitting the results to CFA to obtain further item diagnostics (Hurley et al., 1997). By applying both procedures in this study, the resultant model is derived in part from the theory and in part from the re-specification based on the analysis of the model fit (Gerbing & Hamilton, 1996).

Exploratory factor analysis was conducted individually on each of the four variables in this study, namely prospector strategic orientation (18 items), combinative capabilities (23 items), explorative learning (18 items), and performance (14 items). Subsequently, the items in each variable were also subjected to confirmatory factor analysis. In order to justify the appropriateness of factor analysis to this study, some degree of correlation is required among the variables since the objective of factor analysis is to identify inter-related sets of variables. In this study, the Bartlett test of sphericity, and the measure of sampling adequacy (MSA) were utilised. Both statistical tools measure the sampling adequacy by examining the presence of significant correlations among at least some of the items that explain a variable (Hair et al., 1998). The aim of both tests is to ensure that no statistical assumptions about factor analysis have been violated and to determine the viability of the grouping technique and the data set for factor analysis.

In EFA, appropriate factors were determined based on an eigenvalue representing the amount of total variance explained by the factor (Hair et al., 1998). Only factors with an eigenvalue of more than 1 were selected. All items of a dimension should load strongly on one factor in order to fulfil the requirements of convergent validity and load weakly on other factors to fulfil discriminant validity.

The selected factors were subjected to CFA to confirm that the items fit accordingly into the factors that the researcher created to link the indicators to the latent variables based on theoretical grounds. CFA jointly assesses internal consistency and external consistency to address the issue of uni-dimensionality (Anderson, Gerbing & Hunter, 1987). In CFA, goodness of fit tests justify the strength of the

model and determine whether the model should or should not be rejected. If the result of goodness of fit indicates an ill-fitting model, item-to-total correlations, item loadings, error variances, and residual covariances, all need to be examined to identify items responsible for weak model fits. Item deletion should be exercised to purify component sub-scales that will yield a more parsimonious scale with acceptable fits. This practice is justified to maintain the unidimensionality of the scales used in the study.

3.6.5 Assessment of Model Fit

There are various types of indices of overall fit for evaluating structural equation models. However, there is little consensus on the best index to be used under different circumstances. As suggested by Byrne (2001), the performance of each index is influenced by model misspecifications, sample size, estimation method, model complexity, and violation of normality assumptions. Generally, Root Mean Squared Approximation of Error index (RMSEA) and Goodness of Fit index (GFI) perform better in light of model misspecification and estimation method issues and Comparative Fit index (CFI) in data non-normality, and sample size issues (Fan, Thompson & Wang, 1999).

Since the evaluation of model fit in SEM is not as straightforward as in other statistical approaches that are based on variables measured without error, it is necessary to use multiple criteria to evaluate model fit (Yadama & Pandey, 1995). Based on the recommendations by several authors (e.g. Fan et al., 1999; Finch & Curan, 1995), this study used Chi Square statistics (χ^2), Goodness of Fit index (GFI),

Comparative Fit index (CFI), Tucker-Lewis index (TLI), and the Root Mean Squared Approximation of Error index (RMSEA) in evaluating goodness of fit of the model. If the goodness of fit result of all the indices is within the acceptable range, this indicates that the conclusion derived from the goodness of fit tests have taken into consideration model misspecification, estimation method, data non-normality, and sample size issues altogether. The agreement in all indices in measuring the goodness of fit of the model will generate a more conclusive interpretation of the research findings.

3.6.5.1 Chi Square (χ^2)

The significant value of Chi square (χ^2) at a given degree of freedom indicates the differences in observed and estimated matrices. In other words, when statistical difference is found, it indicates that the difference is due to sampling variation. The objective of any research is to obtain non-significant χ^2 value because it shows that the data fit the model. In other words, a low Chi-square value with large degrees of freedom in a model indicates a good fit between the theoretical model and the data (Joreskog & Sorbom, 1989). However, interpreting goodness of fit based on χ^2 should be done with caution since it is sensitive to the number of sample. As the sample size increases, there is a tendency for the value of χ^2 to be significant although the model is deemed fit by other goodness of fit measures.

