

**DIFFERENTIAL ABSORPTIVE CAPACITIES, AMBIDEXTERITY &  
NEW PRODUCT CREATIVITY: A LONGITUDINAL  
INVESTIGATION OF US HIGH TECHNOLOGY SMES FROM THE  
ATTENTION-BASED PERSPECTIVE**

**Trung T. Nguyen**

BSc, MSc, MBA

*A thesis submitted in fulfilment of the requirement for the degree of Doctor of Philosophy  
of Cardiff University*

*Department of Marketing and Strategy, Cardiff Business School, Cardiff University*

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## Declaration

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# Abstract

The study investigates how SMEs generate new product creativity through different means of innovation strategies and their antecedents. It examines the fundamental role of the CEO in directing a firm's information seeking orientation, a firm's absorptive capacities in facilitating the process of absorbing information and lastly the combination of exploitation and exploration innovations to achieve ambidexterity. To this end, to address the bottom line importance of the ambidextrous strategy, new product creativity is hypothesised to be positively related and acts as a vital bridge linking ambidexterity and financial performance.

Existing literature shows limited empirical support for a firm's ability to pursue both exploitative and explorative innovations for performance outcomes. In particular, very little is known of the ambidexterity consequence in new product creativity. Literature also lacks empirical evidence on leadership-based antecedents and understanding of how ambidexterity works in the context of SMEs.

To examine the relationships, the study uses mixed methods of content analysis, econometrics and financial ratios to generate longitudinal and objective data for 148 SMEs. Seemingly Unrelated Regression is then employed to analyse and test the hypotheses.

Findings show the importance of generating a high number of creative ideas by demonstrating a positive empirical link with future financial performance. It also found that given the resource impediments of SMEs, the most appropriate approach to successful new product creativity is to manage exploitation and exploration innovations sequentially. In addition, contrary to the popular view of external information driving firms' innovation strategy, deep understanding of the firm internally may be most important. Lastly, the result proves that despite being generic in nature and having an insignificant effect in driving either exploration or exploitation separately, future focus becomes an important factor when it comes to the firm's ability to balance innovation ambidextrously.

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## List of Abbreviations

ABV	Attention-based view
ACAP	Absorptive capacity
CEO	Chief executive officer
MKT	Marketing
NPD	New product development
PACAP	Potential absorptive capacity
RBV	Resource-based view
RACAP	Realized absorptive capacity
R&D	Research and development
SFA	Stochastic frontier analysis
SME	Small and medium enterprise
TMT	Top management team
VRIN	Valuable, rare, inimitable, non-substitutable

# Chapter 1 – Introduction to the Thesis

## 1.1 Why is new product creativity so Important?

To understand the importance of new product creativity we shall analyse how the mobile phone has changed since first being introduced. We have been using it for more than 41 years, but if we look back on how it has evolved, we will see a machine that bears little resemblance. In the 1960s, it was known as a radio common carrier where communications were transmitted through a push-to-talk system. Then in the early 1980s, the first “brick phone” Motorola DynaTAC arrived at a price of US\$4,000 that only bankers could afford. Fast forward to 2007 and the Nexus, Android and iPhone were born; although still an expensive machine, the majority of consumers are willing to pay for the innovation and convenience. In 2014, it is estimated that 1.75 billion people will have owned a smartphone (eMarketer, 2014) and the global mobile phone market is now worth US\$150 billion (MarketandMarkets, 2014). The catalyst for this change is the concept of *new product creativity*. Mobile companies such as Apple and Samsung define this phenomenon by constantly producing incremental innovation and at times surprise the market with novel disruptive innovation — a combination which every company should aim for. And through time the result might just be like the evolution of the push-to-talk device to a high-tech gadget that everyone aspires to have.

To examine just how new product creativity can be so critically important, we shall look at the latest Thomson Reuters’ 100 Global innovator report. The report found that the top 100 innovators in 2013 outperform the largest 500 US firms listed in the S&P stock exchange on every metric of business success: stock price, profit and new job creation (Thomson Reuters, 2013). In the recent economic downturn, the world we are told is losing its creativity capacity, hurting our chances for a speedy recovery. Yet inevitably, as worries about innovation deteriorate, Booz&Co Global Innovation 1000 report hundreds of companies rising up with great new products, technology and services. And too often, we do not pay

attention to these quiet stars, which are in fact consistently producing successful innovation as part of their regular practice (Booz&Co, 2012).

The phenomenon does not happen by accident, “innovation”<sup>1</sup> has come to symbolize a kind of mystical element that transcends success from start-ups, multinational companies, to national economies. It is no secret. Every individual and every company wants to be known as an innovator. In fact, press releases issued over PR Newswire in 2012 alone have seen the term “*innovation*” 28,998 times (Groysberg et al., 2012). In addition, the level of innovativeness a company is known for can signal a “*buy*” or a “*sell*” investment decision; a recent study shows that innovativeness is the number one factor that determines the Wall Street analysts’ investment decision (Groysberg et al., 2012).

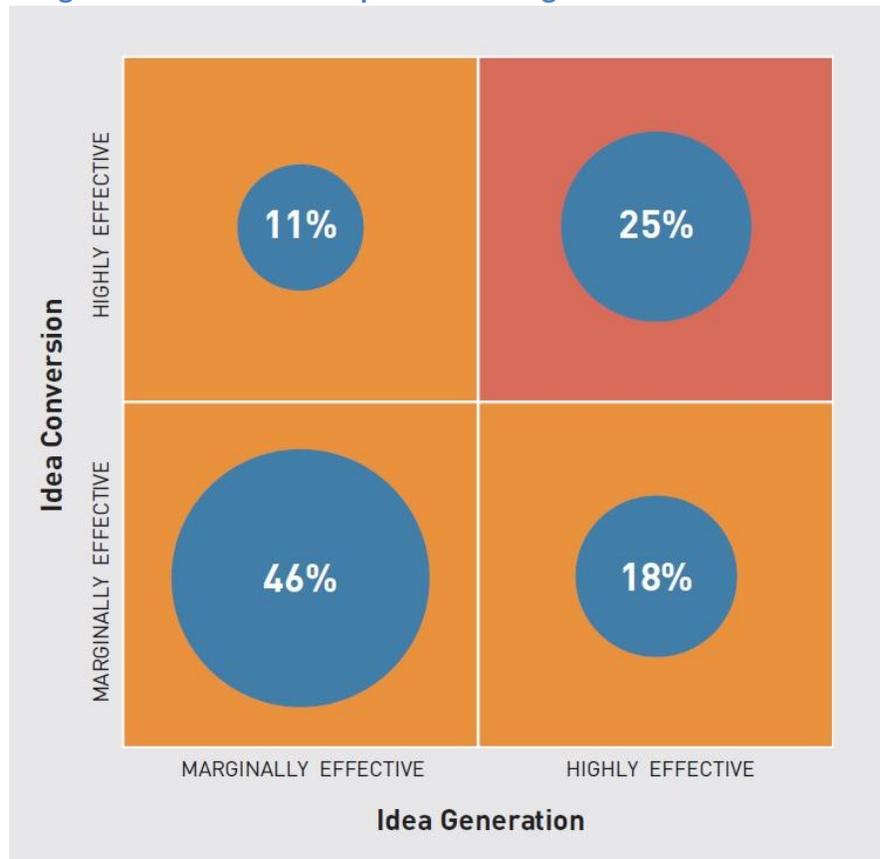
As introduced, being known for creating innovative products is vital. However, companies will have better chances of success if they also create a business model that fosters innovation (Yoon & Deeken, 2013). When the Global 1000 innovators were asked to evaluate their success with idea generation and idea conversion, Figure 1.1 shows only 25 per cent claimed to be highly effective at both (Booz&Co, 2012). And for all the R&D money spent on innovating, over the 8 years of this innovation report, no long-term correlation to financial performance was found (ibid). Matthey Ganz, vice president and general manager of research and technology at the Boeing Company succinctly painted the picture of our current issue:

*“if you have a creative idea and it doesn’t create value. It’s not technology, its art. If you’re all about value creation with no creativity, the accountants are going to take over. You need to prime the pump with creative ideas, and then you need to have rigorous processes in place to turn those ideas into dollars.”*  
(Booz&Co, 2012, p. 3)

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<sup>1</sup> The thesis uses the term new product creativity and innovation interchangeably; although technically new product creativity precedes innovation, at this point of the thesis it is treated alike.

Figure 1.1 - Booz & Co reports on idea generation and conversion



Source: Booz&Co, 2012, p. 3

The reasons above motivate the other part of this research which investigates the underlying elements that make creativity possible. Large companies have abundant resources, capabilities, and growth aspirations to innovate successfully, so the study questions whether small-to-medium sized companies (SMEs) can achieve that too. It also asks a few other questions such as: In what way can SMEs achieve that? What are the organizational elements behind such a business model? Specific research questions are formulated in a later section (1.4) but coming back to the Wall Street study mentioned earlier, out of the other factors that determine an investment decision, organisational elements such as top management team quality, direction and communication strategy were also rated as important.

The next few sections (sections 1.2 to 1.10) will show a broad picture of what the answers to the above questions are likely to be. Essentially, the study aims to unravel the innovation model that many companies aspire to have. It focuses on innovation at the very early stage, also known as the fuzzy-front-end. The study incorporates management theories whilst staying close to practice to propose the top management team as the forefront element of the model. Drawing from attention-based and organizational learning theory, the study suggests that top management may focus their attention on particular directions and their decision based on those directions shapes the company's innovation model. Typically, these decisions may lead a firm to adopt an incremental innovation strategy, known as exploitative, or a disruptive innovation strategy, also known as explorative. These two strategies emerge from contradicting knowledge processing capabilities but increasingly scholars consider pursuing both orientations with equal dexterity as ideal and argue it will help firms to become even more innovative.

To understand how combining contradictory orientations is the aspired innovation model for companies, the following section introduces the concept of *ambidexterity*. Briefly, it is defined as the ability to do two (contradictory) things with equal dexterity. Section 1.2 explains in detail the concept. The section after that examines what underlining components make up the ambidexterity, merits and challenges of combining. Section 1.4 explains the motivations for developing this investigation and links them to the research problem. Next, the study discusses the proposed model to answer the research problem outlined. Following are the research gaps and contributions, underlining challenges and opportunities in the area of innovation strategies. Next, the thesis briefly describes a unique mix of methodologies that employ entirely longitudinal and objective secondary data to investigate the research questions. Lastly, the chapter concludes with the structure of the remaining chapters and a summary of the findings.

## 1.2 What is Ambidexterity?

### Meaning of Ambidexterity

Alongside new product creativity, ambidexterity is a concept of interest to a wide variety of disciplines. Originating from the medieval-Latin word 'Ambi-dexter' in 1646 (Merriam-Webster, 2014), it has three meanings, (i) an ability to use both hands equally well, (ii) double dealing or duplicity and (iii) being unusually skilful or versatile.

The first meaning, ability to use both hands equally well, has been a conundrum to neuroscientists for a very long time. Whilst being ambidextrous has apparent motoric benefits, there is evidence that it can lead to poorer cognitive ability (Crow et al., 1998; Peters et al., 2006). One explanation is that cognitive tasks are usually associated with certain distinct areas of the brain (Annett, 1992), and failure to ascertain a dominance may lead to coordination problems. Similarly, ambidextrous individuals with no established dominance of either the right or left hand side of the brain usually have hemispheric indecision (Crow, Crow, Done and Leask, 1998). In other words, they suffer deficits in cognitive and scholastic achievement. Contrary to Crow et al., (1998), in a different experiment, Mayringer and Wimmer (2002) examined 530 children with equal hand skill; their experiment found that these children did not suffer any deficit in cognitive ability, assessed by their level of non-verbal intelligence, reading and spelling.

In the second meaning, ambidexterity was used to describe characters who are able to combine both an honest face with deceptive deeds in such a way that it becomes very difficult to gauge their true intent. Again, coming from the medieval period, ambidexterity was the characteristic to describe lawyers who accept bribes from both plaintiff and defendant (Rose, 2000). Thus, the word in this early period is used to define the act of 'double dealing' or duplicity (Wentersdorf, 1981). Of course, when found out these lawyers would face long-term imprisonment or even the death penalty.

While both of the above meanings show the benefits of versatility, skilfulness and the flexibility of being ambidextrous, there is difficulty in getting there and sustaining such

dexterity. They also present causes to be sceptical towards the risk-return profile as ambidexterity requires combining belligerent, contradictory elements. Thus, although both in a neuro-scientific and literal sense, ambidextrous individuals can perform feats that their one dominant sided mind counterparts cannot, they can struggle with the trade-off decisions that increase coordination costs and could be drawn into a “jack of all trades, master of none” consequence.

In the management perspective, ambidexterity has evolved to become the central management challenge and the strategy to-go-for to sustain long-term business success (March, 1991; Gupta et al., 2006; Voss & Voss, 2013). In this case, the meaning of ambidexterity is not different in terms of the trade-off challenge as aforementioned. But it has gradually developed to more than a cult. Organizations often strive to overcome these paradoxes to achieve optimal business outcomes (Atuahene-Gima, 2005). In fact, literature has argued ambidexterity as an essential ingredient for organizations to survive (Tushman & O’Reilly, 1996). Empirically, this rise of the concept has also received ample attention (e.g. Burgelman, 1991; Danneels, 2002, Taylor & Helfat, 2009). Given such development, the central question in this introductory chapter is:

*How has ambidexterity come to be perceived as a synergic phenomenon in management literature?*

To gain deeper insight, we need to understand the interplay of the underlying elements in achieving ambidexterity. They are exploration and exploitation. We will attempt to present the development of the concept starting with James March pioneering publication in 1991. Section 1.3 provides the overview of exploration and exploitation, their individual processes and outcomes and two key questions. One is the contemporary research on the outcome when both elements are combined, providing empirical evidence as to whether it is beneficial to pursue both. The second question is how organizations can overcome the underlying contradictory tensions to achieve the combination. Next, section 1.6 provides the possible gaps in the literature, such that with only a certain type of ambidexterity and in a certain context, superior performance can be achieved. In addition, scarce literature has

shown any such evidence for Small-to-medium-sized firms (SMEs). Moreover, research has paid little attention to studying the antecedents to ambidexterity, specifically leadership-based antecedents and the interactions with moderators. This leads to section 1.7 where research contributions are outlined. Section 1.8 presents the aims and objectives of this study. It proposes that due to the resource impediments and the early stage of development, for SMEs to reap the benefits of ambidexterity, they need to reconcile the exploration and exploitation tensions in the form of temporal separation, a system by which SMEs would focus on exploitation activities at one point in time followed by explorative innovation at subsequent points in time.

## **1.3 Merits and Challenges of Combining Exploration and Exploitation**

This section sets the research theme for the rest of the thesis. It is divided into two subsections, the first subsection 1.2.1 attempts to give further insight into the development ambidexterity by explaining the underlying elements of exploration and exploitation, their interplays and trade-off decisions analogous to the Prisoner's dilemma. Subsection 1.2.2 addresses the merits of firms pursuing ambidexterity and how they can overcome tensions to achieve it.

### **1.3.1 Exploration and exploitation tensions and the prisoner's dilemma**

Strategic management studies have shown that firms wanting to enjoy superior ability to adapt to the fast changing environment while achieving the bottom-line requirement of the existing business environment, need to be able to balance exploitation and exploration (O'Reilly & Tushman, 2008; Cao et al., 2009). The origin of this concept is introduced by James March. His 1991 publication in Organization Science proposes that firms can either divide their attention and resources on explorative activities such as “...*search, variation, risk taking, experimentation, play, flexibility, discovery, innovation*” or exploitative activities, which are defined as “...*refinement, choice, production, efficiency, selection,*

*implementation, execution.*" (1991, p.71). The core of his argument is the adaptive process benefits from the interplay of exploration of new possibilities and exploitation of old certainties. This idea was the start of a concept that still amazes and puzzles academics and practitioners today. The terms were new however his idea was actually not. Research in evolutionary models of organizational forms and technologies has discussed the choice between exploration and exploitation in terms of variation and selection (Ashby, 1960; Hannan & Freeman, 1987). The benefits and challenges have also been acknowledged where effective selection among forms, routines or practices is essential to survival, but so has the generation of new practices, particularly in the changing environment. Interestingly, in this line of research the challenge in balancing the two has been framed as a *prisoner's dilemma* (Holland, 1975; Holland, 1992). In such a way, arbitrary to March's core argument, players (exploration and exploitation) face a choice of competing against each other or cooperating. The optimum solution for these players occurs when both players cooperate to attain superior outcomes and the suboptimum solution is when they compete so that only one benefits and one loses out. Figure 1.2 illustrates these compete-cooperate outcomes.

**Figure 1.2 - Exploration exploitation prisoner's dilemma**

Choice	Exploration cooperate	Exploration compete
Exploitation cooperate	Superior return (30/30)	Exploration benefits (0/50)
Exploitation compete	Exploitation benefits (50/0)	Normal return(10/10)

Source: Adapted from Holland, 1992 p.71

For the benefit of the system as a whole, cooperation is the optimal choice. However, Figure 1.2 presents a huge incentive for individual players to compete separately as the cooperative pay-off is significantly lower (50 versus 30). This suboptimal choice to compete represents a trade-off as players selfishly try to reap a bumper pay-off. In the long-run as the play repeats itself, this would mean that their choices will lead closer to the matter of survival as they continue to compete, and the pay-off significantly dies out to a mediocre level (10/10).

Thus, the prison dilemma shows strong long-term incentive for firms to engage in both exploitation and exploration strategies. The continual cooperation can prevent players from

escaping from path dependent forces that entice their suboptimal returns to eventual system failure (Kauffman, 1993). The paradox of the dilemma here is that in order to escape the path dependent forces, players must select a suboptimal choice in a static situation that provides lower pay-off, but yields higher returns when incorporating a dynamic perspective (act of combining the two).

The important development of the incorporation is that it produces the adaptive process, whereby the interactions, combination, and balancing of the separate plays form the basis for the following evolutionary steps (Holland, 1992). Through such repeated interplay the system can evolve and grow in ways that can deviate from the original form.

The final point that we can learn about the process of balancing and combining the plays is that the trade-off implies competing or cooperating for scarce resources (March, 1991; Gupta et al., 2006). They can be space, time, finance, attention, human capital and so forth. However, combining exploration and exploitation does not necessarily mean these resources are evenly divided. At each evolutionary step, the optimal point of distribution can fluctuate, it is dependent on the situation, external factors or how the two activities are being combined. For example, firms can manage the two plays at the same time (i.e. simultaneously) or in cycles of temporal separation (i.e. sequentially) (Cao et al., 2009).

To summarise the insights above, the combination of exploration and exploitation to achieve ambidexterity is analogous to the prisoner's dilemma (Holland, 1975). Operating separately for one period yields high pay-off individually, but for the benefit of the system as a whole, it is through the adaptive process of cooperation that added-value is created (Holland, 1992). Lastly, how firms manage the competition and cooperation of resources can depend on external demands (Michalewicz & Fogel, 2000) and the way exploration and exploitation are combined (Gupta et al., 2006; Cao et al., 2009).

The insights above have led to contemporary development of the concept; managing of exploration and exploitation thinking has shifted from trade-off to paradoxical thinking or orthogonal thinking (Eisenhardt, 2000). The seemingly contradicting tensions have evolved to become an essential factor to generating synergistic outcomes (Adler et al., 1999; Katila &

Aduja, 2002). Empirical evidence has also proven that managing trade-off yields significant sales growth compared to either one dominant strategy (He & Wong, 2004); in economic terms, this is the optimal outcome. In management science, it is often attributed to the ability of firms to pursue organizational ambidexterity (Tushman & O'Reilly, 1996).

### 1.3.2 Ways of overcoming tensions to achieve ambidexterity

The evolution from trade-off thinking to paradoxical thinking means that management of exploration and exploitation requires substantially different organizational factors. They can be resources, capabilities, processes, structures, cultures and strategies. As such, exploration is usually facilitated by a loosely coupled system, decentralized and creativity induced culture; thus, it is associated with changing markets and technologies. On the other hand, exploitation is facilitated by mechanistic structures, tightly coupled systems, highly stable and efficiency-minded culture, hence, it is usually associated with stable market and technologies (Brown & Eisenhardt, 1998). Therefore, their respective returns are also distinctly different. Explorative is more long-term, high-risk high-return, and exploitative is stable, low-risk low-return but certain in the short-term. Due to these distinctive differences, when combining the two, tension arises at the interaction point of explorative and exploitative activities.

Management research thus has acknowledged the need for organizations to reconcile these tensions in order to develop the ability to adapt to the future environmental shifts and at the same time fulfil the current demands. In more recent literature development, research has shown that ambidextrous organizations outperform single strategy counterparts (He & Wong, 2004; Lubatkin et al., 2006), in particular in the face of high environmental dynamism (Jansen et al., 2005), high technological dynamism (Uotila et al., 2009), and increased pace of competition (Raisch & Birkinshaw, 2008).

Although, less clarity has been presented on how organisations can reconcile these tensions. As mechanisms to help organisations achieve the balance, three contenders have been proposed. First, organizations can manage the paradoxical requirements in sequence, one by one, i.e. in a temporal cycle, namely *sequential ambidexterity* or *punctuated equilibrium*. A

number of authors have advocated such a system, they are Brown and Eisenhardt (1997), Siggelkow and Levinthal (2003), Zollo and Winter (2003), Venkatraman, Lee and Iyer (2007), Burgelman and Grove (2007) and so forth. The central argument to this method is that exploitation and exploration activities are complementary or supportive of each other; they are fundamentally not competing for attention, resources and capabilities. Thus, each set of processes may help leverage the effects of the other (Gupta et al., 2006) as the reconciliation occurs at the shift between exploration and exploitation. The second way of managing the paradoxical trade-off is through *externalization*. By forming alliances or outsourcing of one set of activities, the firm can focus on one internally (Holmqvist, 2004; Rothaermel & Deeds, 2004; Lavie & Rosenkopf, 2006). The third option, arguably the most difficult to implement is by internally and *simultaneously* synchronizing both activities (Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004; Lavie & Rosenkopf, 2006; Mom et al., 2007).

All three methods have their supported and unsupported arguments. What they show is that the appropriateness of a method depends on the stance of to what extent organizational tensions can be coordinated or integrated, and the approach one takes when resolving how organizations can juggle exploration and exploitation activities. In the majority of cases, to simultaneously integrate exploration and exploitation internally or externally with other organisations, it will require a demanding mix of financial capital, human capital, flexible organizational design, and the organization also needs to be strategically integrated (O'Reilly & Tushman, 2007). This makes coordination very complex, even for large firms where financial and capital resources are more abundant. On the contrary, externalisation has the advantage of saving the firm the trouble of reconciling resource and attention trade-off, as one set of activities is effectively outsourced. However, arguably it has a more challenging task of achieving strategic integration, due to different vision, culture and governance (Benner & Tushman, 2003). Simultaneous ambidexterity on the other hand, Gupta, Smith and Shalley (2006) argue, has the most complex challenge because it has to manage two parts that have inconsistent alignments within a single entity that also competes for limited resources. Understandably, the challenge of aligning organizational tensions, whether internal or external, can never be effectively reconciled (Ford & Ford, 1994; Lewis, 2000).

While lots of effort has been given to differentiate the concept of exploration and exploitation and their implications for strategies and outcomes, there has been a surprising lack of evidence in studying the interaction effect of the two. It has also become apparent that attention has not been shown adequately towards one specific population, namely small-to-medium sized enterprises. Hence, there has also been limited research on their underlying antecedents of exploration and exploitation under the context of SMEs. These reasons lead the study to choose SMEs as the population, but it is not just due to a lack of attention. Theoretically, SMEs promise an interesting proposal to examine ambidexterity. SMEs face similar competitive pressure to jointly pursue exploitation and exploration. However, they lack the facilitation mechanisms in human resources capital and financial capital (Cooper et al., 1994; Forbes & Milliken, 1999) or the appropriate hierarchical systems (Cao et al., 2009) to assist (or impede) in exploiting existing competencies as well as exploring new opportunities. The limited facilitation mechanisms above make the link between antecedents, strategies and outcome *clean*. In other words, there is less noise. Further, with a simpler hierarchical structure, the CEO and top management team are more likely to have a dual role at both operation and strategic levels. Therefore, their involvement may have more substantial impact on the management of competing knowledge demands inherent in the pursuit of ambidextrous orientation. Such inference provides a cleaner investigation for this study of ambidexterity.

## **1.4 Research Motivation and Problem**

### **1.4.1 Research motivations**

The preceding section has identified several areas where research attention has been limited. This study brings the spotlight to some of these areas. One of the primary focuses is the SME firms and the elements underlying exploration and exploitation in achieving ambidexterity. It also attempts to shed more light on the merit of ambidexterity in terms of new product creativity which has shown to be key in explaining how products such as a push-to-talk device has evolved to change our lives, companies and our economies. It proposes that by excelling at both exploration and exploitation strategies, SME firms can benefit from

creating higher new product creativity. As previously shown, the theoretical reasoning/motivation for firms to strive for ambidexterity is relatively conclusive. Firms would be able to achieve superior performance by aligning their attention on both exploration and exploitation, reconciling their paradoxical tensions to concurrently promote adaptability and operation efficiency. However, this is primarily evidenced in large corporations. Empirically, does such a combination effort really relate to higher performance outcomes in SMEs? Does it relate to other dimensions of performance, particularly new product creativity which all empirical studies have yet to investigate? How would ambidexterity be achieved? What are the antecedents? These questions motivated me to conduct this study.

### 1.4.2 Research problems

After March's (1991) article, the consensus of ambidexterity has been strongly supported with rapidly expanding literature. However, to this point, there still exists a lack of clarity in the conceptual, operationalisation and especially empirical investigations of these various aspects. Given the ambiguity, Raisch Birkinshaw, Probst and Tushman (2009) recently argued that ambidexterity has become disconnected and complex. Questions arise as to whether ambidexterous strategy is necessarily more rewarding than the single sided approach.

It seems the ambidexterity concept is at a crossroads, still in the process of developing into a new research paradigm. As a result, this research set out to identify and address areas that are still under-researched. One aforementioned area is the population of SMEs; recent publications still give calls for further research (Uotila et al., 2009). Compared to larger firms they lack the facilitation mechanism to pursue both strategies concurrently (Simsek et al., 2009). They also employ more than 70 per cent of the people in the US economy (Small Business Association, 2003). Deeper insights into the application of ambidexterity in SMEs is potentially economy changing.

Unfortunately, the varying conceptualisations, operationalizations and limited empirical evidence have left a big question mark for practitioners to apply ambidexterity. Therefore,

the current literature would benefit greatly from an empirical based and comprehensive study that integrates various factors that mimic SME realities. Within the scope and time boundary, the present study will examine SMEs antecedents that make up ambidexterity, moderators and consequences. They are the *CEO attention focus*, the firms *absorptive capacity*, *new product creativity*, and lastly *financial performance*. The following subsections introduce why these variables are of interest.

#### **1.4.2.1 CEO attention focus**

Why study the CEO behavioural impact on the firm? The CEO role in setting the general direction of the firm is widely known; it may seem logical and even obvious to conclude that CEOs play a leading role in determining the firm innovation strategy and its outcomes. However, literature findings are surprisingly mixed. Several authors posit that CEOs get bogged down in the day-to-day activities and that they fail to identify the technological developments around them (Leonard-Barton, 1992; Finkelstein, 2005). Similarly, they can be so steeped in existing technologies that they build resistance to new ones. Finkelstein (2005, p.20) quoted then-CEO of Wang Labs saying,

*“The [personal computer] is the stupidest thing I ever heard of.”*

To an extent, the impact of CEOs depends a lot on the allocation of their available time and cognitive resources. Some CEOs may choose to set a general direction and focus their attention on issues close to the firm, others may be on issues happening outside of the firm. This research is interested in clarifying how these varied CEO behavioural choices lead to exploration, exploitation innovation strategy and subsequent innovation outcomes.

#### **1.4.2.2 Absorptive capacities**

Being one of the most studied areas in strategic management, it is also a crucial mechanism in facilitating learning and innovation at various aspects of the organization (Cohen & Levinthal, 1990). In spite of that, absorptive capacities have not been applied as a moderator between strategic orientation and exploration and exploitation strategies. Hence, this study takes the opportunity to examine the link – to determine whether through firms’ information

processing mechanism, CEO attention can be effectively distributed to shape SMEs exploration and exploitation innovation strategy.

The inclusion of the concept determines how elements of ambidexterity can be successfully managed. In a way it poses a question for CEOs before making a decision on what direction to focus. The study proposes that success in implementing exploration and exploitation strategies depends on the type of absorptive capacity the firm possesses. Existing research shows that absorptive capacity is very powerful in analysing the success of innovation strategy implementation because it incorporates both external and internal dimensions of innovation in the absorption of know-how. Firms want to ensure they possess or develop absorptive capacities that complement the direction of the firm and vice-versa. For instance, firms will be able to gather more insights and engage closely with consumers if the firm focus is on external constituents (such as customers, also revenue emphasis) and also possess strong marketing capabilities. Such a synergistic outcome cannot be achieved if the firm focus is primarily on internal issues. Empirical work based on these ideas provides substantive evidence that management emphasis on the external or internal environment and the nature of resultant interpretations shape organizational actions (Rust et al., 2002; Garg et al., 2003).

Like studies of exploration and exploitation, existing research on absorptive capacity has almost exclusively focused on mature firms and thus has only examined its association to factors such as organizational structures (e.g., Cohen and Levinthal, 1990) and functional capabilities (e.g., Narasimhan, Rajiv, and Dutta, 2006). Factors at the magnitude of SMEs have yet to be developed thus firms have a more urgent need to absorb know-how efficiently. Additionally, extant studies have also almost exclusively focused on research and development (R&D) (Lane et al., 2006), largely overlooking the learning and knowledge absorption that commonly exists in other contexts; such as marketing, operations or top management teams.

In this regard, the thesis attempts to examine the developing field of ambidexterity by combining its antecedents in CEOs focal attention and the moderating role of absorptive

capacities towards exploration and exploitation strategies. Therefore, the primary research questions of the study are formulated as follows:

*Do CEO behavioural attention and a firm's information processing capability play an important role in determining firm innovation strategies? How do innovation strategies and ambidexterity relate to new product creativity and a firm's financial performance?*

The examination of CEO focal attention and absorptive capacities plays an important role in determining SMEs direction to explore and exploit and their eventual financial performance. The findings would have implications for (i) academic researchers in the field; it would add clarity and methodological rigour to existing empirical evidence, (ii) policy makers, who have huge responsibility to maintain high employment rate in the economy where more than 70% come from SMEs, (iii) business practitioners, who are required to innovate and implement an effective strategy to compete against more mature firms.

## **1.5 Proposed Research Model**

To gain a better understanding of the link between organization ambidexterity, performance and antecedents in the context of SMEs, this study proposes a temporal model that integrates multiple firms behavioral mechanisms (please see section 3.4 for conceptual model).

The model comprises of (i) the pivotal role of CEO attentional behaviors, (ii) the firm information processing capabilities, and lastly, the resultant strategic posture of the firm, namely explorative innovation and exploitative innovation strategy. Intended to capture the temporal role of the firm behavior towards ambidexterity, the study builds its reasoning from the attention-based view. Pioneered by Ocasio, the attention-based view suggests that the fundamental driving force of firm behavior comes from actions of CEOs. And what CEOs do “...depends on what issues and answers they focus their attention on [Focus of attention]”

(1997, p. 188). In other words, the issues and answers decision-makers' focus on determine how CEOs behave. That in turn determines how firms behave, respond to internal or external changes, and explain why they undertake one decision and opt out of others. The second driving force for firms to engage in an innovation strategy, arguably at a lesser direct influence, is the information processing capabilities of the firm. They help to process and disseminate information to the rest of the firm. What innovation strategy firms adopt depends on how strong these capabilities are. Henceforth, the thesis probes the interplay of these two forces, to assess whether a particular combination is associated with a certain type of innovation strategy, and subsequently, whether these innovation strategies are related to future innovation outcome. The conceptual model is discussed in chapter 3.

## 1.6 Research Gaps

To investigate the research gaps and opportunities for this research area, a detailed review of important studies from 1991 to 2013 was performed and summarized in Appendix 1. The table summarises core contributions, method employed and theoretical lens. It reveals five major gaps and opportunities open for further research: (i) limited empirical evidence of ambidexterity long term performance (ii) multiple levels of analysis that reflects the multitude aspects of the organization (iii) mediators and moderators of ambidexterity relationships (iv) multiple performance dimensions, and lastly (v) research in SMEs is very limited.

### 1.6.1 Limited empirical evidence

First is the limited *empirical evidence* of the link between ambidexterity and *long-term performance*. Reviewing the highly cited papers since 1991 has shown that organizational ambidexterity has incredibly rich conceptual grounding. But despite this intensive scholarly scrutiny, March's (1991) original formulation of the relationship between the exploration-exploitation and sustained performance still remains largely untested. Of the ones that test, the majority have only examined short-term performance (e.g. 1 year in Lubatkin et al., 2006 to 3 year in He & Wong, 2004), leaving a big question mark on the sustainability of ambidextrous strategies in the long run.

The main reason for such a shortage of evidence is that most studies used cross-sectional survey (e.g. Atuahene-Gima & Ko 2001, Wiklund & Shepherd 2003; Gibson & Birkinshaw, 2004; Jansen et al., 2005; Lubatkin et al., 2006; Cao et al., 2009; Burton, O'Reilly & Bidwell, 2012) or in-depth case studies (e.g. Burgelman, 1991, 2002; Jansen et al., 2008; Taylor & Helfat, 2009; Andriopoulos & Lewis, 2009) to examine ambidexterity constructs and performance link. The nature of the *cross-sectional survey* study also meant that there is limited reliability due to its dependence on the respondents' self-reported retrospective accounts; this would also make it less reliable for multiple time period studies. In addition, survey can often be perceived as less relevant for wider population of firms as is the case with case study design. Longitudinal research designs with larger samples are probably most appropriate to examine sustained performance. In fact, to my knowledge, Uotila et al., (2009) might have been the only study so far to use longitudinal research design to report the long-term performance link; however, it is unclear how many years the lagged Tobin-Q performance was measured. Besides that, longitudinal studies are restricted to case studies (e.g. Burgelman, 2002) or studies that just do not test the sustained performance link.

As seen there is a big empirical research gap. Fortunately, research opportunities are specifically presented for *objective and longitudinal data*, perhaps, through archival means or broad-scale interviews. These avenues provide additional opportunities to validate existing conceptual models and findings that were mainly based on a manager's self-reported perceptions or that have generalizability concerns. In addition, these methodologies have the ability to address the question as to whether higher performance of ambidextrous strategy is sustainable in the face of changing market trends, coupled with impediments of resources and inherent difficulties in SMEs. Given the well-grounded association of ambidexterity to long-term performance, e.g. long-term survival (Cottrell & Nault, 2004), long-term maximization of profit (Van Looy et al., 2005), future studies can fill a large gap on the question of how ambidexterity contributes to both firms' short term and long-term growth and survival. Further, only longitudinal can disentangle the interesting questions much research still seeks to answer. For example, how does the relative

importance of orientations (e.g. integration and differentiation) evolve over time? What are the implications for firms between simultaneous management or cyclical management of exploration and exploitation? Should they manage differently for different stages of economy/industry/firm/product cycle?

Overall, empirical evidence still has a big gap to fill. Twenty years on since March's landmark article, many ambidexterity studies still stress the need for more empirical studies, specifically longitudinal dynamic perspectives of the topic (Raisch & Birkinshaw, 2008; Voss & Voss, 2013).

### 1.6.2 Multiple levels of analysis

Second, studies covering *multiple levels of analysis* are also rather scarce; existing reviews have called for research examining different intra-organizational domains and multiple levels of analysis (Raisch & Birkinshaw, 2008; Lavie et al., 2010). The reason being much ambidexterity research has been focused on one level of analysis. They are either at corporate level (e.g. Probst & Raisch, 2005; Jansen et al. 2009) or business units (e.g., O'Reilly & Tushman, 2004) or individual level (e.g. Beckman, 2006; Jansen et al., 2008). The level of analysis is crucial here because choices of how to address exploration and exploitation tensions at one level of analysis may often be resolved at the next level down (Raisch & Birkinshaw, 2009). For example, a business unit can be ambidextrous by creating subdivisions with different foci; a manufacturing plant can be ambidextrous by having one team responsible for enhancements in flexibility and one responsible for efficiency improvements. In addition, irrespective of the level within the firm, exploration or exploitation may largely originate from top management teams or individual managers of exploration or exploitation activities (Mom et al., 2007). Hence, multilevel concepts and measures may be required to fully capture the interaction of activities within different levels of the firm.

### 1.6.3 Mediators and moderators of ambidexterity relationships

Third, further research has room to find out context under which ambidexterity would be most rewarding. Looking at the existing studies (please see Appendix 1: Review of

ambidexterity studies 1991-2013), those examining the context/condition under which ambidexterity leads to success are perhaps less scarce compared to multiple level of analysis and longitudinal studies. Some examples indicate that size and resource endowment (Cao et al., 2009), resource munificence (Jansen et al., 2012), centralization (Jansen et al., 2012), industry contexts (Andriopoulos & Lewis 2009; Rothaermel & Alexandre 2009) and environmental dynamism (Jansen et al., 2005; Auh & Menguc, 2005; Cao et al. 2009; Mom et al., 2009; Chang et al., 2011) make material difference when associating ambidexterity to performance. However, future studies have many opportunities to develop more fine-grained accounts that consider other *mediators* and *moderators* that may affect the antecedents-ambidexterity-performance relationship.

#### 1.6.4 Multiple performance dimensions

Fourth, on the more specific methodological points, a number of studies have pointed to opportunities to examine ambidexterity with *multiple performance dimensions*. Specifically, where exploitation was found to be more positively related to single dimension indicators such as growth in sales, profits, and market share, whereas exploration was more positively associated to efficient firm performance, measured by return on investment, return on sales, and return on assets (Auh & Menguc, 2005). Research employing one dimensional indicators of firm performance, such as sales growth (e.g., He & Wong, 2004), may thus run the risk of producing biased estimations of organizational ambidexterity's contributions to the firm's overall success.

#### 1.6.5 Context of SMEs

As aforementioned, far less attention has been given to uncovering how SMEs achieve ambidexterity. Almost all empirical studies of ambidexterity to date have studied large firms (Uotila et al., 2009). A possible explanation as to why this is the case is that information on SMEs is often not published. When publicly available, they usually are not complete and can vary markedly among firms. Nevertheless, SMEs provide a very interesting context for examining the concept around ambidexterity.

Overall, there are many more gaps and opportunities to research further as the ambidexterity area is gathering pace. The review so far has shown that ambidexterity literature would benefit from additional longitudinal, multiple level analysis, moderators/mediators, multiple performance dimensions empirical research studies, and particularly within the context of SMEs.

## 1.7 Research Contributions

### Overview of research contributions

The literature review in chapter 2 finds that the tension in exploration-exploitation provides ground in explaining multiple disciplines including: (i) organisation learning, (ii) technological innovation, (iii) organizational adaptation, (iv) strategic management, and (v) organizational design. Within these literature streams, we have come to understand that ambidexterity can be achieved through managing paradoxical requirements of (i) organization structures, (ii) behavioural contexts and (iii) leadership-based processes. And over the past decades, researchers have started to substantiate positive performance evidence in such management. However, empirical research has only begun to explore the antecedents and consequences of these opposing innovations, typically in larger firms (e.g. Gibson & Birkinshaw, 2004; He & Wong, 2004). This present study contributes to existing knowledge by extending the understanding and provides empirical evidence to the links of leadership-based antecedents, contextual effects of moderators, and firm creative outcome. The following is six contributions of the study:

### Contribution to answering the fundamental questions of ambidexterity

The foremost is the contribution to addressing *fundamental questions* of ambidexterity. “Should organizations strive for ambidexterity?” and “How should organizations achieve the management of exploration and exploitation?” (Gupta et al., 2006). Using objective 7-year longitudinal data, the study tests the ambidexterity hypothesis by examining how exploration and exploitation can be sequentially cycled to achieve ambidexterity and influence firm new product creativity outcome. It also examines whether they can

simultaneously influence firm innovation outcome (as an extension of the core model). To date, almost no study has so far empirically compared the merit and appropriateness of these two mechanisms. The study primarily tests sequential ambidexterity, it however highlights simultaneous and sequential ambidexterity as two alternative mechanisms for achieving a balance of exploitation and exploration innovation in the context of SMEs high tech industry.

### **Contribution to antecedents of ambidexterity studies**

Second, the study would be the first to examine the role of *CEO focal attention* as an antecedent of exploratory and exploitative innovation. Findings of top management strategic focus have often shown it to have an irrelevant, indirect effect on innovation, or mixed direct effect on innovation activities (Yadav et al, 2007). One justification for such mixed results is due to the difficulty in examining how top echelons are actually allocating their attention, primarily due to internal company record confidentiality and lack of access. This study uses automated content analysis to clarify how top management allocation of attention supports the firm exploitation and exploration of innovation opportunities.

### **Contribution to moderators of ambidexterity relationships**

Third, although not the first, this present study is one of the few to dissect firm *absorptive capacities* into multiple levels: Marketing, R&D, and top management team (TMT). This is a unique approach because it considers a combination of learning approaches: it looks at both intra and inter-organisation learning by recognising the importance of tacit knowledge inside the firm (i.e. TMT) and outward learning orientation in Marketing and R&D activities. Extant studies have almost exclusively focused on R&D (Lane et al., 2006; Jaider et al., 2008), largely neglecting the learning and absorption commonly presented in other contexts; thus this study provides a more complete assessment of the role of absorptive capacities to the ambidexterity literature.

### **Contribution to new performance outcome of ambidexterity**

Fourth, the study is also the first to empirically study *creativity* as an outcome of exploration, exploitation and ambidexterity. Much existing research has focused on studying financial returns or product innovation as a consequence of innovation strategies. In fact, among innovations studies, only 5% of 815 product innovation articles (1989-2004) investigated issues relating to ideation and creativity (Page & Schirr, 2008 cited in Spanjol, 2011). Thus, this makes an important contribution to the existing empirical study. It provides a different output perspective of innovation strategies that is much closer to the organizational creative process. Specifically, "*all innovation begins with creative ideas*" (Amabile et al., 1996 p.1154); at the 'fuzzy front end', creativity outcome precedes innovation and financial outcomes. Potentially, this can eliminate noise or factors affecting the link between strategies and performance outcome, making the empirical link cleaner.

#### **Contribution to SME research**

In researching the antecedents, moderators and consequence of innovation strategies in the context of SMEs, the study also advanced the idea that SMEs are theoretically distinct from larger firms. The most distinctive characteristics are the SMEs impediments of knowledge process and resource endowments. The complexities of an ambidextrous strategy also make it particularly more difficult for smaller firms (Ebben & Johnson, 2005). Thus, the study would respond to calls for additional research linking ambidexterity (Simsek et al., 2009; Uotila et al., 2009) and examine how SMEs are able to profit from such a strategy. Empirical support for the CEOs attention and innovation strategies can advance current theories of innovation management by addressing the lack of evidence for SMEs, offering guidance for managers in return.

#### **Contribution to existing methodology**

Methodologically, the study contributes substantially by providing a *mixed research design*, with objective data over multiple time periods. It demonstrates the importance of a relatively underused tool, namely content analysis of 'letters to shareholders'. March's definition of exploration and exploitation processes have great theoretical impact but to date still receive little empirical validation due to difficulty of measurement. Given the study

operationalization expands on the exact terms and words used in March's (1991) original definition and measures from hundreds of publicly available shareholders letters, this study methodology offers a relatively cost effective and convenient way to replicate operationalization of March's concepts. In addition, adopting content analysis and objective data source also evade many of the methodology problems related to surveys and case studies. Furthermore, it also evades concerns with cross-sectional studies, one being that findings can often impede providing causality, for example, the finding that TMT behaviour integration might cause greater ambidexterity or the reciprocal also prove to be true (Lubatkin et al., 2006). As such, this present longitudinal study evades the common method bias and causality limitations.

## 1.8 Research Objectives and Questions

The motivation and research problem developed previously have boiled down to seven objectives:

- To empirically assess the role of CEO focal attention on how it relates to firm adoption of innovation strategies.
- To empirically assess the interplay of CEO focal attention and absorptive capacities and how they impact on the firm adoption of innovation strategies.
- To empirically examine how innovation strategies are related to new product creativity outcome.
- To empirically examine how the ambidextrous exploration and exploitation strategy relates to new product creativity performance.
- To empirically assess how new product creativity relates to lagged financial performance.
- To further understand how the above interactions occur within the context of SMEs
- To examine all of the above relationships using solely secondary data and unconventional methodologies.

In attempt to achieve these research objectives, research questions are formulated as follows:

- Does CEO focal attention relate to a specific type of innovation strategy?
- How does the interplay of CEO focal attention and the firm's absorptive capacity form the basis of the firm's innovation strategy?
- Do innovation strategies relate to new product creativity outcome?
- How does ambidextrous innovation strategy relate to new product creativity outcome?
- Does new product creativity relate to the firm's financial performance?

## 1.9 Research Methodology

In the areas of strategic management, constructs are often multi-faceted and dynamic in nature; collection and measurement of data represent a major challenge. Data within these areas are also highly inaccessible, especially for CEOs behavioural constructs and similarly within the SME context. Fortunately, with the development of database management, macro and micro data have become more abundant, new research techniques with rigor have also become more established.

This study acknowledges the challenge and opportunities, it attempts to capitalise on the abundant sources of data and measurement techniques available to examine constructs (please see Chapter 3). It opts against traditional methods in a bid to use solely objective secondary data and mixed research design to answer the research problem. They are Stochastic Frontier Analysis, Content Analysis and Ratio Metrics. Stochastic frontier analysis will be used to operationalize absorptive capacities; content analysis will measure CEO focal attention and exploration and exploitation strategies, and lastly, ratio metrics will measure the remaining constructs. A review of each method is in Chapter 5 section 5.4.

## 1.10 Concluding Remarks

The research overview, ideas and objectives presented in this introductory chapter provide a foundation for the main body of the thesis, which consists of chapters 2 to 7. These chapters explain deeper the steps taken to addressing the research objectives. The study undertakes a rather large number of variables to present a seven year firm's innovative journey. As such, the literature coverage is very broad, reviewing a wide range of research themes within ambidexterity literature, and the methodology adopted is naturally also extensive. However, these efforts are all to arrive at answering the principle question of, whether SMEs can reconcile the conflicting exploration and exploitation tensions in the form of temporal separation, a system in which SMEs would focus on exploitative activities at one point in time followed by explorative innovation at subsequent points in time (Gupta et al., 2006; Cao et al., 2009; Jansen et al., 2009). With respect to the large number of variables and mixed methodologies in the study, chapter 8 presents additional analysis to fully appreciate the richness of the data and versatility in the model. Finally, in chapter 9 the study will be put into perspective with a comprehensive discussion and evaluation of the contributions, in terms of implications to theory, SMEs management and policy makers. Chapter 9 also provides some limitations and suggestions for future research avenues.

This chapter concludes with a summary of what the study encompasses:

### **Model**

Leadership antecedents and moderation effects of differential absorptive capacities in shaping sequential ambidexterity and performance implications.

### **Addressed research aims**

Examining the influence of leadership cognitions and information processing capabilities in shaping ambidextrous innovation strategy and examining the innovation outcome in adoption of such strategy.

### **Main constructs and time line**

- 2003: CEO focal attention (external, internal and future)
- 2004: Absorptive capacities (top management team, marketing, research and development)
- 2005-6: Explore, exploit and ambidextrous strategy (sequential)
- 2007: New product creativity
- 2008-2010: Financial performance

### **Findings**

CEO external focus shapes firms to adopt exploration strategy whilst internal focus leads to exploitation. TMT and R&D moderate the relationship between internal focus and exploitation. SMEs reap superior performance benefits when following a sequential ambidexterity strategy, in which exploitation for one year is followed by exploration in the subsequent year, outperforming simultaneous ambidexterity and the reciprocal sequence of exploration and exploitation.

# Chapter 2 – Literature Review and Theoretical Premises

## 2.1 Introduction

The purpose of this literature review is to discuss the published works relevant to the research areas outlined. It focuses especially on the underlying elements of organization ambidexterity that create new product creativity. To recap, it encapsulates the fundamental questions of:

- What are the exploration and exploitation tensions that make up ambidexterity?
- How does the management of the two relate to superior returns?
- What are the antecedents to ambidexterity?

Chapter one has briefly familiarized part of the background knowledge around these questions, thus some areas of the following literature review are likely to be repeated. Before discussing how ambidexterity becomes a vital organization mechanism in explaining new product creativity, an important concept of resources and capabilities needs to be addressed. It may not be the main construct of the thesis but at the fundamental level it underlines the theoretical framework of ambidexterity (organizational learning) and also the theoretical development of its antecedents (attention-based view), which are discussed in chapter 3.

Thus, the literature review is divided into four sections. Section one will lay the foundation for the literature review in this chapter and the theoretical framework of attention-based view and organisational learning in chapter 3. It will explain what resources and capabilities are; how they are important in becoming the dominant idea in making the company do things in a certain way i.e. be ambidextrous.

The second section introduces ambidexterity by reviewing the evolution of the concept. It then discusses five main literature streams which are organisational learning, technological innovation, organisational adaptation, strategic management and organisation design. Each area shows that both exploration and exploitation involve learning, albeit of different types and/or degrees and it is essential for organisations to pursue both in order to achieve sustained success.

The third section of the literature review discusses the antecedents of ambidexterity. It pays particular focus on the leadership-based antecedents where upon thorough review it is found that the link of CEO focal attention to innovation strategies has not been empirically tested. The theoretical framework of this concept is then developed further in chapter 3 where attention-based view theory is discussed in detail.

The fourth section discusses the business case of adopting an ambidextrous strategy. This section compares the performance evidence of individual exploration and exploitation strategies to ambidexterity, specifically in the case of simultaneous and temporal separation (sequential). Where applicable, references to SMEs will be made in each section.

## 2.2 Resources and Capabilities

The following subsections of resources and capabilities are divided in two areas. The first subsection (2.2.1) introduces the concept of resources where under the theory of Resource-based View (RBV) it has been one of the most influential methods used to explain firms' performance. However, further empirical research developments of the concept found major deficiencies that questioned the ability of resources as theoretical underpinning for firms' performance. This gave rise to a new improved concept affirming that it is not how much resource a firm possess but how it coordinates, deploys and allocates those resources that can produce value-creating strategy (e.g. Helfat, 2000; Barney & Mackey, 2005). In fact, the new idea emerges from questioning why small firms with limited resources could outperform larger firms (DeSarbo et al., 2005). This '*process*' is then named as organizational capabilities. They can be "complex bundles of skills and accumulated knowledge that enable firms to

coordinate activities and make use of their assets” (Day, 1990, p. 38) to create economic value and sustain competitive advantage. Subsection 2.2.2 introduces further development of this concept. It sets the theoretical foundation in explaining firms performance as ambidexterity attempts to explain new product creativity.

## 2.2.1 What are resources and capabilities?

### 2.2.1.1 Resources and firm performance

Under the umbrella of the Resource-based View of the firm, the concept of resources has been one of the most influential perspectives that focuses on understanding drivers of superior performance. It is defined as tangible and intangible factors the firm controls. In particular, factors that are *valuable, rare, inimitable* and/or *non-substitutable* (VRIN) provide the basis of competitive advantage and increase the chance of superior performance (Barney, 1991).

The idea of how important resources are to firm performance dates back to 1959 and Penrose’s ‘The growth of the firm’ book. It was then expanded by Rubin (1973 p.937) that a firm must ‘*process raw resources to make them useful*’. But after more expansion from Wernefelt (1984) and Rumelt (1984), Barney (1991) contended a firm would be able to achieve competitive advantage if their resources are valuable and rare. And this could be sustainable if these resources were also inimitable and non-substitutable. This simple proposition is shared by other analysis such as: core competencies (Hemel & Prahalad, 1994), dynamic capabilities (Teece, Pisano & Shuen, 1997) and the knowledge-based view (Grant, 1996) and form a vital foundation for the two theoretical frameworks of this thesis – attention-based view (Ocasio, 1997) and organizational learning (March, 1991) (please see chapter 3).

Since the formalization of the idea, RBV has been further defined and led to more theoretical applications on how firms can achieve sustainable competitive advantage. Given the level of research and attention over the last 40 years, one would assume RBV to be very well backed up and documented. It is also from the simplicity of the proposition above that RBV had

become more comprehensive and empirically testable. However, recent assessment of RBV empirical research has shown that out of 1152 articles on RBV only 55 had some form of statistical test on the relationships between variables e.g. performance, competitive advantage and in different contexts (Newbert, 2007). These 55 scholar journals contain 549 tests, although 292 (53%) were supported; there has been considerable variation in the level of support across the theoretical approaches tested (ibid). For example, the resource heterogeneity approach was the most sought approach with the independent variables being resources, core competencies or capabilities. However, while in most cases these variables are related to valuable, rare, inimitable and/or non-substitutable, the empirical evidence implied that core competencies and capabilities contribute to a firm's competitive advantage or performance; but "*resources do not*" (Newbert, 2007 p.136).

Along with deficiency in the empirical assessment of Newbert (2007) above, resources as a competitive advantage driver have been extensively criticized conceptually as well, the main selected ones are: (i) *RBV lacks operational validity*, it suggests the manager obtains resources that are valuable, rare, inimitable and non-substitutable (VRIN) to achieve competitive advantage, however it does not say how the manager can go about getting them (Connor 2002; Miller, 2003; Kraaijenbrink et al., 2010). In defence, RBV was never intended to provide managerial prescriptions (Barney, 2005), merely an indication to appropriate management practice and direction for further development of the resource-based view theory (Ghoshal, 2005). (ii) *RBV generalization is also flawed*. The theory of VRIN suggests that a firm's resources are unique, and uniqueness does not go with generalization, thus applications to a specific industry or economy would be restricted. (iii) Other criticisms are that RBV is *static*. In other words, sustainable competitive advantage is not achievable beyond the claims of VRIN. This has been increasingly evidenced as the theory evolves, which provides strong evidence to suggest that resources alone, particularly easily acquired ones cannot provide sustainable or long-lasting competitive advantage (Miller, 2003; Ray, Barney & Muhanna, 2004). With this overemphasis of possession of individual resources, or insufficient knowledge of the effect when resources are deployed or mixed together, it does not give a clear picture on how competitive advantage can be achieved, neither statically or

dynamically (Kraaijenbrink et al., 2010). Nevertheless, resources are building blocks of successful strategy and indeed in the development of the following concept – organizational capabilities.

### ***2.2.1.2 Capabilities and firm performance***

A capability is defined as the firm's ability to undertake value creating activity which is manifested through the 'process' of deployment of resources and factors of production (Teece et al., 1997). They can be '*complex bundles of skills and accumulated knowledge that enable firms to coordinate activities and make use of their assets*' (Day, 1990: 38). This 'process' is commonly characterized as *organizational capabilities* (e.g. Slater et al., 2006; Kale & Singh, 2007). The description shows capabilities can be messy and a complicated combination of many factors. Firms can have hundreds of capabilities such as the capability to price products, capability to procure materials or to invoice customers to create economic value (e.g., Barney and Mackey, 2005; Sirmon et al., 2007). But there are only a handful of capabilities that are truly essential for business success and they need to be better than anyone else to sustain competitive advantage (Teece et al, 1997; Teece, 2007). These are called *distinctive capabilities*. However, to develop their full potential, these differentiating capabilities need to work together in a system that allows interplay and integration of complementarities. This section discusses the former, and the latter is introduced in section 2.2.2 Capabilities integration.

Development of RBV has seen evidence that the deployment of resources (or capabilities) is more important than the absolute resource levels in driving performance (DeSarbo, Di Benedetto & Song, 2007). This emerges from the phenomenon of small firms outperforming bigger firms despite possessing less quantity/quality of resources (DeSarbo, Di Benedetto, Song and Sinha, 2005); evidence shows that such small firms are able to create new innovative products that offer higher customer value (Qian & Li, 2003). For eight years running, Booz & Co Global Innovation 1000 study of R&D spending has consistently shown no long-term correlation between the absolute R&D spending on its innovation efforts and its overall financial performance. Instead, what really matters is how these global innovators

use that money and other resources, together with the quality of talent, processes and decision making (Booz&Co, 2012). This gave more assurance to theorists to explain how innovation and sustained competitive advantage are achieved, and the link is posited as 'capabilities'.

Capabilities can be broad in meaning and exist in many forms, types, at different levels and across the internal or external network of the organization. Newbert's (2007) assessment compiled 32 capabilities and more have been found recently (e.g. exploitation, exploration etc). Many types of capabilities commonly known in strategic management are: technological, product development, production process, manufacturing, and logistics capabilities that allow firms to minimize costs and/or differentiate product offering. Out of these, more than 70% have been linked to performance (ibid). Perhaps not all capabilities are merited as '*distinctive*' or '*differential*' however they have much higher operational validity than the 38% of empirical tests supported for resources. These capabilities help firms achieve performance by increased production efficiency, improved consistency in delivery, and thus reduce costs and ultimately increase competitiveness (Day, 1994).

These suggest that if a firm competes by implementing a strategy that makes use of its capability then it would achieve superior performance. In fact, RBV-capabilities literature suggests organizations should focus on developing capabilities as a means of implementing their strategy (Zott, 2003; Slater et al, 2006). Penrose (1959) suggested that firms that focus on the deployment of key capabilities that best support implementing the firm's strategic plans yields both higher growth and firm performance. Subsequently, numerous studies have linked capabilities with strategies such as Mile & Snow - four distinct strategic typologies (DeSarbo et al., 2004), or Porter's generic strategies of differentiation, cost focus and product-market scope (DeSarbo et al., 2006).

Although the links show great importance to business strategy application, little empirical works have materialised to support whether capabilities are effective in directing implementation of firm strategies (DeSarbo et al., 2006). This shortcoming is illustrated in Newbert's (2007) assessment of empirical work in RBV and capabilities; his assessment

found only 55 articles in leading journals dealing with *capabilities and strategy*; among these, only 4 hypotheses were empirically supported (out of 8 tested). Despite strong theoretical support the assessment left a lot of room for researchers to explore how capabilities and strategies connect. An additional deficiency in the capabilities literature is that few have touched on the integration of capabilities with strategies in a certain context, theoretically and empirically (e.g., Grant, 1996; Teece et al., 1997; Dutta et al., 1999). Despite its synergy potential to superior performance capabilities integration has been investigated in only two of the 55 studies empirically (Newbert, 2007). What is also missing is the integration of capabilities in the context of product creativity which is the focus of this study.

### 2.2.2 Capabilities integration

Newbert (2008) and other authors further suggest that resources in isolation are not effective (Eisenhardt & Martin, 2000; Ketchen, Hult & Slater, 2007) nor the isolation of effective capabilities (Slotegraaf, Moorman, and Inman, 2003). But more important to the development of the RBV is that they also suggest superior firm performance can only be fully realised if resources and capabilities are (i) *complementary* to each other when combined and (ii) at a superior level compared to other firms. Underpinning this development is the argument that firms may earn above normal returns by identifying and acquiring resources and capabilities that are critical to the development of demanded products (Wernerfelt, 1984). This research study argues that overlooking the importance of the interplay between resources and capabilities leaves unexplored knowledge of how firms may achieve beneficial outcomes via this firm-specific characteristic.

The idea of capabilities interplay and/or integration is analogous to this research proposal. It lends knowledge of the idea above to formulate an innovation model that studies the organization mechanism of combining complementary organisation elements to manage exploration and exploitation innovation that eventually creates superior performance i.e. new product creativity. The result of the internal organizational mechanism in integration means that a new bundle of skills and knowledge is even more valuable, rare, difficult to imitate and substitute. Such a concept is also known as combinative (Van den Bosch et al.,

1999), complementary (Song et al., 2005) or configuration (Henderson & Clark, 1990; Gruber et al., 2010). The differential terms all refer to *“reconfiguring of competencies, which reduces the resource deficiency, and generates new application”* (Song et al. 2005 p.262).

Empirical evidence of capabilities integration is demonstrated in recent research in the form of marketing capabilities integration that results in financial performance (Vorhies, Morgan & Autry, 2009). It demonstrates the idea that capabilities integration provides an important mechanism for strategy implementation. As a result, the study confirms the theory and contributes empirically that specialized marketing and architectural marketing capabilities are individually important; however, when combined they provide more advantageous deployment of firm resources and capabilities. This very internalized mechanism that guides the alignment of capabilities makes it difficult for competitors to diagnose, comprehend and imitate (Cohen & Bacdayan, 1994; Hunt & Morgan, 1996); more specifically, it is the tacit nature of the capabilities (e.g., Day, 1994; Teece, 1997). This subsequently leads to superior performance and such an outcome is also supported by other studies (Day & Wensley, 1988; Conant et al., 1990; Day, 1994; Slotegraaf et al., 2003).

Integration studies are in small number and ones that relate to product creativity are still limited but non-existent in the context of SMEs. Hence, the study hopes to lend the knowledge of RBV to align the proposed model with the knowledge gap identified. The RBV introduction of resources and capabilities above analyse firms through the lens of resource possession, exploitation of it and rebundling to create VRIN capabilities. Within the research interest and model proposed in chapter 1, resources and capabilities are explained under the attention-based view and organizational learning theory. And the internal integration/interplay mechanism is reflected by the interplay of exploitation and exploration innovation antecedents to create ambidexterity. They may sound markedly different but the resources and capabilities and integration mechanism under study are both fundamentally interrelated/based on the initial concept of the resource-based view. The next section is dedicated to discussing the literature surrounding exploitation, exploration innovation antecedents and the organization mechanism to achieve ambidexterity. It also discusses and

compares the outcome of such an integration mechanism to the non-integrated approach (please see section 2.5).

## 2.3 Exploration, Exploitation and Ambidexterity in Organisational Theories: A Review

### 2.3.1 Ambidexterity Research Evolution

The evolution of organisational ambidexterity research started in 1976 where it was first introduced by Duncan (1976) in the book “*The management of organization*”. However, it was March’s landmark article in 1991 that created a wave of research on the concept. Until now, the momentum of this research area still grows strongly. In 2004, there were less than 10 studies, but since, more than 80 papers have been published in leading management journals (please see Appendix 1 for a review of the key papers from 1991 to 2013). The growth underlines the importance of understanding exploration, exploitation and ambidexterity. It is suggested to have the theoretical ability to unlock the central dilemma of corporate strategy, give answers to what choices management can make, how much to invest in different types of activities in order to sustain long-term performance.

To begin the review of ambidexterity concept evolution, we start with March’s (1991) paper. He describes ambidexterity as an adaptive process of the firm that considers the relationship of exploration of new possibilities and exploitation of old certainties (Schumpeter, 1934; Holland, 1975). He defines that *exploration* is firm behaviours associated with taking risks, searching for new ideas beyond the locus of the firm, discovery and innovation. *Exploitation* on the other hand implies firm behaviours characterised by sweating out existing competencies, refinement of current processes, efficiency, production and selection (p.102). March’s knowledge is built from Duncan’s work (1976) to propose that exploration and exploitation are two fundamentally different learning philosophies whereby firms must divide their resources and attention. Hence, they require essentially different organizational resources, capabilities, structures, strategies, and context environments to excel. Thus, to align organization ambidexterity there is a trade-off between exploitation and exploration

(Levinthal & March, 1993; Floyd & Lane, 2000; Ancona et al., 2001). This view remains dominant in the early stage of development.

Other authors during this period also asserted that the division of resources and attention to reconcile efficient exploitation and effective exploration may be impossible to achieve (Miller & Friesen, 1986; McGill et al., 1992). Thus, in many of the following years, discrete, dichotomous categories constrained firms to attend to either exploration or exploitation activities (Ghemawat & Costa, 1993; Denison et al., 1995). Despite accepting a similar conclusion, March (1991) argued that aligning organization exploitation and exploration activities is absolutely necessary for long-term success. He reasoned that a primary focus on exploitation activities alone may enhance short-term performance, but it will be at the expense of long-term sustainability, because firms may not be equipped to respond timely and adequately to environmental changes (Leonard-Barton, 1992; Ahuja & Lampert, 2001). This occurs because an exploitation focus can trigger what is commonly called “*success trap*”, where exploitation usually leads to short-term profit thus entices the firm into further exploitation. In time, existing core resources and capabilities grow into core rigidities and reduce the firm’s ability to adapt and respond to significant/fast environmental changes, such as industrial and technological shocks. Therefore, the (short-term) success trap threatens the long-term survival of the firm (Leonard-Barton, 1992; Christensen & Overdorf, 2000). In contrast, consider firms that primarily pursue exploration. The argument is, although primary attention on exploration strategy supports long-term development of the firm, in the long run it can equally be detrimental to the firm’s survival. The focus creates a “*failure trap*”. Firms become accustomed to renewing their knowledge base and discovering new innovations but are stuck in an iterative cycle of unrewarded creations. Exploration failures lead to new search and change, resulting in further failures and trapped in a self-inflicted unrewarded search and change loop (Volberda & Lewin, 2003). Levinthal and March concluded that sustainable success “*depends on organization’s ability to align in sufficient exploitation to ensure current viability and sufficient exploration to ensure future viability*” (1993, p.105).

March's landmark article and the developments from various authors above contributed to a shift in ambidexterity research, from a trade-off to paradoxical thinking (Eisenhardt, 2000; Lewis, 2000). The impossible reconciliation of contradicting tensions has increasingly been viewed as essential for successful firms (Adler et al., 1999; Brown & Duguid, 2001; Katila & Ahuja, 2002). Specifically, studies ranging from organization design to technological change have discussed the need for firms to align exploration and exploitation activities (Burgelman, 1991; Tushman & O'Reilly, 1996; Volberda, 1996; Eisenhardt & Martin, 2000; Benner & Tushman, 2003; Gupta et al., 2006). The following section will discuss in-depth these various literature streams.

### **2.3.2 Main Organisational Ambidexterity Literature Streams**

To understand further the evolution of ambidexterity and the literature scope of this present study, this section discusses five main literature areas. They are (i) organisation learning, (ii) technological innovation, (iii) organizational adaptation, (iv) strategic management and (v) organizational design. Each literature stream continues to discuss the tensions between exploitation and exploration and the implicit need to reconcile in order to achieve sustainable success.

#### ***2.3.2.1 Organisation learning***

Following March's (1991) article, exploration and exploitation have been discussed as to whether they should be associated with learning activities. Throughout all the past studies, exploration-exploitation learning dichotomy is distinguished in two ways, either by the *presence versus the absence of learning* or by the *classification of learning*. Respectively, one group of scholars conceptualised exploitation as mere use of existing knowledge, and hence allocate all the learning to exploration (Vermeulen & Barkema, 2001; Rosenkopf & Nerkar, 2001; Vassolo et al., 2004). And the other group assigns different degree/type of learning to exploration and exploitation activities, akin to March's initial idea (Baum et al., 2000; Benner & Tushman, 2003; He & Wong, 2004; Gupta et al., 2006). They explicitly embrace the idea that exploration and exploitation are associated with different degrees of learning and types of innovations: for example, in Baum, Li, and Usher (2000, p. 768), their classification of

exploration refers to “*learning gained through play, planned experimentation and processes of concerted variation*”; and exploitation refers to “*learning gained through local search, experimental refinement and selection of and reuse of existing routines*”. Similarly, Benner & Tushman (2002, p. 679) define exploration as innovations that involve “*a shift to a different technological trajectory*” and “*exploitative innovations involve improvements in existing components and build on the existing technological trajectory*”. In the same fashion, He and Wong (2004, p. 483) defined “*exploratory innovation as technological innovation aimed at entering new product-market domains*” and “*exploitative innovation as technological innovation activities aimed at improving existing product-market domains*”.

These categories reflect other classifications in different modes of organisational learning, with literature developing them as double-loop versus single-loop learning (Argyris & Schön, 1978), generative versus adaptive learning (Senge, 1990), product innovation versus production-oriented learning (McKee, 1992) and local search versus long jump (Levinthal, 1997). Despite the wealth of distinct concept classifications among the two learning processes, they have all come to the same conclusion that *a well-balanced combination of the two types is essential for sustained organisation success* (March, 1991; Levinthal & March, 1993; Gibson & Birkinshaw, 2004; Gupta et al., 2006; Cao et al., 2009). Accordingly, since March’s initial theorization that exploration and exploitation are fundamentally incompatible, many studies have moved forwards to conceptualise the two learnings as *orthogonal variables* that can be achieved simultaneously. This means that managers can simultaneously engage in high levels of exploration and exploitation activities. Mom, van den Bosch, and Volberda (2007) surveying managers in a leading electronics firm found that top-down knowledge inflows from personnel of higher rank than managers are positively related to exploitation. Conversely, bottom-up and horizontal knowledge inflow communication from peers or personnel of lower hierarchy are found to be positively related to exploration. Despite the limitation of generalizability in their study, assessed as a survey study of just one large international electronics firm, the finding nevertheless suggests that as managers can simultaneously acquire top-down and horizontal or bottom-up knowledge flows, they can indeed engage in high levels of both exploration and exploitation.

### 2.3.2.2 Technological Innovation

The central theme around this literature stream is the distinction of *radical and incremental innovation* (Abernathy & Clark, 1985; Dewar & Dutton, 1986; Tushman & Anderson, 1986). Incremental innovation refers to relatively small adaptations of existing products or business concepts. On the other hand, radical innovation represents new, disruptive, fundamental changes of products or business concepts. Extending from this initial description of the two innovations, Tushman & Smith (2002) define radical innovations as explorative (innovations designed to meet new emergent customer needs) and incremental innovations as exploitative (innovations that improve products to meet existing customers' needs). Voss and Voss (2013) further extend the distinction by separating exploration and exploitation into *product and market domains*. They define product exploration as activities that develop new products, technologies and product capabilities. In contrast, product exploitation emphasizes increasing returns from existing product capabilities. Conversely, marketing exploration refers to "*marketing programs that attract new customers and marketing exploitation emphasizes marketing programs designed to retain and increase purchases from current customers*" (p.1460). Building around this concept, other studies have adopted and further developed the explorative and exploitative innovation classifications (Benner & Tushman, 2003; Holmqvist, 2004; Smith & Tushman, 2005; Atuahene-Gima, 2005).

Similar to organization design, technological innovation scholars acknowledge tensions exist in managing these technological classifications and also stress *the importance for firms to maintain both incremental and radical innovation to gain corporate advantage* (Leonard-Barton, 1992; Dougherty, 1992; Nadler & Tushman, 1997). This point of view contributes to a continuing turn from a trade-off to paradoxical thinking (Eisenhardt, 2000; Lewis, 2000). Leonard-Barton (1992) pointed out a capability-rigidity paradox in product innovation, where activities in exploitation of existing product innovation capabilities may have adversely crowded out exploration of new competencies. This paradox is similar to the lure of the (short-term) success trap mentioned previously. Nevertheless, similar to organisational learning literature, scholars again here stress the importance of pursuing both innovation processes. Within this technological innovation stream, ambidexterity is known as "*the*

*ability to simultaneously pursue both incremental and discontinuous innovation*” (Tushman & O’Reilly, 1996, p. 24). Its importance extends to the dynamic capability field where Ancona et al. (2001) suggested that combining the two innovation processes is fundamental.

Subsequently, Colbert (2004) also supported this view by arguing that the interactions of the two reflect a complex capability that is highly valuable, difficult to replicate and yields sustained corporate advantage beyond individual innovation activity. Several other authors also believed in the combination and outlined different organizational dimensions that are instrumental in facilitating the balance of the two (Brown & Eisenhardt, 1997; Christensen & Overdorf, 2000; O’Reilly & Tushman, 2004; Atuahene-Gima, 2005; Belderbos et al., 2010). These various organizational dimensions are discussed in more detail in the subsequent literature review section – section 2.3 Ambidexterity Antecedents.

### **2.3.2.3 Organizational Adaptation**

One of the central research themes in the organizational adaptation literature is the importance of the balance between *continuity and change* to achieve long-term success (Volberda, 1996; Brown & Eisenhardt, 1997; Leana & Barry, 2000; Probst & Raisch, 2005). For example, Tushman and Romanelli (1985) theorized organizational evolution experiences both periods of incremental evolutionary change and also short bursts of discontinuous revolutionary changes. Thus, to sustain, successful organizations are required not only to engage in exploitation and alignment during these periods of calm incremental change but also to engage in radical transformation and exploration in periods of revolutionary change (Tushman & O’Reilly, 1996). Along the same line, Meyer and Stensaker (2006) related an organization’s capacity for change to the ability to align the need to maintain daily operations whilst making drastic changes. This requirement to balance continuity and change is also reflected in other constructs, including absorptive capacity (Zahra & Geroge, 2002; Jansen et al., 2006; Volberda et al., 2010), organizational identity (Dutton & Dukerich, 1991; Gioia et al., 2000), strategic flexibility (Combe et al., 2012) and recent reconceptualization of organizational routines as sources of flexibility and change (Feldman & Pentland, 2003).

Underlying these theories is again the success and failure trap; the common belief is that too much change could lead to chaos if continuity is not considered; in contrast, too little change can lead to inertia and organization myopia (Levinthal & March, 1993; Huy, 2002).

Consequently, *there is a need for regular and rhythmical temporal punctuate organization change*, in other words, time pacing change (Brown & Eisenhardt, 1997). Cao et al., (2009) unpacked and empirically tested this complexity to a concept of “combined dimension of ambidexterity”. They found that exploration and exploitation are complementary, such that firms may use sequential or rhythmic pacing to shift activities in between. Consistent with He and Wong (2004)’s finding (who tested alternative ambidexterity variables in separate models), the combined dimension of ambidexterity is positively related to firm performance. Other researchers theorized that to balance this concept, managers are key in “mediating between forces for convergence and forces for change” (Tushman & Romanelli, 1985). Specifically, top management is primarily considered the main driver of discontinuous change, and middle management is considered to support incremental change (Shrivastava, 1986; Floyd & Woolridge, 1996). Similarly, these middle managers are posited to facilitate organizational adaptation through emotional balancing of continuity and radical change (Huy, 2002).

#### **2.3.2.4 Strategic Management**

The initial reference of exploration and exploitation to strategic management is perhaps best related to Burgelman’s (1991; 2002) articles on intra-organizational ecology. His model of firm internal ecology distinguishes corporate strategy between “*variation-reducing*”, i.e. induced strategic processes and variation increasing strategic processes. In his 2002 article, Burgelman explicitly referred induced strategic processes to exploitation, which concern initiatives that are within the scope of the organization’s current strategy and *build on existing competencies*. Whereas, variation increasing strategic processes represent initiatives outside the locus of the firm’s current strategy and involve *creation of new competencies*. He also recognized the trade-off of both strategy processes and the competition for scarce resources; however like many scholars of other ambidexterity literature streams, Burgelman suggested the combination would be most beneficial. He

argued that both processes should be kept at “*all times, even though this means the organization never completely maximizes its efforts in the current domain*” (Burgelman, 1991, p. 256).

On the same lines, subsequent scholars have used different terms to provide similar views to Burgelman. For instance, the tensions between *static efficiency versus dynamic efficiency* (Ghemawat & Costa, 1993), where static efficiency represents refinement of existing products, processes and capabilities, and dynamic efficiency refers to the creation of new ones. However, they posit that organizations tend to focus on one strategy process because of the difficulty in balancing the trade-offs. The other term used was *leverage versus stretch*. Hamel and Prahalad (1993) demonstrate the need to exploit existing capabilities and the search for new ones as a key strategic objective for creating competitive advantage. Conversely, Sanchez et al. (1996) and Volberda, et al. (2001) have emphasized *the need to create a mix of – “competence-leveraging and competence-building activities” and “selective and adaptive strategic actions”* respectively – in order to be successful.

### 2.3.2.5 Organizational Design

The last literature stream on elements of organization ambidexterity is perhaps the most extensively discussed challenge of organizational features. It attempts to mix the trade-off of *efficiency and flexibility*. In 1967, Thompson describes this trade-off as the organization “*paradox of administration*” (p. 15). This represents the trade-off from *balancing organisation mechanistic structures and organic structures*, which refer to centralization, hierarchy, standardization versus decentralization and autonomy respectively. Buns and Stalker (1961) argued that mechanistic structures support efficiency whereas organic structures support flexibility. Organic structures help to create innovations and mechanistic structures aid implementing and deploying created innovations (Duncan, 1976). Thus, both structures are required to be successful. However, some scholars argue that they are difficult to reconcile within a single firm (Ford & Ford, 1994; Lewis, 2000). The reasons are because it requires a demanding mix of financial capital, human capital, flexible organizational design,

and the organization also needs to be strategically integrated (O'Reilly & Tushman, 2007). Nevertheless, consistent with prior elements, many argued it is possible by combining each paradox's features (Adler et al., 1999; Jansen et al., 2005) or by developing a collective organizational context (Gibson & Birkinshaw, 2004). As organizational design's central concerns are with the formal structures, ambidexterity in this perspective can be defined as *the organization's ability to operate with intricate mix of organization designs that can bring short-term efficiency and also long-term innovation* (Tushman & O'Reilly, 1996).

As demonstrated, organizational ambidexterity is becoming an intensely researched domain. We have seen the concept expanded to many management research streams. Yet, it is still an emerging theory such that theoretical debates remain disconnected and complex. However, within the five research disciplines discussed, there lies a *general trend of agreement*. Initially, much early management theory has presented organizational ambidexterity as contrasting categories, placing exploration and exploitation as *mutually exclusive orientation*. This view forces organizations to pursue either exploration or exploitation. More recently, research has demonstrated characteristics that may have proven the two orientations *are in fact complementary* and beneficial to firm performance. As demonstrated in all five research disciplines above, more scholars have presented a range of organizational *solutions to support ambidexterity*. The review thus aims to build a solid ground work for this thesis and provide a framework for the subsequent conceptual model. It has shown insights of different arguments, theories, approaches and an evolution of exploration and exploitation leading to organization ambidexterity. However, far less research has been devoted to explain and provide empirical evidence to how these organizations achieve ambidexterity. Thus, the following section

Ambidexterity Antecedents: Leadership-based, p.60, will review the antecedents of organizational ambidexterity, specifically leadership-based, as the focal focus of this present research thesis. Section 2.4 will present the link of ambidexterity to performance outcomes and empirical studies related to leadership-based antecedents.

## 2.4 Ambidexterity Antecedents: Leadership-based in Attention-based View

As reviewed above, most early and even contemporary literature has focused on different elements of organisational ambidexterity. They were presented to align the paradox of (i) single-loop and double loop learning, (ii) incremental and radical innovation, (iii) stability and transformation in organizational adaptation, (iv) induced strategic processes and variation/autonomous increasing strategic processes and finally, (v) efficiency and flexibility in organizational design. In contrast, far less research has been devoted to explain and provide empirical evidence to how these organizations achieve ambidexterity (Siggelkow & Levinthal, 2003; Raisch & Birkinshaw, 2008; O'Reilly & Tushman, 2013). This is even rarer for smaller firms, where their disadvantage in resources magnifies the complexities of managing an ambidextrous strategy and makes the study very interesting (Ebben & Johnson, 2005; Simsek et al., 2009; Voss & Voss, 2013). This section explains the antecedents that have been proposed in explaining how ambidexterity can be achieved.

Over the past decades, many ambidexterity studies have been published. Studies on antecedents have been diverse but can be grouped under (i) *organization structures*, (ii) *behavioural contexts* and (iii) *leadership-based* processes. And recently, researchers have also dedicated more attention to the ambidexterity link with performance outcomes. In addition, researchers also expand the empirical examination with environmental factors and moderators interrelated to antecedents, elements of ambidexterity and outcomes. Perhaps this fast expanding attention has made ambidexterity studies even more complex. To stay within the scope of this study, this section will focus more on the leadership-based antecedents and only describe the organizational structure and behavioural contexts briefly.

From the review of literature, to the best of my knowledge, most of the research in leading management journals (such as Administrative Science Quarterly, Academy of Management Journal, Academy of Management Review, Journal of Management, Journal of Management Studies, Organization Science, and Strategic Management Journal) looked into structural antecedents and the performance implications of ambidexterity. Conceptual papers are

more abundant but empirical studies on other antecedents, particularly leadership-based are very limited. Appendix 1: Review of ambidexterity studies 1991-2013 summarizes the key papers. My intention of creating the appendix is not meant to be all inclusive, but rather to present the majority of the papers that I personally believe are key in relation to the present research theme.

### **Challenges in managing ambidexterity antecedents**

Organizational antecedents help to explain how organizations balance and coordinate exploitative and explorative activities. Duncan (1976), in his original paper, suggested that firms may align conflicting organization elements required for innovation and efficiency such as structures, people, processes and cultures.

To manage these elements, there are broadly *three methods*. First, organizations can manage the paradoxical requirements one by one, i.e. in a temporal cycle, *sequentially* (Duncan, 1976; Tushman & Romnelli, 1985; Brown & Eisenhardt, 1997; Siggelkow & Levinthal, 2003; Zollo & Winter, 2003; Venkatraman et al., 2007; Burgelman & Grove, 2007). For example, internal structures are shifted over time (Duncan, 1976). Second, organizations may *externalize* the activities through forming alliances or by outsourcing (Holmqvist, 2004; Rothaermel & Deeds, 2004; Lavie & Rosenkopf, 2006). The third option, arguably the most difficult to implement is by internally and *simultaneously* synchronizing both activities (Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004; Lavie & Rosenkopf, 2006; Mom et al., 2007). All three methods mentioned have their pros and cons and it really depends on the stance of what extent organizational tensions can be integrated, and the approach one takes when resolving how organizations can juggle exploration and exploitation activities. In the majority of cases, to simultaneously integrate exploration and exploitation internally or externally with other organisations, it will require a demanding mix of financial capital, human capital, flexible organizational design, and the organization also needs to be strategically integrated (O'Reilly & Tushman, 2007). This makes things very complex even for large firms where financial and capital resources are more abundant. However, it is even more challenging to achieve strategic integration, especially in cases of inter-organization or

externalization of exploitation/exploration across independent firms. The reason being strategic integration requires shared vision, similar culture and corporate governance (Benner & Tushman, 2003). Despite such challenges in externalising one part of the activity, Gupta, Smith and Shalley (2006) argued it is even more complex to manage two parts that have inconsistent alignments within an organisation. As an extreme view, it is even said that the challenge of aligning organizational tensions whether internal or external, can never be effectively reconciled (Ford & Ford, 1994; Lewis, 2000).

In the context of SMEs, firms just do not have the abundance of those human and financial resources (Cooper et al., 1994; Forbes & Milliken, 1999) or the hierarchical systems (Cao et al., 2009). Therefore, a sequential temporal system of aligning exploration and exploitation activities seems to be most appropriate. The following paragraphs will briefly discuss three broad approaches aligning the two activities. They are (i) structural antecedents, (ii) contextual antecedents, and lastly the focus of this study, (iii) leadership-based antecedents.

#### 2.4.1 Structural antecedents

Structural antecedents refer to the adaptation of structure designs to address the trade-off of ambidexterity strategy. Various suggestions have been made upon what structural mechanisms of an ambidexterity strategy would be like. There are a few examples such as, a *semi-structure* and *rhythmic switching* that enables organization units to oscillate back and forth between periods of the two strategies (Brown & Eisenhardt, 1997), or a *complex structure* that can combine both flexible organic and mechanistic structure elements (Sheremata, 2000). Boumgarden and colleagues (2012) associated this process to “vacillation” in their Hewlett-Packard and Ford studies and argued that formal structure switching is easier than culture and information organization. To understand these structure switching processes, they are broadly categorized under two underlying concepts of “*parallel structures*” and “*spatial separation*” respectively.

Of the two, most existing literature has focused on *spatial separation* (complex structure) to cope with the competing demands faced by organization alignments and adaptations. This is applied by *splitting the organization into separate units* to pursue either exploration or

exploitation (Duncan, 1976). The arrangement enables each unit to be configured to the task environment's specific requirements (Lawrence & Lorsch, 1967). Supposedly, the unit pursuing exploration would be more decentralized with small teams and loosely controlled, and exploitation is expected to be centralized with large teams and tight processes (Tushman & O'Reilly, 1996; Benner & Tushman, 2003). With this structural differentiation, Gilbert (2005) believes it will help the organization to develop appropriate competencies to cope with the inconsistent demands of exploration and exploitation. However, the main question regarding this solution is to what extent these units should be integrated/differentiated. Mixed views have shown that at an extreme level, exploration units should be completely separated from exploitation in order to pursue disruptive innovation (Christensen, 1997). In contrast, others suggested organization forms that combine both, but are physically and culturally separated, with different incentive systems and management teams. However, these contrasting units are strategically integrated by the shared corporate-wide culture. Bradach (1997) illustrated this with a field study of five large U.S. restaurant chains that use "*plural form*" organizational design. These restaurants simultaneously use company units and franchise units to maintain uniformity within the organization and adaptation to changing external markets. Specifically, within the company units, physical facilities are owned by the company; employees would be hired to operate as with a typical hierarchical structure. In franchise units however, the physical facilities are invested by a franchisee, who pays a royalty fee to use the chain's trademark and to run the franchise under certain operating standards given by the franchisor.

In contrast to spatial separation, *parallel structure* (semi-structure) is an alternative that allows an organization to switch back and forth between two (or more) types of structure, depending on the specific task (Zand, 1974; Stein & Kanter, 1980). Thus, it allows competing demands to be addressed within a single business unit (Gibson & Birkinshaw, 2004). The application is demonstrated by establishing a formal primary structure - used for routine tasks and maintenance of stability and efficiency, and secondary structures (project teams or networks) – used for non-routine tasks and innovation (Goldstein, 1997). Although less prevalent in current research, parallel structures have been used in 21 work units within a

manufacturing and an insurance company to maintain stability yet equipped to cope with uncertainty (McDonough & Leifer, 1983). Nonaka (1994) presents this as a “*hypertext organization*”, where efficiency and flexibility are combined in a hierarchical structure with the dynamism of flat and cross-functional task force organization (p.33).

### 2.4.2 Contextual antecedents

Contextual antecedents are different. Rather than changing the organization structure, contextual ambidexterity requires the organization to create a *system of processes, belief* and *culture* that allow *individuals to judge for themselves* - how to best manage/balance the demand of exploration and exploitation activities. Thus exploitation/exploration tension could be resolved at the individual level, which Gibson and Birkinshaw (2004) defined as “the behavioural capacity to simultaneously demonstrate alignment and adaptability across and entire business unit” (p.209). In this view, the conflicting demands for alignment and adaptability are resolved by the nurturing the ability of individuals to make their own judgements supported in an organization context characterized by an interaction of stretch, discipline, and trust (p.214). In their study of 41 business units, they found that by balancing the hard elements (stretch and discipline) and the soft elements (support and trust) organizations were able to achieve ambidexterity, and that this mediates the relationship between context and subjective ratings of firm performance. An alternative way to understand conceptual antecedents for ambidexterity is seeing alignment and adaptability as a role of a culture that promotes both flexibility and control (Khazanchi, Lewis, & Boyer, 2007). In examining 271 manufacturing businesses innovation supportive culture, Khazanchi and colleagues found that culture of flexibility promoted creativity while norms for control aided execution (2007). Similar illustration was found in a study of IDEO, a renowned product design consulting firm, that emphasises a hybrid culture of creativity and implementation (Hargadon & Sutton, 1997). These antecedents subsequently were found to be linked with firm performance in dynamic environments (Chatman, Caldwell, O'Reilly, & Doerr, 2013). Thus, it posits that alignment and adaptability attributed to contextual ambidexterity is a function of a culture that nurture flexibility and control (Bueschgens, Bausch, & Balkin, 2010).

In practice, processes underlying the culture such as meta-routines (Alder et al., 1999) in Toyota production system, job enrichment and empowerment schemes have been used to support contextual ambidexterity (Gibson & Birkinshaw, 2004). In this instance, workers perform routine tasks such as car component assembly (exploitation) are also expected to continuously change their jobs to become more efficient (exploration). In addition, the use of leaders with complex behavioural repertoires (Lewis, 2000) and creation of a shared vision (Bartlett & Ghoshal, 1989) are also demonstrated. In these cases, the overall management system and culture supports individuals to pursue both exploitation and exploration.

Despite studies (Gibson & Birkinshaw, 2004; Khazanchi et al., 2007; Bueschgens et al., 2010; Chatman et al. 2013) authors (Bartlett & Ghoshal, 1989; Lewis, 2000) claim that these systems do not adequately support contextual ambidexterity. Perhaps, conceptually it is easy to imagine how it may operate within a technological regime. However, it is more difficult to understand how a company may allow individuals to adjust disruptive or discontinuous changes in technologies and markets. For example, the evolution of communication technologies means that print newspapers have to compete with digital space. Firms would be required to restructure significantly (Gilbert, 2005). Decisions on how to adapt thus cannot be left to the discretion of lower-level individuals but require the engagement of senior managers or even external sources to provide resources and legitimacy for the new business model or technology. In this sense, there are shortcomings of contextual antecedents in supporting ambidexterity. It assumes exploratory knowledge is produced by any individuals and is available for use, it does not “consider how a firm can simultaneously conduct radical forms of exploration and exploitation” (Kauppila, 2010, p. 286).

Although, structural and contextual ambidexterity just described were initially demonstrated to resolved exploitation and exploration separately, the evidence clearly suggested that all are potentially viable. As Chen and Katila (2008) observed, *"exploration and exploitation need not always be competing activities, but can and should be complementary"* (p. 208). Several authors present support for this view. For example, Jansen, Andriopoulos and Tushman (2013) found the most successful firms would initially separate exploration and

exploitation structurally, switched to contextual ambidexterity, and switched back to structural ambidexterity over time.

### 2.4.3 Leadership-based antecedents

This is the focus of the study. I believe at the top of the organization, CEOs/top management team have the most important role in fostering the internal mechanism of integrating seemingly contradicting resources and capabilities to achieve ambidexterity. As the attention-based view rationalizes how firms strategize to achieve exploration, exploitation or ambidexterity depends on what issues and answers they focus their attention on (please see chapter 3 section 3.2 for more details). As leaders, CEOs bear their power or arguably their obligation to formulate strategies and set directions (Hambrick & Mason, 1984). Within the scope of driving ambidexterity, Tushman and O'Reilly (1997) state that the *top management team is the main driver*, because they have the "internal process" to handle a large amount of information that can be conflicting and ambiguous (p.23). Although Tushman and O'Reilly did not specify the precise nature of these TMT processes, other studies have gone on to show that leaders also "*support the formulation of an organization context effective in developing ambidexterity*" (Gibson & Birkinshaw, 2004, p. 223). Conversely, Smith and Tushman (2005) suggest that TMT can successfully manage the competing demands that arise from structural separation. Therefore, arguably leadership-based antecedents are the most important of the three types discussed. They make a contextual system of processes, belief and culture effective and structural separation management possible.

Contrary to the structural and contextual ambidexterity antecedents, the development of leadership-based antecedents comes later; most studies are found after the millennium. And recently, the role of leadership in driving ambidexterity has grown prominently.

Nevertheless, the growing assessments still have contradictory views upon how leadership-based antecedents are fostering ambidexterity. In fact, an emergent group of researchers conceptualized leadership internal processes as an *independent* antecedent of organizational ambidexterity (Lubatkin et al., 2006). Some elements of this view lay in the theory that *exploration and exploitation activities are related to different hierarchical management*

*levels*. For example, the exploration of new ideas and experiment of novel solutions is related to the operational management levels, whereas the subsequent exploitation activities of selection and leveraging of these solutions are related to the top management team levels (Floyd & Lane, 2000).

In the other view, scholars suggest that the internal process of how the top management team foster ambidexterity is not done independently, but *simultaneously*. Top management can choose to focus on one orientation, but they can also pursue both at the same time by shifting resources (attention) between existing products and innovations dynamically (Smith, 2006). In a study of a multi-units firm, Volberda (2001) states that the top management team can “*explicitly manage...the balance...by bringing new competences to some units while utilizing well-developed competencies in others*” (p. 165). However, it is not disputed that they still face the *competing objectives* at different levels of the firm. To illustrate, consider operational managers and top management level’s contradictory objectives: the operation manager may invest a substantial amount of effort in developing a new process technology that could improve current production efficiency. On the other hand, for strategic reasons, the TMT may not see the benefit of the project, thus may not support it. Nevertheless, Lubatkin et al., (2006) ‘s survey of top managers from 139 small to medium-sized enterprises (SMEs) found that if management teams are behaviourally integrated then they are found to facilitate the processing of disparate demands.

In the context of SMEs, such as this present study, it is more conceivable for such simultaneous illustration. Perhaps due to the organizational *context of SMEs* compared to large firms, the TMT team are simply much closer to the firm’s operating core. They are more likely to be more hands-on with the day-to-day implementation of strategies in addition to formulating and directing strategies. These are often done separately by the operating managers and senior managers in larger firms. Hence, the TMT team at SMEs are arguably more knowledgeable about the firm’s existing competencies, enabling them to exploit. At the same time, these managers are also closer to the markets and therefore can strategically position, select and leverage innovative solutions to the changing trends - activities that

signify exploration (Lubatkin et al., 2006). As such, these managers are often expected and more prepared to *participate in both operating and strategic roles*. However, within the related areas, a few studies on SMEs have shown evidence to imply the contrary. Zahra, Ireland & Hitt (2000)'s study shows that new ventures on average have high tendency toward exploration processes, such as the proactive search for new information. Busenitz & Barney (1997) also demonstrated a management bias toward higher level learning; other bias toward product leadership was found within U.S. semiconductor ventures (Eisenhardt & Schoonhoven, 1990), and aggressive use of resources in new arenas within the minicomputer industry (Romanelli, 1987). So although managers in SMEs are expected to be more hands-on in both activities, they too have a natural tendency to be trapped in one, as do managers in larger firms.

In brief, the ability of the TMT team to promote ambidextrous orientation is not given. They can and may have a tendency towards one activity. In larger firms, with higher organization impediments of status quo and conflicting demands at different management levels, the top management team will experience more dissonance in trying to balance contradictory knowledge processes. For SMEs, despite facing fewer organizational learning impediments and having a hybrid role of overlooking the operation core and spearheading strategies, senior managers are still under pressure to reconcile the knowledge process dissonance. Thus the dilemma remains as to whether focusing on one is better for improving the firm or trying to pursue both. The following section will examine the performance outcomes and review the empirical evidence, including the short-comings of the methodologies adopted by studies in this literature review and finally, opportunities for new studies.

## 2.5 Ambidexterity Performance Outcomes: SMEs Innovation and Financial Outcomes in Organisational Theories

The dilemma remains as to whether organizations should simultaneously pursue exploration and exploitation. Will that compromise the potential value of each one on its own? Although a few studies have shown positive association (e.g. He & Wong, 2004; Gibson & Birkinshaw, 2004) the causal link of ambidexterity to performance is either not established or theoretically clear (Lubatkin et al., 2006). Indeed, given the complexity in attaining a balance (March, 1991), scholars have argued that the pursuit of ambidexterity is no guarantee of success (Ghemawat & Costa, 1993). Nevertheless, it is hard to contest the importance of both organizational learning facets; Floyd and Lane (2000) asserted that firms must exploit existing competencies and explore new ones in order to be adaptive to the changing market. They also affirmed that the “*two facets are inseparable*” (p.155).

### 2.5.1 Exploration

In seeking answers, organizations may need to make choices to favour one strategy over the other. As previously mentioned, prior research shows that firms naturally have a tendency to develop either one, and not both. First, firms that primarily pursue *exploration* will be considered. On leadership-based antecedents, Zahra, Ireland & Hitt (2000)'s study has shown that new ventures on average have a high tendency toward exploration processes, such as the proactive search for new information. Busenitz & Barney (1997) also demonstrated a management bias toward higher level learning; further bias toward product leadership was found within U.S. semiconductor ventures (Eisenhardt & Schoonhoven, 1990), and aggressive use of resources in new arenas within the minicomputer industry (Romanelli, 1987). However this natural propensity to explore is unhealthy in the long-term as firms fall into an endless trap of innovation search but unrewarding change (Levinthal & March, 1993; Volberda & Lewin, 2003). In fact, a few empirical studies have proven March's (1991) assertion that a balance between both orientations is optimal for firm performance. For example, Uotila et al. (2009)'s study of S&P 500 corporations showed an inverted-U shaped

relationship of relative exploration orientation to future financial performance of the firm. This relationship is even more pronounced when the industry is dynamic. Hence, when the technological outlook of the industry changes quickly, the risk of obsolescence makes finding a balance even more important. As for one piece of orientation evidence, Jansen, van den Bosch, & Volberda (2006) survey 283 unit managers of a large European financial services firm, and found that pursuing exploratory innovation was more effective in dynamic environments and pursuing exploitative innovation was more beneficial in competitive environments. However, for other environmental circumstances or longer term empirical time space, the idea of balancing exploration and exploitation remains untested, i.e. no positive relationship was found with performance when firms predominately pursue neither exploration nor exploitation.

### 2.5.2 Exploitation

As with *exploitation*, earlier conceptual research (Benner and Tushman, 2002, 2003; Lewin, Long, and Carroll, 1999) has suggested that large companies tend to systematically overemphasize exploitation, as opposed to exploration activities in new ventures and smaller entities. A recent survey of Uotila et al. (2009) found that around 80 percent of S&P 500 corporations in their sample are engaged in exploration at levels below the optimum. And as Levinthal and March (1993) state, these imbalances in exploitation will only lead to short-term performance, trapping them in a cycle of obsolescence. Clearly, the majority of these firms would benefit from aligning their emphasis on exploration, an important activity in developing entrepreneurial opportunity and resolving obsolescence.

As a result, a firm's ability to thrive in the long-run may depend on its ability to jointly pursue exploration and exploitation. At this stage, it is fair to speculate that firms, large or small, should engage in the pursuit of both exploration and exploitation. But how? And is there any empirical evidence to prove this? Out of the three ways firms can balance both activities, the following focus is on two mainstream paths: Simultaneous and Sequential. Externalization is not within the scope of the study.

### 2.5.3 Simultaneous Ambidexterity

*Simultaneous ambidexterity* is the predominant and traditional method of understanding ambidexterity, widely advocated by many scholars (e.g. Leonard-Barton, 1992; Dougherty, 1992; Tushman & O'Reilly, 1996; Nadler & Tushman, 1997; Gibson & Birkinshaw, 2004; Lavie & Rosenkopf, 2006; Gupta et al., 2006; Mom et al., 2007; Raisch & Birkinshaw, 2008). The research is both broad and deep. Early studies suggested associations with firm performance (e.g. Katila & Ahuja, 2002; He & Wong, 2004; Lubatkin et al., 2006). But it is arguably the more challenging method to synchronise both activities concurrently. It forces the two activities to compete for scarce resources, leading to complications and inconsistencies in structure separation. O'Reilly and Tushman (2008) noted this method "entails not only separate structural units for exploration and exploitation but also different competencies, systems, incentives, processes, and cultures – each internally aligned" (p.192). These structurally separated units are held together by "common strategic intent, an overarching set of values, and targeted linking mechanisms to leverage shared assets" (O'Reilly & Tushman, 2013 p.328). This is at heart a leadership concern more than anything else (Smith & Tushman, 2005; O'Reilly & Tushman, 2011).