3.6.5.2 Goodness of Fit Index (GFI)

The Goodness of Fit index (GFI) and Comparative Fit index (CFI) are both descriptive measures based on model comparisons. The premise of comparison indices is that the fit of the model under study (estimated model) is compared to the fit of some baseline model (null model). The objective of the comparison is to determine the extent of the improvement in the target model (model under study) relative to the baseline model. The GFI is based on a ratio of the sum of the squared differences between the observed and the reproduced matrices to the observed variances. In other words, GFI measures the relative amount of the variances and covariances in the empirical covariance matrix that is predicted by the model-implied covariance matrix. According to Joreskog and Sorbom (1993), this implies testing how much better the target model fits than the null model. Typically, the GFI ranges between 0 to 1 with higher values indicating better fit. The rule of thumb is that more than 0.95 is indicative of good fit as compared to the baseline model, while values greater than 0.90 are indicative of an acceptable fit (Schumacker & Lomax, 1996).

3.6.5.3 Comparative Fit Index (CFI)

The Comparative Fit Index (CFI) is an adjusted version of the relatively non-centrality index (RNI) as developed by McDonald and Marsh (1990). Similar to the GFI, the CFI is based on the logic of comparing a baseline model (or null model) with an estimated model. In other words, the CFI indicates the relative reduction in model misspecification as one moves from a more restricted model to a less restricted

model. The value of the CFI ranges from 0 to 1 with high values indicating better fit. The general rule for this index is that 0.97 is indicative of good fit relative to the independence model while values greater than 0.95 give an indication of an acceptable model fit. Values between 0.90 to 0.95 can be considered as denoting a satisfactory fit. As mentioned earlier, the advantage of this index is that it is less affected by sample size (Bentler, 1990; Hu & Bentler, 1999).

3.6.5.4 Tucker Lewis Index (TLI)

The Tucker Lewis Index (TLI) is one of the most commonly used incremental fit indices which compares alternative models or a proposed model against a nested baseline model (null model). In addition to that, this index also measures parsimony by assessing the degree of freedom of the proposed model to the baseline model (Garver & Mentzer, 1999). Similar to the CFI, the TLI is recommended due to its resilience against variations in sample size (Marsh, Balla & McDonald, 1988). Generally, values of the TLI range from 0 to 1, but may reach more than 1 in an 'overfit' model. As suggested by Hulland, Chow and Lam (1996), values greater than 0.90 indicate adequate model fit, although others recommended 0.95 or higher as an acceptable threshold (Hu & Bentler, 1999).

3.6.5.5 Root Mean Square Error of Approximation (RMSEA)

The Root Mean Square Error of Approximation **(**RMSEA) is one of the descriptive measures of overall model fit. It measures the discrepancy between the observed and estimated covariance matrices per degree of freedom (Hair et al., 1998). Some

authors believe that RMSEA is a more accurate measure of fit as compared to other indices (Muthen & Muthen, 1998). According to Browne and Cudeck (1993), RMSEA values of less than 0.05 can be considered as a good fit, between 0.05 to 0.08 signifies satisfactory or reasonable fit, between 0.08 to 0.10 indicate mediocre fit, and above 0.10 indicate poor fit. As a cut-off point, a value of RMSEA less than or equal to 0.06 can be considered as a good model fit (Hu & Bentler, 1999).