Existing research thus focuses predominately on *contextual* and *behavioural* (related to leadership-based antecedents) antecedents in trying to explain the balancing act (Adler et al., 1999; Gibson and Birkinshaw, 2004). As a contextual example, the promotion of a contextual "setting" that allows both activities to simultaneously flourish (Gibson and Birkinshaw, 2004, p.209). For example, the context involves joint organization focus on high performance (discipline and stretch) and social support (support and trust). Thus the system encourages individuals to make their own judgement as to how best to allocate their time in integrating the two activities for alignment and adaptability (ibid). Conversely with establishing such a supportive context, the behavioural approach promotes ambidexterity through a system of meta-routines, job enrichment, and task partitioning (Adler et al., 1999; Gibson and Birkinshaw, 2004). Additional suggestions include flexible team-based arrangements and human resource practices; particularly those that promote creativity have been shown to support the alignment of both activities (Bierly & Daly, 2007). Developing

simultaneous ambidexterity thus may benefit from combining both contextual initiatives and a behavioural approach.

Empirical evidence confirms the benefit of this type of ambidexterity. Appendix 1: Review of ambidexterity studies 1991-2013 shows several studies such as Gibson and Birkinshaw (2004) where ambidextrous context is positively related with *business-unit performance* (subjectively rated by middle and senior managers). Hill and Birkinshaw (2006) also observed business units that simultaneously create new capabilities and leverage existing capabilities enjoyed higher levels of *venture strategic performance*, assessed in four metrics: creating breakthrough innovations, investing in disruptive technology, relationships with key external stakeholders, funding for internal venture activities. Furthermore, Cegarra-Navarro and Dewhurst (2007) found that an ambidextrous context is positively associated to *customer capital*, measured as company reputation, prestige and number of profitable customers. Despite the positive evidence, the results should be interpreted with caution. They are not free of common method bias, with performance ratings derived from self-reported internal sources. In addition, scholars concede that the cost of implementing competing innovation orientation is high and requires significant managerial efforts (Gibson & Birkinshaw, 2004; Yang & Atuahene-Gima, 2007), while other scholars have found no empirical support for the performance association (Venkatraman et al., 2007).

#### 2.5.4 Sequential Ambidexterity

Fundamentally, the idea of sequential ambidexterity is that exploration and exploitation are not in direct competition for resources. They operate in different time spaces. Thus firms are able to engage in periods of exploitation interspersed by periods of exploration, and vice-versa. Thus, firms are suggested to realign their structures, culture, processes or informal organization to reflect the changed environmental conditions or strategies (e.g. Rosenbloom, 2000; Kauppila, 2010). This view is reflected in many studies of organizational adaptation, such as Chandler's study (1977) described General Electric and DuPont modification of structures to adapt to changing market conditions. Sequential ambidexterity has two typologies that

are distinguished by “*where*” and “*how*” it is pursued. The first type is ‘cyclical’, the second is ‘reciprocal’.

*Cyclical ambidexterity* is grounded in the literature of *punctuated equilibrium* (Gersick, 1991). It emphasises attaining the optimal balance (“*how*”) of exploration and exploitation within the same unit (“*where*”). As such, organisation ambidexterity is not achieved by structural partitioning but by sequentially shifting resources and attention temporally between two activities within the same unit (parallel structure/semi structure). Conversely, *reciprocal ambidexterity* is also a sequential combination of the two activities across time. However, it is pursued across units (complex structure/spatial structure). In this typology, the interplay between exploration and exploitation takes place both within and between organizations (Holmqvist, 2004). Consequently, the relationship of exploration and exploitation is formed by an ongoing cycle of knowledge exchange, decision making and resource flows extended to for example, strategic alliances. As such, reciprocal is grounded in a social network perspective. Among all ambidexterity typologies, it is the least researched. Perhaps the only study that reports empirical evidence is by Im and Rai (2008), where knowledge sharing in long-term inter-organizational relationship is associated with relationship performance, assessed by the level of satisfaction, worthiness and productiveness of the relationship.

In the context of SMEs, the number of business units is small, resources are scarce, strategic alliances are limited; moreover, senior managers are often required to juggle both strategic and operational roles (Lubatkin et al., 2006). As such, *cyclical ambidexterity is more applicable* to the context of the present study. While this sequential typology is not new, it has only been recently suggested as an alternative method to address the problem of combining exploration and exploitation (Siggelkow & Levinthal, 2003). *This process involves changes in the formal structure and routines, practices and procedures, styles and systems of reward and control, and resource allocation* (Raisch, 2006). In addition, it is usually necessary to establish a system of conflict resolution (Adler et al., 1999), interpersonal relation and facilitation of switching roles (Duncan, 1976; Floyd & Lane, 2000). Despite the apparent complications above and potential significant managerial efforts arising from switching

between activities (Gibson & Birkinshaw, 2004; Yang & Atuahene-Gima, 2007), temporal cycling can provide an alternative mechanism to alleviate some of the resources and administrative requirements of a simultaneous approach.

*Empirically*, sequential ambidexterity in general has had some evidence to substantiate its association with performance (Winter & Szulanski, 2001; Burgelman, 2002; Rothaermel & Deeds, 2004; Lavie & Rosenkopf, 2006; Venkatraman et al., 2007), where combining exploration and exploitation sequentially is understood as a common practice for businesses with strong technological orientation. Naturally, the exploration processes of discovering and developing new technologies precedes exploitation processes of commercializing, apply and leveraging new technologies. However, most studies with evidence of performance above are rather anecdotal. Winter & Szulanski (2001) only give a theoretical argument of the performance association. Burgelman (2002)'s study is a case study that has apparent generalizability drawbacks. Lavie and Rosenkopf (2006) have found interesting observations; they found that over time, firms within the software industry adjust their tendencies to engage in exploration or exploitation within domains. For instance, *"firms that engage in relatively high proportions of knowledge-generating R&D alliances turn over time to knowledge leveraging marketing and production alliances"* (p.814). This observed tendency is consistent with the product development cycle in Rothaermel and Deeds (2004)'s study, where firms leverage partners' technologies before capitalizing on their market access. However, these studies did not test the association with firm performance. Thus, current research still leaves an open question as to whether such adjustment eventually leads anywhere. Similarly, Cao and colleagues (2009) found that exploration and exploitation are complementary, such that firms may sequentially or rhythmically pace to shift activities in between, consistent with He and Wong (2004)'s finding (who tested alternative ambidexterity variables in separate models). However, again *no performance evidence was tested for a sequential pacing* between exploration and exploitation.

## 2.6 Concluding Remarks

This chapter has discussed relevant published work to the research areas outlined. It started with the foundation concept of resources and capabilities (2.2), where it underlines the theoretical framework of ambidexterity (organizational learning) and the theoretical development of its antecedents (attention-based view) in reaching new product creativity. The concept development shows that resources and capabilities alone cannot lead to new product creativity, it requires integration and reconfiguration to reduce resource/capability deficiency, and generates new application. Thus, the study lends the knowledge to combine the interplay of exploitation and exploration innovation antecedents to create new product creativity.

The following section goes deeper into the literature surrounds exploitation, exploration and how ambidexterity is achieved an applied in different literature streams. This section found that since March pioneering paper in 1991, the concept of ambidexterity has grown exponentially. It also has moved from a trade-off to a paradoxical thinking, believing that the contradictory orientation of exploitation and exploration may actually be the key to success. The reconciliation of these two has also been studied widely in numerous fields such as (i) organisation learning, (ii) technological innovation, (iii) organizational adaptation, (iv) strategic management and (v) organizational design. However, there is a lack of empirical evidence to show how this emerging theory actually works. There is also a limited understanding of how ambidexterity is achieved, especially in the domain of leadership-based antecedents.

Further review in these limited empirical studies shows that large companies tend to exploit, and small company tend to explore at the expense of long-term obsolescence and endless trap of innovation search but unrewarding change. As a result, to achieve long-term sustainability, firms were suggested to engage in the pursuit of both activities either simultaneously or sequentially. Simultaneous engagement forces the firm to align separate structural units, competencies, systems, incentives, processes and culture internally, and concurrently. Therefore, this method is complicated and requires strong contextual and

behavioural antecedents. Such that respectively, individuals must be very competence to make their own judgement as to how best allocate their resources in integrating the two activities for alignment, and organisations must provide a flexible context that focuses on both performance (discipline and stretch) and social support (support and trust). Such methods have shown positive performance in survey studies of business-unit (Gibson and Birkinshaw, 2004), venture strategic performance (Hill and Birkinshaw, 2006) and high customer capital (Cegarra-Navarro and Dewhurst, 2007). On the other hand, sequential ambidexterity is manages exploitation and exploration in turns. Thus, firms realign their structure, culture and processes to reflect the changed environmental conditions or strategies. The following table summarises some of the key take-away of the literatures surrounding exploitation, exploration and ambidexterity archetypes.

**Table 2.1 Summary of Explore-exploit literature review**

	<b>Exploitation</b>	<b>Exploration</b>	<b>Simultaneous</b>	<b>Sequential</b>
<b>Firm size</b>	Large	Small	Large	Small
<b>Context</b>	Competitive markets	Dynamic markets	Require strong contextual and behavioural antecedents	Anecdotal evidences suggest it is suitable for technological orientated firms. Require flexible structure and leadership-based antecedents.
<b>Performance</b>	Short-term implications	Long-term implications	Survey evidence of positive association e.g. He & Wong (2004), Hill & Birkinshaw (2006), Gibson & Birkinshaw (2004)	No empirical performance tested

## **Chapter 3 – Conceptual Model and Hypotheses**

### **3.1 Introduction**

The thesis examines the degree to which heterogeneities of CEO attention and information processing capabilities affect organization exploration, exploitation and ambidextrous strategies. To gain a better understanding of the underlying processes, this chapter builds on the Resource-based View theory to analyse firm behaviours to consider a number of theoretical frameworks including upper echelon theory and strategic choice; but Attention-based View of the firm and Organizational Learning are selected to capture the concept. The conceptual model is created to address the empirical and theoretical gaps identified. It combines ambidexterity elements reviewed previously to propose a multi-stage journey of how information is selected, focused, processed, implemented to shape innovation strategies and subsequently used to generate new product creativity and financial performance. Following the conceptual model, key constructs will be described and finally specific research hypotheses formulated for subsequent empirical testing.

### **3.2 Theoretical Framework: Attention-Based View of the Firm**

One of the primary research questions of the study is to explain how the cognitive behaviours of CEOs affect strategic choices. Coincidentally, this is one of the most fundamental questions in strategic management. Research over the past two decades has demonstrated substantial evidence to suggest that TMT and the CEO in particular play a key role in organizational outcomes. For instance, their characteristics (e.g. Cho & Hambrick, 2006), their behavioural integration (e.g. Lubatkin et al., 2006) or their attention focus (Yadav et al., 2007) all have been shown to relate to strategic change, ambidextrous orientation and innovation outcomes respectively. As CEOs hold the most pivotal role in regulating the firms' decision making (Ocasio, 1997), their role in shaping exploration exploitation strategies is crucial. However, the literature review has shown little empirical evidence to demonstrate this relationship, in particular combining the cognition aspect of CEO attention focus and structural aspect of

information processing capabilities. The current study addresses this gap by using Ocasio's (1997) attention-based view of the firm and organizational learning theory (see next section).

### **Introduction to Attention-based view**

The attention-based view (ABV), as set forth by Ocasio (1997), and drawn originally from Herbert Simon (1947), has a central argument that firm behaviour is the result of *“how firms channel and distribute the attention of their decision makers. What decision makers do depends on what issues and answers they focus their attention on. What issues and answers they focus on depends on the specific situation and on how the firm's rules, resources, and relationships distribute various issues, answers, and decision-makers into specific communications and procedures”* (p.187). The essence of this argument allows us to comprehend whether firms can make strategic choices to adapt to changing environments. In particular, it provides us with a framework to answer questions related to studies such as this one. For instance, how do firms behave? Why do firms undertake some decisions/directions but not others? How do firms determine why, when, and how to respond/anticipate changes in the environment or internal processes? It is these questions that highlight the importance of being attentive to the right information to achieve sustained strategic performance. Poor allocation of a firm's attention, i.e. by engaging in too many (or too few) external and internal communication channels can lead to dispersed (or too concentrated) information search efforts that can lead to information overload (or information irrelevance). Thus, choosing the right amount and direction of attention to allocate to search and innovation is critical for organization adaptation.

In relation to this present study, such firm behaviours are regulated by the CEOs. They have the power and arguably the obligation, to set the direction for the firm. Analogous to Ocasio's central argument above, CEOs influence what information others in the firm receive and how it is interpreted (e.g. Simons, 1991; Lefebvre et al., 1997). And the way they influence others is by communicating the issues and answers through procedural and communication channels, such as formal and informal *concrete* (by means of material existence, and specific location in time and space) activities, interactions and communications. Thus, to explain firm behaviour is to

explain how firms “*channel and distribute the attention of their decision makers*” (Ocasio, 1997, p. 203).

### **Origin of Attention-based view**

The origin of the attention-based view was Herbert Simon (1947); it was then a new perspective used to control players in the organization. It grew to be central to the classic studies of organizational decision making and was noted as having cognitive perspectives in organization theory. Simon theorizes that firm behaviour is both a cognitive and a structural process. Thus, decision making in the firms is the result of both limited attentional capacity of individuals and the structural influences of firms on an individual’s attention. Through channelling and structuring and allocation, attention for Simon was an organizing concept and a source of control of individuals and subunits in organizations. This was called administrative behaviour and later became organization theory (March & Simon, 1958). Subsequent collaborations and developments of Simon’s work continued to focus on attention allocation and the concept grew in the study of organizational decision making (March, 1988), including attention structures in the theory of ambiguity and choice (March & Olsen, 1976), shifting the focus to the study of risk preferences (March & Shapira, 1987), etc. However, different authors have gradually moved away from Simon’s original dual emphasis of structure and cognition to emphasize how attention is either shaped by individual bounded rationality or organizational routines (Cyert & March, 1963).

Fifty years after Simon’s initial publication, Ocasio (1997) advances the concept to incorporate current understanding of social structures, environment influences and individual and social cognitions. He also brings back the link of the dual role of cognition and structure through the introduction of the concepts of *procedural and communication channels* and *attention structures*. However unlike Simon, Ocasio focuses on how attention in firms, as systems of distributed attentional processing, shapes organizational adaptation, and not merely senior manager administrative behaviour (Ocasio, 2011) nor issue selling/agenda management (Dutton et al., 2001). Ocasio also has extended ABV to provide aspects of attentional processing

as a multilevel process shaped by individuals, the organization and environment. The idea is based on three inter-related principles.

**The three principles of attention-based view** (Ocasio, 1997, p.188):

1. What decision-makers do depends on what *issues and answers* they focus their attention on (Focus of Attention).
2. What issues and answers decision-makers focus on, and what they do, depends on the particular *context or situation* they find themselves in (Situating Attention).
3. What particular context or situation decision-makers find themselves in, and how they attend to it, depends on how the firm's *rules, resources, and social relationships* regulate and control the distribution and allocation of issues, answers, and decision-makers into specific activities, communications, and procedures (Structural Distribution of Attention).

The three principles capture the concept that, while decision makers ultimately do the attending, individual attention is dependent on the context of the firms' activities and procedures. Collectively, firms are viewed as systems of structurally distributed attention, linking the relationship between individual and organisational-level information processing, in which cognition and actions of individuals "*are not predictable from the knowledge of individual characteristics but are derived from the specific organizational context and situations that individuals find themselves in*" (Ocasio, 1997, p.189).

### **Definition of attention**

Attention is defined to encompass "the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both (a) *issues*: the available repertoire of categories for making sense of the environment: problems, opportunities, and threats: and (b) *answers*: the available repertoire of action alternatives: proposals, routines, projects, programs, and procedures (ibid). Focusing of attention thus provides an explanation of corporate strategic choices. The reason being, corporate strategy is defined as a *pattern* of decisions in a firm that *determines* and *reveals* its objectives, purposes, principal policies and plans to achieve those

goals (Child, 1972, p. 13). In the attention-based view, it can be understood as a *pattern of organizational attention*, in which a distinct focus of time and effort by the firm on a particular set of issues and answers, will determine the organizational strategic choices.

### **Three attention mechanisms**

By emphasizing the role of a concrete set of procedures and communication, together with the attentional structure of the firm, Ocasio explained three separate mechanisms that enable an organization to regulate the distribution of time and effort and attention to turn a particular set of issues and answers into organizational strategic choice. First, the firm's rule, resources and social relations organise attention by generating a set of values, priorities of issues and answers based on relevance, importance and legitimacy. Secondly, these attention structures *channel* and *distribute* the decision-making activities into a concrete set of procedures and communications. Lastly, these patterns of channelling provide a structured set of interests and identities, which in turn generate a set of decision premises and motivations for action.

Building upon the three principles, the attention-based view develops into a cross-level, process model that provides an *alternative explanation* of how firms behave, a fundamental issue in the field of strategy (Rumelt et al., 1994). It is the advantage of capturing both individual cognition perspective and environmental determinism that has enabled ABV to combine insights on organizations from rational choice theories, such as game theory and agency theory, and population ecology.

### **Alternative theories to attention-based view**

Other alternative theories were also considered in the selection of a theoretical framework. All are appropriate in some aspects however were not selected. One reason is due to their specificity in explaining certain phenomena. The second reason is due to the wide scope of the theoretical framework required in order to explain the relatively large conceptual model of the current study. Some of the theoretical frameworks considered are, for example, *behavioural theory of the firm*, which views the firms as a collective number of coalitions that strive to resolve conflicts and uncertainty avoidance within the confines of bounded rationality (Cyert &

March, 1963). Although it remains an influential foundation of the attention-based view, the behavioural theory of the firm emphasizes the problem-solving mechanism at the firm, where coalitions have conflicting attentional perspectives. *Bounded rationality theory* and *upper-echelons view*, on the other hand, emphasise the rationality of managers determined by limited cognitive capacity to process all information. Again, this forms part of attention theory but emphasises the limited information processing/interpretation capacity rather than actual “focusing of time and effort” or the context and structural distribution of attention; thus they were deemed complementary to the attention-based view to explain the current study model but not completely. *Organizational ecology* and *institutional theory* on the other hand, attend to the deeper aspects of social structure and organisational demography respectively, but lack the individual cognitive emphasis the attention perspective requires in this study.

Overall, the attention based view is a meta-theory in itself, a collection of unitary theories to link cognitive neuroscience, central in explaining the limited information processing capacity of individuals, and organization decision making. As advantageous as it seems, it is though by no mean elected to replace other organizational theories nor the traditional resource-based view of the firm, which has a far richer history in explaining (directly and indirectly) firm behaviour and firm competitive advantage (please see Chapter 2). In the context of this present study, the attention-based view model of Ocasio is the most appropriate model focusing on attention. It provides a process-based model of how firms behave that integrates the understanding of individual cognition, organization structure and strategy formulation. The thesis draws upon this theory to study the conceptual model of how firms’ attentional focus and information processing capabilities interact to shape exploration, exploitation and ambidextrous innovation strategies to eventually explain new product creativity.

### **3.3 Theoretical Framework: Organisational Learning**

Complementary to the attention-based view, organizational learning theory asserts that the outcome of information search and attention can lead to two forms of learning: Explorative and Exploitative (Levinthal and March, 1993; March, 1991). Similar to attentional processes, these

concepts are ultimately the result of the individual learning process and build on the foundation of rational choice. However, like organization attention, the organizational learning activity choices are dependent on the context of the firms' activities and procedures. Collectively, firms are viewed as systems of structurally distributed learning, linking the relationship between individual and organisational-level information processing, in which cognition and actions of individuals are derived from a specific organizational context. Successful learning therefore is implemented by individuals and reflected in the structural elements and outcomes of the organization itself. Understanding the learning outcomes thus helps firm to make an appropriate strategic choice of exploration and exploitation; as a central dilemma of corporate strategy, it gives answers to what choices management can make, how much to invest in different types of activities in order to sustain long-term performance. More detailed explanation of these two forms of exploration and exploitation learning occurred in the previous literature review section 2.2 (p.44), and further in the variables used in the study section 3.5.3 (p.96).

### **Nature of learning**

Due to the abstract aspect and widespread application, organizational learning theory has created diversified understanding. But essentially, from past studies of organization learning theory, organizations have often engaged in the competing learning philosophy of exploration and exploitation learning. And they are usually distinguished either by the *presence versus the absence of learning* or by the *classification of learning*. So, either learning occurs versus no learning, or learning exists on different levels. Previously, the literature review showed a group of scholars who conceptualised exploitation as mere use of existing knowledge, and hence allocate all the learning to exploration (Vermeulen & Barkema, 2001; Rosenkopf & Nerkar, 2001; Vassolo et al., 2004); others have assigned degree or type of learning to exploration and exploitation activities (Baum et al., 2000; Benner & Tushman, 2003; He & Wong, 2004; Gupta et al., 2006). Classification of learning is analogous to March's (1991) concept; he classifies explorative learning as the acquisition and use of knowledge from outside the organization's existing competitor and customer repertoire. This complements the outward attentional focus of the study, where the learning exposes the firm to new and heterogeneous information about

competitors and customers that differs from the current knowledge base. Together they advance the organisation's diversity of skills, experiences and knowledge. In contrast, March classifies and argues that exploitative learning captures and uses customer and competitor information within the neighbourhood of the organization's current expertise and experience to refine its existing competencies (March, 1991). Thus exploitative learning orientation digs deeper to the current understanding of market information to ensure the efficiency of organization moves. It reinforces the organization's existing competences rather than the development of new ones.

Subsequent researchers have explicitly embraced the idea that exploration and exploitation is associated with different degrees of learning and type of innovation. For example, Baum, Li and Usher (2000, p. 768) refer to class exploration as "*learning gained through play, planned experimentation and process of concerted variation*" and exploitation as "*learning gained through local search, experimental refinement and selection of and reuse of existing routines*". Similarly, Benner and Tushman (2002, p. 679) differentiate the two as new vs improvements of existing technological trajectory. In the same fashion, He and Wong (2004, p. 483) refer to exploration as "*technological innovation activities in new product-market domains*" versus "*activities in improving existing product-market domains*". These categories reflect other classifications in different modes of organisational learning, for example, double-loop versus single-loop learning (Argyris & Schön, 1978), generative versus adaptive learning (Senge, 1990), product innovation versus production-oriented learning (McKee, 1992) and local search versus long jump (Levinthal, 1997).

## **One agreement**

Despite these ostensibly different classifications, applications and implications of exploration and exploitative learning dimensions, scholars can agree on one point: that a well-balanced combination of the two types is essential for sustained organisation success (March, 1991; Levinthal & March, 1993; Gibson & Birkinshaw, 2004; Gupta et al., 2006; Cao et al., 2009). Thus, the study builds on the attention-based view and organizational learning theoretical frameworks to unlock the firm's strategic behaviour; specifically, the type of learning orientation given the type of issues and answers they choose to focus on, and whether a combination of the two learning orientations will lead to new products and financial performance.

## **3.4 Conceptual Model**

Through the attention-based view and organizational learning, these frameworks have provided convincing arguments that top management cognition is the foundation of the organizational learning orientation, exposing and selecting the appropriate information to shape the firm's strategic choices. Empirical research has backed up the argument with studies to show that executives play an important role in directing various types of strategic choices, including organizational reorientation (Tushman & Rosenkopf, 1996), new product launches (Eisenhardt & Tabrizi, 1995), and changes in R&D investment strategies (Kor, 2006). The managerial cognition literature has suggested that top managers' cognition is the mechanism driving these effects (for a summary see Huff & Huff, 2000). Although the importance of cognitive effects is apparent, recent studies suggests that it would be important to consider the effects of managerial and organizational effects simultaneously. King and Tucci (2002) and Kaplan (2008) have provided a case that managerial factors moderate organizational level effects on a firm's pace of adaptation to technical change. And McGrath (2001) 's evidence showed that managerial capabilities affect organization-level exploration and learning. From these works, it shows that managerial cognition and organizational orientations are often highly interrelated and to understand firm action in the face of change it is necessary to account

for their interactions. Thus, the alignment of managerial cognition and organizational capabilities provides compelling motivation to examine a firm's strategic choice (Tripsas, 2000).

Despite such a compelling argument, no research systematically relates the effects of CEO attention and information processing capabilities (absorptive capacities) at the organizational level towards innovation strategic outcomes, particularly in the context of SMEs. To explore the possibility, the study crystallised this relationship into a longitudinal process model. As set forth by the attention based perspective and organizational learning, the central take away message of the model is -

“the firm's innovation strategic choices are the result of the distribution of attention at the top of the firm. These attentions determine the firm choices, depending on what issues and answers CEOs are attentive to. The CEO attention on what type of issues and answers depends on the context of the firm and the process of how a firm's rules, resources, and relationships distribute various issues and answers through specific communications and procedures to the rest of the firm”.

Put simply, the underlying model proposes innovation strategies are shaped by how CEOs notice and interpret information, absorb and then translate knowledge into strategic choice.

The conceptual model thus provides a framework to answer the research questions previously outlined:

- Does CEO focal attention relate to a specific type of innovation strategy?
- How does the interplay of CEO focal attention and the firm's absorptive capacity form the basis of a firm's innovation strategy?
- Do innovation strategies relate to new product creativity outcomes?
- How does ambidextrous innovation strategy relate to new product creativity outcome?
- Does new product creativity relate to the firm's financial performance?

The conceptual model presented in Figure 3.1, shows a long journey of how firm innovation and financial performance unfolds over time. Starting in 2003 with information search activities of CEOs, then a year of information processing in 2004; in 2005 and 2006 this information translates to actual strategy implementation, namely exploitation and exploration, with expected strategy results of new product creativity outcomes in 2007. Finally, new product creativity is converted into bottom line financial performance in 2008-2010.

The model has *eleven constructs*; each column ( $t - t_4$ ) represents a time period and works towards the left-hand side of the model. Solid lines signify direct hypothesized relationships; dotted lines signify moderating relationships, namely absorptive capacities, and arrows signify the direction of the relationships. All constructs and relationships will be clarified further in sections 3.5 and 3.6.

### **Relationships explained**

Briefly, the effect of managerial cognition of CEO attention and information processing capabilities towards innovation strategies are described as follows. The greater a CEO's attention orientation toward a specific foci, the more likely the firm will have developed related capabilities, processes, complementary assets, and incentives (Barney 1991) to eventually align the firm to a specific strategic direction. The model does not reveal many of these organizational factors but it proposes that when a firm emphasizes its attention toward *future* events and possesses strong R&D and TMT absorptive capacities, the firm will be more likely to pursue an explorative innovation strategy. Subsequently, it will have a favourable impact on a firm's innovation outcomes. The main reason for this expectation is that the higher allocation of attention to future events "*decreases the likelihood that the firm is preoccupied exclusively with the concerns and issues of the past and present*" (Yadav et al., 2007, p. 87). It increases the firm's ability to anticipate and react to new opportunities and future environmental changes.

On the same line, CEOs who are more focused on objects *external* to the firm foci would be more alert to new opportunities emerging from outside of the firm. Arguably, this allows quicker detection of new technologies and market opportunities. In turn it enables CEOs to anticipate customer needs, market moves, technology trends and competitive actions. Moreover, enhanced awareness and responsiveness to emerging information provide stronger foundation for successful development and more extensive deployment of new innovations (Frambach et al., 2003). Therefore, the study hypothesises that external focal attention will align the firm to implementing an exploratory innovation strategy. In contrast, high focus on *internal* issues and answers within the firm boundary leaves the firm detached from new technologies, and market movements. It insulates the firm from the sense of urgency induced by competitor pressure and customers' changing needs (Narver et al., 2000). However, internal focus facilitates efficiency and incremental improvements of a firm's existing competencies. For these reasons, internal focus is expected to lead the firms to implement an exploitative innovation strategy.

### **Role of absorptive capacities**

Strength in technical knowledge in various areas of the firm is expected to help firms recognize new issues and answers, assimilate them into the organization, and translate it into new product creativity in the face of the fast pace high-tech SME environment. The assimilation and translation of information is the role of *absorptive capacities*, higher levels of general technological knowledge, as measured by R&D spending, to create greater abilities to adapt to new technologies (see Zahra and George 2002 for a review).

### **Innovation strategies and outcomes**

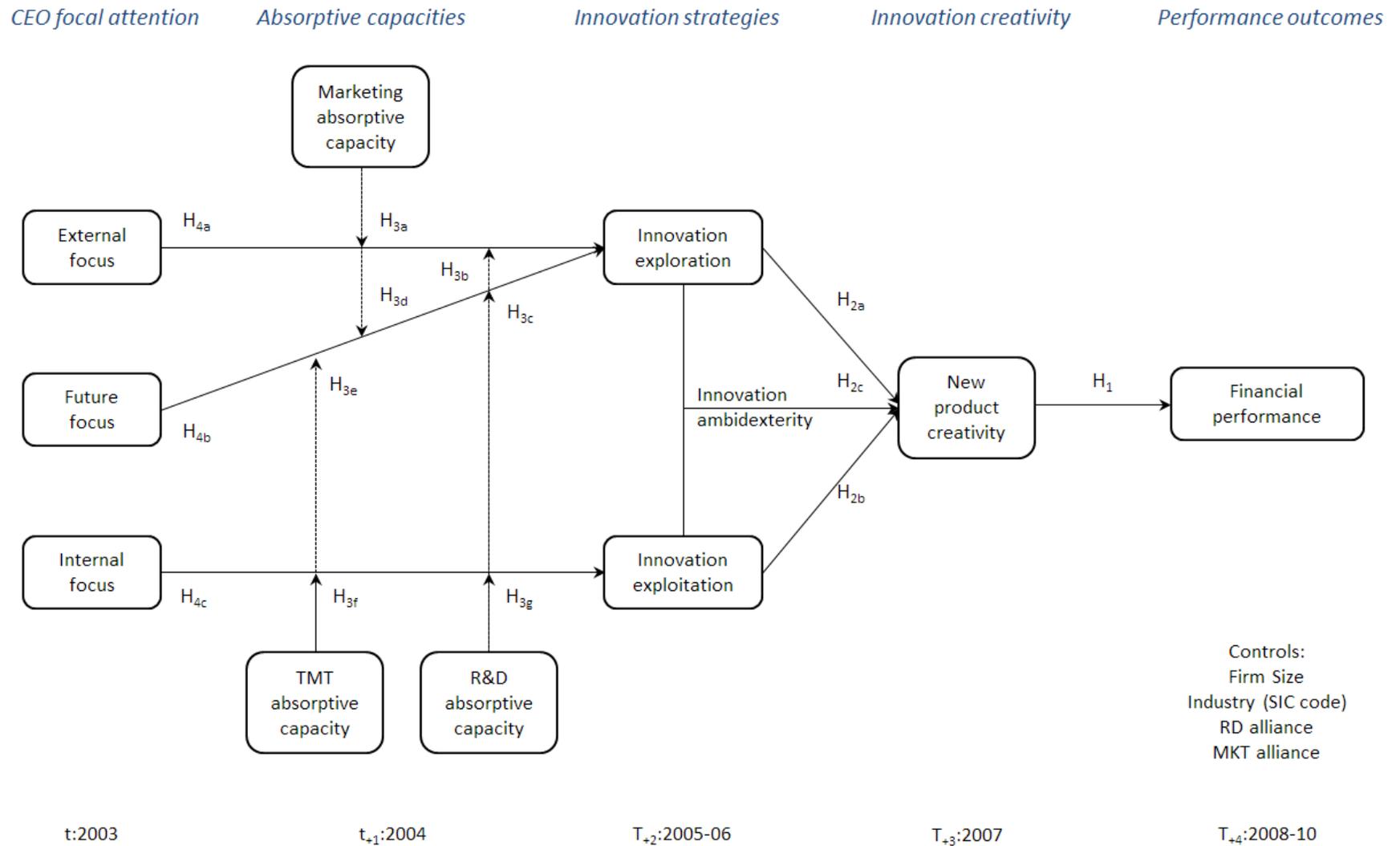
As innovation strategies are shaped by CEOs discretion of attention foci, the model predicts successful new product creativity outcomes when they are implemented *sequentially*, in the order of exploitation in 2005 then exploration in 2006. Research shows that firms may have tendencies to follow just one strategy over a long period of time. Thus, individually, exploration is expected to have a positive impact and exploitation is expected to have a negative impact on new product creativity. However, the high engagement of *exploitation* activities in understanding existing competencies in one period will improve

the effectiveness of *exploration* activities in the next. The sequence will also likely break the success and failure traps, hence, enhance the firm's ability to be effective in both reaching the bottom line and adapting to market changes.

Lastly, the journey of the information comes to fruition as new product creativity in 2007 leads to positive financial performance in 2009. The two year performance lag is explained by the 18-month average length of time the new patent application approval takes.

The next section 3.5 will describe individual variables used in the conceptual model. Section 3.6 will look at the expected independent effects of CEO attention orientations and the interplay with marketing, TMT and R&D absorptive capacities—towards exploration and exploitation strategy—and also consider the expected new product creativity outcome of an ambidextrous strategy.

**Figure 3.1 - Conceptual model**



Note: Hypotheses specifying focal attention interaction terms are not included in this figure

H4d: CEO whose attentional focus is greater toward both external and internal is positively related to innovation ambidexterity

H4e: CEO whose attentional focus greater toward both future and internal is positively related to innovation ambidexterity

In addition, ambidextrous exploration and exploitation is the mean-centred product of innovation exploration and exploitation

## 3.5 Variables Used in the Study

### 3.5.1 Focal Attention

Linked to the attention-based view of the firm, it is necessary to emphasize the *importance of CEOs* and their underlying attentional capacity. CEOs are at the top of the firm and it is in their power or arguably their obligation to set the direction (Hambrick & Mason, 1984) and formulate strategies for the firm. They do so by guiding what information other parts of the firm should receive and how they interpret it (Simons, 1991). In fact, as Ocasio's theory of the firm shows, the way CEOs behave is reflected by their communication and action.

Whether it is substantive or symbolic, their dissemination of communications and activities nurture a pattern of behaviours across operations within the firm (Yadav et al., 2007). Ocasio (1997, p. 188) would attribute such a firm-wide impact to the distinct focus of time and effort on "*a particular set of issues, problems, opportunities, threats..., skills, routines, programs, projects and procedures*" by the decision-makers.

Indeed, the list of accountable issues to decision-makers is not exhaustive and the competition for their attention gets narrower and narrower as we move higher up in the organizations (Simon, 1973; Hambrick & Mason, 1984; Smith & Tushman, 2005). Thus for many firms, scarce resource is no longer "*information*" but the "*processing capacity to attend to information*" (Yadav et al., 2007, p. 85). With competing claims for attention, extensive research explains two processes in *selection* and *expectation* (James, 1890; LaBerge, 1990), to illuminate how people devise their time and effort. Selection is to direct their cognitive resources at particular objects and then engage in a deepened state of anticipation in relation to the focal objects (Posner & Cohen, 1984). These principles and the important role of CEOs suggest that higher attention to particular issues and events can lead to greater awareness, anticipation and responsiveness to these types of issues and events (Bonnell et al., 1987; Downing, 1988; Tushman & Rosenkopf, 1996).

From a sense-and-respond perspective (Srinivasan et al., 2002), research asserts that the mechanisms firms employ to capture insights from the marketplace have significant impacts

on innovation outcomes (Han et al., 1998; Jaworski & Kohli, 1993). Yadav, Prabhu and Chandy (2007) dissect these mechanisms in three categories: detection, development and deployment. They assert that firm awareness in external events and opportunities and the anticipation of future events are crucial to innovation over time, i.e. detecting market signals of new technologies, development of initial product and finally deployment in terms of product improvement and extension strategies after the launch. To achieve this succession flow, CEOs are required to have both temporal and spatial components to increase such awareness. The study argues that choices CEOs make on *spatial attention* (focus on events happening outside the firm) and *temporal attention* (focus on events that have yet to occur) are predictive of a firm's innovation posture/strategy and outcomes. In other words, as proposed in the conceptual model, when CEOs are focused on the future and to the issues and answers externally to the locus of the firm, their communications and actions will shape their directive and distribution of issues and answers towards an explorative innovation strategy. In effect, being future and externally focused leads to faster detection and higher vigilance of new opportunities, and in turn, enables firms to be more explorative in developing innovative products and higher performance based on these new technologies. On the other hand, CEOs focusing attention on internal objects within the boundary of the firm, may not necessarily impede disruptive and novel innovation strategy formulation but are more likely to encourage firms to focus more on detecting, developing technologies and achieving efficiencies by sweating out ideas within the boundary of the firm, i.e. incremental exploitative activities.

#### ***3.5.1.1 Temporal Attention: Future focus***

Drawing from Ocasio (1997), ABV and previous empirical studies, future focus is thereon conceptualised as the amount of time and effort CEOs devote to “noticing and interpreting” events that are yet to occur (Chandy & Tellis, 1998; Yadav et al., 2007). Events in this context are content neutral; the study does not set any a priori restrictions, they simply refer to the temporal discretion exercised by CEOs. When CEOs have a higher focus on the future issues and answers, it decreases the likelihood that the rest of the firm is “*preoccupied exclusively with the concerns and issues of the past and present*” (Yadav et al., 2007, p. 87). As explicit as

it can be, these events are likely to represent actions *to be* taken by the firm, signals of anticipated outcomes of these actions, or developments in general. Research has shown that senior managers often have diverse and contradictory expectations about technological developments in the future, and that these expectations shape their decision making in the marketplace (Chandy et al., 2003). Other research in psychology showed that people in general also exhibit variation in the motivation of future focus (Karniol & Ross, 1996). Norem and Illingworth (1993) explain this variety of motivation as being due to the fact that people often have predisposition to scenarios about the future events and developments. If the divergent expectations of the future apply to CEOs, we expect heterogeneity to exist among firms on the attention they place on actions and other developments that have yet to be realised.

### ***3.5.1.2 Spatial Attention: External and Internal Focus***

Spatial attention is the ability to focus on specific stimuli and it is divided into two groups, external and internal stimuli of the firm. External focus is conceptualised as the amount of attention (focus of time and effort in noticing and interpreting) devoted to issues and events outside of the firm. Internal focus on the other hand is issues and events happening within the firm. It is important to note that the two foci are independent of each other, one type of attentional focus does not necessarily determine the level of the other (Yadav et al., 2007). CEOs have different predispositions and capacities to attend to information (Ocasio, 1997). Over a given period of time, the amount of information they pay attention to will be very different from CEO to CEO. Therefore, CEOs who at their own discretion focus intensively on external issues may exhibit a high or low level of internal issues, and vice versa. For instance, (Miles & Snow, 1978; Sabherwal & Sabherwal, 2007) suggest that different strategy posture adopted by “prospectors” and “defenders” is accompanied (among other factors) by differences related to attentional activities. More specifically, “*prospectors*” tend to seek information about new product-market opportunities, for creating changes and generally seek innovativeness and flexibility in technology (Sabherwal & Sabherwal, 2007). On the other hand, “*defenders*” stress on operational efficiency, economies of scales and are usually

low on product-market dynamism. Defenders do not tend to pursue new and risky opportunities but focus on stability in a few core technologies (ibid).

### 3.5.2 Absorptive Capacities

The concept of absorptive capacity (ACAP) has been used in the past two decades to explain a diversity of phenomena, ranging from technology transfer (Mowery & Oxley, 1995), innovations at national level (Liu & White, 1997) to the efficiency of strategic international alliances (Lane & Lubatkin, 1998; Lane et al., 2001). At the organizational level, ACAP has also been used to analyse innovation processes and the cause-effect of organizational learning on sustaining competitive advantage (Lane et al., 2001; Xiong & Bharadwaj, 2011).

In this study, ACAP is applied at the organisational level to explain the moderating effect of the firms' attentional stance towards exploitative and explorative innovation strategy. It is a powerful concept for studying innovation and appropriate for this study because ACAP integrates both the external dimension of innovation which concerns the evolution of technology and the internal dimension which is the process of learning, knowledge transfer and networking within the organisation. As a major source of competitive advantage (Tsai, 2001; Zahra & Geroge, 2002) it is very important for firms to develop a strong ACAP and balance both external and internal dimensions (Ettlie, 2006). Research found that firms with ACAP supported by novel combination of organisational resources and capabilities are more likely to achieve higher innovation, either in the form of knowledge outputs e.g. scientific, technical or organisational, or commercial outputs e.g. products, services and intellectual property (Lane et al., 2006).

To conceptualise ACAP the theories of Cohen and Levinthal (1989; 1990) have to be reviewed, who are the first and most widely cited authors in this domain. They conceptualised ACAP as a multidimensional construct that has three distinctive components: (i) recognise, (ii) assimilate and (iii) apply external knowledge for commercial ends. Amidst room for refinement and different perspectives, further papers were published to extend the construct (Dyer & Singh, 1998; Lane & Lubatkin, 1998; Van den Bosch et al., 1999; Zahra & Geroge, 2002; Lane et al., 2006). Among these, the biggest extension made is by Zahra &

George (2002) and their re-categorisation of ACAP into four components: acquisition, assimilation, transformation and exploitation. They group these newly formed four components into two fronts of ACAP: potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP). In a similar vein, Lane et al., (2006) distinguish ACAP as an exploratory, transformative and exploitative learning process. As the ACAP concept evolves, it focuses further on the context of knowledge acquisition i.e. PACAP (Zahra & George, 2002) and explorative learning (Lane et al., 2006) because of the important issues raised in cases such as Xerox and Western Union (Sun & Anderson, 2010). Both companies were the first to develop novel technologies i.e. user interface software and Telephony respectively, but it was Apple and AT&T who implemented and captured the benefits (Tushman & O'Reilly, 1996 cited in Sun & Anderson, 2010).

The conceptual model of this study follows such a direction and also supports the view that ACAP as a knowledge exploration process does not guarantee knowledge commercialisation i.e. knowledge exploitation processes. Therefore, ACAP herein is foremost a capacity to explore external knowledge, a predictor of research productivity (Cockburn & Henderson, 1998), innovative outputs (Cohen & Levinthal, 1990) or a *moderator* of an innovative activity (Veugelers, 1997). The thesis's ACAP thus captures Zahra and George's PACAP component of ACAP or the first part of Cohen and Levinthal's conceptualisation to define ACAP as '*the ability of a firm to recognize the value of new external information, assimilate it to apply to commercial ends*' (Cohen and Levinthal, 1990, p. 128). The thesis herein also proposes ACAP as a predictor of innovative strategy formulation and implementation (explorative and explorative innovation) and expects a subsequent impact on new product creativity as illustrated in the model.

As introduced in previous section, the study proposes three types of ACAP, mainly to the reason that almost all previous studies have focused on R&D (Lane et al., 2006; Xiong & Bharadwaj, 2011), largely ignoring the learning process commonly exist in other aspects of the firm. Hence, in addition to R&D, Marketing and TMT absorptive capacity are conceptualised as follows.

**R&D absorptive capacity** is defined as the ability of firms to absorb *technological* and R&D know-how. Strong R&D absorptive capacity facilitates inter and intra-organisational learning, enables firm to assimilate and synthesise new technology knowledge.

**Marketing absorptive capacity** is conceptualised as the efficiency of a firm to absorb *marketing* know-how relative to what it could potentially have absorbed given the resources available. The majority of past literature has exclusively discussed absorptive capacity in terms of absorbing R&D or technological know-how. Marketing absorptive capacity offers an additional dimension to which a firm can absorb knowledge (for further details on the construct and composition see section 5.2).

**TMT absorptive capacity** is conceptualised as the efficiency of a firm to absorb internal *tacit* knowledge relative to what it could have absorbed given the top management team composition and resources it deploys. TMT absorptive capacity also offers a unique and internal dimension to knowledge absorption.

### 3.5.3 Exploration, Exploitation and Ambidexterity Innovation Strategy

#### 3.5.3.1 Innovation Exploration and Exploitation

As the literature review has discussed from the five main organisational ambidexterity research streams, exploration-exploitation innovation strategies present an important and fundamental strategy tension in explaining organizational learning, technological innovation, organizational adaptation, strategic management and organizational design (e.g. Levinthal & March, 1993; Katila & Ahuja, 2002; Benner & Tushman, 2003; Lee et al., 2003; Holmqvist, 2004; Raisch & Birkinshaw, 2008; Belderbos et al., 2010).

However, within this study context of organisational learning, past research has shown that there are two types of conceptualisation. As the literature review has introduced, exploration-exploitation dichotomy can be distinguished either by the *classification of learning* or by the *presence versus the absence of learning*. This study adopts the definition of

the former which has been illustrated by some recent studies (Baum et al., 2000; Benner & Tushman, 2002; He & Wong, 2004). These authors explicitly embrace the idea that exploration and exploitation is associated with different degrees of learning and types of innovation: for example, in Baum et al., (2000, p. 768), exploration refers to “*learning gained through play, planned experimentation and the process of concerted variation*”; and exploitation refers to “*learning gained through local search, experimental refinement and selection of and reuse of existing routines*”. Similarly, Benner & Tushman (2002, p. 679) defined exploration as innovations that involve “*a shift to a different technological trajectory, whereas exploitative innovations involve improvements in existing components and build on the existing technological trajectory*”. In the same fashion, He and Wong (2004, p. 483) defined “*exploratory innovation as technological innovation aimed at entering new product-market domains*” and “*exploitative innovation as technological innovation activities aimed at improving existing product-market domains*”.

Reflecting on the above direction, in this study, innovation *exploration* strategy is defined as the behaviour and orientation of the firm to search, take risks, experiment, innovate and discover new knowledge and opportunities. Innovation *exploitation* on the other hand orientates the organization to behave and formulate strategies towards refinement of existing competencies to achieve efficiency and incremental innovation— staying close to the original work of March (1991).

### ***3.5.3.2 Ambidextrous Innovation***

Ambidextrous innovation strategy occurs when firms combine both elements of exploration and exploitation. It is widely theorized and asserted that when firms achieve a balanced management of exploration-exploitation activities, it will have a positive effect on innovation and subsequently financial outcomes (Raisch et al., 2009). However, past research is unable to provide a clear picture of where the optimum actually is. Given the constraints and impediments of SMEs, the study does not aim to find this point of equilibrium. The study conceptualises ambidexterity as a sequential, cyclical process of exploration and exploitation where empirical evidence has substantiated such an association, but is yet to have empirical

evidence (Winter & Szulanski, 2001; Burgelman, 2002; Rothaermel & Deeds, 2004; Lavie & Rosenkopf, 2006; Venkatraman et al., 2007). These studies show that combining exploration and exploitation sequentially is a common practice for businesses with strong technological orientation. Naturally, the exploration processes of discovering and developing new technologies precedes exploitation processes of commercializing, applying and leveraging new technologies. Nevertheless, in addition to testing sequential ambidexterity, simultaneous ambidextrous innovation strategy will also be examined as part of the extended analysis (see Chapter 8, p.224).

Before defining the concept of sequential ambidextrous innovation strategy, it is important to understand different views of the underlying fundamental trade-offs and which view this study stands by. As the literature review showed, despite the richness in conceptual theories, researchers do not follow a consistent path conceptually, thus this leads to a mismatch in operationalization (Cao et al., 2009). Recently, a few researchers have begun to view ambidexterity as a blend of “balanced dimension” and “combined dimension” to varying extents (e.g., Gibson and Birkinshaw 2004, He and Wong 2004, Lubatkin et al. 2006), but these works have not explicitly distinguished them at the conceptual level, nor have they examined their interrelationship, or their distinct causal mechanisms and differing contingencies with respect to firm performance. Thus, the following distinguishes these concepts into two ambidexterity dimensions, and hopes to provide greater precision to the conceptualization and operationalization of the construct (see Chapter 5).

Firstly, reflecting from the explore-exploit definition previously, one popular view is that exploration-exploitation innovation is opposite to the risk-return expectation, depth and breadth of information processing, and behaviours towards innovation. This view believes that they are seen as *competition* (balanced dimension) because they are two opposing orientations competing for the same resource in an attempt to achieve a balance (March, 1991; Benner & Tushman, 2003; Lavie & Rosenkopf, 2006; Sidhu et al., 2007; Uotila et al., 2009). Failure to achieve a close balance of allocation in firm resources and attention can

leave the risk of competency/product obsolescence (inability to explore) or failure to appropriate (inability to exploit) (Cao et al., 2009).

In the other view, researchers see exploration and exploitation as complementary (in technology and market) and not two conflicting ideologies. Brown & Eisenhardt (1997) and Zollo & Winter (2003) observed that firms may sequentially or rhythmically shift between these two. Burgelman & Grove (2007) found that Intel was actually switching explorative and exploitative processes to support each other. For example, a high degree of focus on exploitation processes was firstly carried out to improve the firm's effectiveness in exploring new knowledge in the following time period. The reason for this *complementary effect* (combined dimension) is two-fold; the repeated use of existing knowledge and resources allows firms to understand better the strength and weakness of their current knowledge and capabilities; subsequently, enabling deeper constructive assessment of existing configuration so that when it comes to any reconfigurations, especially in relation to new discoveries in products and markets, firms would be more capable of recognizing and assimilating new external knowledge (Kogut & Zander, 1992; Fleming, 2001). As an example, Intel's strength in existing knowledge of engineering and market trends in the memory chip business enabled managers to leverage this expertise to identify and take advantage of an early and sustainable benefit in the microprocessor industry (Burgelman, 1994). Therefore, as evidence of rhythmic cycling, exploitation can have a positive impact on developing resources for exploration of new products and markets.

In the reverse sequence, when firms want to *appropriate* the broader product lines they have recently explored, they would sequentially allocate greater effort to exploratory processes prior to exploitation. In this instance, Apple Computer's success with the Ipod, Iphone and Ipad product lines has revitalized the entire Apple brand. Their first phase of innovation is novel with breakthrough products such as Iphones, I pads; however their subsequent upgrade is incremental as they focus on appropriating these wide ranges of products. Thus, successful exploratory processes of wider and innovative product lines allow and improve the breadth and depth of existing exploitation endeavours. This happens

because through exploration, the firm internalizes more external knowledge and resources, thus exploitation can occur in a larger pool of competencies, and efficiency is applied on a greater scale of routines and processes.