3.6.5.6 Summary of Goodness of Fit Indices

Although some rules of thumb exist as a guideline to determine model fit (as illustrated in Table 3.10), it should be noted that these rule of thumb cut-off criteria are quite arbitrary and should be taken with caution. As mentioned in the earlier discussion, model misspecification, small sample bias, effects of violation of normality, and estimation-method effects, may all affect fit indices (Hu & Bentler, 1998). Therefore, it is important to fulfil the requirements and assumptions of SEM in order to ensure validity of goodness of fit indices results. Nevertheless, it is still possible that a model may fit the data even though one or more fit measures may suggest bad fit in the model.

As mentioned earlier, all these five indices were used to assess goodness of fit in the measurement and structural model in this study and the interpretation of model fit was based on the rule of thumb as recommended by prior authors.

Table 3.10
Recommendations for Model Evaluation: Some Rules of Thumb

Fit measure	Good Fit	Acceptable fit
χ^2	$0 \leq \chi^2 \leq 2df$	$2 < \chi^2 \leq 3df$
GFI	$0.95 \leq GFI \leq 1.00$	$0.90 \leq GFI < 0.95$
CFI	$0.97 \leq CFI \leq 1.00$	$0.95 \leq CFI < 1.00$
TLI	$0.95 \leq TLI \leq 1.00$	$0.90 \leq TLI < 0.95$
RMSEA	$0.00 \leq RMSEA \leq 0.05$	$0.05 < RMSEA \leq 0.08$

Source: Engel et al. (2003)

3.6.6 Measurement and Structural Model

Anderson and Gerbing (1988) recommended a two step procedure for using SEM. The first step involves validation of the measurement model through confirmatory factor analysis. The statistical results derived from CFA will also generate results for unidimensionality, reliability, convergent validity, and discriminant validity that will confirm construct validity. Once the measurement model is validated, the next step involves estimation of the structural relationship between latent variables. The structural model depicts the link among latent variables in the study. This is different from the measurement model that depicts the links between latent variables and their observed measures.

3.6.6.1 Measurement Model

"*The purpose of a measurement model is to determine how well the observed indicators serve as a measurement instrument for the latent variables*" (Joreskog & Sorbom, 1993, p.15). In other words, a measurement model defines the relationship between latent variables and their indicator variables (Byrne, 2001). In a measurement model, multiple indicators are assigned to specific latent variables

based on theoretical justifications. If a measurement model fails to obtain a satisfactory fit, there is no point in proceeding to test the structural model until proper measurement of the latent variables is achieved through model modification.

In this study, the measurement model is assessed independently and prior to the structural model, as suggested by Anderson and Gerbing (1988). Using this procedure, the process of evaluation and refinement of unidimensionality can be conducted independently on each latent variable (Garver & Mentzer, 1999). Unidimensionality, which is defined as the existence of one construct underlying a set of items, is considered as the most basic assumption in measurement theory. It is important to confirm unidimensionality to ensure that each item represents only one underlying latent variable. After each construct is deemed acceptable on the basis of unidimensionality, an overall measurement model will be assessed where each construct is evaluated for unidimensionality in the presence of other constructs (Medsker, William & Holahan, 1994). Using a combined measurement model, discriminant validity is established by measuring each item in the presence of other constructs (Cheng, 2001).

Together in the measurement model, multiple indices of model fit will be observed to indicate measurement model fit. In the case of an ill-fitting model, diagnostic indicators such as factor loadings, standardised residuals, or modification index will be examined for model modification. However, as mentioned earlier, this procedure should be exercised with caution, taking into consideration the theoretical justification for item deletion (Byrne, 2001). After the measurement model is deemed acceptable, it will be subjected to structural model analysis.

3.6.6.2 Structural Model

The confirmation of the structural model is the objective of any SEM research. As the structural model depicts the link among latent variables involved in the study, the analysis involves evaluation of the relationships between the latent constructs. The structural model can be just-identified, over-identified, or under-identified. In SEM, the aim is to specify a model that meets the criterion of over-identification (Byrne, 2001) which results in positive degrees of freedom that allow rejection or non-rejection of the model. Similar to the measurement model, the objective is to find favourable goodness of fit using goodness of fit indices.

The structural model incorporates hypothesised causal relationships and it is developed based on the theoretical justifications. The first step in this stage of the analysis is to identify significant hypothesised relationships. The most important examination involves the significance of the estimated coefficients which will determine rejection or non-rejection of the hypothesised relationships. If most of the hypothesised relationships are significant, generally the goodness of fit indices will achieve acceptable levels. Non-significant hypothesised relationships between latent constructs, or significant relationships in the opposite direction will generate an ill-fitting model. Besides goodness of fit indices, an overall coefficient of determination (R^2) can also be used as an indicator of fit for each structural equation (Hair et al., 1998).

Any insignificant relationships need to be theoretically justified in order to propose new relationships. Therefore, the testing of a series of nested models, stemming from

prior models and based on theoretical grounds, needs to be undertaken. Basically, any non-significant relationships will be deleted and theoretically-justified relationships may be added for a newly-created nested model. The purpose of this process is to generate the 'best fitting' structural model that fulfils the requirement of goodness of fit indices.

3.6.7 Model Misspecification and Modification

Model misspecification refers to the extent to which the model suffers from specification error resulting from the omission of relevant variables from the model. It is academically accepted that all structural equation models cannot avoid misspecification error, because not every potential construct and indicator can be incorporated in the model. However, the impact of the non-inclusion of relevant constructs should be minimal and negligible, and this is possible if the extraction of the constructs and variables is done based on deliberate analyses of the theory and literature. Model misspecification can be examined through standardised residuals and modification indices. Once model misspecification has been ruled out and the model is considered acceptable, model modifications can still be undertaken to support theoretical justifications and improve goodness of fit results (Hair et al., 1998).

3.6.7.1 Standardised Residual

The standardised residual represents the differences between the observed covariance or correlation matrix and the estimated covariance or correlation matrix.

According to the rule of thumb, standardised residual values which exceed 2.58 are considered as statistically significant at the 0.05 level (Hair et al., 1998), which signifies substantial prediction error for a pair of indicators. Usually, items with cross-loading or that correspond to more than one factor will show large residuals and should be excluded from the model.

3.6.7.2 Modification Index (MI)

In SEM, the Modification Index (MI) can be used to assess the impact of removing certain variables or constructs that are based on theoretical justifications. The MI value corresponds to the reduction in Chi square that would occur if the coefficients were estimated. A larger MI indicates greater improvement in fit if the item is deleted. Therefore, the item with the highest MI should be considered first in model modification. However, it should be noted that the decision should be based on theoretical considerations.

3.7 MEDIATION ANALYSIS

In SEM, a well-known test of mediated relationship was presented by Baron and Kenny (1986). This technique postulates that to establish mediation, the independent variable must affect the mediator, then the independent variable must affect the dependent variable, and finally the mediator must affect the dependent variable. Full or perfect mediation is indicated when the independent variable has no significant effect on the dependent variable when the mediator is controlled, and

partial mediation when the effect of the independent variable is reduced in magnitude but still significant when the mediator is controlled (Baron & Kenny, 1986; Chen, Aryee & Lee, 2005). However, the presence of multicollinearity between the independent variable and the mediator may reduce the power in the coefficient estimate. In order to avoid misinterpretation of the test results, it is also critical to examine the absolute size of the coefficients.

To translate the procedure recommended by Baron and Kenny (1986), a sequence of tests is performed using SEM. Firstly, as illustrated in Figure 3.1, a fully-mediated model is developed. The coefficient estimates between variables are examined to confirm significance and the value of χ^2 is estimated as a relative measure to indicate comparative fitness. However, merely using χ^2 statistics as an indicator of comparative fitness is insufficient, especially when it is known that χ^2 is highly sensitive to sample size (Hair et al., 1998). Therefore, Kelloway (1995) suggested that analysis of multiple indices of model fit is essential to substantiate the results. Hence, in addition to comparison of χ^2 statistics, fit indices such as GFI, CFI, TLI and RMSEA are also examined to confirm the necessity and sufficiency of mediated relationships. The same procedures are applied to a partially-mediated model and a non-mediated model.