Both orders of strategy switching have legitimate arguments, however the study adopts the exploit-explore reasoning because it is more in line with research on technological trajectories (e.g. Tushman and Anderson, 1986; Tushman and O'Reilly, 1997) where patterns of investment in technology-oriented firms closely follow an S-shaped curve. Essentially, firms engage in a high level of investment for R&D of new product designs until they are ready to be commercialized (Chen, 2005). This is followed by a dramatic increase in production as the new innovation is exploited. Eventually, at the top of the S-curve, exploitation of the product becomes saturated and force the innovation cycle repeats anew. Rothaermel and Deeds (2004) found evidence that biotechnology firms were engaging exploration alliances to discover new knowledge, and subsequently establishing exploitation allies to develop and exploit that knowledge.

Reflecting on the fundamental argument of both sequential versus simultaneous and orthogonal versus continuum above, this thesis adopts the view that exploration-exploitation innovation processes are not at the two ends of a continuum but *orthogonal* and *sequential*. This contradicts March's (1991) logic who believes exploration-exploitation are essentially fundamentally incompatible in the long-run. March's logic is in some ways impossible to dispute. However, it is possible to argue otherwise by dissecting the application of March's assumptions. Firstly, he assumes that firm resources are scarce, thus both processes would have to compete to achieve balance. Even though this is mostly true for many organisational resources, not all types are scarce. Some resources such as information and knowledge are infinite (Shapiro & Varian, 1998). Also, firms can access information both from within and outside of the firm (Powell et al., 1996). Therefore, it is possible that exploration and exploitation processes are not in competition with finite resources. In addition to argue against scarcity of resources as well as the mind-sets, when both processes are either loosely connected or connected through standardised interfaces such as Cisco, it is possible and of

practical sense to pursue both exploration and exploitation. Specifically, Cisco as in many technology firms operate in a very competitive short life-cycle products and services market, making it imperative to maintain explorative innovation strategy. At the same time, these radically invented products are manufactured, sold and serviced through a pre-existing commercialisation substructure within the organisation (Rangan, 2005). In other words, over the long-run, to thrive in such a competitive market, Cisco operates on a standardised organisation design where it is possible to engage in both explorative processes as a form of R&D operations, and also exploitative processes as a form of manufacturing, sales, and services. A few other studies have also found the explore-exploit dichotomy to be orthogonal for practical reasons. For example, on similar ground with this study, Baum et al., (2000) see exploitation as learning from its own experience and exploration as learning from others. Both are potentially unlimited, thus they treated the two as orthogonal. Similarly, Beckman, Haunschild and Phillips (2004) treated exploitation as a form of “additional relationships with existing partners” and exploration as “relationships with new partners”; given the relationship number has no defined limit, the two are also treated as orthogonal.

To conclude, despite the conventional trade-off argument between exploration and exploitation, combining the two innovation strategies is achievable and has practical benefits. In particular, sequential cycling of the two fundamentally conflicting processes is more relevant when firms operate in a knowledge-based industry, where the resources are more abundant and perhaps infinite. Also, when firm operations are loosely connected or connected in a standardised interface (with subsystems or departments), in such cases, exploration and exploitation will generally be orthogonal (Gupta et al., 2006). Therefore, innovation ambidexterity in this study is referred to as the combination of exploitation and exploration whereby innovation exploitation is performed in one period and innovation exploration in the next, alleviating some of the resources and administrative drawbacks of a simultaneous approach.

### 3.5.4 New Product Creativity

Creativity as a general construct has been researched widely in the fields of psychology, organizational behaviour and marketing. From individual to organization and country level analysis, creativity has been conceptualised accordingly as (i) new ideas that are generated by personality traits at the individual level, (ii) as a process of generating new ideas, (iii) as an outcome of creative processes, and (iv) as an environment conducive to new ideas and behaviour (Rhodes, 1961; Im & Workman, 2004). These four perspectives led to multiple definitions of creativity. For Martins and Terblanche (2003), creativity is the capacity of a firm to generate new and valuable ideas for products, services, processes and procedures. As an output of the marketing process, creativity in the marketing department represents the meaningful marketing program deviation from common marketing practices in product or services categories (Andrews & Smith, 1996). For Sternberg (1999), creativity is the ability to produce work that is both novel (i.e., original) and appropriate (i.e., useful). For Amabile (1996), it is the set of qualities of products or responses that are judged to be creative by appropriate observers. Creativity is a complex and diffuse construct, difficult to define consensually (Sternberg, 1999). Thus this may explain why the constructs have not been studied as much as other organisational outcomes such as new product development or financial performance.

Drawing from management and marketing literature (e.g., Amabile, 1983; Andrews & Smith, 1996; Sethi et al., 2001) and adopting the 'output perspective' of Amabile (1983), creativity is viewed as an outcome of creative processes of the organisation. These processes are at the fuzzy front end where idea generation comes before structured development processes (Koen, 2004). It is often chaotic, unpredictable, unstructured and inexpensive compared to later stages of the product development process (i.e. new product development and commercialization); thus an organisation can reap early benefits by maximizing its output: *'the greater the number of ideas at the start of the new product development process, the greater the probability of successful products'* (Flynn et al., 2003). In this study, creativity is

conceptualised as *"the consequence of a number of organisation processes that result in an ability for the organisation to commercialise ideas into new products"*.

### 3.5.5 Financial Performance

There are numerous financial performance constructs including return on equity (ROE), return on assets (ROA) and sales growth to name a few. Academic researchers and industry analysts have recently favoured using a cash flow measure of financial performance against earnings based metrics (Dechow et al., 1998; Kroll et al., 1999; Vorhies et al., 2009). The study chooses to use operating cash flow as the main financial performance for the base model analysis. The reason for using cash flow is because it is by far the most objective measure of financial performance. Unlike profit measures, it is not susceptible to manipulation such as accrual accounting methods and may be less sensitive to commonly used accounting manipulation. Other financial measures outside of the financial account such as Tobin's Q are also deemed to not fit. The reason being such a measure is stock-market based and they are forward-looking indicators containing the assessment of public firms' future financial results from current technological activities. This assessment is made by the stock market, and fundamentally by expectations of individual investors. Hence, cash flow would capture more of the variation in organizational performance than other accounting-based measures (Otley & Fakiolas, 2000). As a dependent variable of creativity, which is innovation at the fuzzy front end, the study will use subsequent two-year cash flow to account for the lagged effects of creativity turning into cash. This also reflects the average length of patent application pendency, which is 24.6 months (USPTO, 2003).

## 3.6 Hypotheses

### 3.6.1 Relationship between Focal Attention and Innovation Strategy

#### **The relationship between future attention focus and explorative innovation**

CEOs focus of attention is a critical driver to innovation; it builds awareness and foundation for acting on innovation strategies. Given that players within the firm compete for CEOs attention, CEOs that place emphasis toward future events are more likely to pursue an explorative innovation strategy, and consequently will have a favourable impact on a firm's

innovation outcomes. The main reason for this expectation is that higher allocation of attention to future events “decreases the likelihood that the firm is preoccupied exclusively with the concerns and issues of the past and present” (Yadav et al., 2007, p. 87). Prioritising attention to the needs of today, although vital for sustaining the standards a firm may have accomplished, is less likely to facilitate long-term explorative activities and subsequently unlikely to serve as a basis for innovation (Chandy & Tellis 1998). Benner and Tushman (2003) and He and Wong (2004) found that a focus on current processes and responding to existing environmental demands are essential for short-term returns, however it decreases the firm’s ability to react to radical new opportunities and future environmental changes. Ironically, Christensen (1997) found that an extreme focus on what currently makes a firm effective may actually be a recipe for failure in subsequent periods.

Thus, the thesis argues that firms that pull away from current needs will experience increased awareness of technology foresight and economic forecasts that leads to better preparedness for the changes in the technological landscape. More specifically, CEOs greater focus on the future allows firms to do more experimentation, innovation and discovery of opportunities. From a process view, in turn, this will lead to faster detection and higher vigilance of new opportunities. Furthermore, future focus involves long-term planning and preparation, thus it will also enable firms to be more explorative in development of innovative products and subsequently with higher returns in product deployment based on these new technologies. Therefore:

*H4c: CEO future attention focus is positively related to innovation exploration*

#### **The relationship between external attention focus and explorative innovation**

A higher level of external focus is expected to provide strong rationality on managerial formulation of explorative innovation strategy. CEOs who are more focused on objects external to the firm foci would be more alert to new opportunities emerging from outside of the firm. Along the same lines, an explorative innovation activity involves discovering and experimenting with new unique ideas. Thus external focus and exploration orientation match. CEOs who are externally focused are more likely to be engaged in activities that

require being vigilant to customer feedback so that market insights of articulated and unarticulated needs are more thoroughly listened to. They are also more likely to be engaged in technology led events such as road mapping, cross business and tech-community meetings. As a result, the engagements allow quicker detection of new technologies and market opportunities provide a suitable platform for explorative innovation activities to anticipate, test and act on customer needs, market movers, technology trends and competitive actions. Furthermore, enhanced awareness and responsiveness to emerging information provides a stronger foundation for successful development and more extensive deployment of new innovations (Frambach et al., 2003). Therefore, the study hypothesises:

*H4a: CEO external attention focus is positively related to innovation exploration*

#### **The relationship between internal attention focus and exploitative innovation**

In contrast, although a heightened internal focus stance may facilitate innovation by the firm making the most of available resources and sweating out existing options, it is unlikely to support innovation outcome that involves new opportunities with which the firm has partial or no previous experience (Tripsas & Gavetti 2000). The reason being, new opportunities are usually noticed and captured through ample sources such as interactions with customers, suppliers, competitors and other external entities (Hurley & Hult, 1998; Frambach et al., 2003; Perry-Smith & Shalley, 2003). Limited interactions with these external entities insulate the firm against exchange of new ideas on technologies and market movements, leaving the firm vulnerable to respond to new opportunities. It also insulates managers from a sense of urgency in the market place such as the pressure from competitive entry or customer need changes (Narver et al., 2000). Besides the exceptions, in most cases even when the majority of new ideas come from within the firm, limited interactions with external entities will leave new ideas unfavourable for subsequent development into something new, disruptive and novel. As mentioned, market and technology insights such as customer feedback from explorative activities are most likely to be missed. Heighted focus internally is argued here to be detrimental to innovative development, deployment and long-run pursuit to explore new

opportunities. For these reasons, the study argues that CEOs who are more attentive to internal issues within the firm are more likely to gear towards exploitation of old certainties. These CEOs are more interested in risk-adverse activities, efficiency building and refinement of existing processes. Any activities involving taking risk, experimenting with innovative ideas are thus considered irrelevant. The path of the exploitation innovation strategy is logical and appropriate with firms that tend to innovate using existing options they have already mastered. Hence:

*H4b: CEO internal attention focus is positively related to innovation exploitation*

As hypothesized, internal focus is positively related to exploitation and external and future focuses are positively related to exploration. Thus as an additional analysis, the study also hypothesises the interaction effect of the focal attention:

*H4d: A CEO whose attention focus is greater toward both external and internal is positively related to innovation ambidexterity*

*H4e: A CEO whose attention focus is greater toward both future and internal is positively related to innovation ambidexterity*

To summarise, the study posits a lag cause-effect link between a CEO's attentional stance and innovation strategy posture. Specifically, the study argues that high CEO attention focus on the future and external issues lead to explorative innovation strategy formulation. In contrast, a heightened internal focus leads to more incremental exploitative innovation.

### **3.6.2 Relationship between Absorptive Capabilities and Innovation Strategies**

#### **Marketing absorptive capacity moderates external focal attention and exploration innovation strategy posture**

A small and medium enterprise with strong marketing absorptive capacity is more likely to be receptive to marketing knowledge, more likely to develop and enhance its own marketing capabilities through the transfer of knowledge. This is particularly plausible when its marketing alliance network is extensive; firms will be far less dependent on other entities in

terms of distribution channels, marketing support, and partners' brand. However, at the same time they would hold higher bargaining power in marketing alliance cooperation, for instance when it comes to allocating a fair share of equity in cobranding or other marketing cooperation arrangements.

Marketing absorptive capacity has been found to have an impact on the innovative output of the firm, especially for firms with a strong technological base (Dutta et al., 1999). As previously outlined, the study hypothesises that firms with CEOs who are externally focused are in a more favourable position to follow an explorative strategy. Given that the orientation towards customers and competitors is one of the most fertile sources of ideas for innovation (ibid), a strong marketing absorptive capacity would enable firms to take advantage of this new idea generation and subsequently process them to develop more innovative products and technologies. Thus, firms may look externally for new ideas and network with alliances but they will need marketing absorptive capacity to leverage that.

*H3a: Under the condition of high marketing absorptive capacity, the positive relationship between CEO external attention focus and innovation exploration is greater*

**R&D absorptive capacity moderates both relationships between CEOs' external focal attention to exploration innovation strategy and internal focal attention to exploitation innovation strategy.**

R&D absorptive capacity in the context of high technology markets is known to have critical importance to superior firm performance (Dutta et al., 1999). In these markets, product and services life-cycles are usually shorter and the rate of new technology generation is high. Thus R&D absorptive capacity helps to quickly and effectively process and transform the new knowledge acquired and subsequently facilitate innovative strategy implementation, shortening the journey of converting ideas into products. Firms may look externally for ideas to experiment or innovate radically, but they will need R&D absorptive capacity to leverage these ideas. Similarly, searching for ideas internally to refine or improving existing systems will also need R&D absorptive capacity to turn ideas into actionable plans. Therefore, R&D

absorptive capacity enhances the relationship between external (internal) attention focus and explorative (exploitative) innovation strategy. Formally,

*H3b: Under the condition of high R&D absorptive capacity, the relationship between CEO external attention focus and explorative innovation strategy is greater.*

*H3c: Under the condition of high R&D absorptive capacity, the relationship between CEO future attention focus and explorative innovation strategy is greater.*

*H3g: Under the condition of high R&D absorptive capacity, the relationship between CEO internal attention focus and exploitative innovation strategy is greater.*

### **TMT absorptive capacity moderates the relationship between future and internal attention and innovation strategies**

Innovative ideas can come from diverse sources but at the heart of a firm, senior employees are the prime source for inspiration of new ideas and directions. Their influence is critical for firm innovativeness and firm performance because innovative strategies are shaped at the top management level (Talke et al., 2011). Hambrick and Mason (1984) argued that firms perform at varied levels because of the different strategic choices they make, but ultimately these choices are a result of their idiosyncratic TMT composition. A commonly examined aspect of TMT composition is diversity, defined as the degree to which TMT members differ with respect to background characteristics such as functional experience, age, and tenure (Bunderson & Sutcliffe, 2002; Bunderson, 2003; Carpenter et al., 2004).

The composition of TMT in this study is differentiated by the level of remuneration, age and tenure diversity (for more details on each component see chapter 5). Individually, the amount of *remuneration for the top management team* reflects the quality of TMT human capital and the commitment of the firm to invest in it, thus a high amount of investment implies high capacity of TMT to absorb know-how to apply to commercial ends i.e. maximising profits. Executive age and tenure at the absolute level have also been found to convey human resource quality and reflect the amount of experience and overall organisational tenure of executives (Wei et al., 2003) or tacit knowledge since the longer

their experience on the board within the firm, the higher the tacit knowledge they possess. In fact, executive age was related to firm performance (Wei et al., 2003) and tenure was related to team performance in terms of efficiency (Bell et al., 2011). However, no performance-related evidence has been found on firm level performance mainly because of the varied conceptualisation (Hambrick & Mason, 1984).

*TMT diversity* on the other hand has been found to facilitate proactive innovation orientation of the firm (Talke et al., 2011) towards an innovation strategy that addresses emerging, latent customer needs and/or more open to new technologies. This strategic stance increases the firm's new product portfolio innovativeness (Talke et al., 2011) and subsequently leads to higher firm performance. TMT diversity has varied measurement constructs (Talke et al., 2011; Simons et al., 1999), but can be understood as heterogeneity of the TMT's educational, functional, industry, or organisational background; together these often represent the level of cognitive heterogeneity in TMTs (Hambrick & Mason, 1984). The important factor is diversity leads to information variety, alternative views and innovative posture (Milliken and Martins, 1996). Heterogeneity of education leads to diversity of knowledge bases; this variety of access of knowledge bases enhances the creation and combination of new knowledge. Functional diversity is found to positively associate with information sharing when TMT has wide-ranging experience in functional areas within the organisation (Bunderson & Sutcliffe, 2002). This reduces group thinking in the heterogeneity group (Hambrick & Mason, 1984) and allows greater information use (Hinds & Mortensen, 2005). Like executive age and tenure and other research, TMT diversity and general group work diversity subjects are described as a "two edged sword" (Milliken & Martins, 1996) or "mixed blessing" (Williams & O'Reilly, 1998) because their theory hypotheses are both constructive and destructive (positive and negative) to performance.

In this study TMT absorptive capacity is measured as the efficiency to maximise profit from the combination of all the above separate components. Secondly, these are internal resources with little information sharing with external entities unlike marketing and R&D

function; therefore, high TMT absorptive capacity is expected to improve the relationship between future, internal attention and exploitative and explorative innovation.

*H3e: Under the condition of high top management team absorptive capacity, the relationship between CEO future attention focus and explorative innovation strategy is greater.*

*H3f: Under the condition of high top management team absorptive capacity, the relationship between CEO internal attention focus and exploitative innovation strategy is greater.*

As there are many relationships and hypotheses linking absorptive capacities and innovation strategies and their moderation effects, for clarity the hypotheses are summarized with key variables highlighted in bold:

*H3a: Under the condition of high **marketing** absorptive capacity, the positive relationship between CEO **external** attention focus and innovation **exploration** is greater*

*H3b: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **external** attention focus and **explorative** innovation strategy is greater.*

*H3c: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **future** attention focus and **explorative** innovation strategy is greater.*

*H3d: Under the condition of high **marketing** absorptive capacity, the relationship between CEO **future** attention focus and explorative innovation strategy is greater.*

*H3e: Under the condition of high **top management team** absorptive capacity, the relationship between CEO **future** attention focus and **explorative** innovation strategy is greater.*

*H3f: Under the condition of high **top management team** absorptive capacity, the relationship between CEO **internal** attention focus and **exploitative** innovation strategy is greater.*

*H3g: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **internal** attention focus and **exploitative** innovation strategy is greater.*

### 3.6.3 Relationship between Innovation Strategies and New Product Creativity

#### **Innovation Exploitation – Exploration to New product creativity**

Evidence on the impact of exploration and exploitation innovation strategy individually on a firm's outcomes are abundant and fairly consistent. Scholars argue that over time key decisions at the corporate strategy level are positively related to the division of attention and resources between explorative and exploitative activities (e.g., Levinthal and March, 1993; McGrath, 2001; He and Wong, 2004; Jansen et al., 2006; Uotila et al., 2009; Belderbos et al., 2010). By reducing change or focusing on efficiency, firms are more likely to strategize to improve the effectiveness and efficiency of existing core capabilities. This improves adaptation to current environments and leads to positive short-term performance effects. For example, Jansen (2006) found that firms that pursue exploitative innovation are more effective in highly competitive environments, whereas exploration innovation strategists fare better in dynamic environments. March and Levinthal (1993) suggest, however, the positive effect of the exploitation strategy comes at the expense of long-term performance. Exploitation focus can trigger a success trap. Temporally, existing core capabilities become core rigidities, whereby the emphasis on exploitative activities reduces the firm's ability to adapt and respond to significant or fast environmental changes such as industrial and technological changes. Therefore, the success trap threatens the long-term survival of the firm (Christensen and Overdorf, 2000; Leonard-Barton, 1992). In contrast, when considering firms that primarily pursue exploration, in the long-run, it can equally be detrimental to the firm's performance outcomes. This occurs with a reinforcing iterative cycle in which "exploration failure leads to search and change, which leads to failure, which leads to more search and so on" Levinthal and March, 1993, p. 105–106). It is therefore argued that in the short-term, firms that are able to pursue an explorative innovation strategy will be able to generate higher new product creativity and an exploitative innovation strategy will be less able. Formally:

*H2a: A firm's innovation exploration strategy is positively related to new product creativity*

*H2b: A firm's innovation exploitation strategy is negatively related to new product creativity*

### **Ambidextrous Innovation Strategy to New product creativity**

As reviewed, ambidexterity does not guarantee success and its implications are still inconsistent. However, authors can agree theoretically that successful combination of the paradoxical exploitation and exploration activities increases the possibility of being able to shape the evolution of the firm (O'Reilly & Tushman, 2004; Tushman, 1997). And it is widely accepted that managing the combination of the two strategies is necessary to achieve optimal performance (e.g. Benner and Tushman, 2002, 2003; Gupta et al., 2006). He and Wong (2004) were the first to test the ambidexterity hypothesis and found a positive effect on sales growth and that any imbalance between the two would yield negative growth. A recent study found an inverted U-shaped relationship between a firm's market value and exploration orientation (Uotila et al., 2009), providing further evidence of the need to align exploration and exploitation activities.

Whilst studies on the impact of exploitation and exploration innovation on creativity are scarce, particularly the sequential temporal cycle, suggestions have been made that firms should temporarily cycle through periods of exploration (Brown & Eisenhardt, 1997; Siggelkow & Levinthal, 2003; Venkatraman et al., 2007). To the best of the author's knowledge, despite little empirical evidence of such an association, there is sufficient evidence and rationality to hypothesise that the sequential combination of the two has a positive impact on innovation outcome i.e. new product creativity. With respect to the sequential combined temporal ambidexterity, underlying the argument is the idea that exploration and exploitation activities are not necessarily in competition, i.e. complementary in technologies and market (Gupta et al., 2006). Thus, great effort in explorative innovation processes in one period can often improve subsequent effectiveness of exploring new knowledge and reconfiguration of existing competences in support of new products and markets. The reason is illustrated by how Intel's existing knowledge in engineering market enabled managers to identify and seize early advantage in the microprocessor industry (Burgelman, 1994). Thus, the proficiency in exploitative processes will better facilitate

exploration in the following period. In addition, because sequential switching of exploration-exploitation activities breaks the firm's self-reinforcing iteration in the short-term "success trap" (exploitation drives out exploration) and long-term "failure trap" (failure of new idea leads to searching for newer ideas), it is more likely to ensure the firm evolves with changes in the market whilst maintaining the efficiency of the current core capabilities. Therefore, the study proposes that because organizational knowledge and resources can often be effectively leveraged across both types of activities, exploratory and exploitative processes complement each other and lead to enhanced firm new product creativity.

*H2c: The cyclical ambidexterity of exploitation and exploration is positively related to new product creativity*

As an additional analysis, simultaneous ambidexterity hypothesis and other alternative models are also performed (See Chapter 8 – Extension analysis for more information).

### **3.6.4 Relationship between New Product Creativity and Firm Performance**

New product creativity is an outcome of the organization's creative process. This process is at the fuzzy front end where ideas generation come before structured development processes (Koen, 2004). It is often chaotic, unpredictable, unstructured and inexpensive compared to later stages of the product development process (i.e. new product development and commercialization), thus organisations can reap early benefits by maximizing their output: *'the greater the number of ideas at the start of the new product development process, the greater the probability of successful products'* (Flynn et al., 2003). The logic follows that only one in five promising ideas make it past the various idea funnelling stages to eventual products in the pharmaceutical drug industry (Chandy et al., 2006). Although the odds can vary substantially across industry and firms, surprisingly, meta-analysis findings suggest there is no direct effect of product innovativeness on product financial performance (Henard & Szymanski, 2001). However, one of the reasons is most likely due to contingences related to different operationalization and contextual factors

(Szymanski, Kroff & Troy, 2007). Thus, despite the empirical results, there are considerable reasons to believe that the relationships between new product creativity and firm financial performance should be statistically significant. The rationale of supporting such a positive connection suggests the creativeness, newness or uniqueness of an idea can bring greater opportunities for differentiation and thus be patentable, and in the long run provide the basis for sustainable competitive advantage over competitors (Kleinschmidt & Cooper, 1991; Song & Parry, 1996). In addition, commercial value of research and development activities was suggested to be associated with the number of products introduced to the market (Katila and Ahuja, 2002). Although not a direct inference to new product creativity and financial outcome, as a relevant metric for highly innovative firms, the number of new products introduced into the market has been associated with sustained growth, profitability, and survival of such firms (Schoonhoven et al., 1990). New product creativity of this study represents the *“consequence of a number of organisation processes that result in an ability for the organisation to commercialise creativity into a new product”*. Patent applications are unique from those used in the past, thus the higher the innovativeness outcome of the patented idea and the higher the volume of the idea the more transferable it is to a number of products, hence higher product creativity, productivity and consequently financial performance. Hence:

*H1: New product creativity is positively related to lag financial performance.*

### **3.7 Concluding Remarks and Summary of Hypotheses**

This chapter has examined the theoretical framework, of how firms focus their attentions, utilise differential information processing capabilities to engage in exploitation, exploration or both, through the lenses of Attention-based View and Organizational Learning.

Attention-based view explains the effect of cognitive behaviours of CEO on strategic choices. It unearths the fundamental question of strategic management which is *“how do CEOs make strategic choices?”* it also helps to answer the research question of the thesis by providing a process-based model of how firms behave that integrates the understanding of individual

cognition, organization structure and strategy formulation. The thesis draws upon this theory to study the conceptual model of how firms' attentional focus and information processing capabilities interact to shape exploration, exploitation and ambidextrous innovation strategies to eventually explain new product creativity.

Complementary to the attention-based view, organizational learning theory asserts that the outcome of information search and attention can lead to two forms of learning: Explorative and Exploitative. Understanding the learning outcomes thus helps firm to make an appropriate strategic choice of exploration and exploitation; as a central dilemma of corporate strategy, it gives answers to what choices management can make, how much to invest in different types of activities in order to sustain long-term performance. We learned from the literature that despite exploitation and exploration are markedly different classifications, applications and implications, scholars can agree on one point: that a well-balanced combination of the two types is essential for sustained organisation success. Thus, the study builds on the attention-based view and organizational learning theoretical frameworks to unlock the firm's strategic behaviour.

The conceptual model is then developed to address the gap in the theoretical and empirical studies. It combines ambidexterity elements reviewed previously to propose a multi-stage journey of how information is selected, focused, processed, implemented to shape innovation strategies and subsequently used to generate new product creativity and financial performance.

Following the conceptual model, key constructs were described. Finally, specific research hypotheses formulated which are summarised as followed

*H1: New product creativity is positively related to lag financial **performance***

*H2a: A firm's innovation **exploration** strategy is positively related to new product creativity*

*H2b: A firm's innovation **exploitation** strategy is negatively related to new product creativity*

*H2c: The **cyclical ambidexterity** of exploitation and exploration is positively related to new product creativity*

*H3a: Under the condition of high **marketing** absorptive capacity, the positive relationship between CEO **external** attention focus and innovation **exploration** is greater*

*Explore H3b: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **external** attention focus and **explorative** innovation strategy is greater*

*H3c: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **future** attention focus and **explorative** innovation strategy is greater*

*H3d: Under the condition of high **marketing** absorptive capacity, the relationship between CEO **future** attention focus and explorative innovation strategy is greater*

*H3e: Under the condition of high **top management team** absorptive capacity, the relationship between CEO **future** attention focus and **explorative** innovation strategy is greater*

*H3f: Under the condition of high **top management team** absorptive capacity, the relationship between CEO **internal** attention focus and **exploitative** innovation strategy is greater*

*H3g: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **internal** attention focus and **exploitative** innovation strategy is greater*

*H4a: CEO **external** attention focus is positively related to innovation **exploration***

*H4b: CEO **future** attention focus is positively related to innovation **exploration***

*H4c: CEO **internal** attention focus is positively related to innovation **exploitation***

*H4d: A CEO whose attention focus is greater toward both **external** and **internal** is positively related to innovation **ambidexterity***

*H4e: A CEO whose attention focus is greater toward both future and internal is positively related to innovation **ambidexterity***

# Chapter 4 – Epistemological Approach and Research Design

## 4.1 Introduction

The aim of this chapter is to create a connection of the conceptual model hypothesis with the empirical results presented in chapters 6 and 7. Chapter 4 introduces the research principles in terms of what major scientific research paradigms to follow and then describes the research design used to collect data.

It is structured around three major topics of methodology: (i) the research philosophy, (ii) the identification of research strategy and designs, and (iii) the choice of research methods. Data analysis methods will be explained in chapter 5. The selection of these methodologies is fundamental to any study; it drives the types of research questions that can be resolved and the nature of the evidence generated. It will also determine what implications the research outcomes can have, for example the possibility of generalisation of findings if a positivist approach was followed, whereas this may not be even a purpose for interpretivist studies (Schofield, 1993).

## 4.2 Research Questions Revisited

At this point it would be worthwhile to provide a summary reminder of the research questions that will guide conceptual development. This will also serve as a useful reference point to these research questions rather than having to refer to separate sections in chapters 2 and 3 to review the questions. The research questions identified in Chapter 2 were:

- Does CEO focal attention relate to a specific type of innovation strategy?
- How does the interplay of CEO focal attention and the firm's absorptive capacity form the basis of the firm's innovation strategy?
- Do innovation strategies relate to new product creativity outcomes?

- How does ambidextrous innovation strategy relate to new product creativity outcome?
- Does new product creativity relate to the firm's financial performance?

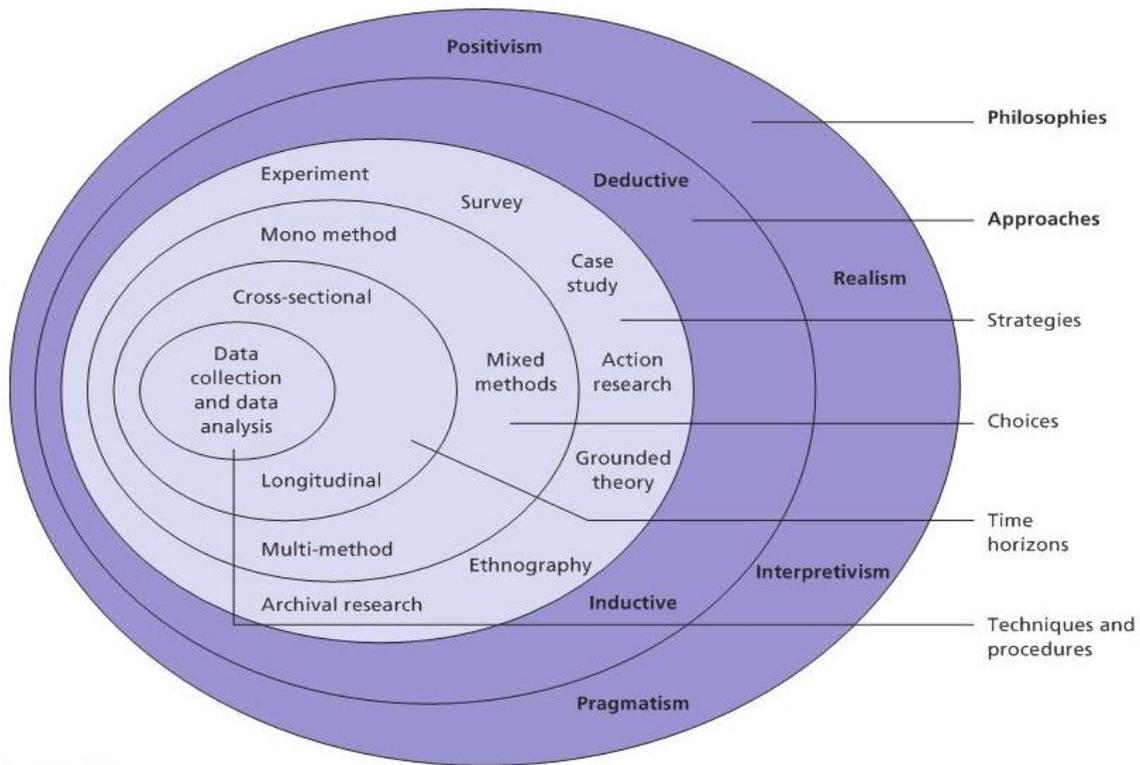
## 4.3 Research Philosophies

The adoption of a research philosophy relates to the way in which the researchers view the world. It guides the choice of research strategies, designs, techniques and has significant impact on not just what researchers ought to do but more importantly what researchers have to understand about what they are investigating (Lee & Ian, 2008).

### 4.3.1 Approaches to Research Philosophies

The research 'onion' in Figure 4.1 shows six layers of research one must peel to conduct research appropriately. Crotty (2007) narrowed them down to epistemology, theoretical perspective, methodology and methods. It may seem straight forward to follow however it is unavoidable sometimes to fall into the trap of thinking one perspective is 'better' than another. The steps show choices and paths to research different things 'better' and 'better' here depends greatly on the research question(s) at hand. In practice, a particular research question may not fall perfectly into only one philosophical domain. Thus, each layer will be explained to clarify the options and its implications on the research at hand.

Figure 4.1 - The research 'onion'



Source: Saunders et al., 2008 p.108

Firstly, *ontology* concerns how the researchers assume the world operates or 'the nature of reality' (Lee & Ian, 2008). The central question here is whether social entities exist in reality external to social actors or social phenomena are created from the perceptions and consequent actions of social actors (ibid). These form two aspects of ontology *objectivism* and *subjectivism* respectively. Deriving from ontology is *epistemology*, a branch of philosophy that enquires what constitutes knowledge or 'how do we know what we know?' Epistemology legitimises knowledge or provides the credibility and framework for the research methodologies that aim to produce valid, reliable/replicable and representative answers. In other words, ontology is the 'reality', epistemology is the relationship between reality and the researcher, and methodology is the techniques and procedures employed by the researcher to investigate 'reality' (Healy & Perry, 2000). Thus the stages of 'peeling' the onion to get to data and analysis of the study is an iterative process, where initial decisions

made on the ontological layer inform one's epistemological stance and similarly establish a context in which the methodology is conducted.

### 4.3.2 Research Paradigm

To draw this section on philosophies together, Guba and Lincoln (1998) distinguished four major research paradigms: positivism, realism, interpretivism, and pragmatism, as shown in the most outer layer of the onion. Table 4.1 explains these paradigms in terms of the research 'onion' layers described previously.

**Table 4.1 - Four research philosophies in management research**

	<b>Positivism</b>	<b>Realism</b>	<b>Interpretivism</b>	<b>Pragmatism</b>
<b>Ontology:</b> <i>The researcher's view of the nature of reality or being</i>	External, objective and independent of social actors	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question
<b>Epistemology:</b> <i>The researcher's view regarding what constitutes acceptable knowledge</i>	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements	Observable phenomena provide credible data, facts. Insufficient data Means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a	Subjective meanings and social phenomena. Focus upon the details of a situation, a reality behind these details, subjective Meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the

		context(s)		data
<b>Axiology: The researcher's view of the role of values in research</b>	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
<b>Data collection techniques most often used</b>	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple method designs, quantitative and qualitative

Source: Saunders et al., 2012 p. 140

Selecting a particular epistemological position for the study is a delicate decision and could even be a misconception as there is a tendency to draw on beliefs from numerous epistemologies which might be in a competitive ring with each other (Bryman & Bell, 2007). As Deshpande (1983) adds, researchers have a tendency to categorise as if epistemologies are independent and mutually exclusive. The task gets harder over time as epistemologies evolve and the lines between various philosophies become increasingly hazy. A glance at Table 4.1 demonstrates the difficulty inherent in distinguishing each school clearly. Moreover, this table does not include many others such as hermeneutic, critical theory or post-modernism. Reichardt & Cook (1979) categorise quantitative epistemologies by deduction, verification and confirmation of theories whereas qualitative epistemologies stress induction, exploration and discovery of theories. As researchers would treat these choices exclusively, one can argue that the researchers are in fact dealing with a philosophical continuum that stretches from positivism to idealism. To fully appreciate the diverse ideologies and to reap the benefits of adopting multiple epistemologies without creating inconsistent and conflicting research methodologies, this thesis employs a combination of qualitative and quantitative epistemological positions.

The reasons for the chosen perspective are firstly, human beings and organisation structures are dynamic and far more complex than the quantitative approach or scientific approach alone may appreciate (Burns, 2000), hence not all events and phenomena can be quantified and accounted for in observable metrics. Secondly, on the other hand, employing the qualitative approach alone eliminates some capabilities of the consequent methodologies to provide validity and reliability to the result. Any desire to make inference cannot rely on subjective interpretation alone. In addition, adopting qualitative epistemologies alone will unfavourably mean more constrained methodology due to the large amount of time required to study reactions and interactions of the subject holistically (ibid). For these reasons, combining elements from both epistemologies will help to deliver a more profound understanding and implementation of the research whilst maintaining validity and reliability.

To conclude, this thesis appreciates the complementary benefits of a multi-method research; it however, acknowledges that one cannot entirely claim objectivity or definitivism of any verification made by the study. Therefore, I fully appreciate the nature of knowledge and theory, and any findings and contributions to research will enhance the richness of existing literature; but perhaps more importantly discover insightful questions that can be asked in future investigations.

Table 4.2 (next page) explains the various epistemological perspectives that might be argued as pertinent to the prior identified research questions this thesis seeks to tackle. All perspectives have been highly criticised and have subsequently witnessed evolution both in their meaning as well as outlook on knowledge creation. This, however, has proceeded to the point where the philosophy of science is arguably suffering from a loss of direction as to how to understand the creation and constitution of knowledge (please see Delanty, 2000).

From Table 4.2, it may be legitimately reasoned on available evidence that no one epistemological stance defeats all others as each has its own advantages and limitations. In fact it is accepted that no methodology is epistemically superior and that all are partial and fallible modes of engagement (Johnson & Cassell, 2001). There is such a fuzzy line between

choosing one over another thus there is a need to consider alternative epistemological foundations in social science research (Davies & Fitchet, 2005). However, authors reject viewing different paradigms as fixed choice alternatives. A number of researchers (Hassard, 1991; Lowe et al., 2005) suggest that multiple paradigm research if operationalized successfully may indeed improve learning and develop analytical skills. For example, critical theory/science aims to produce a particular form of knowledge that acknowledges the various ways in which knowledge is distorted (Carr, 2000; Cox & Hassard, 2005). In other words, a theory is only critical if it explains what is wrong with social reality, identifies actors to change it and provides clear norms for criticism and practical goals for the future (Carr, 2000). Consequently, the focus of critical theory is not to mirror reality as it is, but to change it, unlike traditional theory. As such, critical theory has reflective meaning to researchers trying to understand where reform in an organization is possible and makes them sensitive to the constraining nature of some forms of logic.

**Table 4.2 - Epistemological stances**

Epistemology	Explanations
<b>Positivism</b>	Is defined as “...a philosophy that argues for the application of the methods of the natural sciences to the social sciences and thereby presupposes the unity of science” (Delanty, 2000, p. 11) “...to collect and assemble data on the social world from which we can generalize and explain human behaviour through the use of our theories” (May, 2001, p. 11). Thus positivism emphasises empirical data collection so that knowledge would rest on observations and ultimately seek power of explanation in statistical causality.
Merits	Firstly, behaviours are explained and predicted through empirical observation so as to give a stronger base for knowledge claims, excluding the superfluous. Secondly, it sees reason as a psychology and hence is mentally perceptual and can be doubted until clear observable evidence is found (Delanty, 2000). Thirdly, arguments emphasise acceptability, validity and generalizability therefore knowledge generated can form the bases for making predictions (Burns, 2000). Lastly, positivism facilitates statistical analyses that allow a firmer basis than simply intuition or interpretation.
Drawbacks	Asserts that science is superior to all other forms of knowledge in which there is an overly relentless emphasis on rationality (Delanty, 2000).

	<p>However, the irony is that statistics themselves, as other empirical findings, are subject to interpretation. Reality to each and every person is not objective but subjective on her or his attitudes, beliefs, values and perceptions and interpretations (Burns, 2000).</p>
<b>Empiricism</b>	<p>Is defined as <i>“The facts speak for themselves”</i> (Bulmer, 1982, p.31). <i>“The empiricist school of thought believes that the facts speak for themselves and require no explanation via theoretical engagement”</i> (May, 2001, p.11). Although positivism and empiricism<sup>2</sup> both attempt to gather data/facts about the social world, positivism relies on the methods of empiricism and uses the data to relate to theory whereas empiricism lets the facts speak for themselves (May, 2001)</p>
Merits	<p>Acknowledge that objects by their nature are difficult or impossible to measure thus empiricism allows flexibility in the demonstration of fact. If a “fact” can be seen, then it is allowed to speak for itself, e.g. facts stemming from an interview.</p>
Drawbacks	<p>It lacks the depth of the positivist approach in that any breach of objectivity in research risks biasing ‘facts’. ‘Fact’ requires careful and clear definition as it is dependent on the interpretation of the researcher. But mostly, it lacks reference to theory and the detail of positivism in guiding design and data collection. Non-reference to theory can arguably detract from the substance of what is argued and its strength.</p>
<b>Hermeneutics</b>	<p>Hermeneutics means interpretation and stands for the seconding of explanation and description to interpretation, which cannot be reduced to mere observation. Hence, the hermeneutic epistemological stance relates to the theory and practice of interpretation (Delanty, 2000; May, 2001). It employs a much softer approach to the use of scientific knowledge. It is the main rival approach to positivism as social reality is seen as a meaningful construction and not as an objective reality (Delanty, 2000). Thus it welcomes subjectivity and searches to produce meanings.</p>
Merits	<p>Due to the nature of interpretivism, it allows for plurality of meanings. Both objectivity and subjectivity are accepted; however, in doing so it risks confusion over its imperative. Methodologically it accepts the interpretation of both text and linguistics to find meanings. Appreciates the impact of context on interpretation.</p>
Drawbacks	<p>It believes that science cannot solely offer meaning on reality thus it is conceived more in terms of a dialogue than an interrogation of reality.</p>

<sup>2</sup> Empiricism is not the same as empirical (May, 2001)

	<p>Reality thus is often understood/interpreted but left untouched by critique (Delanty, 2000). It shares a common presupposition with positivism that represents a serious drawback: value-freedom-science does not make judgements or enter into a critique of its own subject matter. Both see themselves as independent of ethical self- reflection or personal subjective elements but in reality this cannot be the case due to the different attitude, belief, and value composition of the researcher (Hughes, 2004)</p>
<p><b>Critical theory</b></p>	<p>Is defined as <i>“at the heart of critical social research is the idea that knowledge is structured by existing sets of social relations. The aim of a critical methodology is to promote knowledge which engages the prevailing social structures”</i> (Harvey, 1990, p. 2)</p> <p>Critical theory attempts to explain society in its totality, aiming to grasp the contradictory nature of society. It challenges both positivism and hermeneutics as it separates from the belief of ethical neutrality of value-freedom (Delanty, 2000). Thus, the main difference from hermeneutics is that critique of contemporary society is the main priority not interpretation of the past.</p>
<p>Merits</p>	<p>Critical theory can be compatible with both positivism and hermeneutics in so far as it uses the methods of explanation and understanding in a critical manner (Delanty, 2000). This “critical manner” is embodied in the notion that science does not seek to explain or understand society for its own sake, rather, knowledge is inherently critical of the prevailing order and seeks to reveal the dominant systems without emphasising absolutism but realising the role of contradictions.</p> <p>Critical theory also emphasises and advocates the right of research to go against the status quo for the benefit of critique and thus to better appreciate phenomena.</p>
<p>Drawbacks</p>	<p>High emphasis on emancipation (or liberalism). The critical tradition reflected a belief in the emancipatory power of modernity and the demystifying role of science in the universal quest for emancipation (Delanty, 2000). Its ideological foundation in a sense gets the better of it. It can be very difficult to integrate its diverse components into an integrated discussion (Wagner, 1994). In this sense it has been criticised for often failing to reunite theory with practice and hence it is important that care is taken in its application.</p>

## 4.4 Research Design

Determining a suitable research design for this research project is essential to the data generation and analysis strategy. An appropriate research design lays the fundamental principle and characterizes the framework for the research. It is effectively a guideline for the implementation of the data generation and analysis. However critical it is to select an appropriate design, there is not necessarily a single precise method one has to apply (Simon, 1969). Hence the following sections will examine a range of research designs that would be most applicable to the current research objectives and problems. Exploratory, descriptive and causal research designs are the three dominant structures in extant empirical research literature and they are examined next.

### 4.4.1 Spectrum of Research Design

#### 4.4.1.1 Exploratory Research

Exploratory research is a type of research that attempts to ask further questions or dig deeper into a subject that has not been clarified in earlier studies. The purpose is to emphasise discovering patterns, ideas or hypotheses (Collis & Hussey, 2009) or insights (Churchill, 1999). It is particularly appropriate for studies where the research issue is unclear. Thus a preliminary study is required in order to understand the problem deeper and subsequently develop hypotheses. It is not a research type to test or confirm hypotheses of an association or causality against empirical evidence.

There are three principal techniques employed in exploratory research (i) focus group interviews, (ii) interviews with experts on the subject, and (iii) literature analysis (Saunders et al., 2009). Other techniques can be in the form of conducting case studies or observations. All those combined can provide both quantitative and qualitative data (Churchill, 1999). These techniques share a common fundamental idea of explorative design in that their approach is very open and centred on gathering a wide range of data and impressions (Collis & Hussey, 2009). Despite this inherent flexibility, exploratory design does not mean absence of direction and focus in the research investigation. What it means is that initially the

research can be open and progressively becomes narrower as more insights are gathered (Saunders et al., 2009).

One point to reiterate is the purpose of exploratory research; it is about finding out '*what is happening*' and understands a particular phenomenon deeper. Thus conclusive answers to problems or issues are rarely provided. However, it is a valuable means of building a guide on what further and future research should be conducted.

#### **4.4.1.2 Descriptive Research**

Descriptive research aims to describe a phenomenon as it exists where the research problem is well structured and understood. The objective is to '*portray an accurate profile of persons, events or situations*' (Robson 2002, p.59 cited in Saunders et al., 2009). Compared to exploratory research, descriptive research goes further to examine the problem, and is conducted to ascertain and describe the characteristics of the relevant issue (Collis & Hussey, 2009). To expand, there are several purposes that descriptive research is used for: first, to describe the characteristics of certain groups, second, to estimate the common behaviour of a sub-group in a specified population, third, to make a particular prediction, and lastly, it is used to examine relationships between variables (Churchill, 1999). These purposes can perhaps be deduced into 'what' and 'how' questions because they aim to describe a phenomenon, for instance, what is the absence rate in a particular class? Or how do commuters travel to work in Paris? etc...

A descriptive study is typically guided by one or more initial hypotheses (Churchill, 1999) and is mostly concerned with the relationship between two variables. This does not necessarily lead to improved knowledge of the questioned variables. Rather, it is to link pre-developed theory of these variables in order to define solutions to problems or supplement information on developed hypotheses. As such, hypotheses tend to guide the research to specific directions; henceforth, descriptive research is more rigid relative to the flexibility of exploratory design (Churchill, 1999). Naturally, exploratory research would be very insightful for subsequent descriptive research.

A typical technique applied in descriptive research is survey/questionnaire (Yin, 1994) and is commonly classified into two: cross-sectional and longitudinal design.

### **Cross-sectional design**

Cross-sectional design is the more common of the two descriptive studies; it is usually referred to as a social survey and closely connected in most people's minds with a questionnaire (Bryman & Bell, 2007). Cross-sectional design "*entails the collection of data on more than one case and at a **single point in time** in order to collect a body of quantitative or quantifiable data in connection with two or more variables which are then examined to detect patterns of association*" (Bryman & Bell, 2007, p. 55). The definition shows how a questionnaire is prevalent in this research design; it takes a snapshot of a case (s) at a single point in time to generate quantifiable data that can then be assessed for patterns of associations between variables. The selection of cases and the success of a cross-sectional design rely upon the sample being representative of the known target population (Churchill, 1999).

The subsequent key properties to understand about this design is that any inference of causality would be ambiguous and uncertain (Bryman & Bell, 2007), and at most have partial credibility compared to a causal or experimental design (see next subsection). The main reason for this lies within the *ex-post factor* nature of cross-sectional designs; responses from informants cannot be directly controlled in the research setting and are usually based on retrospective accounts; lastly, cross-sectional research designs produce associations rather than causality (ibid). Therefore, only variables that are correlated and related can be ascertained.

Despite the weak *internal validity* demonstrated above, cross-sectional research designs tend to have strong *external validity* particularly when the sample data is randomly generated. Measurement validity and hence study reliability can also be strong given variables measured have precedent from pre-existing literature. Cross-sectional research studies are also highly replicable hence findings can be rerun and re-examined when necessary.

### **Longitudinal design**

Longitudinal design is referred to as 'contextualist' research design that involves "*drawing on phenomena at vertical and horizontal levels of analysis and the interconnections between those levels through time*" (Pettigrew, 1990, p. 269). It is technically a collection of cross-sectional studies through multiple time periods. This allows studies to map the change of the subject matter in studies. Longitudinal designs are therefore dynamic but because partly due to the longer time and higher cost involved, they are relatively less studied within business management research (Bryman & Bell, 2007). Hence, empirically they exist in the form of an extension of social survey research based on structured interview or self-reported questionnaire within the cross-sectional design. Consequently, the criteria for quantitative research evaluation are very similar to those of cross-sectional design i.e. reliability, replication, and validity (ibid). However, the benefit of multiple time periods means that it can generate more insights to variables under study, thus researchers can draw stronger causal inferences. Nevertheless, these still only lead to inferences and not relationships.

#### **4.4.1.3 Causal/Experimental Research**

Causal or experimental research design, also known as explanatory design, aims to explain the phenomenon being studied. The main difference to exploratory and descriptive designs is the '*explanatory*' element. Since the design is experimental in nature, the studies have more degree of control within the research settings; it is more useful in 'explaining' the presence of causal relationships than descriptive and exploratory designs. This expands to a very important point about appreciating the advantage in causal research design over exploratory and descriptive research design. Even though the latter two frequently employ sound logic in regression analysis to argue causality in X to Y, by examining the presence of X and Y in respondents and a lack of X and Y in other respondents' cases, it is inaccurate to assert causality. This only indicates the general direction of the relationship not the direct cause. In addition to this point, these two research designs are *ex post facto* in nature, so the researcher is actually retrospectively searching for plausible explanations by starting with the observation of a dependent variable and working backwards (Churchill, 1999).

Causal research removes this shortcoming as it purposely tests the direct cause of X to Y hypotheses (ibid). The research problems are typically required to be more detailed and specific. It is also often tested in an experiment setting where the researchers manipulate the independent variables and observe the effect on the dependent variable(s) (Kerlinger, 1986). Thus an experimental or causal design usually results in more robust and trustworthy data on causes (Bryman & Bell, 2007).

Having clear superior scope to determine causality, implementing causal studies is very demanding. To outline a few, firstly the researchers need very clear cause-effect hypotheses where independent variables must be adjustable in order to observe the cause-effect effectively. Secondly, the effect of the external factors must be eliminated to ensure a fair and valid test. Such control problems raise costs, time and applicability challenges (Churchill, 1999) as well as the potential variability in the managing and subjective interpretation of the experimenters (Burns, 2000).

#### ***4.4.1.4 Selecting Research Design***

The examination of the three research designs shows that there are distinct differences and the selection of the design depends on the problem and objective of this research. As Churchill (1999, p.99) succinctly concludes the *“crucial tenet of research is that the design of the investigation should stem from the problem”*. There are other considerations besides this and sometimes a researcher might require adopting different designs at a different stage of the research depending on the situation (Balnaves & Caputi, 2001). In practice, there is actually no *perfect* or *one-size-fits-all* design (Simon, 1969).

Based on the research objective outlined, preliminary exploratory research was conducted to gather insights around the attention-capability-innovation framework. An extensive literature search was appropriate at this stage. However, the core area of the study is to test the hypotheses formulated from exploratory design; subsequently, descriptive design will be conducted. Based on the amount of time and cost and research objective, it is also decided that a longitudinal study would be the most appropriate. Moreover, this would mean that the research design is *ex post facto* in nature, and the researcher has no control over the

independent variables, thus entirely eliminating the ability to apply a causal or experimental design.

In light of the review above, to assess the relationships between variables and to make inferences with recognised explanatory confinements, a longitudinal descriptive design is selected as the research strategy to resolve the research problem.

#### 4.4.2 Primary vs Secondary Data

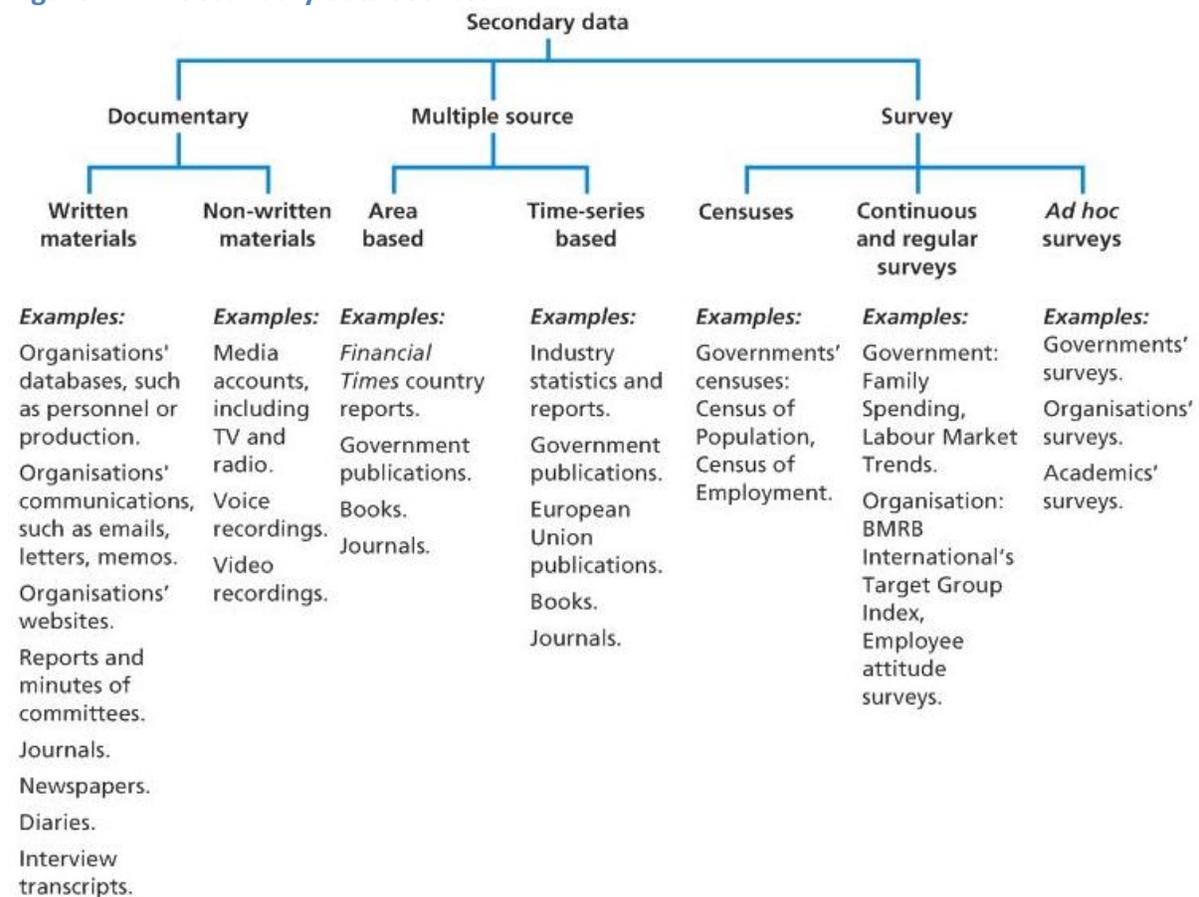
Research can typically be distinguished into secondary and primary. Secondary research collects data that is already generated but published for some purpose other than the immediate study at hand (Churchill, 1999). In other words it is second-hand material (Burns, 2000). Primary research on the other hand is produced solely for the purpose of the study at hand (Churchill, 1999).

There are apparent benefits to choosing primary research. Primarily, it is generally understood to be a better fit to the research problems where measurement constructs are operationalized exclusively for the purpose of the immediate research (Slater & Atuahene-Gima, 2004). It is also considered timelier and more up-to-date relative to the obsolescence of secondary data, hence it has wider scope to provide greater completeness to the data collected. However, primary data research can give rise to higher cost, time, and more importantly, there is a higher risk of having non-response data and subjectivity in the responses. This can impact both the validity and generalizability of findings (Bryman & Bell, 2007).

The other option is secondary research, even though it is usually not produced for the purpose of the research at hand. It provides an opportunity for collection of high quality data with less cost and time; choosing the right source, data have usually gone through very rigorous sampling procedures and non-response bias is minimised as non-respondents are usually followed up (Proctor, 2000). Secondary data include both raw and published data (please see Figure 4.2 4.2); for example, many organisations especially publicly listed, collect and store a variety of data to both comply with external reporting responsibilities and to

support their internal management operations e.g. payroll details, CEO letters, meeting minutes etc... Government, trade organisations and press agencies also collect and produce a wealth of data including demographic reports, consumer reports or events announcements such as mergers and acquisitions. However, as aforementioned, secondary data potentially poses problems of fit. First, infrequently will secondary data sources accurately fit the defined research problem of the immediate study (Churchill, 1999). Second, problems relating to the accuracy of the initial research and errors intrinsic in the initial research are further exacerbated as the ability to generate and capture data expands, and cause difficulties in the application of secondary data sources to an immediate research problem (e.g. Bulkeley, 1992; Stewart & Kamins, 1993).

**Figure 4.2 - Secondary data sources**



**Source: Saunders et al., 2009 p.259**

Therefore, in considering secondary data sources, it is paramount that the researcher examines the context and the purpose of the research for which such data was generated

(Yin, 1994). It must be viewed with the same caution as any primary data that researchers collect (Saunders et al., 2009). In addition, attention should be on the access to the data and the costs of getting the access. If there exists a degree of fit (meets the objectives) and high quality, secondary data can be used as a means to resolve an immediate research problem.

Empirically, during the last decade of management research, there have been calls for further research to be done with secondary data. The main reason lies with the apparent benefit of objectivity in the response and greater potential for slippage and response bias in primary research (Newbert, 2007). And with the growing development of methodology and tools from other disciplines, recent research in top journals has been carried out using secondary sources (e.g. Slotegraaf et al., 2003; Sabherwal & Sabherwal, 2007; Yadav, etl., 2007; Rao et al., 2008; Cuervo-Cazurra & Un, 2010). Some of these tools are very powerful but greatly underused such as content analysis of CEO letters to shareholders. Text analysis of these letters enables Yadav et al (2007) to circumvent many drawbacks attached to surveys, yet still manages to accurately study a complex construct of managerial cognition. Furthermore, they are all publically available documents, objectively collected, highly accountable and easily found over multiple periods. This application of secondary data in Yadav et al (2007) and other studies suggests that further research has much to gain from their use, coupled with the more general implementation of content analysis to other sources of textual data on different aspects of a firm such as archival documents, media releases, and public interviews of members within a firm.

At this stage the initial conclusion is that the study requires generation of secondary data in order to address the research questions posed and to investigate the accuracy of the hypotheses. This conclusion is reached owing to the potential benefits and calls for further secondary data research.

## 4.5 Methods of Generating Data

### 4.5.1 Approaches to Collect and Measure Variables

Within the fields of organizational capabilities and strategic orientation, collection and measurement of data represent a major challenge considering these constructs are multi-faceted and dynamic in nature. Fortunately, with the development of database management, macro and micro data in the business field have become more abundant, new research techniques with rigor have also become more established. These developments have allowed scholars to study organisations' capabilities more creatively and rigorously (Clougherty & Moliterno, 2010 p112); for example, the capability's component resources *ex ante* and *ex post* acquisition (Denrell et al., 2003); (Makadok, 2001), and also the resource-specific value created in the bundling process (Sirmon et al., 2008). Hence, methodologically, it is now more conceivable to carry out empirical studies in more ways and more rigorously.

This study acknowledges the challenge and attempts to capitalise on the abundant sources of data and measurement techniques available to examine constructs (see Chapter 3). The following subsections review some of the popular techniques and select Stochastic Frontier Analysis, Content Analysis and Ratio Metrics as ways to measure the study's constructs (see Chapter 5.4 for more details).

#### 4.5.1.1 Survey and Interview-based

Survey and interview-based studies traditionally represent the principal means via which empiricists have produced TMT cognition and firm capabilities. A survey assessment of the empirical literature by Newbert (2007) found that researchers almost universally rely upon direct-report data to elicit organizational capabilities and firm orientation (see (Hitt et al., 2001; Sabherwal & Sabherwal, 2007; Benner, 2009; Joshi et al., 2010 for notable exceptions). While primary data collection techniques such as survey or interview generate considerable insights into management research questions, their main shortcoming is the risk of respondent bias. For example, a large cross-national study of management practice (Bloom et al., 2007) finds that it is difficult for managers to objectively evaluate their own firm's

qualities. Arguably, there are great subjectivities across all self-completion studies and these are more particularly apparent when measuring intangible concepts such as firm capabilities or management cognition. Such self-assessment biases have also been evidenced in other areas of managerial responsibility: for example, managers overwhelmingly report their own company's acquisition activity to be beneficial and synergistic, when in fact acquisitions seem to have a neutral impact at best (Bruner, 2002). As expected, (Newbert, 2007, p. 137) concludes that *'measuring capabilities . . . often necessitates a greater need for primary data collection techniques, and often introduces a greater potential for slippage and respondent bias'*. Thus to more accurately examine heterogeneity in capabilities and other management constructs, researchers have accordingly employed several analytical techniques such as dummy variable estimation (Anand & Khanna, 2000; Guler, 2007; Henderson & Cockburn, 1994), Chow tests of beta coefficients (Makadok, 1999), stochastic frontier modelling (Dutta et al., 2005; Xiong & Bharadwaj, 2011), and content analysis (Yadav et al., 2007; Heyden et al., 2012). The following sections briefly review these approaches.

#### ***4.5.1.2 Dummy Variable***

As a statistic and econometric technique, a dummy variable is commonly used to sort data into mutually exclusive categories such as male/female, smoker/non-smoker etc. Within the application to this study, it can be used as a "proxy" variable for a capability. Even though it is an early approach employed by empiricists to capture firm-level heterogeneity in capabilities, it is still common as Henderson & Cockburn (1994) used it to prove distinctive firm effects in pharmaceutical research, with other examples being joint venture management (Anand & Khanna, 2000) and venture capitalist capabilities (Guler, 2007) to name a few. While this technique is efficient and elegant, dummy variable estimates are extremely sensitive to the omitted variable bias; any unidentified correlation between or within these non-measured variables and the dependent variable will be captured by this approach (Clougherty & Moliterno, 2010). Thus, this poses a relatively high level validity threat when interpreting dummy variable coefficient estimates and the accuracy of capturing firm capabilities.

#### ***4.5.1.3 Econometric Modelling - Stochastic Frontier***

Stochastic Frontier Analysis (SFA) is an econometric technique co-created by Aigner, Lovell, and Schmidt (1977) and Meeusen & van den Broeck (1977); it allows scholars to calculate a firm's productivity by functioning firm inputs and outputs relative to other firms or a different year. A firm that has a higher score input-output ratio is then interpreted to be more efficient or productive. Since its introduction, this technique has represented an important step in increasing the empirical rigor of capability estimation, and may prove particularly useful for researchers examining the relationship between a firm's resources (efficiency) and performance outcomes (Clougherty & Moliterno, 2010). Dutta et al. (2005) recently employed SFA to estimate firm capability to convert R&D spending in the semiconductor and computer industries into citation-weighted patent counts. Newbert (2007)'s recent review also confirms that SFA is useful for scholars employing a 'resource heterogeneity' approach, where the principal research question surrounds firm capabilities' heterogeneity and higher-level (i.e. firm) performance. However, SFA is less suitable for empirical research where the objective is to examine organizational variation in bundling resources and building capabilities (Makadok, 2001; Moran & Ghoshal, 1999) and where the output factor is more difficult to determine. It also has a number of stringent assumptions that variables must meet in order to run in SFA.

#### ***4.5.1.4 Content Analysis***

Content analysis is a fairly new and underused approach in management. It is used to analyse data from documents and texts using predetermined categories/codes in a systematic and replicable manner (Bryman & Bell, 2007). It is often employed to seek a deeper meaning of a phenomenon signalled in documents and texts. Within media research this method is very popular. Research questions such as '*which topics were most interesting in the news*' or '*what stances does each newspaper have on a particular topic*' can be effectively tackled by using content analysis. It is also a very flexible method that can be applied to varied types of text. Some of the examples are: Bettman and Weitz (1983) compared a bad year (1974) and a good year (1972) of stock performance by examining shareholders' letters from the annual reports of 181 companies; Yadav et al., (2007) have

also used a similar method to examine CEO patterns on innovation attention from 1990-1995 through a collection of 867 letters from 87 US retail banks; and recently, Heyden et al., (2012) carried out a comparative study of the influence of the UK vs Germany board structures to organisation learning orientation (exploration vs exploitation) within the pharmaceutical industry.

In relation to measuring managerial cognition and strategic orientations, Eggers and Kaplan (2009) found an increasing number of studies utilising text analysis. Specifically letter to shareholders in the annual report was a common source (Cho & Hambrick, 2006; Kaplan, 2008). They use word counts derived from these documents. Content technique such as word counts thus has been acknowledged as a valid way of operationalising attention (Duriau et al., 2007). Such an approach is most appropriate given the need to quantify measures of large qualitative information. The appeal of this method is that it is relatively cheap, easily replicable and prospective (Bettman & Weitz, 1983).

However, despite its apparent flexibility and efficiency in uncovering deep phenomena in mass volume data research circumstances, content analysis is still known to be underused in management research (Bryman & Bell, 2007). Perhaps, it is too labour intensive or researchers are unsure how to use it appropriately. Devising a coding manual is also difficult and will not capture the phenomena within a text if not formed accurately. It is also less able to tackle 'why' research questions (ibid).

To summarise, the four empirical approaches outlined above entail both advantages and disadvantages in exploring heterogeneity of cross firm behaviours. In addition to the uses, pros and cons noted above, this brief review indicates that the empirical researcher's toolkit is abundant when it comes to techniques for modelling organizational capabilities. Thus, in addition to adding to the empirical rigour in capturing capabilities, and overcoming some of the limitations of the existing empirical options such as objectivity etc..., the research methodology illustrated in Chapter 5 is specifically targeted at measuring CEO cognition, information processing capabilities, innovation orientations and creativity using solely secondary sources and generated by a combination of methods.

## 4.6 Access and Ethics

Across all subject disciplines, academic research can raise challenging legal, social and ethical issues. Before carrying out the research, the primary concern is the safety and protection of the humans and/or animals involved in the study. This study requires access to many secondary databases and includes sensitive and/or confidential information. There are ways of dealing with confidentiality within this research; there will be no disclosure of names, addresses and occupational and locational details of the companies involved. This issue is assured as part of the process of gaining informed consent.

Research ethics also require the researchers to conduct research projects objectively, free from personal biases and data manipulation. Improper execution of research includes using biased sampling, ignoring relevant data, or misusing statistics, all of which lead to erroneous or misleading results. The researcher has a responsibility to adhere to high ethical standards and sign an agreement with the ethical procedure in accordance with the University of Cardiff; the research community guideline is attached in Appendix 12: Ethical approval form.

## 4.7 Concluding Remarks

This chapter reviews and examines epistemological approach related to this thesis research objective. It assessed the most suitable research design to guide the development of the research strategy for this study.

The take away message is that no single epistemological perspective is inherently superior to another. They were examined in terms of a spectrum from a positivism natural science end to more subjective critical theory end. Each offers its own advantages and disadvantages in the pursuit of knowledge creation. To fully appreciate the diverse ideologies and to reap the benefits of adopting multiple epistemologies without creating inconsistent and conflicting research methodologies, this thesis employs a combination of qualitative and quantitative epistemological positions. Therefore, combining elements from different epistemologies will help to deliver a more profound understanding and implementation of the research whilst maintaining validity and reliability.

Based on the research objective and epistemological stances, preliminary exploratory research was conducted initially to gather insights around the attention-capability-innovation framework. An extensive literature search was appropriate at this stage to create a platform from which to develop the research strategy. The next research step is to employ a descriptive research design to test the hypotheses formulated from exploratory design. And based on the amount of time and cost and research objective, it is also decided that a longitudinal study would be the most appropriate. Moreover, this would mean that the research design is *ex post facto* in nature, and the researcher has no control over the independent variables, thus entirely eliminating the ability to apply a causal or experimental design.

Finally, as the research is conducted solely on secondary data, collection and measurement of data would represent a major challenge. Thus, a combination of methods and database were examined and it was decided that content analysis, stochastic frontier analysis and ratios would be used to collect and measure variables.

## Chapter 5 – Research Methodology

### 5.1 Introduction

With the research philosophy and research design driving the decision to select specific methodologies, this chapter starts with operationalization of constructs. The chapter then describes the empirical context and the sampling process which targets the population of Small and Medium Sized Technology companies in the US. Putting the inner layers of the research 'onion' in chapter 4 into practice, this chapter presents how the data generation is executed using content analysis and stochastic frontier analysis. The final part of the chapter shows how data is analysed using Seemingly Unrelated Regression (SUR).

### 5.2 Measures and Source of Variables

#### **Process of operationalization**

Informed by the positivist approach, the aim of scientific enquiry is to establish and examine the relationship among theoretical constructs with observable data (Popper, 1959). These constructs, also known as latent variables are unobservable in nature, but to prove if the underlying theory is supported or refuted it is imperative to gauge them with the empirical world (Bagozzi, 1984). This process of linking them with the empirical world is determined through the process of 'operationalization', where theoretical constructs are to be measured. In social science, quantitative research in particular, constructs measurement is typically operationalized by the designation of numbers to observations according to a certain set of rules. These rules can be difficult to establish and, depending on their ability to accurately portray 'reality' or observable variables, can potentially be arbitrary. As a result, the theoretical constructs are inferred from observations of 'proxy' measurements in reality.

In this respect, constructs operationalization is sometimes subjective. In survey research, it is designed by establishing measurement scale items and a scale type. These can be derived from existing research or by establishing a new set of scales. The majority of research today is done by the former, obtaining scales from academic journals (Hair et al., 2010). As

explained in previous chapters, this research data rely entirely on secondary sources, generated unconventionally from content analysis, stochastic frontier analysis and ratios, hence theoretical constructs are operationalized by single-indicator metrics generated from these tools. The following section explains in detail how they are operationalized and the literature they are adapted from.

### 5.2.1 Focal Attention

Focal Attention conceptualised in Chapter 3 is a firm's search behaviour. Directed from the top management team, firms can focus their attention on three fronts: external (spatial), internal and future (temporal). They are reflected in the firm's communications and actions and they drive employees' attention to particular events and opportunities.

Finding an appropriate measure of CEO attention was challenging. Past studies have used managerial demographics as a proxy for cognition (Virany & Tushman, 1986; Norburn & Birley, 1988) but these are relatively fixed. CEO cognition can be time-varied to issues and tenure. The most appropriate source would be information made by CEOs that are consistent over time. This cannot be captured through surveys or interviews. CEOs' comments and public speeches or conference calls would lack consistency in all time periods and are not comparable for all firms. Fortunately Yadav, Chandy and Prabhu (2007) have already developed a measure for such requirements.

Thus, the study adopts Yadav, Chandy and Prabhu (2007)'s methodology and uses companies' letters to shareholders as the data source to measure the three focal attention constructs. Yadav, Chandy and Prabhu (2007) followed guidelines within the computer-aided text analysis literature (Kabanoff, 1997; Weitzman, 2000); communications and actions of firms signifying each direction are captured by using counts of specific sentences (future focus) and words (external and internal focus). The sampled companies of the study are public listed thus historical records are available, with letters to shareholders at the point of interest covering each fiscal year. More importantly, it is consistent over time and across a wide range of companies. Specifically, each letter has a relatively similar format and covers a

wide range of topics, although similar in relation to performance review of the year, key achievements, competitors, strategic relationships and long and short-term future directions. This makes letters to shareholders a unique source of insight into the CEO's mind in a way hardly possible through other means. An extensive track of studies shows that letters to shareholders in a firm's annual reports reflect CEO attentional foci and these foci can be meaningfully examined (D'Aveni & MacMillan, 1990; Abrahamson & Hambrick, 1997; Kabanoff, 1997). Even though in practice CEOs may not produce the letters actively, it is usually the product of the top management team including more than the CEO alone. Furthermore, it is the statutory and fiduciary responsibilities that CEOs sign off that reflect his/her and the top management team thinking. CEOs such as Warren Buffet and Bill Gates have established keen following from the press and investment community and are closely studied for insights into their thinking.

There are drawbacks. One criticism of letters to shareholders is that they may be perceived as one of the public relation tools which aim to make a good impression on firms. However, if these letters' sole purpose was to be an impression management tool designed to show a more polished picture to an external audience, with little correspondence in the genuine decision-making in firms, the use of these documents would yield null results, but previous literature proved otherwise (e.g. Divinney & Kabanoff, 1999; Eggers & Kaplan, 2009; Yadav et al., 2007). It would also mean that all firm behaviour would be either similar (in creatively developing the impression better) or in a random or distinctive manner that is unique to the firms' public relations team.

The study does not assert that the proxy produced for top management cognition has predictive ability to the future decision outcomes of the firms. However, the author and others have presented a case for a systematic and logical link between top management cognition and firm actions, consistent on theoretical grounds (e.g., Bowman, 1978; D'Aveni & MacMillan 1990; Barr, 1998; Noble et al., 2002; Yadav et al., 2007). Consistent with this link, Divinney & Kabanoff (1999, p. 61) investigated the role of words in annual reports over

seven years and found significant positive correlation between “words” and “deeds”. This finding tentatively indicates that management public communications seem to provide substance and value contrary to the perception of “cheap talk” and impression management. Fiol (1995) provides further evidence for the concept; she compared top management cognitions articulated in letters to shareholders with those recorded in internal management planning documents during the same period. She concludes that executive’s public statements reflect internal private company communications. Specifically, non-evaluative statements examined in the study such as “*internal/external orientation, customer orientation, service/product orientation and past/future orientation*” (Fio, 1995 p.534; see also Barr, 1998) appeared to reflect internal communications more than evaluative statements. In addition to past research precedent, section 5.4.1.2 Search Dictionary and Validity provides further validity of this text analysis approach.

This study uses ThomsonOneBanker, Compustat and online SEC Filing database to collect all letters to shareholders from 2001 to 2007 fiscal years. 2003 is used for focal attention, and 2005-2007 are used for exploration and exploitation strategy variables operationalization. The timeline is selected chronologically, so that focal attention precedes the actual ‘action’ of the firms i.e. absorptive capabilities and exploration-exploitation in action, to reflect the search behaviour of the firm.

### **External Focus**

External focus directs attention to events and opportunities which are primarily coming from outside of the firm. To assess the emphasis on these various themes, external focus construct is measured by the number of times words signifying attention to customers and competitors are mentioned in letters to shareholders in 2003. The words dictionary is adopted from Yadav et al., (2007) and is shown in Appendix 3: List of Search Strings used for the Content Analyses of CEO focal attention.

### **Internal Focus**

Internal focus directs attention to objects whose primary locus is within the firm. Contrary to the external focus, the internal focus is operationalized as the number of times words

denoting the firm's attention occur on specific issues. For example, some of the words are 'organization', 'employee' or 'manager'. The full list of words is shown in Appendix 3: List of Search Strings used for the Content Analyses of CEO focal attention.

One thing to take notice is the term "stakeholders". Arguably it describes all the parties, external and internal, that relates to a firm. It was however, included in the internal focus search dictionary. The reason for that are two-folds, when external stakeholders are mentioned, it is mostly referred to customer, consumer or the competitors. These aspects are already covered in the external focus dictionary list. In addition, the term *stakeholders* is divided into primary and secondary groups (Small Business Chronicle, 2015). Primary stakeholders are employees, owners and investors, who has more direct interest in the business. Secondary meaning of stakeholders is referred to society, residents living close to the business or others who have more indirect interest in the business. They are in effect care less about the company's behaviour and financial performance. Nevertheless, the term could be included in external focus to some extent. However, to keep it consistent with what has worked in Yadav et al, (2007) dictionary, stakeholder and stakeholders will be keep in the internal focus dictionary.

### **Future Focus**

Future focus refers to attention of the firm toward events and opportunities that have yet to occur. It is measured by the number of times the word "will" is mentioned in the letters to shareholders in 2003. This measure is based on Pennebaker et al., (2001) and Mehl & Niederhoffer (2003)'s work and then refined by Yadav, Chandy and Prabhu (2007) through iterative steps. Specifically, the former work's linguistic analysis shows that sentences indicating events that have yet to occur have mentioned these words: "will", "may", "might", "shall", "be", "tomorrow" and the related contractions such as "we'll", "they'll", "I'll" and "you'll". Using computer-aided content analysis software (Diction 5 and N6) Yadav, Chandy and Prabhu (2007) refined the list into one single word "will" because they found that contractions are rarely used in formal letters to shareholders. Furthermore, besides the word "will", sentences with alternative words are ambiguous and inappropriate for the

purpose of the analysis. Thus, it was established that “will” was the most indicative of attention being directed at events that have yet to occur.

### **5.2.2 Absorptive Capabilities**

Absorptive capacity is operationalized by employing stochastic frontier estimation. Following Cohen & Levinthal’s (1990) definition and the production frontier model in economics (e.g. Silberberg, 1990), ACAP is defined as the efficiency of absorbing know-how, given the available resources. Thus, the maximal amount of know-how absorbable for firm *i* is a function of the resources it possesses (Dutta et al., 1999; Dutta et al., 2005; Narasimhan et al., 2006).

$$(M1) \quad Y_{mi} = f(X_i: \text{Resources } i, \alpha),$$

where

$Y_m$  = the maximal amount of know-how absorbable,

$X$  = a vector of resource inputs, and

$\alpha$  = a vector of parameters for the resources.

The maximal amount of knowledge absorbable ( $Y_m$ ) is influenced by firm  $i$  available resources ( $X$  variable). These resources are categorised into internal and external sources. They can vary depending on the type of knowledge absorbable. Examples and each model specification are presented in the sub-sections that follow. However there are two important practical adjustments that must be applied to the model to reflect reality. First, the maximal level cannot be achieved because there are random shocks that are out of the firm's control (e.g. macroeconomic factors or luck) and secondly, it is not possible for a firm to be at its most efficient point of absorption. Mathematically, the maximal amount of knowledge absorbable is:

$$(M2) \quad Y_{Ai} = f(X_i: \text{Resources } i, \alpha) \times \exp(\varepsilon_i) \times \exp(-\eta_i),$$

where

$Y_A$  = the actual amount of know-how absorbed,

$\varepsilon$  = is the random shock, and

$\eta$  = the inefficiency of absorbing know-how,  $\eta \geq 0$ , represents the short-fall between the maximal and the actual level of knowledge absorption.

Following Dutta Narasimha and Rajiv (1999) the know-how frontier represents the input-output concept, underlying how Cohen and Levinthal's (1990) '*acquiring, transformation and applying*' concept is manifested so that eventually absorbed external knowledge is deployed to commercial ends. In other words, this means that the know-how absorption process embedded in all three absorptive capabilities of the study includes not only the identification

and acquisition of know-how but also applying the acquired know-how to commercial ends (ibid). For example, the purpose of absorbing is applied differently to different absorptive capacities:

- (i) Top management team knowledge to improve profit or
- (ii) Marketing knowledge to improve a firm's revenue.

### **Top Management Team Absorptive Capability (TMTAC)**

Innovative ideas can come from diverse sources but at the heart of a firm, senior employees are the prime source for inspiration of new ideas and directions. Their influence is critical for firm innovativeness and firm performance because innovative strategies are shaped at the top management level (Talke et al., 2011). Hambrick and Mason (1984) argued that firms perform at varied levels because of the different strategic choices they make, but ultimately these choices are a result of their idiosyncratic TMT composition. A commonly examined aspect of TMT composition is diversity, defined as the degree to which TMT members differ with respect to background characteristics such as functional experience, age, and tenure (Bunderson & Sutcliffe, 2002; Bunderson, 2003; Carpenter et al., 2004).

Following the input-output concept of M1 to M2 model, TMT collective output is judged in the amount of earning they generated i.e. profit (before tax, depreciation and amortisation is used to avoid effects of capital structures and tax disparities particularly for small firms where market share is low (Robinson & Pearce, 1983)). The inputs can enhance the know-how absorption efficiently to generate economic gains. They are the firm level of resource commitment to TMT (total remuneration), the stock of TMT knowledge diversity (TMT age diversity) and tenure diversity.

$$M(3) \quad \ln (PROFit) = \alpha_0 + \alpha_1 \ln (REMTMTit) + \alpha_2 \ln (AGEit - a) + \alpha_3 \ln (TENit) + \alpha_6 \ln (PROFikt - 1) + \epsilon_{it} - \eta_{it},$$

where

PROFikt = Total gross profit of firm i in time t

REMTMT<sub>it</sub> = Total remuneration for top management team

AGE<sub>it</sub> = TMT age diversity

TEN<sub>it</sub> = TMT tenure diversity

PROF<sub>ikt</sub> – 1 = Total gross profit of firm i in time t-1

The amount of **remuneration for top management team** reflects the quality of TMT human capital and the commitment of the firm to invest in it, thus a high amount of investment implies high capacity of TMT to absorb know-how to apply to commercial ends i.e. maximising profits. Executive **age** and **tenure** have been used as components to convey human resource quality; it reflects the amount of experience (Wei et al., 2003) or tacit knowledge since the longer the experience on the board within the firm, the higher the tacit knowledge possessed. In fact, executive age was related to firm performance (Wei et al., 2003) and tenure was related to team performance in terms of efficiency (Bell et al., 2011). However, no performance-related evidence has been found for firm level performance mainly because of the varied conceptualisation (Hambrick & Mason, 1984). Thus, TMT age and tenure **diversity** were used. These two constructs on the other hand facilitated proactive innovation orientation of the firm (Talke, et al. 2011) towards an innovation strategy that addresses emerging, latent customer needs and/or more open to new technologies. This strategic stance increases the firm's new product portfolio innovativeness (Talke et al., 2011) and subsequently leads to higher firm performance. TMT diversity has varied measurement constructs (including ones in Talke et al., 2011; Simons et al., 1999), but can be understood as heterogeneity of the TMT's educational, functional, industry, or organisational background; together these often represent the level of cognitive heterogeneity in TMTs (Hambrick & Mason, 1984). The important factor is diversity leads to information variety, alternative views and innovative posture (Milliken and Martins, 1996). Specifically, heterogeneity of education leads to diversity of knowledge bases; this variety of access of knowledge bases enhances creation and combination of new knowledge. Functional diversity is found to positively associate with information sharing when TMT have wide-ranging experience in functional areas (Bunderson & Sutcliffe, 2002). This reduces

group thinking in the heterogeneity group (Hambrick & Mason, 1984) and allows greater information use (Hinds & Mortensen, 2005). Nevertheless, executive age, tenure and other research showed that TMT diversity and general group work diversity subjects are described as a “two edged sword” (Milliken & Martins, 1996) or “mixed blessing” (Williams & O’Reilly, 1998) because their hypotheses are both constructive and destructive (positive and negative) to performance.

On the specific note of the inputs of the model, remuneration of executives is proxied as only the basic and bonus salary for the year for executive is tenured. Other long-term, stock options are not included for two reasons. Firstly, the stock options pay is inconsistently rewarded among firms and secondly the basic and bonus salary adequately reflects the most fundamental responsibility of the CEO. Tenure and age diversity was calculated as the coefficient of variation (e.g. average tenure/standard deviation) of the tenure and age of executives; it is a scale invariant measure of dispersion (Allison, 1978; Bantel & Jackson, 1989; Knight et al., 1999 cited in Maccurtain, 2010). A score of zero indicates perfect homogeneity of tenure among the executive team and a higher score indicates a higher level of diversity. The remaining input is profit from prior year. This is the lagged dependent variable and is included to the right hand side of the equation to control for potential momentum effect.

### **Marketing Absorptive Capability (MKTAC)**

**MKTAC** is constructed using the same logic of the input-output model of Dutta et al. (1999) specified in Equation M3 to estimate a firm’s (in)efficiency in absorbing marketing know-how. The operationalization of the outputs in TMT know-how stochastic efficient frontier (M3) reflects just that, using profit measure to capture the desired commercial outcome. In the case of MKTAC, generation of sales revenue is the desired commercial outcome. Therefore, the maximal marketing knowledge absorbed is measured by the sales revenue generated.

M(4)

$$\ln (REV_{ikt}) = \alpha_0 + \alpha_1 \ln (TMS_{it}) + \alpha_2 \ln (MKE_{it}) + \alpha_3 \ln (REV_{ikt-1}) + \varepsilon_{it} - \eta_{it},$$

where,

$REV_{ikt}$  = firm i's sales revenue generated year t,

$TMS_{it}$  = Trademark stock of firm i in year t

$MKE_{it}$  = Marketing and advertising expenditure of firm I in year t

$REV_{ikt-1}$  = firm I's sales revenue generated in year t-1

Inputs are first captured by trademark stock of the firm in year 2004. Similar to technology stock, it is argued to increase sales because the customer can be convinced about the marketing brand advantage thus is more likely to retain the relationship (Dutta et al., 1999). The second input is marketing and advertising expenditure. Attracting and retaining key customers require investments and long term relationship, thus the higher the expenditure in marketing the more resources are available for maintenance of strong customer relationship (Dutta et al., 1999).

### **Research and Development Absorptive Capability (RDAC)**

Absorptive capacity is measured by the proxy of R&D intensity, following the approach of Cohen and Levinthal (1990). R&D intensity is calculated by dividing R&D spending by sales. This proxy is found to boost the number of NPD projects (Song et al, 2011), firm performance (ibid) and innovations (e.g. Zahra and George, 2002). However, as in some prior studies, R&D intensity does not have strong explanatory power of absorptive capacity (Mowery et al., 1996, Lane & Lubatkin, 1998). The main reason is because R&D intensity neglects the essential parts of absorptive capacity; *it primarily focuses on technological knowledge*, whereas the importance of market knowledge is undervalued (March, 1991; Todorova & Durisin, 2007). Nevertheless, in the context of this research, the focus of the innovative output is patents in technology firms, thus ACAP would predominantly focus on

technology knowledge; therefore, the proxy R&D intensity would reflect a firm's absorptive capacity.

An alternative of R&D intensity was also considered. RDAC is initially measured by stochastic efficient frontier like TMTAC and MKTAC. However, the condition of the inputs and output did not meet the criteria of SFE. Regression assumptions of linearity, homoscedasticity, and normality analysed visually in R, SPSS, STATA did not meet its assumption.

Thus alternatively, RDAC is measured by adapting the traditional concept of RDAC operationalization i.e. R&D intensity. R&D intensity (R&D spending over sales) indicates that to generate a dollar of sales a certain amount of R&D spending is required; the higher the ratio the higher the R&D capability. Using the same concept, the study also considered additional alternative measures by establishing the ratio of New Patent Class obtained in year 2004 divided by the citation stock in the same year. It argues this to be a better representation of R&D capability because both metrics are more closely related and relevant to firms' R&D activities. Both measures are used, with R&D intensity analysed in the core model and alternatives in extended analysis.

### 5.2.3 Innovation Strategies

As briefly introduced, the study uses content analysis of letters to shareholders to capture the core concept of exploration, exploitation and innovation ambidexterity. This approach is chosen on the ability and efficiency to derive deep theoretical meaningful managerial cognition. By analysing patterns in usage of text, it is also relatively simple to replicate (Heyden et al., 2012). And to capture the core concepts, 296 letters of shareholders over the period of 2005-2006 will be analysed. As reviewed previously, letters of shareholders are a valid and valuable source for cognitive concepts such as this study's attentional orientation (e.g. Cho & Hambrick, 2006).

In choosing content analysis, a few other ways were considered. Firstly and perhaps the more traditional method was the use of patent data (e.g. Lanjouw & Schankerman, 1999, Katila & Ahuja, 2002, Rosenkopf & Nerkar, 2001). Explore, exploit and ambidexterity were

operationalized by simple counts of patents, counts weighted by forward citations (Trajtenberg, 1990), counts of patent category (Belderbos et al., 2010), years of renewal (Pakes, 1986), or by measuring patent family size (Putnam, 1996). These applications of patent measurements dominate the innovation literature in economics and remain a popular approach; patent data tends to capture codified output of exploration and exploitation, as such successful learning outcomes are likely to be over-represented (Katila & Ahuja, 2002). The second method was the traditional survey-based. It was not an option because it would require a large number of questions and respondents in order to achieve the firm-year observations in this study data. In addition, the chance of retrospect response bias would be high. Content analysis thus shows high validity and reliability for the study purposes and can help to achieve operationalization of the concepts within cost and time constraints.

#### **Exploration and exploitation operationalization**

In practical terms, QSR NVivo 10 package was used to filter and categorize the frequency of references to exploration and exploitation activities (see word dictionary in Appendix 2: List of Search Strings used for the Content Analyses of Innovation postures). As the execution of operationalization has certain software protocols, validity and reliability checks, a separate section is dedicated in Section 5.4.1 Content Analysis.

Exploration and exploitation variable scores were based on the total references to indicators of each search string. The frequency results are then normalized because it could be affected by the relative length of letters. Thus, this normalized count is finally used to determine a firm's exploration and exploitation strategy for each firm-year observation.

#### **Ambidextrous innovation strategy**

Reflecting on the conceptual treatment of ambidexterity previously, in which I propose that high level of exploration and exploitation activities can complement and may synergise upon combining sequentially, within various terms of ambidexterity this treatment would be called a combined dimension of ambidexterity. Therefore, exploration and exploitation

scores would be multiplied as used previously by Gibson and Birkinshaw (2004), and He and Wong (2004). In particular, the scores are mean-centred before multiplying to mitigate the potential for multi-collinearity.

Other operational approaches were also considered; for example, balanced dimension, in which the two exploration and exploitation scores are subtracted from each other in order to generate a relative magnitude of the two activities. This approach was also used by He and Wong (2004) and Heyden, Oehmichen and Nichting (2012). Another way of operationalizing ambidextrous strategy was to sum the two scores. These two ways were eventually deemed unsuitable due to the underlying theoretical treatment, in which they assume that explore and exploit reflect endpoints of a continuum. There are other methods but this shows the abundance of options and potential for mismatch of theory and operation as shown with one of the gaps within the research area previously. To demonstrate, Lubatkin and colleagues (2006) even tested all the methods and chose the one which produces the highest beta. Although in-line with Edwards (1994) incremental approach, this reiterates the point above and demonstrates that ambidexterity research is still gathering speed.

#### 5.2.4 New Product Creativity

In Chapter 3, creativity was conceptualised as *"the consequence of a number of organisation processes that result in an ability for the organisation to commercialise ideas into new products"*. This section produces a valid and reliable measure of creativity as the first step to validation of the concept. Previous literature has had a semantic scale of creativity construct from psychology literature (Andrews & Smith, 1996; Sethi et al., 2001) or a creativity measure that focuses on assessing the degree of the changes by new product ideas (Moorman, 1995; Moorman & Anne, 1997). The most recent semantic scale creativity construct is measured by a number of ideas and the level of novelty in Spanjol, Tam, Qualls and Bohlmann's (2011) product innovation paper. In other creativity constructs of the strategy and management literature, novelty and meaningfulness are the two most

important dimensions of creativity. Amabile (1983) insists that both should be included in the concept.

Despite that, creativity will be measured as the number of patent applications in this study. The patent filing date offers an objective measure of the birth of an idea. Chandy, Hopstaken, Narasimhan and Prabhu (2006, p. 499) used this idea to proxy creativity as a "*birth of a promising idea*" and so do Dranove and Meltzer (1994). Sceptically, this measure is merely representative of the volume of ideas an organisation generates, but in essence, this represents creativity. Creativity in this study only concerns the volume dimension because it is conceptualised as "*the consequence of a number of organisation processes that result in an ability for the organisation to commercialise ideas into new products*". The number of firm patent applications is therefore a justifiable proxy for creativity and can prove valid for the following reasons. Firstly, in contrast to Amabile's (1983) argument of including necessary dimensions in the creativity concept (novelty and meaningfulness), at birth, ideas are difficult to evaluate thus novelty and meaningfulness are difficult to assess. Moreover, it is often ill-chosen due to the political process of firms. Secondly, ideas that pass a firm's specific funnelling process and are perceived high value enough to be worthy of a patent application are generally considered novel in its own right, at the time. Those that are truly unique and meaningful will only be rightly perceived so when patent application is granted. Thirdly, patent filing date is an objective measure of an idea. Many patent applications will not turn into actual patents but it is argued that this is a result of the creative process of an organisation. Be it novel or not, the idea at the time of application is considered creative and the study expects a more creative firm to generate a higher successful patent acceptance rate and also probably more innovation (measured by citations). Thus the number of patents filed will be used as a proxy for the measure of firm creativity. Last but not least, creativity will be a one-year lag measure from the point of exploration and exploitation measurements. Consistent with the methodology recommendation of Podsakoff, MacKenzie, Lee and Podsakoff (2003) that the time of lag should correspond to the process of examination, this one-year lag is considered reasonably long enough to reflect the performance impact of exploration, exploitation and

ambidextrous innovation strategy. It is also a reasonably short enough period to mitigate the intervention of other “noise” factors.

### 5.2.5 Financial Performance

There are many ways to measure financial performance; two types that this study considers are. One is the profitability measures, which include sales and net profit. The other is cash based firm performance indicators which have been recently more favoured by both academia and industry practitioners (Dechow et al., 1998; Kroll et al., 1999; Bond et al., 2004; Vorhies et al., 2009). The study chose lagged cash based operating cash flow from year 2008 to 2011. Year 2009 will be used as in the core model and other years are analysed and discussed in the extension analysis chapter. It is collected from Compustat, which corresponds to the published 10-K reports.

Cash flow indicator is chosen over earning-based profitability measures for the following reasons. First and foremost, it is the more objective measure and less susceptible to accrual accounting methods and idiosyncrasies of account reporting procedures (Ismail & Kim, 1989). Among accounting literature and practitioners’ views, they perceive cash flow as relatively free from manipulation that often profit earnings-based is subjected to, particularly in earnings understatement for corporate tax purposes or overstatement for finance purposes (Kim & Kross, 2005). As a result, organizational performance heterogeneity is better captured by this measure than other accounting-based measures (Otley & Fakiolas, 2000). Second, cash figures take account of working and fixed capital investments which can be relatively significant in small-medium growth firms, however are disguised in earning figures (Rayburn, 1986). Third, profitability is often a short-term target managers aim for thus profit performance may not reflect the viability of future activities and strategies. Although no doubt profitability remains an important performance indicator, the short-term nature shows compromises on the long-term competitiveness that cash flows detect more readily (Locander & Goebel, 1997). Fourth, operating cash flow is considered to be one of the cleanest measures of performance. It eliminates the disparities of performance because it purely refers to the amount of cash a firm generates from the revenues, excluding costs associated with capital investment e.g. securities and capital items, taxes paid, interests and

dividend paid. This indicates a pure measure of how well a firm generates cash regardless of the capital structure. For all of these reasons, cash flow is chosen as the main performance indicator in the core model.

Similar to creativity, it is necessary to capture the lagged effects from creativity outcome because the time for an idea to be commercialised from a patent to firm performance can take 18-24 months (USPTO, 2003), which is usually the average length of time it takes for a patent to be approved. Thus, subsequent two-year cash flow will be used to help distinguish the lagged effects from new product creativity changes to firm performance.

Lastly, although profitability measures are not chosen for the core model, they are analysed in the extended analysis chapter, including return on equity and operating cash flow return on equity.

## 5.2.6 Control Variables

### **Firm size**

To reduce the influence of firm size in the model, the total number of employees was logarithmically transformed to normalize the variable and consequently used to represent the impact of firm size.

### **Industry**

There are two industries represented in the sample, thus a dummy variable was created to represent the industry effect it could have on the model (0 for computer and 1 for software).

### **R&D alliance and Marketing alliance relationship**

As small firms, R&D and marketing alliance relationships can make a big impact at all stages of the model. Alliances enable social exchange and add value to the firm through creation of asset specific investments and technical exchange (Toon et al., 2012). Any alliance relationship possessed by a SME is expected to be benefited from these exchanges. Thus, it is important to include the relationships as a control in the model. The R&D and marketing alliance relationships variable is number of SME partners in the active R&D and marketing

alliances in which it participates from 2003-2005. Some of the examples are cobranding, joint marketing alliances, channel sharing alliances, product integration alliances. The study uses the absolute local centrality measure to capture the number of alliances.

### 5.2.7 Summary of Measures

**Table 5.1 - Summary of measures**

<b>Variable</b>	<b>Operationalization</b>	<b>Label</b>	<b>Methodology Source</b>	<b>Data Source</b>
External Focus	Frequency of key words count. See Appendix 3 for the list key words.	EXT03Log	Yadav et al., 2007	Annual Report – Shareholders’ Letter
Internal Focus	Frequency of key words count. See Appendix 3 for the list key words.	INT03Log	Yadav et al., 2007	Annual Report – Shareholders’ Letter
Future Focus	Count of the word future.	FUT03Log	Yadav et al., 2007	Annual Report – Shareholders’ Letter
TMT Absorptive Capability	1 - Technical inefficiency of absorbing know-how	TMTACsq	Adapted from Dutta et al., 2005, Xiong & Bharadwaj, 2011	Annual Report, Proxy Report, ThomsonOneBanker directors database
MKT Absorptive Capability	1 - Technical inefficiency of absorbing know-how	MKTACsq	Adapted from Dutta et al., 2005, Xiong & Bharadwaj, 2011	Annual Report, USPTO
R&D Absorptive Capability	R&D intensity	RDACLog	Traditional R&D intensity measure e.g. Cohen & Levinthal, 1990	Annual Report
Exploration Innovation	Frequency of key words count See Appendix 2	EXPLORE	Heyden, 2012	Annual Report – Shareholders’ Letter
Exploitation Innovation	Frequency of key words count See Appendix 2	EXPLOIT	Heyden, 2012	Annual Report – Shareholders’ Letter
Ambidextrous Innovation	Mean-centred multiplication of Innovation Exploration and Exploitation	AMBI	Adapted from theory of Cao et al., 2009	Interaction term of exploitation 2005 and exploration 2006

New product creativity	Number of patent application in 2007	CREATIVITY	Chandy et al., 2006) and Dranove & Meltzer, 1994)	USPTO – US Patent and Trademark Office
Financial Performance	Return on equity 2008-2010 Operation Cash flow 2008-2010 Operating cash flow return on equity 2009	ROE OCF OCFROE	Adapted from Vorhies et al., 2009	Annual Report
Firm size	Log employee number	FirmSizeLog		ThomsonOneBanker
Industry	SIC code dummy variable	Software		ThomsonOneBanker
R&D Alliance	Number of alliances	RDAlliance		Annual Statement and LexisNexis
MKT Alliance	Number of alliances	MKTAlliance		Annual Statement and LexisNexis

All variables in the study are measured by single-indicator constructs. Thus, these constructs are assumed to have error-free terms, or be perfectly measured in all analysis packages. The way to identify error therefore is usually by examining the reliability of the method (Hayduk, 1987; Choi et al., 2011). These, including validity examinations, are explained in Section 6.2.1 page 187.

### 5.3 Sampling Method

The previous chapter explained in detail the methods of generating data and the actual executions are in the next section (Section 5.4); but before data can be collected, data sampling is required. This section defines precisely what subject data are collected and the extent to which it can be generalised. There are different procedures in establishing what sample to collect (Aaker et al., 2007; Churchill & Iacobucci, 2005). Firstly, it involves defining the target population of participating companies. Secondly, an appropriate sample frame must be selected to ensure the group of companies under study is as representative to the population as possible. The third step involves selecting a sampling procedure and there are many ways of generating a sample. These steps are examined next.