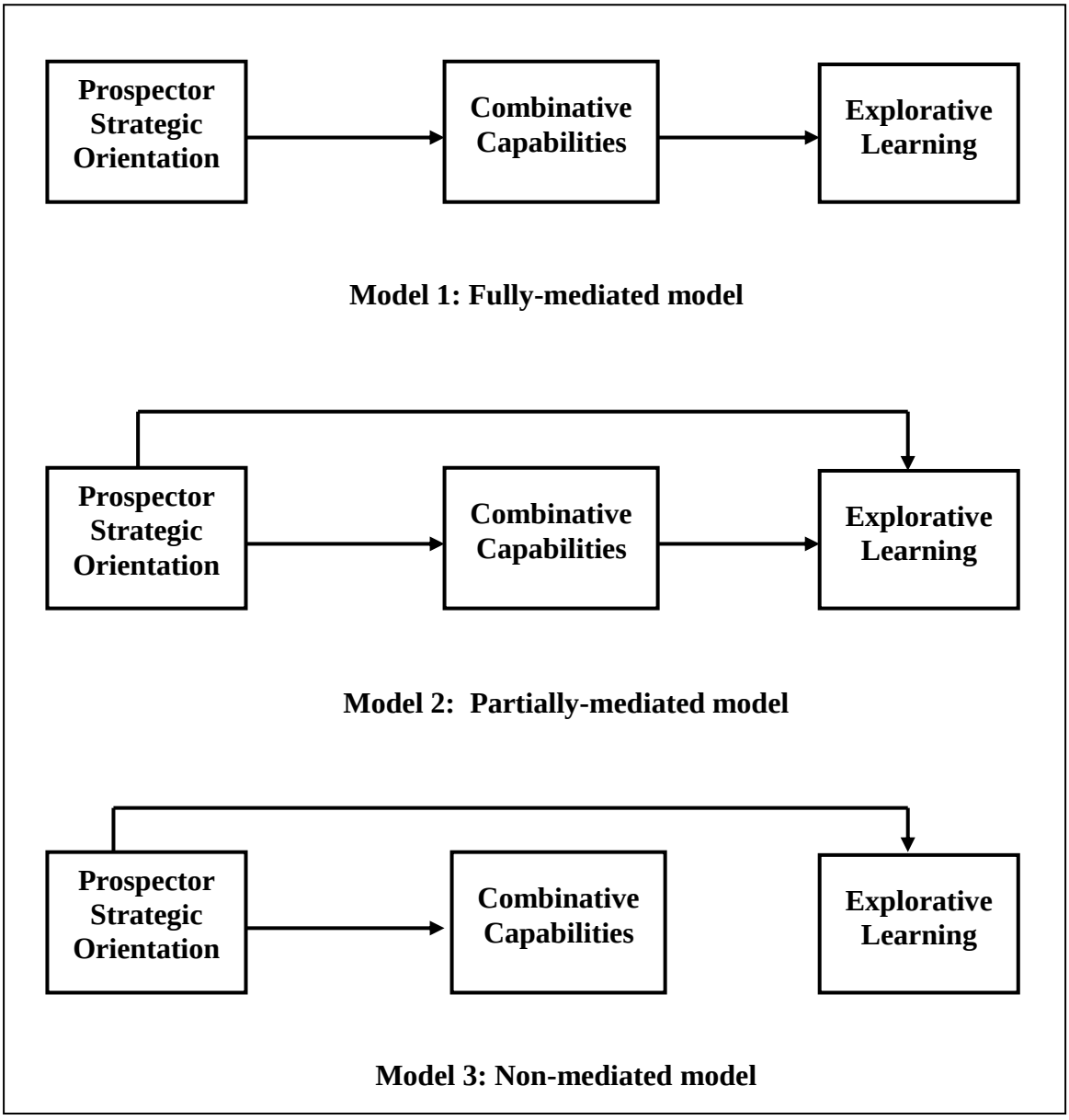


Figure 3.1
Graphical Presentation of Mediation Test Comparison

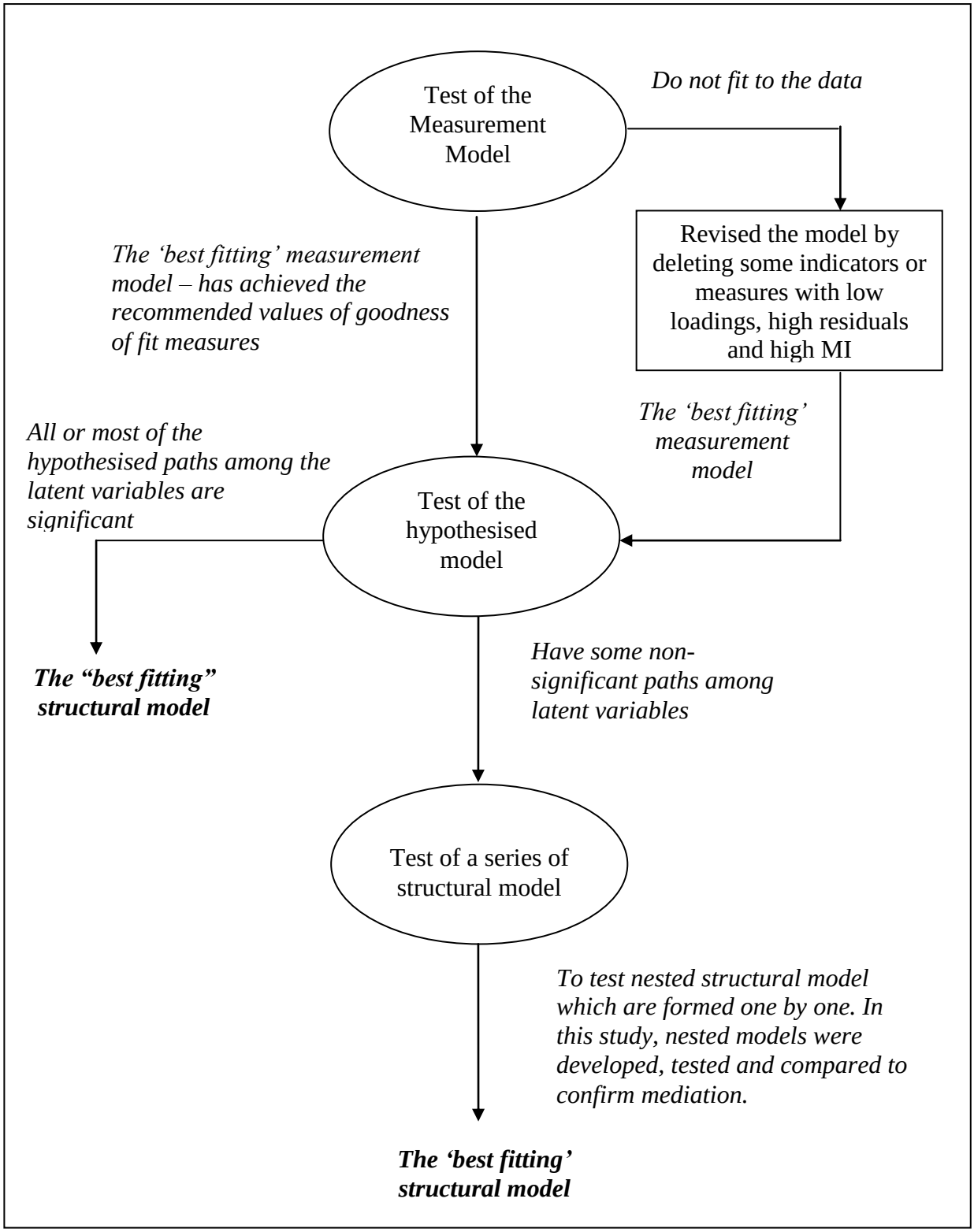
The partially-mediated model is used as the basis for model comparison with the constrained model where one or more of the paths in the hypothesised model is either removed or set to zero. Significant change in the Chi-square between the hypothesised model and the constrained model reflects the effect of removing the paths, which suggests that the removed paths are significant. The score of χ^2 of the partially- mediated model is compared to the fully-mediated model and the non-