### 5.3.1 Target Population

Identifying the target population is critical and is the first step to finding the appropriate sample to study. Population definition needs to match the research purpose and context (Malhotra & Birks, 2007). As outlined, the study aims to investigate the effects of CEO search behaviour, information processing capabilities and innovation outcomes. Thus the target population needs to be in an innovative high technological business environment. The most fitting choice is perhaps the high-tech industry as it aligns with the following key criteria of the target population.

Firstly, participating firms must be businesses which are innovators and are knowledge-based in nature; therefore high technology industry fits well with the model proposed in Chapter 3. Secondly, participating firms should be categorised as small and medium sized, although the categorization may vary depending on the country and sector. Having homogenized the firms' selection, it is important to note that participating companies should be internally diverse. For instance, some companies were found to produce high technology products but also allowed for a mix of low technology products and services such as support services. On the other side, it is also important to maintain some level of homogeneity because in case of having too much diversity, for instance, technologies domain (indicated by SIC codes), the companies would be excessively diverse and of no direct strategic consequence to each other. Therefore in regards to establishing an appropriate target sample, firms with less than 50 employees were eliminated because they would be too small and may run the risk of having limited internal diversity in output of products and services or input of resources and capabilities. The author acknowledges that these fine-grained criteria limit the study to a degree but it is a necessary screening given the large number of rather extended longitudinal time spans of the study. The author also acknowledges that sample homogeneity is important in any study and these fine-grained adjustments may homogenize the population to high technology and highly internal diversified firms. These adjustments do not however homogenize the population to the general composition; therefore, the heterogeneity of firms within the sample is still retained.

With all the criteria above, the study chose small-to-medium sized US high-tech computer and software enterprises as the target population. A number of alternative countries and industries were considered but the selected population fit the most to the criteria outlined. A detailed description of the steps as to how the target population and sample frame were derived is as follows.

### 5.3.2 Sample Frame

The second step is to select a sample frame that is adequately representative of the target population. The reason for this is that it is rarely possible to study all cases of the defined population, thus selecting an appropriate sample frame would make the research more feasible yet remain robust. In addition, the degree of generalisation to member firms outside of the sample depends largely on how comprehensive and representative the sample frame is. The study acknowledges that no strenuous attempts can identify a perfect correspondence between the target population and the sampling frame (Churchill, 1999). There will always be elements that can be invariably overlooked due to non-registration, newness or systematic displacement. Therefore, the sampling frame itself can be a seldom-considered source of bias in empirical research. Different sampling frames can cause different representativeness of the population and thus can result in skewed findings (Murphy, 2002). Consequently, the study adopts a screening approach to all sampling frames to determine and limit the risk of possible bias. Alternative sampling frames are also considered. Furthermore, the methodology behind the construction of the sample frames was also examined for bias, representativeness, hence validity and applicability to the purpose of the study. Where possible, to mitigate the possible sampling errors arising such as overlooked elements, inaccuracies or out of date information, double-checking and cross-referencing with other sources were performed as much as possible during the selection and construction of the sampling frame.

#### **Justification of sample frame and application of screening criteria**

As above, while an attempt was made to identify an appropriate sampling frame, a number of key factors were considered in seeking sources of such information. First and foremost,

demands included that a sampling frame must consist of public listed companies as the sole research data sources will be secondary. Thus, a complete array of company information must be publicly available. Information in the frame must also be accurate and up to date and apply to all firms in the population. Credibility and depth were necessary to any potential sampling frame.

An inspection of prospective sampling frames was made in order to determine which one, or a combination of which, would be most suitable for the purpose of this study. However, with the demand to have public listed small-to-medium sized US firms, the number of directories is limited.

Nevertheless, there are some options which this study could use. The *Small Business Administration* (SBA) has a directory of SMEs in the US. Similarly, the *International Society for Small and Medium Enterprises* (ISSME) has a World SME Directory. They are both comprehensive directories of SMEs, however many participating firms are private and more importantly the directories may not be representative of the population. The reason being that participating companies in these directories are enlisted or registered voluntarily; it is not mandatory such as being listed on a stock exchange directory once the company goes public. For these reasons, alternative sampling frames were examined based on the criteria used in their construction and assessment of how they matched the requirements of the present study. To assist with the formulation of the population and eventual sample frame, the study uses *Thomson One Banker* database of publicly listed companies to start with.

Careful examination shows that *Thomson One Banker* is one of the most complete sources of global and integrated financial data. They have most of the company files such as annual reports, deals, directors' remuneration and many more. Upon double-checking and cross-referencing to COMPUSTAT, LexisNexis and company websites, the database appears to be complete, up-to-date and accurate for the information of firms listed. One of the very useful tools of the database is that all listed SMEs are presented in a master database which can be categorized into different criteria. Given these benefits, it was deemed satisfactory and the directory reflects the population criteria thus is suitable for the purpose of the study.

Upon deciding on the sample frame, the following criteria were applied to develop the final sample frame and also to homogenise the population as aforementioned (see Section 5.4.1

Target Population):

1. *Country - US*
2. *Industry - Technology (SIC codes: 357, 7371 and 7372)*
3. *Company size (10-1000 employees)*
4. *Time of sample frame (2004)*

### **5.3.2.1 Application of Population Screening Criteria**

#### **Country**

The chosen country was the US; however, the possible research population included the UK, EU countries, China and Japan. Investments in innovation activities and outputs are the highest in these countries (Thomson Reuters, 2013) . However, out of the three, the US was chosen for the highest R&D activity and investment spending; they spent a total of \$408.6 billion, outspending Japan (\$141 billion), France (\$49.9 billion) and the UK (\$39.5 billion) all together. The US also consistently produced the highest amount of intellectual property (Thomson Reuters, 2013) during the 2001-2010 period.

#### **Industry Selection**

Past empirical studies have shown evidence that *“commonly recognised industry categories are too broad to be relied upon to control for confounding effects...firms lumped together may differ markedly on important criteria such as the composition and breadth of product lines, the markets in which they compete, and their strategic posture”* (Teece, 1981: p180 cited in Clougherty & Moliterno, 2010). For example, when inferencing firm-level R&D capability differences in the semiconductor industry, assessed as the ability to translate R&D expenditure into citation counts in Dutta, Narasimhan and Rajiv (2005), Dutta and co effectively treated Texas Instruments with US\$8 billion in sales and 36,000 employees and Cypress Semiconductor with US\$401 million in sales and 5000 employees in the same cross-firm comparison group. Such a broad difference of firm composition in intra-industry

comparisons may be subject to validity concerns (ibid). In addition, it is particularly important for this study to mitigate as much of the gap between firms as possible because one of the main aims is to examine the ability of small firms to implement ambidexterity strategy. Larger firms would have more resources and established capabilities to adopt ambidexterity, thus inclusion of larger firms in the sample would mislead the findings.

For this reason, the study applies additional screening criteria to ensure a more controlled homogeneous sample frame. As aforementioned, high technology industries are appropriate for the purpose of this study, so only certain industries were selected in deriving the sample frame. In the US, industry sectors are categorised by the four-digit Standard Industrial Classification (SIC) code. The first two digits indicate the major group, the first three digits of the SIC code indicate the industry group and the fourth and last digit indicates the product division. For example, the following codes: 3570 to 3579 correspond to computer equipment (357) with the last digit representing the type of computer equipment and peripherals.

**Table 5.2 - Computer equipment SIC code**

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3570	Computer & Office Equipment
3571	Electronic Computers
3572	Computer Storage Devices
3575	Computer Terminals
3576	Computer Communications Equipment
3577	Computer Peripheral Equipment, (No Electronic Computers)
3578	Calculating & Accounting Machines (No Electronic Computers)
3579	Office Machines, (No Electronic Computers)

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At this point it is appropriate to specify deeper on what exactly *high-tech* or *high technology businesses* are. Although various formal approaches to characterising high technology exists, such as the OECD's criterion of an R&D to sales ratio of more than four percent, there are nonetheless many exceptions. Morgan and Strong (2003) and Parker-Pope (1999) point to the example of nappies, or diapers. Hardly renowned as a typical high technology product, this is one of the most heavily patented products with new designs being introduced approximately every six months (Parker-Pope, 1999).

Another definition of high tech businesses by Doran and Gunn (2002) entails four common characteristics. They say that high-tech businesses would employ highly skilled staff, have research and development expenditure to sales ratio significantly higher than other types of businesses, experience shorter cycle of new technology utilisation, and lastly they predominantly have faster rate of growth, largely due to the self-reinforcing fast changing features of technology. On the whole, all these four characteristics portray the type of innovativeness and technology-oriented traits that are appropriate for the purpose of this study sample population.

Given the combination of definitions presented, for the purposes of this study, a liberal interpretation of high technology was applied which typically possesses all or a combination of the following characteristics. Hence, firms should participate in high product innovation, frequent exploitation of new technologies in production processes and broader business processes, possess a high degree of technical and scientific expertise necessary to conduct operations, and lastly, these firms would have R&D being one of the key drivers underlying future growth, and where the business is reliant upon technology for its business to operate and compete.

Importantly, this combination of criteria allows greater sample homogeneity yet allows adequate internal diversity for empirical studies. Nevertheless, further refinements were attempted to establish a highly valid and reliable sample frame. Firstly, volatile contextual factors inherent in technology SME participants are alleviated by including only two related technological industries i.e. computer hardware and computer software. Secondly, vaguely technology-oriented firms were excluded where they could potentially cause a degree of internal diversity too erratic; for example, firms that operate under the specified SIC codes are examined further to ensure their operations are closely related to the product and services described within the SIC codes, firms such as investment funds within these industries are eliminated from the sample. Such steps to improve sample homogeneity coupled with a fine-grained methodological framework are necessary before any generalised coarse-grained research can be conducted with validity and reliability (Hult et al. 2002). The

steps performed are in the hope of enhancing the external validity of the finding. This is particularly necessary in respect to strategic management where there is clearly a lack of empirical grounding.

Finally, coming to the selection of industries, as shown, it is imperative that the industry must meet the criteria outlined. The table below shows that computer and peripherals has the highest innovation activity, assessed by the patent volume, at 30 per cent of the total volume in the US. Closer examination of the firms in this industry shows that they fit to the sample frame requirement of the study. Their business operations have high product creativity aspects. Secondly, they participate in frequent exploitation of new technologies in production processes and broader business processes. Thirdly, they also possess a high degree of technical and scientific expertise necessary to conduct operations, and lastly, these firms' R&D expenditure is very high (see more in descriptive analysis in Chapter 6), indicated as one of the key business drivers. Although the target sample population is studied from 2003-2010, the source of the table is in 2012-2013 but it was only in 2010 that the world patent statistics were produced, namely Derwent World Patent Index; in addition the innovation proportion is unlikely to be drastically different thus the source table is representative of what industries were like half a decade earlier. Computer and peripherals has been the most active sector by new patent volume since 2010 when the Derwent World Patent Index was first created.

**Table 5.3 - Derwent world patent index 2012**

		2012 Volume	2012 Ranking	% of Total	2010 Volume	% Change in Volume (2012 v 2010)
A	Computers & Peripherals	232,549	1	30%	212,622	9.4%
B	Telecommunications	94,516	2	12%	87,920	7.5%
C	Automotive	90,816	3	12%	86,479	2.2%
D	Semiconductors	84,058	4	11%	88,867	-2.8%
E	Pharmaceuticals	60,890	5	8%	59,350	2.6%
F	Medical Devices	60,300	6	8%	52,117	15.7%
G	Domestic Appliances	41,249	7	5%	36,816	12.0%
H	Aerospace	36,837	8	5%	32,622	12.9%
I	Biotechnology	26,809	9	4%	N/A*	N/A
J	Petroleum	13,234	10	2%	N/A*	N/A
K	Food, Tobacco, Beverage Fermentation	11,736	11	2%	N/A*	N/A
L	Cosmetics	6,304	12	1%	6,438	-2.1%

Source: Thomson Reuters Derwent World Patents Index (DWPI)

## Company Size

The next step to homogenising the sample is setting criteria for company size. Even though the target sample population is SMEs, this step is necessary because SME size definition varies across industries and type of products or services it provides. The majority of the sample frame examined would have not differentiated this. Thus, the study adopts separate SME guidelines from the U.S Small Business Administration (SBA). The study acknowledges that the SBA guide does not carry any legal weight; it is however distributed officially from the US government and acts as an advisory standard to the Code of Federal Regulations and Small Business Size Regulations. Therefore it is deemed reliable.

Small businesses can be classified according to methods such as employee number, sales, assets, or net profits. The following table presents the size guide standard used:

Firms within the service industries: for example, computer programming, data processing and system design has sales limits of \$25.5 million. They have SIC and NAICS codes as follows:

**Table 5.4 - 737 SIC industry codes**

<b>SIC Code</b>	<b>SIC Description</b>	<b>NAICS Code</b>	<b>NAICS Description</b>
7371	Custom Computer Programming Services	541511	Custom Computer Programming Services
7372	Prepackaged Software	334614	Software and Other Prerecorded Compact Disc, Tape, and Record Reproducing
7372	Prepackaged Software	511210	Software Publishers

Source: (Small Business Administration, 2012)

Firms within the computer and software manufacturing industries have slightly different SME status criteria. It is set by employee number. For the 357 SIC code industries below, the size standard set in the SBA guide is determined at 1000 employees.

**Table 5.5 - 357 SIC industry codes**

<b>SIC Code</b>	<b>SIC Description</b>	<b>NAICS Code</b>	<b>NAICS Description</b>
3571	Electronic Computers	334111	Electronic Computer Manufacturing
3572	Computer Storage Devices	334112	Computer Storage Device Manufacturing
3575	Computer Terminals	334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing
3577	Computer Peripheral Equipment, Nec	333316	Photographic and Photocopying Equipment Manufacturing
3577	Computer Peripheral Equipment, Nec	334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing
3577	Computer Peripheral Equipment, Nec	334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing

3577	Computer Peripheral Equipment, Nec	334613	Blank Magnetic and Optical Recording Media Manufacturing
3578	Calculating and Accounting Equipment	333318	Other Commercial and Service Industry Machinery Manufacturing
3578	Calculating and Accounting Equipment	333318	Other Commercial and Service Industry Machinery Manufacturing
3578	Calculating and Accounting Equipment	333316	Photographic and Photocopying Equipment Manufacturing
3578	Calculating and Accounting Equipment	334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing
3579	Office Machines, Nec	333318	Other Commercial and Service Industry Machinery Manufacturing
3579	Office Machines, Nec	334519	Other Measuring and Controlling Device Manufacturing
3579	Office Machines, Nec	339940	Office Supplies (except Paper) Manufacturing

Source: (Small Business Administration, 2012)

Other SIC code companies that have similar products and operations like 357 (or having sub SIC code as 357) are also considered in for the sample population: 3559, 3530, 3560, 3621, 3661, 3663, 3669, 3674 3679, 3690, 3823, 3825.

As previously mentioned, firms that have fewer than 50 employees are considered micro enterprises and were not considered for this study. The reasons being such small firms tend to reflect part-time operations, family-run, may also have unclear TMT composition, unstable objectives or other factors that may skew the study outcomes (Kirpalani & MacIntosh, 1980).

### Sample time period

The data time spans from 2003 to 2010 to cover the journey of how information was searched by the TMT search behaviour initially to the final impact on the firm performance in 2009 (see conceptual model for details).

### Final sample frame

At this point the database criteria are complete and ready to be examined for data collection. To judge the accuracy of the newly formed sample frame, three elements were evaluated: the source of the database, the purpose of the publication and its quality (Churchill & Iacobucci, 2005). In addition, following the eligibility criteria set, a total of **518 SMEs** were generated.

To summarise, the criteria applied for the sample frame is:

**Table 5.6 - Sample frame criteria**

SIC Code	Criteria Applied	Number of firms
357	US, public companies, Sales < \$ 25 million	121
7371, 7372	US, public companies, Employee <1000	397

\*Note: the final sample would have been gone through additional screening with criteria such as: cross-checking of SIC code with company profile, Employee number to be equal or larger than 50, firm has to be in operation after 2005 and it will also have to pass the missing data threshold and outliers elimination.

### 5.3.3 Sampling Procedure

The sample frame of the population is 518 SMEs, which is a relatively small sample frame. Normally, this would be too small and thus the sampling procedure would not be necessary. Sampling is useful if population size and the sample frame are large and when cost and time associated with obtaining information from the population is high (Churchill & Iacobucci, 2005).

Under normal circumstances, random sampling would be the ideal approach. For which, individual member in the sample frame or population would have an equal chance of being selected (Burns, 2000). It is also more advantageous than others, for example non-probability sampling. First, non bias in selection of firms allows the sample to be more representative of the population. Secondly, it explicitly implies how much variation has been introduced in the sample, instead of a census of the population. Thirdly, the probability sample provides the soundest approach to generalization or external validity of the findings.

However, generalizability is not always possible due to variability in the population definition in international settings.

Considering that the customized sample frame of this study is relatively small, upon application of further screening criteria and the demanding completeness of data over a long period, it is likely that after screening and cleaning the number of firms eligible for empirical studies would be reduced significantly. Thus, for the purpose of the study, no further sampling procedure is necessary.

#### 5.3.4 Sample Size

The sample size is usually determined by the sampling distribution procedure previously. Before collecting data, the firm participation number can have many implications on the analysis methods and findings implications. Hence, how many firms to be selected as the final sample is an important step. However it is complex and highly dependent on a number of things. It depends on the type of sample, the statistics in question, the homogeneity of the population, the resources in terms of time, money, and human capital for the study (Murphy & Myors, 2004).

The present study collects information of SME high-tech firms in the US. The customized sample frame of 518 firms is a reasonable size. The number of variables required to model and analyse is 11 excluding controls and extended analysis constructs. It is a large conceptual model with a complex relationship, thus a decent number and size of firms is required to facilitate a stable analysis in the chosen tool, namely Seemingly Unrelated Regression (more of SUR in section 5.5 – Data Analysis Methodology). Nevertheless, the decision on the exact number can be arbitrary, in that there must be a compromise between statistical accuracy, cost, time, and other resources.

The study acknowledges that the sample size has important implications on any meaningful estimations and interpretation of findings (Hair et al., 2010). With consideration of the factors above, the most widely accepted approach in deciding the sample size is on the statistical tool being conducted. Hence, it is influenced by “*a priori*” requirements of the SUR

for measuring statistical relationships. The rule of thumb is that the higher the complexity of the relationship and data analysis, the larger the sample size needed. In addition, the suggested range for common statistical analysis methods is from 150 and not exceeding 400 (Hair et al., 2010). This study aims to use a sample size within the range.

From cleaning and placing additional criteria such as cross-checking of SIC code with company profile, Employee number to be equal or larger than 50, a firm has to be in operation after 2005 and it will also have to pass the missing data threshold and outliers elimination. The final sample generated was 148 SME firms. The number is close to the range recommended, thus is deemed fit for SUR analysis and is described in the next section.

### **5.3.5 Sample Elements**

The sample of this study is based on high technology SMEs at a relatively young age. As mentioned, these firms are chosen within strict sampling criteria to ensure sample homogeneity, yet retain a degree of heterogeneity. A too standardised sample would lead to limited internal diversity of participating firms and limit the power of generalizability of the study, i.e. external validity. On the other hand, excessive internal diversity would imply firms under study have no direct strategic consequences with each other. Similarly, this damages the power of generalizability of the result.

Thus not all high tech sectors were included and firms with less than 50 employees were eliminated. The final number of firms studied is 148. Out of which the majority employ 50 to 300 people (please see Table 5.5). The large number of firms with more than 500 employees indicates firms within hardware and more production related technology SIC code industries. Approximately 80 per cent of firms are 9 years or younger as public firms. These are fairly young firms and are a typical characteristic of SMEs.

## **5.4 Execution of Data Generation**

### **5.4.1 Content Analysis**

Content analysis methodology was briefly introduced in Chapter 4 and employed to generate and measure CEO focal attention and explore-exploit innovation postures. Chapter

5 (Section 5.2.1 Focal Attention) then presented in detail how shareholders letters are a valid and valuable data source for scholars to measure managerial communications and cognitive concepts. This section focuses on the steps of execution in QSR NVivo 10 package and the checkpoints employed to ascertain reliability.

#### *5.4.1.1 Computer-aided Text Analysis of Letters to Shareholders*

To recap, this research showcases the significance of a relatively underused tool to research questions concerning CEO cognition and innovation strategy—namely, firms' letters to shareholders. Methodologically, computer-aided text-analysis (CATA) provides an alternative perspective in analysing deep meaningful cognitive communicators by analysing language and patterns in its usage to reflect deep-level concepts (Duriau et al., 2007). CATA enables the study to bypass many of the problems related to surveys. Among the many benefits, letters to shareholders are available publicly with regularity and over multiple periods; they also have high reputation in terms of objectivity and accountability.

This research uses QSR NVivo 10 computer-aided content-analysis, as recommended by Uotila, Maula, Keil and Zahra (2009) and Heyden, Oehmichen, Nichting and Sven (2012), built on Volberda, Baden-Fuller and Bosch (2001) to measure exploration and exploitation innovation posture constructs and also used Yadav, Prabhu and Chandy (2007) to measure CEO focal attention focus constructs. CATA helps to filter, categorise, and process information by combining expert human judgement with computer efficiency and reliability (Krippendorff, 2004). The steps of how CATA was used will be explained here and in the next few subsections but essentially, CATA archives shareholders' letters, analyses text by using theoretical meaningful terms call 'markers' from a comprehensive search dictionary that signify manifestations of the interest phenomenon, technically called 'nodes' (Heyden et al., 2012). Validation of markers is performed by human coders to ensure validity within the context of the study.

Five year panel data (2003-2007) of annual shareholders' letters in annual reports were retrieved from Thomson One Banker research database and SEC files. Annual reports have been shown to be useful and comparable over time between firms. Although it has been

criticised as a public relation tool to make a good impression on firms, thus could mislead stakeholders (Crawford, 2003), it is however unlikely to be excessive as the top management team do have **fiduciary responsibility** and all published annual reports are signed with the board's blessing. Therefore, important issues and discussions are unlikely to be misdirected (Eggers & Kaplan, 2008). Yadav, Prahbu and Chandy (2007) provided further evidence to prove that letters to shareholders actually reflect the topics to which CEOs pay attention. Their additional analyses of topics in directors' meetings show each firm differs in the issues they attend to and that their result asserts letters to shareholders reliably reflect how senior managers in firms allocate their attention.

#### **5.4.1.2 Search Dictionary and Validity**

The search dictionary contains a list of theoretical meaningful '*markers*' that indicate the phenomenon of interest, '*nodes*'. The list of markers was adopted from a very robust and reliable dictionary developed by Heyden, Oehmichen, Nichting and Sven (2012). It is an expanded version of markers suggested by (March, 1991), applied in Uotila, Maula, Keil and Zahra (2009). The search dictionary can be viewed in Appendix 2: List of Search Strings used for the Content Analyses of Innovation postures and Appendix 3: List of Search Strings used for the Content Analyses of CEO focal attention.

In total, 695 letters of shareholders were collected and imported to NVivo 10 package. After formats are neutralised, hyphenations and graphics removed, the three constructs are ready to be measured. To ensure **validity** and **reliability** of the dictionary, consultation with the author of the dictionary, Heyden, and inter-coder reliability tests were performed. Table 5.7 below shows a moderately high number of letters missing from both Annual reports and SEC files. It also shows the total number of letters each year after treatment of missing data. This is important and a preparatory action point before any analysis can be performed. Missing data can be detrimental to the analysis and a potential for bias in the findings, thus a dedicated section in Chapter 6 (Section 6.2.4 Missing Data) will explain how they were treated and evaluate whether any remedies were necessary.

**Table 5.7 - Shareholders letter**

	2001	2002	2003	2005	2006	2007	Average
<b>Missing letter</b>	33	30	34	40	40	40	24%
<b>Collected letter</b>	119	122	118	112	112	112	76%
<b>After Imputations</b>	152	152	152	152	152	152	100%

#### **5.4.1.3 Inter-coder Reliability**

Reliability in content analysis is about ascertaining consistency of the string search results under similar conditions. Following Krippendorff (2004) 's guide, two equally competent coders were given the same coding instructions to perform the analysis. The fundamental purpose is to see whether the word (frequency/count), once extracted in QSR NVivo 10 and interpreted by human judgement, corresponds to the marker/node defined in the search dictionary. Thus, reliability here concerns whether using the same measurement instrument (the search dictionary), computer-aided coding and human coding yield consistent results within an acceptable interval.

To run the reliability test, a reliability coefficient alpha needs to be calculated. Krippendorff (2004) produced a coefficient called Krippendorff's Alpha which can be run using a macro in SPSS statistical package. The coefficient measures the score of agreement between inter-coders. The steps and how Krippendorff's reliability coefficient alpha performs is presented in the following chapter and results displayed in Table 11.

#### **5.4.2 Stochastic Frontier Analysis**

Stochastic frontier analysis is a tool that concerns measuring the performance of firms, which converts inputs into outputs. It has been briefly introduced in Chapter 4 (section 4.5.1) as an increasingly empirical rigor method of capability estimation. As such, it is employed in this study to measure TMT and Marketing capability constructs. This section focuses on presenting the steps taken to generate the two capability constructs through SFA software R-Studio, including the mechanisms and assumptions implied.

### 5.4.2.1 Technical Efficiency

Financial and non-financial data are collected from annual reports in 2003 and 2004 as presented in equations M(3) - TMT capability and M(4) - Marketing Capability (see section 5.2 Measures and Source of Variables for more details of each variable):

$$\mathbf{M(3)} \quad \ln (PROFit) = \alpha_0 + \alpha_1 \ln (REMTMit) + \alpha_2 \ln (TENit - a) + \alpha_3 \ln (DIVit) + \alpha_6 \ln (PROFikt - 1) + \varepsilon_{it} - \eta_{it},$$

where,

- PROFikt = Total gross profit of firm i in time t
- REMTMit = Total remuneration for top management team
- TENit = TMT age diversity (heterogeneity in TMT age)
- DIVit = TMT tenure diversity (heterogeneity in TMT tenure)
- PROFikt - 1 = Total gross profit of firm i in time t-1

$$\mathbf{M(4)} \quad \ln (REVikt) = \alpha_0 + \alpha_1 \ln (TMSit) + \alpha_2 \ln (MKEit) + \alpha_3 \ln (REVikt - 1) + \varepsilon_{it} - \eta_{it},$$

where,

- REVikt = firm i's sales revenue generated year t,
- TMSit = Trademark stock of firm i in year t
- MKEit = Marketing and advertising expenditure of firm i in year t
- REVikt-1 = firm i's sales revenue generated in year t-1

The two frontier production functions to be estimated are Cobb-Douglas functions as proposed by Coelli, Rao, O'Donnell and Battese (2005). Cobb-Douglas functions are widely used to explain returns to scale (e.g. Battese and Coelli, 1995; Dutta et al., 2005). The essence of calculating these equations is to measure the term " $\eta_{it}$ " in the equations or the "technical efficiency" (TE) of the firm in utilising its available resources. This is also where the difference of the SFA technique compares to another such as one performing the equations using multiple regression, in the sense that it contains an **extra error term**. Regression

equation has only one standard random error term “ $\epsilon_{it}$ ”. Whereas SFA would have two; one is the standard “noise” error term of the model, and the other is the non-negative technical inefficiency component. It is this extra one that shows the values of the inefficiency for each participating firm relative to the frontier (Dutta et al., 2004). In other words, “ $\eta_{it}$ ” indicates the ability of firms to use the inputs compared to the optimal proportions of the most efficient frontier.

#### *5.4.2.2 R-Studio Application*

There are a variety of software packages that can perform SFA calculations; the author chose R Studio software package because the coding and interface is the most user-friendly and the online support is very extensive. One consideration to note is that all software has different distributional assumptions, and this may give rise to different absolute predictions of technical efficiency. However, as far as relativity and ranking of TE among participating firms is concerned, the orders are usually quite robust to distributional choice (Coelli et al., 2005).

With regard to R Studio, it has several inherent production function assumptions that underpin much of the economic analysis for the remainder of the calculations (Chambers, 1988). They are:

- a. Nonnegativity: The value of  $f(x)$  is a finite, non-negative and real number.
- b. Weak Essentiality: The production of positive output is impossible without the use of at least one input.
- c. Nondecreasing in  $x$ : (Or Monotonicity) Additional units of an input will not decrease output. More formally, if  $x^0 \geq x^1$  then  $f(x^0) \geq f(x^1)$ . If the production function is continuously differentiable, monotonicity implies all marginal productions are non-negative.
- d. Concave in  $x$ : Any linear combination of the vector  $x^0$  and  $x^1$  will produce an output that is not less than or the same linear combination of  $f(x^0)$  and  $f(x^1)$ . Concavity implies all marginal products are non-increasing (i.e., the well-known law of diminishing marginal productivity).

As there are two random error terms in stochastic frontier functions “ $\varepsilon_{it}$ ” and “ $\eta_{it}$ ”, the estimation methods are underpinned by a few more assumptions (Coelli et al., 2005). Each error term “ $\varepsilon_{it}$ ” is distributed independently of each error term “ $\eta_{it}$ ”, and both errors are uncorrelated with the explanatory variables (the inputs).

- a.  $\varepsilon_i = 0$  : Zero mean
- b.  $\varepsilon_i^2 = \sigma_\varepsilon^2$  : Homoskedastic
- c.  $\varepsilon_i \varepsilon_j = 0$  for all  $i \neq j$  : Uncorrelated
- d.  $E(\eta_i^2) = \text{constant}$  : Homoskedastic
- e.  $E(\varepsilon_i \varepsilon_j) = 0$  for all  $i \neq j$  : Uncorrelated

The noise component  $\varepsilon_i$  is assumed to have identical properties to the noise component in the classical linear regression model. The inefficiency “ $\eta_{it}$ ” on the other hand has a non-zero mean. More details on the assumptions are described in Coelli, et al. (2005). However, there are two additional assumptions that are underpinned specifically in the Half-Normal model of R Studio software package. They are:

- f.  $\varepsilon_i \sim iidN(0, \sigma_\varepsilon^2)$
- g.  $\eta_i \sim iidN^+(0, \sigma_\eta^2)$

Assumption f above says that  $\varepsilon_i$  are independently and identically distributed normal random variables with zero means and variance  $\sigma_\varepsilon^2$ . Assumption g says that  $\eta_i$  are independently and identically distributed normal random variables with zero means and variance  $\sigma_\eta^2$ .

### **Data preparation and running of query**

As seen there are quite a number of assumptions that the data need to meet in order for SFA to work. Thus, prior to running the queries in R-Studio, more checks and edits need to be carried out to make sure data is totally clean, robust and fit for analysis. A few simple, standard but very important checks are outliers, non-meaningful zeros, and consistency of financial ratios or numbers that are inputted from annual statements. Once these are performed, data can be loaded in R Studio and the results are shown in chapters 6 and 7.

## 5.5 Data Analysis Methodology

### 5.5.1 Overview of Statistical Techniques

This section provides a sequential overview of different statistical techniques that will guide data analysis. Generally, statistical techniques are classified into three types depending on the number of variables and type of data under investigation (Bryman and Cramer, 1994, 2001; Churchill, 1999; Hardyck and Petrinovich, 1976). They are univariate, bivariate and multivariate analysis techniques.

**Univariate** analysis involves analysis of a single variable at a time (Bryman & Bell, 2007). Since the variable is examined in isolation using several measures such as central tendency and dispersion, it is therefore often known as a descriptive statistical technique. Thus, the main use of univariate analysis is to explore the data for initial screening, cleansing and general observation.

**Bivariate** techniques involve analysis of two variables at a time. The main difference here is this technique allows examination of interactions of the two variables to uncover trends and relatedness (Bryman & Bell, 2007). The common use is therefore often analysis for correlation where insights into potential relationships can be revealed.

**Multivariate** techniques on the other hand involve multiple, more than two variables in a single relationship or a group/set of relationships (Hair et al., 2010). There are two types of multivariate data analysis; its distinction depends on the presence or absence of the dependent variable. The first type is where multiple variables are examined without the dependent variable. In this case all variables are categorised as independent variables and are analysed equally. This type of technique is commonly used to develop construct scales which form the basis to test hypotheses. The second type is with the dependent variable. It usually refers to exploration of relationships, in situations particularly where one or more independent variable is specified as having a relationship or related in some way to a set of independent variables. Multiple linear regression analysis is a prime example of this second method, which also serves as the basis to test hypotheses.

Suggested by methodology literature, the choice of which statistical technique or a combination of statistical techniques to use depends on satisfying three criteria (Green & Tull, 1966; Kepper, 1982; Churchill, 1999; Bryman & Bell, 2007). Firstly, the measurement (nominal, ordinal, interval or ratio) and type of data (quantitative or qualitative) should be considered to see which technique is most relevant. Secondly, the consideration of the research design adopted. Lastly, the assumptions underpinning each technique may define which technique is more appropriate to utilise e.g. data distribution, structural equation modelling (SEM) inability to model multiple categorical variables or multiple and complex moderators.

With consideration of the three criteria above, it is decided that a combination of techniques will be used for data analysis. Initially, the univariate techniques of measures of central tendency and measures of dispersion would be used for exploration and description of the individual variables. Bivariate correlation technique will then be used to examine potential interactions between measures and variables before further investigation at a dependent level (multiple regression analysis). Figure 5.1 below presents a summary of statistical techniques adopted for the purpose of data analysis. These techniques are explained in more detail in the next sections.

**Figure 5.1 - Summary of statistical techniques adopted for data analysis**

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**Summary of Statistical Techniques Adopted and Executed for Data Analysis**

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1. Descriptive tests: Analysis of constructs.
  2. Correlation analysis: Detection of potential underlying relationships within constructs and among variables.
  3. Pair sample test: Detection of differences between two variables, used in treatment of missing data.
  4. Correlation analysis: performed to explore hypothesized relationships.
  5. Seemingly Unrelated Regression used to model all hypotheses simultaneously.
-

## 5.5.2 Descriptive Techniques

As the name suggests, descriptive techniques are used to describe data in ways to reveal initial insights and indicate preliminary avenues for further examination (Foster, 2001).

Techniques adopted are measures of central tendency, and measures of dispersion and variance in the data. Execution of these techniques is fairly straightforward and outlined as follows.

### 5.5.2.1 Measures of Central Tendency

Mean, median and mode are the three measure outcomes of central tendency. The mean is the average or arithmetic mean, measured as the sum of all individual scores divided by the number of scores. The median is the mid-point value, representing the point in a distribution where below and above has an equal number of scores. The mode is the value of the variable that occurs most frequently. They are simple measures that can reveal important information of the data, especially insights into the type or shape of its distribution. For instance, when all three measures are fairly similar, it indicates a normal distribution.

There are advantages to using one measure and not the other. The advantage of using mode and median measures are that they do not suffer from the risk of extreme values (or as strongly as the mean), especially for the mode. They are also less susceptible to outliers compared to the mean measure. However, the mean remains the most popular out of the three because it is more capable of indicating the point in a distribution where the two halves balance each other out. Nonetheless, the combination of the three would be ideal. They form a fully and more insightful picture of the data and preparation for the next stages of analyses, i.e. bivariate and multivariate analysis.

### 5.5.2.2 Measures of Dispersion

The most prominent measure of dispersion is the standard deviation ( $\sigma$ , SD). It measures the distance of each variable from the arithmetic mean. It shows that the greater the distance from the mean, the higher the standard deviation, and thus, the greater the dispersion of the data. This indicates levels of homogeneity or heterogeneity of the data and supplements the measure of central tendency. It also importantly provides the best insight into the

normality of the data distribution compared to other descriptive techniques discussed earlier.

### 5.5.3 Correlation Analysis

Correlation analyses the relationships of two variables. Its purpose is to identify their extent of association or co-relation. When they co-variate, it means that as one score changes, the score of the other variable changes in a predictable way depending on the direction of its correlation. In other words, they are not independent of each other (Dancey & Reidy, 2007). The extent of the association is measured by “*statistical power of correlation*”.

**Statistical power of correlation:** *Power* measures the strength of the relationship of variables, scaled from 0 to 1, where 0 means zero power, thus zero association. The rule of thumb says that a 0.7 power of correlation would show high chance of a relationship between variables, where the study would be worth spending time and money on (Dancey & Reidy, 2007, p.248). One important thing to note is that as the sample size gets bigger so does the power of correlation, thus it may seem a good idea to collect more data in a larger sample size, but it needs to balance between obtaining a larger sample size (for lower chance of sampling errors and potential of distorting the findings as relationships are overestimated due to large sample size) against the time and budget (Dancey & Reidy 2007, Hair et al. 2006). Last but not least, it is crucial to understand that the correlation analysis ability to indicate the strength of variables relationship and its ability to specify the direction of the relationship are two different things. Correlation analysis identifies association but not causation.

**Causation** shows what causes things to happen e.g. the infamous relationship of an apple falling to the ground and gravity. To establish such a causal relationship, ideally, a random allocation of respondents to different conditions would be required e.g. in an experimental design. However, statistical methods such as SEM can make an attempt at causal modelling when variables are temporally ordered and preferably adopt a longitudinal design (Shook et al., 2003). Thus, the relationship of variables analysed and tested with *Pearson’s product*

*movement correlation* might be statistically significant (or not). It cannot however be regarded as a causation.

The study adopts correlation design as part of the preliminary analysis stage. It is merely observing and recording changes in variables and attempting to see if they co-vary in some meaningful way (Dancey & Reidy, 2007, p10). Therefore it is not to establish whether a change in one variable (independent variable) causes change in another (dependent variable). In addition, sometimes when two variables are statistically related, there might be no real association between them as there could be other factors that actually influence the relationship. It is also possible to produce a completely spurious significant correlation between two variables in the absence of other variables. And lastly, even when two variables are not statistically significant, it is *not* always possible to infer that there is no association or relationship at all, because the relationship could be non-linear (Dancey & Reidy, 2007, p.174). Any interpretation of correlation association thus should always be with great caution.

#### **5.5.4 Seemingly Unrelated Regression Analysis and Alternatives**

At this final stage of analysis, the available tools considered were OLS regression and structural equation modelling and Seemingly Unrelated Regression. These are very appealing alternatives as they offer the ability to test a wide range of hypothesised relationships among any combination of unobserved (latent) and/or observed variables. They are all appealing choices because they enable researchers to test a wide range of hypothesised relationships among any combination of observed and/or unmeasured latent variables.

Traditionally, Ordinary Least Squares regression is among the most popular tools in doctoral studies (Shook et al., 2003). It was used in 57 per cent of strategic management studies (within Strategic Management Journal) in the 1990s and 63 per cent of the studies in 2000s (Shook et al., 2003). OLS is a statistical technique that attempts to analyse the relationship between a single dependent variable and several independent variables at any one time (Hair et al., 2010). It is widely known as a versatile tool and able to test on a relationship-by-

relationship basis. It is also considered a powerful statistical technique for examining multiple relationships and testing hypotheses. However, as studies are becoming more complex and data types more abundant, Hitt, Gimeno and Hoskisson (1998) affirmed that strategy research is moving beyond the traditional “cross-sectional” tools such as multiple linear regression. Thus, this coincides with the rise of more specialized research techniques as scholars attempt to capture more complex strategic phenomena.

Next, the study moves on to consider Structural Equation Modelling (SEM) as a possible candidate for the core analysis. The main distinction of SEM from OLS regression is that it has added features such as simultaneous estimation, latent factors and autocorrelation. It is also considered a more powerful technique that can handle longitudinal design. Therefore, SEM enjoys a variety of benefits over OLS. However, it is not always the case that SEM is the optimal tool. The most common concern is the complexity of SEM; its requirement of variables and relationships can be stringent to many of the conceptual models.

Lastly, Seemingly Unrelated Regression (SUR) was considered and in fact it was decided as the main analysis technique for this study. There are three main reasons why SUR would be more appropriate than OLS and SEM:

First, regardless of the respective technique advantages, it is important to examine if these techniques are applicable to the context of the study. The conceptual model of the study has a relatively large number of variables, the research design is longitudinal, with multi firm levels but most importantly the analysis *requires simultaneous causal structure testing*. As introduced, multiple linear regression is a relationship-by-relationship hypothesis testing method; it is also usually used for cross-sectional research design. Thus despite its popularity, the technique is not optimal for the study. Nevertheless, multiple linear regression is a good alternative and chapter 8 reports an extended result using this method. Structural equation modelling (SEM) is another very powerful tool. It has the ability to fulfil all of the requirements of the conceptual model. However, due to its particular assumptions and the complexity of the study’s moderators it is not possible to run SEM reliably. Therefore SEM is not applicable. This leads to the next point where complexity of the conceptual model is a concern for both SEM and OLS, but not SUR.

SUR is more advantageous and suitable in this complexity respect because it can fulfil the complexity demand of the model. It allows all the stages (search behaviour of CEO focal attention; information processing capabilities of firm absorptive capabilities; innovation strategy postures - explore, exploit and ambidexterity) of the firm's complex innovative process to be sequentially and simultaneously modelled in such a way that they impact on the creativity and financial performance of the firm directly and indirectly. For example, exploration and exploitation alone may not impact creativity directly, but when combined temporally the impact on creativity is believed to be materially significant. The model gets *more complex* as the analysis moves to the front end where information was initially searched by the firm (external/internal/future). For example, looking externally outside the firm for big ideas and networking with external alliances may all be good antecedents to exploration, but firms need strong R&D capabilities (moderator) to leverage that. Exploitation on the other hand is believed to hinder creativity creation, as the firm has a confined space when looking inward thus usually does not yield many new ideas. However, when coupled with strong R&D or TMT capability, looking inward may help to pursue incremental innovation successfully. So the complexity of the interaction of variables demands the model to capture the underlying theory that having those combinations of search behaviours and capabilities are great, but independently explore and exploit may not always positively yield higher firm creativity. To be innovative, they need to be combined successfully. Thus, firms are expected to have the ability to match or balance the firm strategy with its leadership direction (Yadav et al., 2007), resources and capabilities (Raisch & Birkinshaw, 2008) and exploratory and exploitive learning (Kostopoulos & Bozionelos, 2011). In choosing which analysis tool can meet the demands of such complexity in variable interactions, moderators and temporal relationships, SUR is found to allow the model to factor all these stages of the innovation process simultaneously and is able to capture the complex relationships inherent in the model.

To put these reasons into more technical interpretation, SUR allows the *error terms* of regression equations to be correlated, unlike multiple linear regression. Thus more

information can be combined by the inclusion of more equations. This system helps to produce more efficient estimates. And compared to SEM, as briefly mentioned, the conceptual model at hand comprises multiple stages and multiple categories thus SEM was deemed inappropriate due to the inability to model multiple categorical variables practically (Bollen, 1989). In addition, SEM tends to be very delicate with interaction terms, especially when they are modelled as endogenous variables (Ping, 1995). Accordingly, SUR is selected as the most appropriate method (Greene, 1998).

## **5.6 Concluding Remarks**

This chapter has comprehensively detailed the bases underpinning the methodological decisions taken in this phase of the study. Methods on how to measure the key variables based solely on secondary data were implemented. Despite all efforts in the design of the research and the methods of collection and measurement of key constructs, these are reliant upon the sampling process if they are to achieve generalizability and validity characteristics. Moreover, irrespective of the data generated, the data must then be subjected to appropriate and relevant data analysis techniques from which outcomes can be derived. Consequently, the sampling process was described comprehensively from deriving the target population of SMEs US high-tech computer and software to customising the sample frame. Careful attentions were also paid on delivering a homogeneous sample with high degree of heterogeneity. This ensured satisfactory internal diversity of participating SMEs and retains the power of generalizability of the study.

# Chapter 6 – Result (I): Descriptive and Correlation Analysis

## 6.1 Introduction

Chapters 4 and 5 discussed the methodology adopted for this research. Before discussing the descriptive results, this chapter explains the preparatory steps taken to get the data valid and reliable for further testing. These steps include checking for errors, treating for outliers, missing data, normality, multicollinearity, linearity, homoscedasticity and testing for model endogeneity. After the data quality check, the following areas will be clarified:

- Sample demographics
- Constructs statistics
- Correlation analysis

## 6.2 Preparatory Steps for Data Analysis

Multivariate analysis techniques such as SUR have incredible analytical power to test hypotheses. Naturally, it requires data to fit assumptions and requires particular distributional characteristics. For accurate analysis, meticulous preparation of data generation methods and data cleansing techniques are the first and most important step. Thus the following sections explain the steps taken to ensure that variables of the model are validated and the data are highly reliable. Subsequently, data collected are checked against stringent screening criteria such as missing data, outliers and tests of assumptions underlying normality, multicollinearity, linearity and homoscedasticity. Finally, the presence of endogeneity in the regression model is tested.

### 6.2.1 Validity and Reliability

The variables used in the study are generated from content analysis and the econometric stochastic frontier efficiency model. Chapter 5, section 5.4 explained a detailed account of how validity and reliability were achieved. The following table summarises what has been carried out and shows how they are achieved.

**Table 6.1 - Summary of validity and reliability assurance**

<b>Variables</b>	<b>Method</b>	<b>Validity</b>	<b>Reliability</b>
External focus Internal focus Future focus	Content analysis	Shareholders' letters confirmed as an appropriate source measures (Fiol, 1995; Barr, 1998) and search dictionary developed by Yadav et al., 2007 as appropriate measuring device of CEO cognition	Inter-rater test, Krippendorff's Alpha
TMT absorptive capacity MKT absorptive capacity	Stochastic Frontier Efficiency	Stochastic Frontier Analysis is an established method of measuring organisation capabilities, derived following Battese and Coelli (1992). Measure operationalization are adapted from Xiong & Bharadwaj (2011) and Dutta et al., (2005) and consulted with two economics experts on the measurement	Data obtained from reliable and trustworthy source: Annual Report, Proxy Report, ThomsonOneBanker directors database
R&D absorptive capacity	Ratio	Objective measure adopted from Cohen and Levinthal (1990)	Data obtained from reliable and trustworthy source: Annual Report, COMPUSTAT
Innovation exploration Innovation exploitation	Content analysis	Shareholders' letters confirmed as an appropriate source measures (Fiol, 1995; Barr, 1998) and search dictionary developed by Heyden et al.,	Inter-rater test, Krippendorff's Alpha

		(2012) as appropriate measuring device of firms innovation orientation	
Ambidextrous strategy	Interaction term	Mean-centred measurement adopted from theory of Cao, Gedajlovic and Zhang (2009)	Interaction term of exploitation 2005 and exploration 2006
New product creativity	Frequency count	Objective measure of how many applications were applied in 2007 adopted from Chandy, Hopstaken, Narasimhan & Prabhu (2006) and Dranove & Meltzer (1994)	Data obtained from reliable and trustworthy sources: USPTO – US Patent and Trademark Office
Operating cash flow; Return on equity	Ratio	Objective measure of financial performance adopted from Vorhies, Morgan and Autry (2009)	Data obtained from reliable and trustworthy source: Annual Report, COMPUSTAT

As presented, the wealth of background work of precedents and reliable sources means that the constructs of the study already have a pre-established degree of validity and reliability. An additional check performed was the Krippendorff's Alpha Inter-rater test which further confirms the reliability of the main constructs.

Therefore, it is possible to conclude that: first, the source of the data is reliable, dependable and trustworthy. Secondly, the constructs are valid given the high degree of precedents in the measurements in previous publications. This also reinforces the reliability property of the data.

### ***6.2.1.1 Inter-coder Reliability Test***

To run the reliability test, a reliability coefficient alpha needs to be calculated. This study uses Krippendorff (2004)'s method where a coefficient called Krippendorff's Alpha is run in an SPSS macro. The coefficient measures the score of agreement between the inter-coders result. To calculate this, a sub-sample of 102 randomly selected shareholders' letters was assembled over a five year period (2003-2007). From these letters, two independent coders

(Master students) perform their analysis under the same instructions which are the basic face-to-face training of the content analysis methodology from selected chapters of Krippendorff (2004), essential functions of NVivo 10 software and the steps on how to tally their counts in Excel spreadsheet to use for scoring reliability. Finally, tallies are collected and results are compared with the computer-aided result. The corresponding Alpha score is displayed in Table 6.2 (for SPSS output excerpt please see appendix 6). The results are run several times to further ensure reliability. Based on the coefficient score of 0.9070 we can be confident that the content analysis is reliable and can proceed to data analysis.