mediated model. If the result indicates equivalent fit between the two models (partially- mediated versus fully-mediated model, and partially-mediated versus non-mediated model) the necessity of the mediated relationship is impugned (Kelloway, 1995). It should be noted however, that as a rule, all estimated parameters must be found significant in all cases.

3.8 THE INCREMENTAL APPROACH OF SEM

To summarise the processes involved in SEM analysis, Cheng (2001) has presented an incremental approach to SEM as illustrated in Figure 3.2. This approach clearly specifies the procedures involved in SEM analysis to establish the best fitting structural model. The SEM analysis starts with the application of CFA procedures using a measurement model. Items with low loadings (less than 0.4), high standardised residuals (more than 2.58), and high MI will be excluded, taking into consideration theoretical justifications. Once an acceptable fit is achieved, hypothesised relationships between latent variables are transferred into a hypothesised structural model. If all or most of the hypothesised relationships are found to be significant and recommended values of goodness of fit are met, this indicates that a 'best-fitting' structural model has been achieved. However, it is important to confirm mediating relationships by developing and comparing the nested model (Baron & Kenny, 1986). Once the mediation is confirmed, a best-fitting model which is based on substantial theoretical grounds is, therefore, established. Although this incremental approach is able to illustrate the processes involved in SEM analysis, on the sideline, assumptions of SEM requirements has to be met and reliability and validity have to be confirmed in order to achieve the best-

fitting model. Based on the significant path relationships, SEM analysis is able to justify direct relationships between latent variables and importantly, explain the interaction effects among variables. The virtue of examining a series of dependence relationships simultaneously will, therefore, address the complicated relationships as presented in this study.



Source: Cheng (2001)

Figure 3.2
A Flowchart of the Incremental Approach to SEM

3.9 CONCLUSION

The first part of this chapter described the research design employed in this study and methodological concerns of past research. Among the pertinent issues highlighted were measurement issues. Due to the scant empirical work that contributes to the establishment of sound measures, the study adopted measures compiled from several authors. This is partly the contribution of this study towards enriching and establishing measures of the variables involved. A mailed survey research design was employed since the majority of the instruments were extracted from mailed surveys. Furthermore, based on the analysis of prior empirical analysis, this method was believed to be a popular approach in both strategic management and organisational learning research.

The instrument design was extensively discussed in later part of the chapter. For each variable, the original scales were presented together with the scale used in this study. The reasoning behind the selection of measurement scales was also presented and discussed. The next part of the chapter focussed on the data analysis techniques employed in the study. The discussion began with the justification for using SEM in the study, and this was followed with an overview of the SEM techniques involved. Basically, the decision to employ SEM was not influenced by the increasing popularity of this technique, but due to its ability to allow answers to the research questions to be found. The virtue of SEM in testing all of the hypothesised relationships in the model simultaneously and its ability to extend stronger inferences about the hypothesised model, were the main reasons for applying this technique. A ‘step by step’ approach was also highlighted to explain the variety of

procedures involved in SEM in an effort to simplify the complexities of the overall process.

The subsequent two chapters will present the findings of this study based on the procedures explained and discussed in this chapter.