**Table 6.2 - Krippendorff's Alpha reliability estimate**

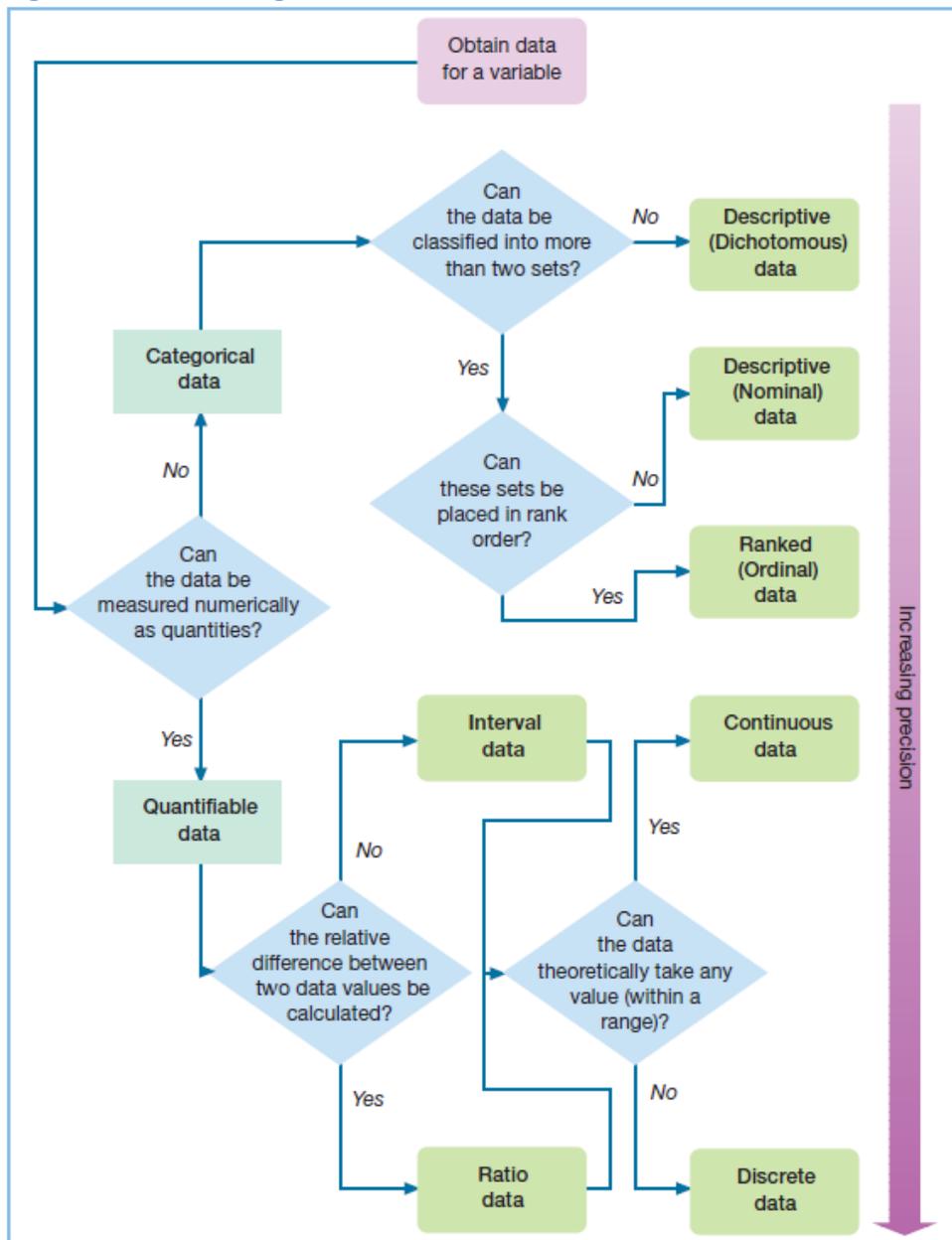
	<b>Alpha</b>	<b>Units</b>	<b>Observers</b>	<b>Pairs</b>
Nominal	0.907	306	3	918
Judges used in these computations				
NVIVO	Coder1	Coder2		

### 6.2.2 Coding and Checking for Data Errors

With the size of the data collected and high number of variables in the model, getting it conducive to data analysis is a tedious process and requires a lot of attention to detail. Firstly, a master sheet of all variables was prepared for easy management and reference during hypothesis testing insertions. Secondly, each variable was quantitatively coded. Different types of data have different levels of numerical measurements (precision) and they dictate the range of statistical techniques available for presentation, summary and analysis. Therefore, data types were examined, and quantitatively coded in broad groupings (e.g. continuous financial data vs non-financial categorical data), sub groupings and in some instances aggregated. Thirdly, the master code sheet was imported to SPSS® for *Windows*™ (Version 20) statistical package (SPSS Inc., 2002) to prepare for further examinations.

Once all data were inputted into SPSS, descriptive analyses were performed for preliminary analysis and screening of possible errors. Data entry errors were found to be minimal in number and once these were cleansed, copies of the data were backed-up. However, missing values were quite a big part of the cleansing. There was a fair amount of shareholders letters missing or not published annually thus extensive steps were taken to ensure data are as reliable and robust as possible (see section 6.2.4 – Missing Data).

Figure 6.1 - Deciding level of numerical measurement



Source: Saunders et al., 2007 p.410

### 6.2.3 Outliers

Outliers are extreme observations. As a rule of thumb, observation points that are further than three or four standard deviations from the mean are typically considered as “outliers”. These points can occur due to measurement errors or naturally originate as deviations in populations, and this is particularly higher in high kurtosis distributed data.

Using this rule of thumb, an outlier in a distribution is a number that is more than 1.5 times the length of the box away from either the lower or upper quartiles. Specifically, if a number is less than  $1^{\text{st}}$  Quartile -  $1.5 \times$  Inter Quartile Range or greater than  $3^{\text{rd}}$  Quartile +  $1.5 \times$  Inter Quartile Range, then that number will be identified as an outlier. Table 6.8 shows the number of outliers identified and treated.

The next step is to examine if these outliers have any impact on the regression. Removal or exclusion of outliers is one option. It may improve the fit of the regression model and reinforce the assumption of linearity (see section 6.2.6 Linearity and Homoscedasticity), however this is not recommended. Typically, Cook's Distance statistics can be used to diagnose the extent of influence an outlier can have on the regression compared to other outliers. Alternatively, questions can be asked of each outlier to see if there exists any substantive information about these points that suggests they should be eliminated. Particularly, assessing is required if they are the result of measurement errors. Examination showed that no such distinguishing features can be found. Individual cases with extreme values were remedied by appropriate data transformations. In addition, comparative analyses of regression were performed for both *with* and *without* these outliers. Results showed no substantial difference thus outliers identified are considered harmless to the regression analysis. Descriptive statistics in section 6.4 describe the data collected without these outliers; however the main regression analysis is performed with the outliers.

#### 6.2.4 Missing Data

The sample database consists of 11 main variables and 148 useable cases (in the base model). In order to determine the extent of missing data and the causes of missing data, all missing values were analysed in Excel. The result shows that the majority of missing data was presented in focal attention and exploration-exploitation variables. This is expected as not all annual reports publish shareholders' letters yearly. However, all other financial data, patents and trademarks are published completely with few missing financial data that could be easily traced, thus there are no missing data issues in these variables at all. The following table

summarises missing data and the mean-inputted treatments for focal attention and innovation strategies.

**Table 6.3 - Summary of missing data**

	2001	2002	2003	2005	2006	2007	
<b>Missing letters</b>	33	30	34	40	40	40	23%
<b>Letter collected</b>	119	122	118	112	112	112	77%
<b>After case substitution</b>	123	127	127	115	115	114	80%
<b>After mean substitution</b>	152	152	152	152	152	152	100%

According to Hair et al., (2006, pp. 56-64), variables with excessive levels of missing data can be treated in two ways: (i) delete (ii) or treat by imputation of the mean if the missing data is not substantial. There is no hard rule on what is the cut-off point but the rule of thumb suggests three levels of treatment:

- Under 10 percent : missing data can be ignored unless non-random
- Above 15 percent : candidate for deletion but can be remedied up to 30 percent
- Above 50 percent : definite candidate for deletion

Table 6.3 shows that 23 percent of letters of shareholders are missing. According to Hair et al (2006), this places the missing data points as candidates for deletion. However, before deciding how to treat this, the pattern and nature of the missing data must be examined.

First, it is important to note the source of missing data from the absence or presence of letters to shareholders. They can be considered non-random. There is a systematic reason these letters are not found on all annual letters every year. It is common to observe that a high number of public companies do not publish shareholders' letters on a yearly basis. They can publish every few years and few even do not have a policy to publish at all. Thus, it is common not to have a full collection of the letters; the norm is understood to be around 70-90 per cent as previous studies with shareholders' letters have witnessed (Yadav et al., 2007; Heyden et al., 2012; Heyden, 2012). In addition, arguably the message in the letter is strategic in nature, it indicates long-term plans and expectations of the top management

team. Hence, for cases where letters in the year before or the year after are found, these values will be used to replace the missing data point. Thus, additional letters in the years 2002 and 2001 were collected to fulfil the remedy. Table 6.3 shows there are 3% of cases treated using this method, reducing the total letters missing completely around the period of collection from 23 per cent to 20 per cent. And as recommended by Hair et al., (2006), the rest of the missing cases are replaced using mean inputted values.

All in all, despite the missing letters being at a moderate high level of 23 per cent, the missing data is non-random. In addition, the nature of it does not make it a substantial influence on the quality of the data. It is also under the 30 percent guideline thus the case substitution<sup>3</sup> was used to reduce the missing data to 20 percent prior to the remaining cases mean imputation.

**Table 6.4 - Mean imputed cases**

	2001	2002	2003	2005	2006	2007
<b>External focus</b>	18	18	18			
<b>Internal focus</b>	7	6	6			
<b>Future focus</b>	4	4	4			
<b>Exploration innovation</b>				9	10	9
<b>Exploitation innovation</b>				4	4	4

To ensure the mean imputation remedy does not impact on the data significantly, paired-sample tests were performed to compare the mean imputed data and the non-treated data. The reason for this additional step is because there is no definitive guideline regarding what level of missing data can safely be considered ignorable or extensive; this missing values test would give further assurance of the treatment. Table 6.5 provides t-test results between groups of missing and non-missing values. As indicated, no statistically significant differences

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<sup>3</sup> Even company with 1 letter will also be operationalized as the measure of the 3 years focal attention. This is possible as company do not change their direction quickly hence the impact of incompleteness logically will not affect the result. Secondly, focal attention is measured by continuous successive years; therefore arguably directions from 1 year will be sufficiently similar in other two years.

exist when comparing variables with missing versus non-missing data. This analysis indicates that no significant differences can be found due to the remedy of the missing data. Thus, the effect of this non-random pattern of missing values is likely to be insignificant; therefore it was deemed safe to consider the data as MACR (Missing at Complete Random).

**Table 6.5 - Paired samples test**

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	External - ExternalMD	.18110	3.84780	.34144	-.49459	.85680	.530	126	.597
Pair 2	Internal - InternalMD	.25853	5.35679	.47534	-.68215	1.19921	.544	126	.587
Pair 3	Future - FutureMD	-.11549	4.37316	.38806	-.88344	.65246	-.298	126	.766
Pair 4	Exploration - ExplorationMD	.16522	8.33537	.77728	-1.37456	1.70500	.213	114	.832
Pair 5	Exploitation - ExploitationMD	-.14058	3.54487	.33056	-.79542	.51426	-.425	114	.671

### 6.2.5 Normality and Multicollinearity

Normality is the most fundamental assumption of multivariate analysis. It refers to the shape of the data distribution. Multivariate analysis requires individual variables and all variables in combination in the study to be normally distributed. Violation of the assumption may have a negative impact on the estimation and interpretation of the analysis results. West et al., (1995) found that non-normality can cause moderate to severe underestimation of standard errors of parameter estimates, where normality indicators were at a skewness of 3 and kurtosis of 21.

There are a few ways that the normality assumption can be examined. The simplest is by visually checking the histograms, box plots or stem and leaf plots of the variables

distribution. A more accurate way is by obtaining skewness and kurtosis scores. While kurtosis represents the “*peakness*” or the height of the distribution, skewness refers to the balance of the distribution. Kurtosis and skewness are tested using SPSS statistical package, where as a rule of thumb if the calculated z value exceeds the critical value ( $\pm 2.58$ ), then the assumption about normality can be rejected at the 0.01 probability level (Hair et al., 2010). Alternatively, if the skewness absolute value is greater than 3.0 then the dataset is regarded as “extreme” and if the kurtosis absolute value is greater than 10, this would indicate a distributional problem. However, only when it surpasses skewness of 20 would the dataset be considered “extremely” problematic (Kline, 2005). Nevertheless, the potential detrimental effect to normality tends to diminish as the sample size gets larger (Hair et al., 2010).

Upon inspection of kurtosis and skewness absolute scores, 5 variables have shown high skewness or kurtosis. Consequently, these variables have been remedied by appropriate transformations. The following table reports the datasets after transformations. It confirms satisfactory indications that all datasets lie within the acceptable range of a normal distribution. Moreover, the study sample size is considered to be sufficiently large to compensate for potential biases in parameter estimates (Hair et al., 2010).

**Table 6.6 - Skewness and kurtosis scores**

	<b>Skewness</b>	<b>Kurtosis</b>
External focus	-.864	2.140
Internal focus	-.437	.180
Future focus	.003	-.478
TMT absorptive capacity	.145	-.386
MKT absorptive capacity	-1.649	4.578
R&D absorptive capacity	-.335	.619
Innovation exploration	-.880	1.042
Innovation exploitation	-.117	-.111
New product creativity	2.077	3.939

Operating cash flow	.316	-.969
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**Multicollinearity** is a term used to describe the relationship between three or more independent variables (Hair *et al.*, 1998). Multicollinearity is high if these independent variables exhibit a high correlation with each other, a correlation coefficient that is close to 1. At the other end, if the correlation coefficient nears 0, a lack of multicollinearity exists and thus the assumption of independence remains unbroken.

Multicollinearity is not a statistical occurrence, does not arise as a result of any mathematical computational or data analysis technique. Rather, it pertains to the nature of the data. Thus, it does not arise out of the specification or application of the regression model; nonetheless, it can have a substantial impact on the successful use of multiple linear regression analysis.

Multicollinearity undermines the interpretation and explanation of results since it interacts negatively with the process for separating the effects of independent variables because it limits the size of the coefficient of multiple determination (Hair *et al.*, 1998). Therefore, multicollinearity makes it difficult to determine the contribution of each independent variable to the dependent variable because the effects of the independent variables are mixed.

The second effect of multicollinearity occurs in the estimation of the regression coefficients and their statistical significance (Hair *et al.*, 1998). It can reduce the accuracy of regression coefficients estimates and in some cases attach the wrong signs to regression coefficients (Hair *et al.*, 1998). The possibility of counterintuitive and misleading results thus requires the researcher to carefully scrutinise each regression output for multicollinearity.

It is not directly possible to 'test' for multicollinearity. Instead, it is a question of measuring its degree. Methods to examine for multicollinearity include collinearity diagnostics during the regression procedure. In doing so, the important assessment is the variable inflation factor (VIF) statistic (de Vaus, 2002; Hair *et al.*, 1998). Any variable that has a VIF of 5 or more *could* indicate problems with multicollinearity (de Vaus, 2002). A cut-off threshold

beyond which multicollinearity is unacceptable is suggested to be 10 (Hair *et al.*, 1998). These rules of thumb were adopted in the appraisal of multicollinearity. Appendix 7 presents the result of VIF statistics. No evidence was found to suggest problems with that multicollinearity for all variables.

### 6.2.6 Linearity and Homoscedasticity

Another implicit assumption of all multivariate techniques is that the relationships of variables should be linear. This means that any change in the dependent variable is related to the change in the independent variables. Non-linear associations will not be presented in correlation measures. Thus often, the strength of a relationship or presence of one could be underestimated as a result of this omission.

Homoscedasticity on the other hand assumes the dependent variables display equal levels of variance across all independent variables. This assumption is also important because it ensures the variance explained in the dependent variable is not being concentrated in one or limited independent values (Hair *et al.*, 2010).

Both linearity and homoscedasticity assumptions are diagnosed visually in residual scatter plots in the SPSS regression function. The results detected no violating concerns. Additional statistical test using Breusch-Pagan/Cook-Weisberg test and White's test for homoscedasticity in STATA also confirms the diagnoses (excerpts of some of the tests are presented in Appendix 7).

### 6.2.7 Test for Endogeneity

Endogeneity is a type of error where an independent variable is correlated with the error term (residual or disturbance) in an ordinary least squares (OLS) regression model. For an in-depth review, please see Kennedy (2008). It is most typically described in the context OLS and may bias the assertions of causal inferences. To this end, multiple disciplines have increasingly identified endogeneity as an alternative or complementary explanation for results presented in journal papers. In various cases, endogeneity may epitomise as a reason for manuscript rejection (Semadeni, *et al.*, 2014).

Endogeneity can be caused by four reasons: measurement error, omitted variables, autoregression, and simultaneous causality. The first two are most common source of endogeneity. Measurement errors occur when the independent variables do not perfectly measure what they intend to. Instead, they measure something else, thus the noise or measurement error is large and this increases the chance of correlating with other parameters in the model. Endogeneity can also occur when the part of the uncaptured variance in the dependent variable lies in an unobserved explanatory variable. This is an omitted variable that the model fails to include, thus this has a negative effect on the accuracy of all parameters in the model. These are represented by the error term in an OLS regression model which is not random. It correlates with an independent variable, this leads to biased coefficient estimates (Kennedy, 2008). Bias occurs when on average, the coefficient estimate based on the same does not equal the true value of the coefficient in the population (Cohen et al., 2003).

A test for endogeneity thus ensures that the model does not have these errors, and remedies can be performed to complement the OLSS regression findings. Such a test is important because selecting suitable independent variables to explain a phenomenon requires sound theoretical grounding and a robust measurement method. If all the independent variables do not adequately explain the dependent variable, this may indicate errors somewhere in the model.

To inspect whether the model suffers from endogeneity, Durbin-Wu-Hausman test statistic is performed in STATA. Each equation was run and tested and reported in appendix 8. To briefly report the result, the SUR model used in the analysis suffers with endogeneity with two variables. There are solutions to the problem and Instrument Variable method was adopted to complement the analysis findings in chapter 7. However, there are a few points researchers must be aware in regard to endogeneity and validity of findings.

- First, to truly be able to make a causal claim, a study needs a truly exogenous variable - that is, a variable which is not related to any of the other variables in the system, unobserved and observed. The problem with observational data is that there are an infinite number of unobserved variables which could render our observed relationship endogenous. This is the problem of unobserved heterogeneity in our sample.
- In strategic management, the idea that managerial decisions are endogenous to their expected performance outcomes-if not, managerial decision making is not strategic. This enforcement of endogeneity is “superfluous” (Hamilton & Nickerson, 2003). Accordingly, most firm-level variables (e.g. R&D spending, alliance, acquisitions, etc..) can all be considered decisions made by managers to influence firm outcomes. In fact, many other variables have been considered as endogenous in other studies such as employee stock ownership, human capital investments, CEO hubris (Semadeni, et al., 2014).
- So to consider a solution for such a problem that can be arbitrary, especially in social science it would not be certain to give better validity in analysing the model. One standard solution is Instrumental Variables. Instrumental variables replace endogenous variable. To qualify, they must be relevance and exogeneity (Kennedy, 2008). Relevance refers to the theoretical sense that the variable can be a close proxy/estimator of the replaced variable. Exogeneity refers to the degree to which an instrument is uncorrelated with the disturbance term. Testing for exogeneity reduces the chance researcher to replace one endogenous independent variable with another, see Bascle (2008) for more details. The reason that solving for endogeneity and in this case Instrument Variable can be arbitrary are because firstly instrumental relevance and exogeneity are trade-off, they work against one another. As instrument strength increases (more like the endogenous variable, higher correlation), it would not be surprising if it may be related to the error term in the same ways as the original endogenous variable.

- To sum it up, this problem has led to much discussion among economists. Although aware of the problem, sociologists have been traditionally less concerned with the issue. Due to a different conception of how arguments are presented and empirically tested in social science. In fact, out of 110 leadership publications in top tier journals in the previous 10 years, over 66% suffer and fail to address the issue of endogeneity or other estimation conditions that make causal claims invalid (Antonakis, et al., 2010). Thus, in this thesis it is acceptable that there is endogeneity because of:
  1. Much of all variables and relationship are as they are. For detailed causal relationship discussion please refer to the hypotheses relationship.
  2. Empirical data are consistent with the hypothesis and empirical reasoning.
  3. Lastly, available empirical data are inconsistent with counter-arguments for how and why things are as they are or possess considerable strength of argument/empirical findings.
- The bottom line is that no method can perfectly recover causality from observational data, but in certain cases we can effectively reduce the range of plausible counter-stories.

### **6.3 Demographic Profile of the Sample**

To revisit the description of the participating firms, this section recaps the composition of the sample. Note that firms with less than 50 employees were eliminated. The final number of firms in the sample is 148. The majority of the participating firms employ between 50 to 300 employees (please see Table 6.7). The large number of firms with more than 500 employees indicates firms within hardware and more production related technology SIC industry codes. Approximately 80 per cent of firms are 9 years or younger public firms. These are fairly young firms and thus are a typical characteristic of SMEs.

**Table 6.7 - Sample firms descriptive**

Employee number	Number of firm	%
<b>50 – 99</b>	25	17%
<b>100-199</b>	34	23%
<b>200-299</b>	25	17%
<b>300-399</b>	19	13%
<b>400-499</b>	14	9%
<b>More than 500</b>	31	21%
<b>Firm age (year old as at 2004)</b>		
<b>Less than 3</b>	8	5%
<b>3-5 year</b>	20	14%
<b>5-7 year</b>	43	29%
<b>7-9 year</b>	48	32%
<b>More than 9</b>	29	20%
<b>Primary SIC Code</b>		
<b>357</b>	63	43%
<b>7371</b>	59	40%
<b>7372</b>	26	18%
<b>Sales (\$mil)</b>		
<b>Less than 25</b>	38	26%
<b>25-50</b>	25	17%
<b>50-100</b>	35	24%
<b>100-200</b>	31	21%
<b>More than 200</b>	19	13%

## 6.4 Descriptive Statistics of Constructs

The primary goal of this section is to explore the data and get a feel of their distribution, extent of occurrence and indications of possible relationships. This section is an important step guiding the next stage of analysis. Descriptive findings for each construct are illustrated in the Table 6.8 **Error! Reference source not found.**. The table reports the central tendency, range and spread of distribution.

**Table 6.8 - Descriptive statistics of data**

	Minimum	Maximum	Mean	Standard deviation	Outliers treated
External focus	0	62	17.09	9.17	14

Internal focus	0	17	6.20	3.78	9
Future focus	0	17	4.13	3.33	13
TMT absorptive capacity (%)	0	100	50	16.8	0
MKT absorptive capacity (%)	0	100	80	12.7	0
R&D absorptive capacity	0	1.33	.16	.177	0
Innovation exploration	0	27	9.74	5.81	6
Innovation exploitation	0	9	3.55	1.92	10
New product creativity	0	5	1.26	1.91	23
Operating cash flow (million)	-37	61	15.63	23.78	20

\*Note: These statistics are computed after outliers and missing data were treated. The author acknowledges that elimination of outliers could cause meaningful loss of information. Thus extended analysis was performed and found that keeping or eliminating them would not make a difference to the result. Hence, the outliers were kept for the purpose of analysis (please see Appendix 4: *Descriptive statistics of original data collected for descriptive statistics of the data used for SUR analysis*) and the treated data is described here.

### 6.4.1 Focal Attention

Descriptive statistics show that external focus's mean score of 17 words (62%) per shareholders' letter in 2003, is relatively higher than both internal and future focus, at 6 words (22%) and 4 words (15%) respectively. This indicates a higher tendency of CEOs to direct their cognitive resources at a particular set of issues, opportunities and threats outside the foci of the firm. This is consistent with the general consensus given the computer software and hardware industries are one of the most innovative industries. Ideas and events take place the most outside of the firm where consumers and competitors are dynamic and competitive. Thus, most firms will be externally focused to some extent. Being more externally or to some extent externally focused may suggest that these firms will have some awareness of the market changes. However, whether that leads to better anticipation, faster market response and tendencies to innovate exploratively, only the analysis of correlation statistics and SUR can answer.

### 6.4.2 Absorptive Capacities

Marketing and top management team absorptive capacities are operationalized by stochastic efficiency frontier analysis. Their result statistics are presented in percentages. R&D absorptive capacity on the other hand is measured conventionally, as R&D intensity ratio.

Descriptive analysis (please see table 6.8)**Error! Reference source not found.** shows that on average, firms are using their marketing resources at 80 per cent efficiency at producing sales. This indicates an 80 per cent efficiency of marketing absorptive capacity of all firms. This is a higher efficiency than top management team absorptive capacities, at 50 per cent. This also indicates that there is a lot of room for improvement, especially at the top of the firms where the statistics indicate that resources can be more efficient. There is no outlier treated here as SFE produces relative efficiency measures among sample firms to create an efficient frontier. Therefore, at least one firm will be operating at maximum capacity i.e. 100 per cent and one will be totally inefficient relative to others.

R&D intensity ratio result on the other hand shows that on average for every pound of sales generated 16 pence is spent on research and development activities; the higher the ratio, the higher R&D absorptive capacity. For further details of individual inputs and outputs of descriptive statistics and SFE results of marketing and top management team absorptive capacities, please see Appendix 5: Absorptive capacities SFE result.

### 6.4.3 Innovation Strategies

Descriptive statistics show that innovation exploration mean score of 9.7 words (73%) per shareholders' letter in 2006, is relatively higher than innovation exploitation, at 3.55 words (27%) in 2005. This indicates firms may have a tendency to adopt a more active strategy towards innovation. This is consistent with the research evidence discussed in Chapter 2 – Literature Review. The statistics found in this study reemphasize that particularly in high pace, dynamic markets such as computer and software technology where the product cycle is short, firms that want to be successful are required to evolve constantly. Therefore, new ventures have a high tendency toward exploration processes, such as pro-active search of

new information (Zahra, Ireland & Hitt (2000)). This can be related to, as seen, the high number of externally focused CEOs in this sample, and it may indicate such an inclination to explore versus exploitation. The fact that more CEOs are externally focused and firms have high tendency to explore shows a management bias towards higher learning as seen in the U.S semiconductor ventures (Eisenhardt & Schoonhoven, 1990) or the aggressive allocation of resources in new arenas within the microcomputer industry (Romanelli, 1987).

However, it is naturally unhealthy in the long-run as innovation exploitation is the bedrock of any firm. Efficiency and maximisation of profit appropriation is essential to survival, it ensures firms do not get trapped in an endless unrewarding change (Levinthal & March, 1993; Volberda & Lewin, 2003). Hence, a deeper look at the coefficient of variation in both innovation strategies shows that there is a smaller variation in adoption of exploitation strategy among firms (coefficient of variation: 1.92 sd /3.55 mean) versus exploration strategy (5.81 sd/ 9.74 mean). In other words, the number indicates that firms tend to be more consistent when adopting an exploitative strategy than an explorative strategy. As firms get larger, transforming from a pro-active, dynamic venture to a large rigid multinational, and even to a “too big to fail” size, they tend to switch back to exploitation activities. In fact, a recent survey of S&P 500 largest firms by Uotila et al. in 2009 shows that the majority of these big firms are engaged in exploration at levels below the optimum. As they get too big, their strategy orientation changes; for many the sooner they realise the better.

#### **6.4.4 New Product Creativity and Financial Outcomes**

The study models the lagged outcome of innovation strategies by using new product creativity and objective operating cash flow. Descriptive statistics show on average a firm produces 1.26 patent applications in 2007 and 15.63 million of operating cash flow two years later. In the fast pace market such as technology, high growth firms are expected. Thus, as the descriptive statistics show firms can experience negative operating cash flow; particularly firms that try to expand aggressively by providing longer debtor terms, experience high

inventory, or have highly seasonal businesses, where again, inventory and debtors can consume the majority of operating cash flow during seasonal build up.

## 6.5 Correlation Analysis

At this preliminary analysis stage, the study adopts correlation design. Correlation statistics can be used widely to discover patterns of correlations. This is a very useful method particularly for survey design, where researchers can use patterns to cluster variables together into groups, which gives confidence to their questionnaires.

In interpreting correlation statistics for this study, it is merely observing and recording changes in variables and attempting to see if they co-vary in some meaningful way (Dancey & Reidy, 2007, p. 10). It is not to establish whether a change in one variable (independent variable) causes change in another (dependent variable). In addition, sometimes when two variables are statistically related, there might be no real association between them as there could be other factors that actually influence the relationship. It is also possible to produce a completely spurious significant correlation between two variables in the absence of other variables. And lastly, even when two variables are not statistically significant, it is **not** always possible to infer that there is no association or relationship at all, because the relationship could be non-linear (Dancey & Reidy, 2007, p.174).

The correlation matrix in Table 6.9 was created using Pearson product-movement correlation coefficients. The matrix shows the extent of the relationship between each of the variables on the basis that if inter-correlations were high among variables, then it could be claimed that some common relationship between them exists. Nevertheless, as mentioned above the following observations could also be a result of some unidentified variables or merely a result of a spurious relationship.

The correlations are relatively consistent with the hypotheses, showing a promising sign of the actual relationships to be truly significantly related to each other. Despite the two year time lag and the process distance of creativity at the fuzzy front end to eventual financial performance, new product creativity is 0.293 ( $p < 0.01$ ) positively correlated to operating

cash flow and 0.241 ( $p < 0.01$ ) positively correlated to operating cash flow return on equity. However, innovation exploration and exploitation do not correlate with new product creativity as shown. They are -0.193 ( $p < 0.05$ ) and -0.229 ( $p < 0.01$ ) negatively related to ambidextrous strategy. This indicates a potential relationship to creativity if firms combine exploration and exploitation activities as hypothesised. Similarly, the study expects to see a positive relationship of external focus and future focus to exploration and internal focus to exploitation. The correlation matrix indicates that all of those correlations are at a significant level. Interestingly, absorptive capacities do not show any correlation with the innovation strategies but fairly strong significant relationship to financial performance. This may indicate a random and spurious relationship, as the time period between the two variables is rather far away. Any theoretical explanation would be difficult. Lastly, the fact that only two correlations were above 0.50 shows strong evidence of the limited sign of the multicollinearity problem.

Table 6.9 - Correlation matrix

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	Operating cash flow	1														
X2	OCFROE	.613**	1													
X3	New product creativity	.293**	.241**	1												
X4	Innovation exploration	.021	-.030	.123	1											
X5	Innovation exploitation	-.007	.001	.019	.277**	1										
X6	Ambidextrous strategy	.175*	.104	.252**	-.193*	-.229**	1									
X7	External focus	.000	-.104	-.078	.224**	.219**	-.085	1								
X8	Internal focus	-.128	-.214**	-.166*	.039	.283**	-.067	.336**	1							
X9	Future focus	-.104	-.096	-.158	.183*	.155	-.065	.285**	.170*	1						
X10	TMT absorptive capacity	.384**	.263**	.367**	.033	-.060	.328**	.072	-.083	-.134	1					
X11	MKT absorptive capacity	.333**	.193*	.210*	.025	.058	.146	.083	.029	.003	.249**	1				
X12	R&D absorptive capacity	-.090	.001	-.039	.001	.035	-.126	-.026	-.072	.047	-.174*	-.143	1			
X13	Firm size	.098	.120	.039	.031	.165*	.016	.024	.120	.054	.002	.091	-.026	1		
X14	R&D alliance	.048	.049	-.040	.061	.041	-.028	.137	-.091	-.032	.011	-.071	.021	-.012	1	
X15	Marketing alliance	.019	-.060	-.061	.031	-.045	-.005	.095	-.026	-.063	-.028	-.202*	.084	-.043	.617**	1
X16	Industry	-.067	-.113	.128	.130	.052	.165*	.007	-.179*	.028	.207*	.030	-.213**	-.041	.001	-.081

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

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

The VIF and tolerance statistics for all variables were also checked for multicollinearity problems, and none identified.

## 6.6 Concluding Remarks

This chapter has provided an account of the demographic profile of the sample, the descriptive findings of the main variables and lastly the initial correlation analysis of relationships. The quality of the data was also checked, irregularity found and remedies applied where necessary.

Presentation of the descriptive results was made from the eleven main variables in the conceptual model. Based on the descriptive findings there is significant variance in the data for every construct. Insights into the data have been derived from this analysis for subsequent regression (SUR) analyses and discussions of the present study. Correlation analysis in particular indicates many interesting and expected relationships, aligning to past theoretical and empirical works (revisit Chapter 3 for Hypotheses of relationship). Chapter 7 will prove if these initial indications of variable relationships do actually relate to each other. In addition, chapter 8 shows some extension and variation of the relationship other than hypotheses in the base model.

## Chapter 7 – Result (II): Hypothesis Testing and Discussion of Findings

### 7.1 Introduction

Previous chapters determined that individual variables measurements were robust. Preliminary findings from correlation analysis were also reasonably in-line with past theories and empirical propositions. Using SUR to simultaneously model the focal relationships, this chapter presents the result for the main model. It found that CEOs who are attentive to *external* issues and answers tend to implement exploration innovation strategies; *internal* focal attention on the other hand insulates the firm from the resourceful external information thus CEOs who are more attentive to these issues and answers were found to adopt an exploitative innovation strategy. *Future* focal attention was not found to be significantly related to explorative innovation strategy. However, when *TMT* and *R&D* absorptive capacities are high, they would facilitate the formation of an explorative innovation strategy (at 0.10 significant levels). *TMT* and *R&D* absorptive capacities were also found to support the implementation of exploitative strategy from the use of internal information. In contrast, *marketing* absorptive capacity was not found to have any influence on strategy implementation. Moving on to the outcomes of the strategies, both *exploration* and *exploitation* hypotheses leading to new product *creativity* outcomes were not supported. Perhaps, it is not a surprise in the case of firms following exploitation orientation, but with exploration, one would expect the direction to yield positive innovation outcomes with all the resources and attention allocated. However, this leads to the pinnacle point of the model and the repeated question that past research has left unanswered. Does combining exploration and exploitation yield significant positive outcome? With so many impediments, can SMEs achieve successful ambidexterity? The answer is, yes they can. The study found that when exploration and exploitation strategies are combined *sequentially*, the effect on the firm creativity outcome was momentous. Finally, new product creativity

was found to mediate the relationship between sequential ambidexterity and lagged *firm performance*. Alternative relationships and conceptual models are reported in chapter 8.

## 7.2 Hypothesis Testing Results and Discussions

### 7.2.1 Base Model SUR result

The simultaneous systems of equations used standardised data to reduce the effects of variations in the units of measurement across the constructs in the model. Transformations of variables and remedies of errors were also applied where necessary. Adjusted  $R^2$  values of the equations range from 0.09 to 0.32 (please see Table 7.119). These figures suggest that the independent variables account for significant variance in the dependent variables for the firms in the sample. Using McElroy's technique to measure the goodness of fit for these four equations (McElroy, 1977), the overall system adjusted  $R^2$  of 0.11 also suggests the independent variables in these equations as a whole explain significant variance in the dependent variable for firms in the sample.

The next few subsections will present and discuss the results of each hypothesis individually.

**Table 7.1 - System of equations (SUR) results - Base model**

	<b>Equation 1</b> Operating cash flow 2009		<b>Equation 2</b> New product creativity 2007		<b>Equation 3</b> Innovation exploitation 2005		<b>Equation 4</b> Innovation exploration 2006	
	<i>Coefficient estimate</i>	<i>t-value</i>	<i>Coefficient estimate</i>	<i>t-value</i>	<i>Coefficient estimate</i>	<i>t-value</i>	<i>Coefficient estimate</i>	<i>t-value</i>
<b>Independent variables:</b>								
New product creativity	0.57	4.31***						
Innovation exploitation			-0.06	-0.45				
Innovation exploration			0.15	1.26				
Ambidextrous strategy			0.19	3.39**				
External focus					0.13	1.61†	0.24	2.22*
Internal focus					0.30	3.8***	-0.02	-0.20
Future focus					0.04	0.69	0.08	1.04
TMT absorptive capacity					-0.18	-0.52	0.14	0.33
MKT absorptive capacity					0.39	1.15	0.27	0.62
R&D absorptive capacity					0.02	0.52	-0.01	-0.15
<b>Interactions:</b>								
External x internal					0.08	2.52*	0.01	0.16
External x future					-0.03	-0.90	-0.04	-0.97
Internal x future					-0.04	-2.1*	-0.06	-1.9†
External x MKT ACAP							-0.01	-0.16
External x RD ACAP							0.07	1.03
Future x RD ACAP							0.06	1.82†
Future x MKT ACAP							0.05	1.04
Future x TMT ACAP							0.06	1.73†
Internal x TMT ACAP					0.07	2.37*		
Internal x RD ACAP					0.49	4.2***		
<b>Control variables:</b>								
Firm size	0.18	1.04	0.05	0.48	0.09	1.61†	0.02	0.29
R&D alliance	0.04	0.66	0.00	-0.02	0.03	1.53	0.01	0.25
Marketing alliance	0.00	-0.06	-0.02	-0.56	-0.02	-0.99	-0.01	-0.27
Industry	-0.41	-1.37	0.15	0.83	0.14	1.37	0.19	1.53
Individual equation R2	0.11***		0.09*		0.32***		0.15†	
System weighted R2	0.11***							

Notes: Reported coefficient estimates are standardized

†: significant at p<0.1 \*: significant at p<0.05 \*\*: significant at p<0.01 \*\*\*: significant at p<0.001

## 7.2.2 Hypothesis on New Product Creativity and Firm Performance

*H1: New product creativity is positively related to lag financial performance*

Testing hypothesis 1 demonstrated support for the predicted relationship between new product creativity and lag financial performance ( $\beta = 0.57$ ,  $t=4.31$ ). The finding demonstrates the importance of firms to generate a high number of creative ideas to support the formulation of new product designs and protection of novel ideas (through patenting). The benefit has shown to yield positive future performance by helping the firms to be the first in the market, securing the technology or designing and insulating the firms from competition. From a process view, firm performance begins from innovation, and innovation originates from the fuzzy front end where creative ideas are made. Thus as much as success, the finding shows that creativity is not a god-like esoteric feature that only the special firms among the S&P 500 possess. Firms may just need a well-balanced sequential led management of CEO focal attention and absorptive capacities to realize firm performance.

Additional examinations were carried out to explore the nature and importance of such a creative process. First, an assessment of *Sobel-Goodman mediation* test were carried out. The purpose of this test is to examine the significance of a mediation effect. In mediation, the relationship between ambidexterity and lag financial performance is hypothesized to be an indirect effect that exists due to the influence of a third variable, in this case - new product creativity. As a result, when new product creativity is included in the model, the effect ambidexterity is reduced and the effect of new product creativity remains significant. The mediation tests shows that the direct effect of ambidexterity to financial performance was not significant ( $p$ -value = 0.185) and the indirect effect with new product creativity as the mediator was significant ( $p$ -value = 0.02). The Sobel test statistics result also shows that the mediation effect of creativity was statistically significant with 38.2% of the total effect (of ambidextrous strategy on financial performance) being mediated, (please see Appendix 10: Sobel-Goodman mediation test, page 277 for the result). The mediation effect was so strong that in the second examination of the relationship, the SUR model of direct effects between

explore/exploit/ambidexterity to lagged operating cash flow confirms that innovation strategies do not directly yield lagged financial performance. Thus, Creativity is extremely vital as it *fully* mediates innovation strategies and financial performance (please see Appendix 11: Mediation test of new product creativity, p.278).

### 7.2.3 Hypotheses on Innovation Strategies and New Product Creativity

*H2a: A firm's innovation exploration strategy is positively related to new product creativity*

*H2b: A firm's innovation exploitation strategy is negatively related to new product creativity*

*H2c: The cyclical ambidexterity of exploitation and exploration is positively related to new product creativity*

**Testing hypotheses 2a & 3b** demonstrated no support for the predicted relationship between exploration strategy, exploitation strategy and new product creativity, despite the apparent benefits of different degrees of learning in explorative and exploitative activities, and the common tendencies of firms to adopt one— in that small firms tend to explore (Zahra et al., 2000) and larger incumbent firms tend to exploit (Gilbert, 2005; Uotila et al., 2009). In this sample of SME firms, no significant effect of exploration towards new product creativity was found. The finding contradicts suggestions that taking risks, experimenting and shifting different technology trajectories may lead to creativity. It shows that these risk taking activities may not necessarily improve the firm's creativeness. Conversely, the finding also contradicts the hypothesis for firms that are primarily engaged in exploitative activities; results show that incremental improvement of existing products-market or technology domains may not necessarily hamper the creativity of the firm.

Despite being the first study to examine the effect of innovation strategies to creativity, the result has similarity with some existing research that studies other organizational outcomes. Jansen, Van Den Bosch and Volberda (2006) for example did not find empirical evidence that exploration or exploitation relates to firm performance, unless the environmental condition was right. In particular, firms that pursue exploitative innovation are only effective in highly competitive environments, and exploration innovation strategists fare better in dynamic environments. Numerous other research also found no relationship and suggest firms combine both sets of activities to avoid unhealthy consequences in the long-term as firms fall into an endless trap of innovation search but unrewarding change (Levinthal & March, 1993; Volberda & Lewin, 2003). On this note, hypothesis 2c was tested next.

**Testing hypothesis 2c** demonstrated support for the predicted relationship between ambidextrous innovation strategy and new product creativity ( $\beta = 0.19$ ,  $t = 3.39$ ). This confirms three theoretical underpinnings brought forward by past research. First, to produce high output, new product creativity in the case of this study, firms cannot rely solely on an exploitation or exploration innovation strategy; they need to engage in both. Secondly, the result shows SME firms can benefit from being ambidextrous; in this case in the context of a dynamic high-tech industry as suggested by a few authors e.g. Jansen, van den Bosch, & Volberda (2005), Raisch & Birkinshaw (2008). Thirdly, as literature showed, how firms can manage two strategies at the same time varies; they can either manage simultaneously (e.g. He & Wong, 2004), sequentially (e.g. Cao et al., 2009) or by externalization of one of the activities (e.g. Lavie & Rosenkopf, 2006). The result of Hypothesis 2c shows that sequential cycling between activities works, adding empirical evidence to popular theoretic reasoning already suggested by numerous authors (e.g: Winter & Szulanski, 2001; Burgelman, 2002; Rothaermel & Deeds, 2004; Lavie & Rosenkopf, 2006; Venkatraman et al., 2007). The result also provides evidence that management practice of cycling exploration and exploitation activities in high-tech industry can outweigh the management costs and impediments, such as substantive management efforts of complexities required for an ambidextrous strategy, impediments in SME resources and administrative arrangement.

The sequential switching also supports the conventional belief that firms can break the “success traps” and “failure traps”. In line with organization adaptation instinct, Probst & Raisch (2005) found the mutual logic of corporate failure by revealing that in most cases, companies grew and changed too quickly. They are trapped in the lure of success and change, their fundamentals were insufficiently developed and cause firms to age prematurely. Conversely, to sustain success, firms have to keep a balance between these pursuits of rapid growth and short-term profit. Specifically, the cycle breaks the firms’ short-termism in search of profit to reintroduce new discoveries of capabilities and product-market-technology knowledge so that market changes can be met and efficiency is achieved at the same time.

The positive outcome of the cycle in this study confirms March (1991) 's long standing assertion of ambidexterity theory and that the contemporary concept of sequential ambidexterity can lead to positive performance outcomes, which has remained an open question left by past studies (e.g: Winter & Szulanski, 2001; Burgelman, 2002; Rothaermel & Deeds, 2004; Cao et al., 2009).

One question that may have arisen is which sequence of exploit-explore is applicable? To establish further support of the hypothesis in the sequence of exploit-explore, an extended analysis of the reciprocal sequential ambidexterity ( $\beta = 0.13$ ,  $t = 2.46$ ) and simultaneous ambidexterity ( $\beta = 0.10$ ,  $t=1.84$ ) were reported in chapter 8 (section 8.2 and 8.3). As it shows, when firms engage in exploitation prior to exploration, creativity is superior, assessed by the superior beta and significant value ( $\beta = 0.19$ ,  $t = 3.39$ ) compared to the reciprocal sequence and simultaneous ambidexterity results above.

#### 7.2.4 Hypotheses on Focal Attention and Innovation Strategy

*H4a: CEO external attention focus is positively related to innovation exploration*

*H4b: CEO future attention focus is positively related to innovation exploration*

*H4c: CEO internal attention focus is positively related to innovation exploitation*

**Testing hypothesis 4** demonstrated a mix of supported and non-supported results. The direct relationship in hypothesis 4a predicted CEO external attention focus is positively related to innovation exploration ( $\beta = 0.24$ ,  $t = 2.22$ ), and hypothesis H4b CEO internal attention focus is positively related to innovation exploitation ( $\beta = 0.30$ ,  $t = 3.80$ ); however, the predicted relationship between CEO future attention focus and innovation exploration in hypothesis H4c was not found to be supported.

Corporate strategies are reflections of decision patterns; over time key decisions at the corporate level are positively related to the division of attention and resources between explorative and exploitative activities (e.g., He and Wong, 2004; Uotila et al., 2009; Jansen et al., 2006; Levinthal and March, 1993; McGrath, 2001; Belderbos et al., 2010). The results

have shown that a higher level of external focus provides suitable ingredients for managers to formulate explorative innovation strategy. By allocating more focus and time on objects external to the firm foci, firms are more vigilant about new opportunities emerging from outside of the firm; for instance, consumer moves, rivals' competitive actions or new latent technologies. Being externally focused thus certainly helps with quicker detection of new technologies and market opportunities. And in turn enables CEOs to apply the customer feedback, market trends, new technology and competitive actions into the firm's existing products and services, better yet, enhance the firm's ability to explore extensive deployment of new innovations (Frambach et al., 2003). Nevertheless, having all this external exposure does not guarantee success, the real foundation for the successful deployment lies within focusing on the internal issues. Understanding existing processes and capabilities of the firm ensures the firm gauges its ability to avoid diving in too far to reach targets. Strong focus and understanding of internal capabilities have also shown to be positively related to the speed of developing initial products based on new technologies (Yadav et al., 2007), suggesting that internal focus facilitates deployment of new product development. This finding also implies a possible complementary effect of being internally focused and externally focused. Lastly, hypothesis 4c finds that future focus has a neutral effect on exploration; no significant effect was found. Perhaps, the result is due to the nature of the future focus construct. It is not a clear cut specific focus such as internal or external, where issues and answers, events and opportunities are more generic in nature. Despite the null effect on innovation strategies, the argument for its influence remains. For CEOs to manage the firm innovation efficiently and effectively, they still need to exhibit a broad and forward-looking perspective, particularly in management of the temporal sequence of strategies.

Although not the core objective of the study, the above argument leads to an interesting hypothesis to examine the combination of focal attention.

*H4d: A CEO whose attention focus is greater toward both external and internal is positively related to innovation ambidexterity*

*H4e: A CEO whose attention focus is greater toward both future and internal is positively related to innovation ambidexterity*

Ambidextrous strategy as a dependent variable is reported in Chapter 8 as extension analysis. The main reason it was analyzed separately in the extended model is because ambidextrous strategy is essentially made up of two antecedents - exploration and exploitation. Thus the main model only aims to explain ambidexterity through the effect of innovation exploration and exploitation independently.

Testing the hypotheses of focal attention interactions as hypothesized above also provides an interesting proposition to examine. The analysis found that external and internal focus are not necessarily the winning formula. It is actually a combination of being both inward looking at existing capabilities and forward looking to the future that is most likely to shape the firm's ambidextrous strategy. The result yields a significantly positive association between internal x future to ambidextrous strategy ( $\beta = 0.33$ ,  $t = 5.62$ ; please see section 8.1 for result and further explanation).

Like the analysis of the direct effect in individual focal attention, no focal attention has individually contributed any influence to ambidextrous strategy (please see more results in Section 8.1); nevertheless, the result shows that internal attention has proven to be the bedrock in shaping exploitation (internal-exploit  $\beta = 0.30$ ,  $t = 3.80$ ) with higher beta and significant value leading to their respective strategies (external-explore  $\beta = 0.24$ ,  $t = 2.22$ ). Thus this also shows that contrary to the prominent view of external information driving a firm's innovation strategy, deep understanding of the firm internally may be most important. In addition, the result also proves that despite being generic in nature and having an insignificant effect on hypothesis 4c, future focus becomes an important factor when it comes to balancing the ability of a firm to innovate ambidextrously. This reminds firms of the importance of being forward looking. Overall, these additional analyses support the relationship that firms need to be internally and future focused if they are to pursue both innovation strategies.

## 7.2.5 Hypotheses on Moderation Effects of Absorptive Capacities

### External → Exploration:

*H3a: Under the condition of high **marketing** absorptive capacity, the positive relationship between CEO **external** attention focus and innovation **exploration** is greater.*

*H3b: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **external** attention focus and **explorative** innovation strategy is greater.*

### Future → Exploration:

*H3c: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **future** attention focus and **explorative** innovation strategy is greater.*

*H3d: Under the condition of high **marketing** absorptive capacity, the relationship between CEO **future** attention focus and explorative innovation strategy is greater.*

*H3e: Under the condition of high **top management team** absorptive capacity, the relationship between CEO **future** attention focus and **explorative** innovation strategy is greater.*

### Internal → Exploitation:

*H3f: Under the condition of high **top management team** absorptive capacity, the relationship between CEO **internal** attention focus and **exploitative** innovation strategy is greater.*

*H3g: Under the condition of high **R&D** absorptive capacity, the relationship between CEO **internal** attention focus and **exploitative** innovation strategy is greater.*

**Table 7.2 – Summary of result of moderation effect**

Hypothesis	Hypothesised relationship (interaction effect of moderators)	Coefficient estimate ( $\beta$ )	Critical ratio (t-value)	Result
H3a	External x Marketing -> Exploration	-0.01	-0.16	Not supported
H3b	External x R&D -> Exploration	0.07	1.03	Not supported
H3c	Future x R&D -> Exploration	0.06	1.82 <sup>†</sup>	Partially supported
H3d	Future x Marketing -> Exploration	0.05	1.04	Not supported
H3e	Future x TMT -> Exploration	0.06	1.73 <sup>†</sup>	Partially supported
H3f	Internal x TMT -> Exploitation	0.07	2.37 <sup>*</sup>	Supported
H3g	Internal x R&D -> Exploitation	0.49	4.2 <sup>***</sup>	Supported

Notes: Reported coefficient estimates are standardized

†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$

**Testing hypothesis 3** (moderating effects) demonstrated that under the condition of high marketing and R&D absorptive capacity, there are no significant relationships between CEO **external** focal attention and innovation **exploration**. Under the condition of high marketing absorptive capacity, there is also no significant relationship between CEO **future** focal attention and innovation **exploration**. However, under the condition of high R&D and top management team absorptive capacity, the predicted relationships are significant (R&D:  $\beta = 0.06$ ,  $t = 1.82$  and top management team:  $\beta = 0.06$ ,  $t = 1.73$ ). In other words, R&D and top management team absorptive capacity have a small but significant moderation effect between future focal attention and innovation exploration (significant at  $p < 0.1$ ). In regards to the relationship between internal focal attention and innovation exploration, top management team and R&D absorptive capacity are found to have a larger and higher significant moderation effect (R&D:  $\beta = 0.49$ ,  $t = 4.20$ ; top management team:  $\beta = 0.07$ ,  $t = 2.37$ ).

Overall, the moderating effect on antecedent-ambidexterity linkage shows marketing absorptive capacity has no effect, however TMT and R&D absorptive capacities influence both future-explore and internal-exploit relationships. The results are consistent with new product development literature, where marketing is found to have a stronger influence on the later stage of new product development project performance and R&D is more

important in the early concept and product development stage (Ernst et al., 2010). Regarding TMT, this shows that an effective composition and highly remunerated team of TMT can make a difference to the management of corporate strategy, both in exploitation and exploration.

Further investigation of the result also shows TMT absorptive capacity also in fact facilitates the pursuit of ambidexterity, with very strong direct effect of TMT;  $\beta = 0.33$ ,  $t = 3.81$  (please see Section 8.1 extended analysis). The general consensus is that a more capable board structure is more likely to allow firms to pursue ambidextrous innovation strategy (e.g. Volberda et al., 2001; Smith & Tushman, 2005). When remuneration motivation and human diversity is high it raises commitment and reduces group-thinking. In the case of the SMEs, the effect may have been even higher. The literature review has already shown that SMEs have fewer hierarchical levels thus TMT is also expected to engage in both strategic and operational roles (Lubatkin et al., 2006). Therefore, their direct experience in juggling competing innovation orientations reinforces the direct association with the pursuit of ambidexterity in this study. This finding is in-line with upper echelons research, as suggested by Tushman and O'Reilly (1997); the senior management team's internal processes play a big role in facilitating ambidexterity.

As set forth by the attention based perspective and organizational learning, the central take away message of the model is that *"the firm's innovation strategic choices are the result of the distribution of attention at the top of the firm. This attention determines the firm choices, depending on what issues and answers CEOs are attentive to. The CEO attention to what type of issues and answers depends on the context of the firm and the process of how a firm's rules, resources, and relationships distribute various issues and answers through specific communications and procedures to the rest of the firm"*. Put simply, the underlying model proposes innovation strategies are shaped by how CEOs notice and interpret information, absorb and then translate knowledge into strategic choice.

## 7.3 Summary of Hypothesis Testing Results

**Table 7.3 - Summary of hypothesis testing results**

Hypothesis	Hypothesised relationship (interaction effect of moderators)	Coefficient estimate ( $\beta$ )	Critical ratio (t-value)	Result
H1	Creativity -> Performance	0.57	4.31***	Supported
H2a	Exploration -> Creativity	0.15	1.26	Not supported
H2b	Exploitation -> Creativity	-0.06	-0.45	Not supported
H2c	Ambidexterity -> Creativity	0.19	3.39**	Supported
H3a	External x Marketing -> Exploration	-0.01	-0.16	Not supported
H3b	External x R&D -> Exploration	0.07	1.03	Not supported
H3c	Future x R&D -> Exploration	0.06	1.82†	Partially supported
H3d	Future x Marketing -> Exploration	0.05	1.04	Not supported
H3e	Future x TMT -> Exploration	0.06	1.73†	Partially supported
H3f	Internal x TMT -> Exploitation	0.07	2.37*	Supported
H3g	Internal x R&D -> Exploitation	0.49	4.2***	Supported
H4a	External -> Exploration	0.24	2.22*	Supported
H4b	Future -> Exploration	0.08	1.04	Not supported
H4c	Internal -> Exploitation	0.30	3.8***	Supported
Extension Analysis section 8.1				
H4d	External x Internal -> Ambidexterity	-0.07	-0.86	Not supported
H4e	Future x Internal -> Ambidexterity	0.33	5.62***	Supported

Notes: Reported coefficient estimates are standardized

†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$

All in all, seven hypotheses were supported, two hypotheses were partially supported and seven hypotheses were not supported (please see table 7.3). The results reflect a complex innovation strategy model shaped by multi-organization attention perspectives, temporal spaces and organizational resources and capabilities. It promises an array of implications for existing research, management practice and policy makers.

To appreciate the complexities and theoretical richness underpinning the model, Chapter 8 extends the core model to demonstrate alternative views, relationships and analysis methods. Chapter 9 concludes the study with implications, limitations and suggestions for future research avenues.

## Chapter 8 – Result (III): Extension Analysis

### 8.1 Key Extensions

The analysis of the core model affirms the positive effect of sequential ambidexterity in the context of technological innovation and SMEs. It provides direct empirical evidence to a sequential ambidexterity that only has been mentioned in descriptive literature. The extension analysis extends and substantiates this direct empirical evidence by affirming the order of the sequence and making comparisons to the more traditional method of simultaneous ambidexterity, more commonly studied in normative literature.

This chapter has three contributions to the core analysis. First, the extension analysis adds further weight to the first contribution of this study which is to answer the two fundamental questions of ambidexterity studies: “Should organizations strive for ambidexterity?” and “how should organizations achieve the management of exploration and exploitation”? Secondly, this chapter also extends the analysis of individual relationships in focal attention, through absorptive capacities. It found TMT absorptive capacities to have a significant effect on the adoption of ambidexterity and that the direct effect of CEO focal attention to innovation processes is consistent with the core analysis. Lastly, the extension analysis validates the SUR findings with the more traditional tool in OLS multiple linear regression.

While the core analysis and extended analysis of this thesis are limited to the specific context of SMEs and technological innovation, I suggest that the methodological approach of this study may be adapted to test the ambidexterity hypothesis in other management research domains as well.

## 8.1 Extended Model with Ambidextrous Strategy

**Table 8.1 - Extended model with ambidextrous strategy**

	Equation 1 Operating cash flow 2009		Equation 2 New product creativity 2007		Equation 3 Innovation exploitation 2005		Equation 4 Innovation exploration 2006		Equation 5 Ambidextrous innovation strategy	
	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value
<b>Independent variables:</b>										
New product creativity	0.59	4.39***								
Innovation exploitation			-0.08	-0.54						
Innovation exploration			0.17	1.42						
Ambidextrous strategy			0.24	4.18***						
External focus					0.12	1.52	0.23	2.15*	-0.10	-0.50
Internal focus					0.30	3.68***	-0.02	-0.15	0.05	0.27
Future focus					0.06	0.95	0.08	1.00	0.15	1.00
TMT absorptive capacity					-0.16	-0.45	0.30	0.68	0.29	3.56***
MKT absorptive capacity					0.30	0.89	0.19	0.43	0.34	0.43
R&D absorptive capacity					-0.02	-0.04	-0.03	-0.48	0.02	0.20
<b>Interactions:</b>										
External x internal					0.07	2.41*	-0.00	-0.02	-0.07	-0.86
External x future					-0.04	-1.10	-0.05	-1.09	-0.14	-1.71†
Internal x future					-0.04	-1.88†	-0.07*	-2.11	0.33	5.62***
External x MKT ACAP							-0.00	-0.08	-0.04	-0.50
External x RD ACAP							0.06	0.99	0.11	0.91
Future x RD ACAP							0.07*	2.06	0.02	0.34
Future x MKT ACAP							0.06	1.29	0.07	0.96
Future x TMT ACAP							0.07†	1.86	-0.07	-0.82
Internal x TMT ACAP					0.07	2.36			-0.13	-0.47

Internal x RD ACAP					0.47	3.91			-0.09	-1.47
<b>Control variables:</b>										
Firm size	0.23	1.29	0.03	0.31	0.09	1.55	-0.00	-0.05	-0.04	-0.03
R&D alliance	0.06	1.02	0.00	0.02	0.03	1.54	0.00	0.16	-0.05	-1.10
Marketing alliance	-0.02	-0.25	-0.02	-0.60	-0.02	-1.05	-0.01	-0.38	0.00	0.10
Industry	-0.45	-1.47	0.12	0.66	0.12	1.20	0.21	1.61	0.22	0.96
Individual equation R2	.12***		.08**		.28**		0.16†		.36***	
System weighted R2	.17***									

Notes: Reported coefficient estimates are standardized

†: significant at p<0.1 \*: significant at p<0.05 \*\*: significant at p<0.01 \*\*\*: significant at p<0.001

Table 8.1 presents an alternative model that adds ambidexterity as a separate construct. The reason it has been analysed separately is because I wanted to examine ambidexterity hypothesis as traditionally done by scholars such as He & Wong (2004). The logic behind this is to explore both exploitation and exploration independently to see how those *differential effects* act on each of them and how both act on creativity. Fundamentally, independent exploitation and exploration do not yield any significant effect on creativity but when combined sequentially we observe a positive synergic effect.

This additional analysis also helps to explore further if other organization factors might have a direct relationship to ambidexterity not considered in the core model. As shown in the table above, TMT influence on the ambidextrous management of exploitation and exploration is crucial ( $\beta = 0.29$ ,  $p < 0.001$ ). Higher TMT capability helps to facilitate the absorption of complex knowledge and juggle both operational and strategic roles as SME managers are expected to. Hambrick and Mason (1984) argued that firms perform at varied levels because of the different strategic choices they make, but ultimately these choices are a result of their idiosyncratic

TMT composition. Further analysis of the direct effect of TMT and other absorptive capacities also supports the importance of TMT capabilities in facilitating ambidexterity.

The second finding is the synergy effect of internal and future focus on the tendency of a firm to innovate ambidextrously ( $\beta = 0.33$ ,  $p < 0.001$ ). It shows that CEO attention does not have equal impact. A focus on external and internal issues may have shaped exploration and exploitation innovation strategies, but for successful ambidexterity a combination of focus on the future and internal appears to be more essential than a focus on the external environment. In some ways, primary focus on the external and internal environment is necessary but not sufficient—companies must think long-term. A recent quote from the current CEO of Amazon succinctly put this research finding into practice. He said in an in-depth interview in 2013 that:

*“I don’t think that you can invent on behalf of customers unless you’re willing to think long-term, because a lot of invention doesn’t work. If you’re going to invent, it means you’re going to experiment, and if you’re going to experiment, you’re going to fail, and if you’re going to fail, you have to think long term.”* (GeekWire, 2013)

Jeff Bezos has his work cut out for this extension analysis; his view underlines the important synergic effect of being future focus, regardless of the way the company is trying to innovate, internally or externally, they must think long-term.

## 8.2 Reciprocal of Exploit Explore: Explore05 x Exploit06

**Table 8.2 - Reciprocal of exploit explore - explore05 x exploit06**

	<b>Equation 1</b> Operating cash flow 2009		<b>Equation 2</b> New product creativity 2007		<b>Equation 3</b> Innovation exploitation 2006		<b>Equation 4</b> Innovation exploration 2005	
	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value
<b>Independent variables:</b>								
New product creativity	0.58	4.39***						
Innovation exploration			0.02	0.16				
Innovation exploitation			-0.06	-0.56				
Ambidextrous strategy			0.13	2.46*				
External focus					0.13	1.40	0.26	2.42*
Internal focus					0.08	0.87	0.05	0.49
Future focus					0.11	1.56	0.17	2.14*
TMT absorptive capacity					0.03	0.09	-0.33	-0.79
MKT absorptive capacity					0.59	1.51	0.17	0.38
R&D absorptive capacity					-0.05	-1.09	0.02	0.34
<b>Interactions:</b>								
External x internal					0.06	1.75†	-0.01	-0.35
External x future					0.08	2.16*	-0.08	-1.87†
Internal x future					-0.07	-3.3**	-0.04	-1.35
External x MKT ACAP							-0.03	-0.85
External x RD ACAP							-0.03	-0.53
Future x RD ACAP							0.03	0.99
Future x MKT ACAP							0.08	1.7†
Future x TMT ACAP							0.08	2.21*
Internal x TMT ACAP					0.06	1.84†		
Internal x RD ACAP					0.31	2.33*		
<b>Control variables:</b>								
Firm size	0.18	1.05	0.08	0.76	0.08	1.31	0.07	0.94
R&D alliance	0.04	0.65	0.00	0.01	0.03	1.47	0.01	0.33
Marketing alliance	0.00	-0.07	-0.01	-0.36	0.00	0.13	-0.02	-0.59
Industry	-0.37	-1.24	0.21	1.13	0.08	0.65	0.17	1.30
Individual equation R2	.11***		0.07		0.20***		0.23**	
System weighted R2	.09***							

Notes: Reported coefficient estimates are standardized

†: significant at p<0.1 \*: significant at p<0.05 \*\*: significant at p<0.01 \*\*\*: significant at p<0.001

In the previous chapter, the result of hypothesis test 2c shows a synergic effect on new product creativity when firms exploit in one period and explore in the subsequent period. Such sequence yields significant positive new product creativity. This extended analysis tests the reverse sequence (this section 8.2) and simultaneous (please see result in section 8.3). Table below also shows the correlation matrix of the reverse order.

**Table 8.3 - Explore-exploit correlation matrix**

	Exploit 05	Explore 06	Explore 05	Exploit06
Exploit 05	1.0000			
Explore 06	0.2766*	1.0000		
Explore 05	0.3293*	0.6078*	1.0000	
Exploit 06	0.6513*	0.4626*	<b>0.2854*</b>	1.0000

†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$

In theory, when firms want to *appropriate* their innovative product lines they have recently explored, they would sequentially allocate greater effort to exploitation processes following exploration. In this sequence of management, the firm would switch its attention to sweat out the profit of the broad product line recently developed. As an example, Apple Computer's success in discovering and exploiting the iPod, iPhone and iPad product lines have revitalized the entire Apple brand. The result of successful exploratory processes of wider product lines allows and improves the breadth and depth of subsequent exploitation endeavours. Through exploration, the firm internalized more external knowledge and resources, thus exploitation can occur in a larger pool of competencies, and efficiency is applied on a greater scale of routines and processes.

The result above does not explicitly show if the reverse order leads to better appropriation ability or higher financial performance than the other sequence. But it shows that the magnitude and significant values of ambidextrous strategy to new product creativity is smaller in the reverse order, i.e.  $\beta = 0.13$  (2.46,  $p < 0.05$ ) versus  $\beta = 0.19$  (3.39,  $p < 0.01$ ), in fact, the management of exploration exploitation does not lead to new product creativity at all ( $R^2 = 0.07$ ,  $p$ -value = 0.20). Thus, if firms want to be more proficient in innovating, the sequence of management should be exploitation then exploration. And if firms want to appropriate their

recent innovation, in theory they should manage exploration and exploitation in the reverse order.

## 8.3 Simultaneous Ambidexterity

**Table 8.4 - Simultaneous ambidexterity**

	Equation 1 Operating cash flow 2009		Equation 2 New product creativity 2006		Equation 4 Innovation exploitation 2005		Equation 3 Innovation exploration 2005	
	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value
<b>Independent variables:</b>								
New product creativity	0.49	3.73***						
Innovation exploration			0.05	0.44				
Innovation exploitation			-0.14	-0.98				
Ambidextrous strategy			0.10	1.90†				
External focus					0.13	1.65†	0.25	2.31*
Internal focus					0.31	3.94***	0.07	0.74
Future focus					0.04	0.56	0.16	1.89†
TMT absorptive capacity					-0.25	-0.74	-0.28	-0.65
MKT absorptive capacity					0.34	1.02	0.27	0.61
R&D absorptive capacity					0.03	0.59	0.03	0.51
<b>Interactions:</b>								
External x internal					0.09	2.81**	-0.02	-0.46
External x future					-0.03	-0.88	-0.07	-1.60
Internal x future					-0.04	-2.23*	-0.04	-1.33
External x MKT ACAP							-0.04	-1.05
External x RD ACAP							-0.03	-0.50
Future x RD ACAP							0.03	0.98
Future x MKT ACAP							0.07	1.67†
Future x TMT ACAP							0.08	2.18*
Internal x TMT ACAP					0.06	2.26*		
Internal x RD ACAP					0.52	4.55***		
<b>Control variables:</b>								
Firm size	0.18	1.06	-0.07	-0.69	0.09	1.66†	0.07	0.91
R&D alliance	0.04	0.66	-0.01	-0.44	0.03	1.58	0.01	0.30
Marketing alliance	0.00	-0.08	0.00	0.05	-0.02	-0.99	-0.02	-0.57
Industry	-0.39	-1.30	0.30	1.73†	0.14	1.43	0.20	1.58
Individual equation R2	.11**		0.04		0.29***		.22***	
System weighted R2	.12***							

Notes: Reported coefficient estimates are standardized

†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$

As noted in the literature view and multiple references throughout the analysis, simultaneous ambidexterity is the normative approach to managing exploration and exploitation paradoxes. Sequential ambidexterity on the other hand is viewed as the alternative. Tushman and Benner (2003) view it as a way of bypassing conflict goals and a simplification of experiments in organisational change. The result of this extended analysis shows in the context of SMEs; it is a more viable mechanism than simultaneous with superior and significant influence to new product creativity. The table below shows a superior coefficient estimate, t-value and significant  $R^2$  of exploit-explore sequence compared to the other two alternatives.

**Table 8.5 - Viability of mechanisms compared**

<b>Mechanism</b>	<b>Coefficient estimate</b>	<b>t-value</b>	<b>R<sup>2</sup></b>	<b>p-value</b>
<b>Exploit → explore</b>	0.19	3.39	0.09	0.02
<b>Explore → exploit</b>	0.13	2.46	0.07	0.20
<b>Simultaneous</b>	0.10	1.90	0.04	0.19

On similar lines, Burgelman's (2002) ten year analysis of CEOs of Intel Corporation appears to suggest that sequential ambidexterity is in fact a more viable approach than simultaneous ambidexterity.

*“Does optimal long-run adaptation follow a punctuated equilibrium pattern (e.g., Tushman and Romanelli, 1985), perhaps involving a series of discrete periods, each focused on maximally exploiting the available opportunities, rather than a more continuous evolutionary process of balancing exploitation of available opportunities at a given time with preparing the ground for future growth opportunities? . . . This study's findings raise the question of whether induced and autonomous strategy processes are fundamentally at odds with one another or can be effectively pursued simultaneously. Maintaining the simultaneity of induced (variation reducing) and autonomous (variation increasing) strategy processes may involve difficulties similar to maintaining a balance between exploration and exploitation in organizational learning (March, 1991).” (Burgelman, 2002: 354)*

Given that both mechanisms are very different yet both viable ways to achieve a balance between exploration and exploitation (Burgelman, 2002), this leads to a further question of whether in the long run, the two mechanisms are equal substitutes or one approach is more appropriate in a certain environmental and organizational context. One thing we can answer from this extended analysis is that in a more single domain, smaller sized firms' sequential ambidexterity (exploit-explore) is more appropriate as findings show firms can generate higher new product creativity.

## 8.4 Direct Effect of Focal Attention and Differential Absorptive Capacities

**Table 8.6 - Direct effect of focal attention and differential absorptive capacities**

	<b>Equation 1</b> Operating cash flow 2009		<b>Equation 2</b> New product creativity 2007		<b>Equation 3</b> Innovation exploitation 2005		<b>Equation 4</b> Innovation exploration 2006		<b>Equation 5</b> Ambidextrous innovation strategy	
	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value
<b>Independent variables:</b>										
New product creativity	0.57	4.28***								
Innovation exploitation			-0.03	-0.25						
Innovation exploration			0.24	1.98*						
Ambidextrous strategy			0.26	4.49***						
External focus					0.12	1.35	0.22	2.11*	-0.30	-1.42
Internal focus					0.25	3.07**	-0.02	-0.21	-0.02	-0.11
Future focus					0.05	0.78	0.13	1.60	-0.01	-0.03
TMT absorptive capacity					-0.39	-1.07	0.03	0.08	0.33	3.81***
MKT absorptive capacity					0.13	0.35	0.04	0.09	1.01	1.16
R&D absorptive capacity					0.05	1.01	0.02	0.30	-0.06	-0.56
<b>Control variables:</b>										
Firm size	0.18	1.04	0.04	0.39	0.10	1.68†	0.02	0.34	0.03	0.22
R&D alliance	0.04	0.66	0.00	-0.02	0.02	1.22	0.01	0.29	-0.03	-0.59
Marketing alliance	0.00	-0.06	-0.02	-0.59	-0.02	-1.07	0.00	0.14	0.04	0.82
Industry	-0.41	-1.37	0.10	0.54	0.17	1.57	0.20	1.52	0.31	1.17
Individual equation R2	.11***		.09***		.15**		0.09		.14**	
System weighted R2	.09***									

Notes: Reported coefficient estimates are standardized

†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$

The simplified system of equations in Table 8.6 confirms the direct effects of focal attention and absorptive capacities:

**Table 8.7 - Direct relationship of focal attention and absorptive capacities**

Direct relationships	Coefficient estimate ( $\beta$ )	Critical ratio (t-value)	Result
External -> Exploration	0.22	2.11*	Supported
Future -> Exploration	0.13	1.6	Not supported
Internal -> Exploitation	0.25	3.07**	Supported
TMT -> Ambidexterity	0.33	3.81***	Supported

**Notes: Reported coefficient estimates are standardized**

**†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$**

The result agrees with the relationship found in the core model. External focus helps shape exploration innovation processes and internal focus helps shape exploitation innovation processes. TMT absorptive capacity as found in the extended model (section 8.1) helps to facilitate the management of sequential ambidexterity.

## 8.5 Base Model Analysis Using Multiple Linear Regression

**Table 8.8 - Base model analysis using multiple linear regression**

	<b>Equation 1</b> Operating cash flow 2009		<b>Equation 2</b> New product creativity 2007		<b>Equation 3</b> Innovation exploitation 2005		<b>Equation 4</b> Innovation exploration 2006	
	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value	Coefficient estimate	t-value
<b>Independent variables:</b>								
New product creativity	0.31	3.82***						
Innovation exploitation			-0.03	-0.34				
Innovation exploration			0.16	1.92*				
Ambidextrous strategy			0.28	3.29**				
External focus					0.13	1.50	0.21	2.08*
Internal focus					0.30	3.38**	-0.02	-0.20
Future focus					0.04	0.55	0.08	0.90
TMT absorptive capacity					-0.02	-0.22	0.05	0.56
MKT absorptive capacity					0.10	1.19	0.06	0.66
R&D absorptive capacity					0.04	0.55	-0.01	-0.07
<b>Interactions:</b>								
External x internal					0.22	2.35*	0.04	0.37
External x future					-0.07	-0.78	-0.10	-0.95
Internal x future					-0.21	-2.12*	-0.28	-1.92†
External x MKT ACAP							-0.04	-0.377
External x RD ACAP							0.12	1.30
Internal x TMT ACAP					0.21	2.43*		
Internal x RD ACAP					0.31	3.74***		
Future x RD ACAP							0.19	1.77†
Future x MKT ACAP							0.15	1.32
Future x TMT ACAP							0.16	1.50
<b>Control variables:</b>								
Firm size	0.08	1.04	0.03	0.30	0.11	1.50	0.03	0.30
R&D alliance	0.07	0.65	-0.01	-0.12	0.14	1.43	0.03	0.25
Marketing alliance	-0.01	-0.07	-0.05	-0.49	-0.09	-0.91	-0.03	-0.29
Industry	-0.10	-1.29	0.06	0.67	0.10	1.26	0.12	1.40
Individual equation R2	.08**		.06*		.21***		.03	

Notes: Reported coefficient estimates are standardized

†: significant at p<0.1 \*: significant at p<0.05 \*\*: significant at p<0.01 \*\*\*: significant at p<0.001

This section analyses the hypothesized relationships using multiple linear regression. With more than 60 per cent of studies using this method, it is among the most popular tools in doctoral studies and strategic management journals (Shook et al., 2003). It is a very effective and powerful tool to analyse cross-sectional studies and on a relationship-by-relationship basis. However, this study model is a complex system of relationships interrelated to each other. The tool used, SUR, also allowed the error terms of regression equations to be correlated, thus more information could be combined by the inclusion of more equations. Multiple regression does not allow such inclusion thus meaningful information can be lost. Thus it was not considered as the optimal tool. Nevertheless, it is still a good alternative to confirm individual relationships. The result here (please see Table 8.8) shows very similar findings to the SUR method with a few exceptions: exploration now is positively related to new product creativity and the coefficient estimates and significant values are slightly different.

## **8.6 Summary of Extension Analysis Result**

The extended analysis compares the magnitude of association of the mechanisms and new product creativity between sequential ambidexterity and simultaneous ambidexterity. It confirms that the optimal mechanism for managing ambidexterity in the context of SMEs is sequential management in the order of exploit then explore. Central to this finding is the idea that explorative and exploitative processes are not necessarily in fundamental competition. Consistent with Brown and Eisenhardt's (1997) observation and Burgelman and Grove's (2007) longitudinal study of Intel, exploitation and exploration can take place in complementary domains (e.g. technologies and markets) thus SMEs can shift attention sequentially or use rhythmic pacing to shift between activities.

The extended analysis concludes that with respect to the positive effects of exploitation on exploration, firms that aim to leverage the repeated use of existing knowledge and resources to reconfigure capabilities and apply to novel discoveries in products and markets would first exploit then explore. In an analogous manner, proficiency in exploration processes enhances successful exploitation in the next period. In this respect, the management is less ideal for

improvement of creativity but perhaps more logically optimal for appropriation of existing product lines as with the example of Apple's appropriation strategy performed to improve the economics of existing exploitative endeavours in its iPhones, iPads and iPods. With regard to simultaneous management, with less positive coefficient and insignificant  $R^2$  value it was deemed the least appropriate for SME firms to adopt. Although there are many unexplained factors to such an inferior result, it does show that in the context of SMEs where resources are more limited and the organization is usually in single domains, simultaneous management has been argued to be less favourable (Gupta et al., 2006).

# Chapter 9 – Conclusions, Implications, Limitations of the Study and Directions for Future Research

## 9.1 Conclusions of the Study

### 9.1.1 Implications for Theory and Research

#### **Theory**

*Alignment of management cognition and the firm's capability.* In this study, through attention-based view and organizational learning, I have found that CEOs cognition is the foundation of organizational learning orientation. CEOs discretion in exposing and selecting a particular set of issues and answers shape the firm's strategic choices. In particular, the study has shown that CEOs exercising their discretion to allocate scarce attention resources has significant implications for the innovation strategy orientation of the firm over a long period. Together with differential absorptive capacities, CEOs focusing on a particular set of issues and answers also has long lasting innovation outcomes.

My empirical finding linking attention focus to explore/exploit/ambidexterity innovation is the first. The finding is different from much existing research, which often views CEOs as (1) impediments to innovation, (2) irrelevant for innovation, or (3) having an indirect effect on innovation. The attention perspective adopted in the study also contrasts with the existing literature view of the effects of top management through the lens of observable characteristics, such as personality, demographics, or leadership style (e.g., Kitchell, 1997). Little is actually known about the link between the alignment of management cognition and organizational capabilities and the specific innovation outcomes that occur in SMEs. This research effort, which focuses on CEO cognition and the information processing mechanism,

represents a compelling case towards fuller understanding of the nature of management cognition and organizational learning.

*Refocusing organization.* The study also shows that CEO attention does not have equal impact. A focus on external and internal issues may have shaped exploration and exploitation innovation strategies, but a focus on the future and internal appears to be more essential than a focus on the external environment when it comes to ambidexterity and longer term success. In some ways, primary focus on the external and internal environment is necessary but not sufficient so companies must think long-term. In fact, the result of extended analysis found that the effect of being just externally and internally focused was actually negative to an ambidextrous strategy.

External and internal attention has been more widely examined against innovation outcomes (Miles & Snow, 1978; Jaworski & Kohli, 1993; Hurley & Hult, 1998; Day, 1994) but much less work has emphasised the importance of a focus on the future. This study opens the suggestion that further research could benefit from deeper examination of CEO attention in general and its temporal dimension in particular.

*Invest in more in R&D and less in Marketing at ideation phase.* The study also shows an interesting take-away in terms of organization capabilities. As small companies and early stage firms alike, it is very tempting to get the product to market quickly and start selling to build traction and brand. However, as the result shows, having high spending on marketing expenses and strong branding does not help transfer CEO external and future perspective to more a more explorative innovation strategy. However, marketing capabilities is very important helping the company to introduce the new products to the market.

Overall, the moderating effect on antecedent-ambidexterity linkage shows marketing absorptive capacity has no effect. However, TMT and R&D absorptive capacities influence both future-explore and internal-exploit relationships. The results are consistent with new product development literature, where marketing is found to have a stronger influence on the later stage of new product development project performance and R&D is more

important in the early concept and product development stage (Ernst et al., 2010). Thus early stage firms can focus their resources more on establishing an effective TMT composition and R&D capabilities which can make a more significant difference to the management of corporate strategy, both in exploitation and exploration.

*Sequential ambidexterity or simultaneous.* Through organizational learning, I have found that firms enjoy a differential effect upon sequential management of exploitation and exploration activities compared to specialization orientations, achieving superior new product creativity and subsequently bridging the firm to higher financial performance. The finding echoes March's (1991) original arguments about the need for management of both strategies. However, it is premature to claim that firms must excel at both tasks and that it may not necessarily be logical in all contexts.

The study acknowledges resources can be limited in the context of SMEs, however it believes the outcome of exploitation and exploration activities are complementary in effect; thus combining them sequentially, in the order of exploit then explore, brings higher innovation synergy to the firm. Compared with simultaneous or reciprocal sequence, it also yields a superior innovation synergy effect. Thus, the finding also implies the two mechanisms are not substitutes, but the order of management is important for success. Addressing the questions that were previously silenced of whether these two ambidexterity mechanisms are equally viable, so that firms can pick one or the other at will (Gupta et al., 2006), system design logic dictates that this sequential management is an appropriate adaptation mechanism for balancing the need for both exploitation and exploitation, especially where the firm does not consist of loosely connected domains (Gupta et al., 2006). It gives support to the traditional view of exploitation and exploitation as two ends of a continuum as March posited in his original publication but also acknowledges the orthogonality of the concept.

My empirical finding of sequential ambidexterity to performance is the first. Most studies with evidence linking to performance are anecdotal as shown in the literature review (e.g., Winter & Szulanski, 2001; Burgelman, 2002; Lavie & Rosenkopf, 2006; Rothmaermel & Deeds, 2004; He & Wong, 2004; Cao et al., 2009). The finding is also different to normative

literature on strategy, which primarily advocates simultaneous ambidexterity or externalization, while sequential allocation of attention to divergent goals is more prominent in descriptive accounts (Cyert & March, 1992). Thus, my research has shown alternative paths, theoretical beliefs, moving away from the traditional view, adding implications and contribution to both theory and practice.

## **Method**

*Longitudinal data set and text-based method.* I have established a clear temporal separation between the measurement of CEOs focal attention, innovation strategies and innovation outcome. Thus, my approach relaxes the often mentioned criticisms of cross-sectional survey-based research that investigates such issues. Furthermore, the content-analysis method represents an underused and reliable approach to assess cognitive patterns of CEOs, who are often difficult to assess through survey method. Among the many benefits of the text-based method, letters to shareholders specifically, are that they allow the study to examine the top management cognition in a very objective and highly accountable manner as their source is public, audited and available with regularity over multiple periods. This study suggests that further research can benefit from their use, along with the more general application of text analysis, such as press releases, archival material, and interview scripts with top managers. Indeed, finer-grained measures of focal attention and innovation strategies would allow for stronger tests of our underlying conceptual arguments.

### **9.1.2 Implications for Small and Medium Size Enterprises**

*Prioritize the future now.* This study reiterates and shows that CEOs are the heads of firms in more ways than one. Their cognitive capability allows them to be dynamic leaders, directing the attention of others in the organization towards particular behavior that ensures the growth of the firm. The findings have shown that SMEs can particularly benefit from CEOs who are internally aware and forward thinking and not merely in the spatial environment as prior research suggests. Detailed data on how CEOs actually allocate their attention are not within the scope of this study; it is also difficult to obtain because of confidentiality and lack

of access. However, Hamel and Prahalad (1994, p. 4) estimated that senior management devote “less than 3% ... of its energy to building a corporate perspective of the future” and Yadav, Prabhu and Chandy (2007) estimated 9.21% in their sample. In this study data set from 148 public firms, future focused thoughts (sentences) accounted for 15%. The majority of attention was allocated to external issues at 61% and the remaining 24% categorized as internal. A significant implication of these findings is that CEOs can influence the process of innovation simply by allocating more time to the future and internal issues.

*Letters to shareholders as a management tool.* Letters to shareholders is not often used as an internal management tool, but rather a communication tool to engage with external audiences such as investors and officials (e.g., Abrahamson and Amir 1996). However, the findings of the study present an important message that letters to shareholders too can have a crucial internal purpose. They can be a powerful directional tool to steer employees into committing resources to activities that are vital to the firm’s long-term survival and growth. As with advertising (Gilly & Wolfinbarger, 1998), letters to shareholders can be used to motivate employees by sharing clear goals and ambitions, creating a sense of togetherness and belonging to the organization. Delivering the right message, they can implant a vision that aligns their goals with those of the firm. Thus letters to shareholders can be exploited as a motivational factor, driving employees to work with a higher sense of purpose and pride.

*Cycle through the innovation journey.* Prior research suggests that the natural tendencies of firms are to develop either an exploitation or exploration strategy, but not both. This is often referred to as the “competency trap”, a key dilemma for organizations that want to keep up with the market. From the findings of this study, an optimistic message can be delivered to senior SME managers: the competency trap can be solved. Despite their firm’s impediments in resources or their underdeveloped structural mechanisms to promote ambidexterity, the findings show that the best-in-class SMEs are rewarded for their efforts in implementing an ambidextrous strategy.

A manager can apply the statement by firstly appreciating that innovation is a long-term process rather than a discrete event. Innovation is more than absorbing information from outside the firm; it is as much internal and looking forward to the future. Secondly, prior research has left gaps unfilled as to whether firms should be more concerned with a trade-off and seek a way to manage both. Managers should acknowledge the growing literature to support the mutually enhancing argument of exploration and exploitation (e.g. Gupta et al., 2006; O'Reilly & Tushman, 2013). BCG study of the financial performance of 2000 public listed companies in the US found that only 2 per cent consistently outperformed their industry in both stable and turbulent periods (BCG, 2013). There are very limited firms who know how important it is to start becoming ambidextrous. Moreover, the growing economic importance of emerging markets and increasingly "flat world" have enabled even individuals to compete with any companies. Evidently, the PC took 15 years to reach 40 per cent market penetration, Internet took 5 years and now smart phones in just fewer than 3. It is thus imperative that managers acknowledge the importance of being ambidextrous. This study further confirms the complementary effect, hence, in the context of resource constraint and a fast moving industry such as high-tech SMEs, managers may benefit from a strategy to cycle both exploration and exploitation innovation.

*Practical implication of researching SMEs:* I acknowledge that aside from theoretical reasons for studying SMEs, there is also an important practical justification. In the US, SMEs represent over 70% of total employment to the economy and represent a vital component of most other nations' economies (Small Business Association, 2003). Yet, despite being the bedrock of economies, studies on SMEs tend to be overlooked by management scholars, understandably due to the difficulty in getting access to data. Nevertheless, the extant literature on TMT and ambidexterity has tended to concentrate on larger firms, ones that often possess different business structures, markets and products, leaving a gap in our understanding. The study provides an attention-based managerial cognition explanation of SME-level ambidexterity and performance. In doing so, it fills some knowledge to the gap theoretically and practically, setting a step in the right direction for those who wish to study this largely overlooked organizational form.

### 9.1.3 Implications for Government and Public Policy Makers

The study has shown that despite limited resources, SMEs should and can benefit from adopting an ambidexterity. Firms are significantly more innovative and more likely to survive and grow in subsequent periods. The case for implications for government and public policy makers therefore is clear. With 70 percent of employment coming from SMEs, it is imperative that the government commits to promoting innovation initiatives and continues to set favourable tax policies to attract and retain SME innovativeness. Thomson Innovation report of 2013 shows that government commitment to innovation is directly related to its ability to attract and retain innovative organizations. The top three countries in the world with the highest number of innovators in the Top 100 innovative organizations are the US, Japan and France. They are not surprisingly also three countries with long track records of government innovation initiatives. In the US, tech start-up has benefited greatly from R&D tax credits and extensive collaboration between government and the private sector. Conversely, in Japan, R&D tax credits have increased from 10 to 12 percent for any R&D expenses against income. In France, since the reform in 2008, after large pharmaceutical firms left the country, the tax credit regime has been a lot simpler, enabling corporate tax to directly offset R&D spending. For example, the U.K. government has recently introduced “Patent Box legislation” in 2013, which aims to cut the corporate tax rate for revenue generated from patented technologies (Thomson Reuters, 2013). It may take years to find out if these strides to address the innovation issues actually work. But going forward, the study provides strong justification for government to invest in innovation stimulus programs such as tax incentives. For it will provide significant dividends in the form of new jobs, a higher technological society and a robust business environment.

## 9.2 Limitations of the Study

*Scope of findings comparison.* At the outset of the literature review, we have come to understand that despite the expanding support for the concept of ambidexterity, the way it has been conceptualized and operationalized remains ambiguous. On the one hand it can be viewed as a balancing act of the two resource competing activities. On the other hand, it can

be viewed as complementary orthogonal activities. The alternative views still show lack of clarity which has led to differing operationalization (e.g. He and Wong, 2004; Lubatkin et al., 2006). Thus, the limitation is that a comparison of results across studies should proceed with caution.

*Scope of generalization.* The study sample population is based on high technology software and hardware SMEs in the US. Thus the results should not be generalized to markedly different populations given the cultural, competitiveness and environmental differences that exist among industries and countries.

*Erosion of meaningful data.* My reliance on 1-year, time-lagged data from each stage, although argued to be superior to cross-sectional data, is susceptible to other extraneous effects that may influence the relationships during that period of time. Arguably, focal attention and tendencies of strategy implementation are stable over the short term; given their normative base and the membership changes at TMT, I cannot rule out to what extent the meaning of data is eroded, which may have contributed to the unexplained variables in the model. Perhaps, more extended longitudinal studies of these relationships will show more precisely whether focal attention really leads to different strategies and whether ambidexterity consistently leads to sustained new product creativity, coupled with limited resources and the inherent complexities in reconciling resource and capability dissonances within the same firm. Such extended studies would also minimize the concerns over intervening phenomena during such a lagged period.

*Constructs limitations.* Absorptive capacities have been predominantly operationalized by the ratio R&D, dummy variable or in my case SFA. Technically, the output input model is robust and has past literature support. However, to be more precise, the output estimate is not exactly knowledge, but merely the estimate of efficiency in resources used in different departments. For example, marketing knowledge absorption would be more appropriate if it was measured by a marketing output such as new trademark classes obtained in a certain year. R&D output would be more appropriate with new patent classes obtained, instead of research intensity ratio. Nevertheless, the method and input-output of all constructs have

been adequately supported and therefore fit the purpose of this study. In the future, alternative measures could be used to improve the robustness across different measures of these constructs.

*Causal inference with care.* The research regression model is subject to endogeneity. Efforts have been made to address the issue in terms of acknowledging the issue and providing alternative instrument variables in the regression model. The results showed a slight difference in coefficient and standard errors within the regression model. Moreover, the fact that in social science, finding a group of truly exogenous variables to explain a management phenomenon is very difficult. However, endogeneity is a 'bacteria' in the regression model and any causal inference made must be done with this issue in mind.

*Environmental properties.* The research acknowledges the lack of environmental properties in the model, which could hinder the intention to represent business realities. Thus this limitation could be minimized by including some relevant environmental variables in future study.

*Does CEOs attention drive innovation strategy adoption and firm outcomes?*

The study advocates CEOs attention as crucial in spearheading an organization's innovation process. A counterargument of my findings is that other unobserved variables may also be very important, such as organizational culture, structure and norms in driving firm strategy formulations and innovation outcomes. The theory section has presented thorough support that CEOs' attention foci drive innovation. The study then provides empirical evidence using lagged dependent variables to control for unobserved firm-specific heterogeneity. Durbin-Watson statistics also reinforce the confidence that the parameter estimates in the model are not biased and inconsistent. Nevertheless, in practice it is very difficult to find appropriate parameters that have genuine information about factors which affect firms differentially (Griliches & Mairesse, 1995). I acknowledge these limitations of my work and defer the improvements for more varied and effective instruments or more structural modeling approaches, to future research.

### 9.3 Directions for Future Research

*A step to more objective longitudinal research.* My research shows in some aspects that it is possible to gain access to objective longitudinal data for the SME population. Further research may take advantage of advanced academic, commercial and governmental databases as additional means to overcoming managers' self-reported or generalizability concerns in surveys. In addition, only longitudinal design can adequately address the fundamental research question of whether higher performance of ambidextrous strategy is sustainable in the face of changing market trends. Given the well-grounded association of ambidexterity to long-term performance, e.g. long-term survival (Cottrell & Nault, 2004) and long-term maximization of profit (Van Looy et al., 2005), future studies can fill a large gap on the question of how ambidexterity contributes to both firms' short term and long-term growth and survival. Future studies can also take advantage of the secondary data sources to answer other questions for example, how does the relative importance of orientations (e.g. integration and differentiation) evolve over time? What are the implications for firms between simultaneous management or cyclical management of exploration and exploitation? Should they manage differently for different stages of the economic/industry/firm/product cycle?

*Sequential Ambidexterity.* The study answered a very fundamental question of recent ambidexterity research. It also showed the interesting role of capabilities, particularly the role of TMT where direct association was found with ambidexterity. Although it is not within the scope of this research, this point poses interesting research questions for the future. They are: What types of TMT composition enable sequential pursuit of exploitation and exploration? What is the optimal capabilities configuration for achieving sequential ambidexterity? Looking into the existing research, the link between leadership practices/ characteristics and successful ambidexterity are demonstrated (Carmeli & Halevi, 2009; O'Reilly & Tushman, 2011). For example, Beckman (2006) found that founding team member is an important antecedent of ambidexterity. Lubatkin and colleagues (2006) found high behavioural integration –wholeness and unity of effort – of the top management team as an

important precursor of ambidexterity. While these studies and others has partly answered the above questions or related in a different context they do not provide insight into how TMT/leaders actually manage the interfaces between exploitation and exploration, whether simultaneous, sequential or in the context of SMEs. The essence of ambidexterity is to be found in the ability of the firm to leverage existing resources and capabilities from the established side of the business to gain competitive advantage in new areas. Previously, the introduction of the study stated the significant restructuring print newspapers required to adjust to digital space in Gilbert's (2005) study. The study found that the main problem of adjustment is not related with the amount of resources (e.g., investment) but the failure of the organization to change processes to leverage the existing resources effectively. Thus, the study implies to be successful at ambidexterity, TMT must be able to orchestrate the allocation of resources between the old (exploitation) and the new (exploration) domains. To understand deeper insight in-depth qualitative research may be most appropriate. Questions above and insights about how the interfaces of old and new need to look like or how TMT can deal with the inevitable new conflicts that arise. Future research in these areas is needed to clarify how TMT can resolve these strategic challenges (Cao et al., 2010; O'Reilly & Tushman, 2011)

Despite the study identifying that technological oriented firms are well suited to sequential exploitation and exploration, little can be explained from the study as to *what drives these firms to shift* between episodes of dissonance activities successfully, or precisely at what point a firm switches and how this takes place? From research of existing literature and practice, change management and overcoming path dependencies in exploitation or exploration are complex, thus further research could find out how firms make the transition from stability and routinization to embracing new technological trajectories. I envisage that TMT, capabilities profiles and formal structure will play an important role in driving the transition. Thus I anticipate future researchers to examine the role of changes in reward systems, human resources flexibility and TMT compositions.

The third future research avenue is actually a shortcoming of my study. I would have liked to examine the impact of sequential ambidexterity on both *incremental* and *radical innovation* performance. This is actually possible to implement from my existing database, however my time line is not long enough, thus it has to be deferred to the future. This additional examination would add breadth and depth to the extant research, where only short-term financial performance and crude creativity (in this case) have been investigated. Thus, this study encourages further studies on different levels of innovation outcomes and *long-term performance* implications of sequential ambidexterity.

*More fine-grained future research avenues.* Conducting research using secondary data has many advantages as discussed; one is the flexibility it brings to analysis. For example, external focal attention as a theoretical construct is comprised of *competitors* and *customers' focal attention*. The future research opportunities here are that one can disintegrate the constructs to investigate the orientations of the firm deeper. As I am writing this conclusion, Chuang, Morgan and Robson's (2015) journal paper is already in press on this very idea.

Similarly, as fore-mentioned, my new product creativity measure could also be disintegrated into incremental and radical levels by forward citation tracking or alternatively by patent approval rate. Thus this flexibility allows greater understanding of the outcomes of innovation strategies I have studied.

Lastly, the use of *content analysis* has shown great utility for the study; its ability to operationalize March's (1991) exploration and exploitation concepts presents great promise for empirical research. As we have seen, the concepts have limited empirical validation because of the difficulty in measurement. Given this study's operationalization of these concepts captured all the terms and words used in March's original definition, derived from hundreds of publicly available annual reports describing these activities, the methodology offers a robust and relatively simple procedure to replicate. I hope that this research contributes to existing knowledge of strategic management and inspires future empirical research examining the antecedents and implications of SME ambidexterity.

## 9.4 Concluding Comments

The research project was set out to answer these five research questions

- Does CEO focal attention relate to a specific type of innovation strategy?
- How does the interplay of CEO focal attention and the firm's absorptive capacity form the basis of the firm's innovation strategy?
- Do innovation strategies relate to new product creativity outcome?
- How does ambidextrous innovation strategy relate to new product creativity outcome?
- Does new product creativity relate to the firm's financial performance?

These questions were set out to unravel the popularly theorized path to innovation success. Using mixed methods entirely based on secondary data, the results have shown that despite all the impediments of SMEs, when they manage their innovation strategies appropriately, they too can achieve great innovation like mature firms.

They will require a mix of CEO attention directions, information processing capabilities and lastly to manage their innovation strategies sequentially in the order of exploitation then exploration. Table 9.1 shows which method of ambidexterity yields best creativity in the subsequent periods:

**Table 9.1 - Methods of managing ambidexterity to generate creativity**

Methods of managing ambidexterity	Coefficient estimate	t-value
Exploit then Explore	0.19	3.39**
Explore then Exploit	0.13	2.46*
Simultaneous	0.10	1.84†

†: significant at  $p < 0.1$  \*: significant at  $p < 0.05$  \*\*: significant at  $p < 0.01$  \*\*\*: significant at  $p < 0.001$

Coming back to the five research questions, the message above underlines these research questions and research objectives that, SMEs can innovate successfully by sequentially managing their exploitation and exploration activities. However, it requires a complex mix of

organizational behavioural and capability profile, at the top management level and firm level. In addition, management will need to be competent and focused, not necessarily on external issues but understanding deeply the internal issues and answers generated within the firm, as well as maintaining a forward looking perspective.

In answering the outlined research questions, my findings have contributed to existing knowledge. Firstly, my research provides objective longitudinal empirical proof that ambidexterity leads to long-term new product creativity and subsequent performance, an empirical aspect that was much needed to support the overly populated theoretical link, yet limited in the context of SMEs and rare in the sequential ambidexterity method. Secondly, the research shows that “less is more”, even in the context of resource-demanding strategic orientation of ambidexterity. Smaller firms may have fewer resources to adopt multiple strategies, but they also require less coordination and management, to the point where size becomes an advantage. Thirdly, my research methodology represents an underused yet robust approach to access managerial cognitive behaviour, which is often difficult to assess through traditional methods. Along with more general applications of text analysis, richer research can result from their use.

To conclude, the PhD project has proven that ambidexterity matters, and raises worthy questions for future research to find out how it can be successfully implemented. It hopes to stimulate future research development in the field and advocate the importance of practical implications for SMEs. Perhaps it has shown an optimistic method for SMEs to innovate, but these methods are also data-driven.

## Appendices

### **Appendix 1: Review of ambidexterity studies 1991-2013**

The following table of ambidexterity studies is sorted alphabetically by “Method & level of analysis”. Some of the review contents are taken from Raisch & Birkinshaw (2009) and Raisch, Birkinshaw, Probst & Tushman (2009).

Article	Research focus	Theoretical Lens	Method & level of analysis	Context/ Sample	Core Contribution
Groysberg & Lee (2009)	Performance outcomes	Organizational design	Archival/ hypothesis testing - Individual	Sample of 1,053 analysts in 78 investment banks	Examination of the role of individuals (star security analysts) in exploitation and exploration activities in professional service firms. They find that star employee hired for <b>exploration roles</b> experience an immediate <b>decline in performance</b> that persists for at <b>least five years</b> . This decline is most pronounced among star analysts who move by themselves rather than with a group of colleagues from the originating firm. Star analysts who join new firms in <b>exploitation roles</b> also exhibit a <b>drop in performance, but only for a year</b> . The article shows that individual, group, and organizational factors affect ambidexterity.
Venkatraman et al (2007)	Ambidexterity	Organizational learning; strategic Management	Archival/ hypothesis testing - Organisation	Sample of 1005 software firms over 12 year period	Using a sample of 1005 software firms in a cross-sectional time series design, we find that <b>sequential ambidexterity</b> significantly predicts <b>sales growth</b> as a main effect, as well as jointly with a set of contingency effects.
Probst & Raisch (2005)	Ambidexterity	Organizational adaptation	Case study - Organisation	Field research in 52 multinational firms	Analyzing <b>corporate crises</b> , the authors reveal a mutual logic of failure. In most cases, companies grew and changed too quickly. Conversely, if these factors were insufficiently developed, companies aged prematurely, which likewise led to failure. To sustain success, companies have to keep a balance between these extremes.
Adler, Goldoftas, & Levine (1999)	Antecedents	Organizational design	Case study - Organisation	Toyota Production system	In a case study of the Toyota Production System, the authors describe the functioning of four organizational mechanisms meta-routines, partitioning, switching, and ambidexterity used in the production process to manage the <b>efficiency</b> and <b>flexibility</b> paradox.
Bradach (1997)	Antecedents	Organizational design	Case study - Organisation	Five large U.S. restaurant chains	From interview and observational data, the authors model how chains use a <b>plural form</b> - the simultaneous use of company and franchise units-to achieve uniformity and system-wide adaptation. The simultaneous use of different structures was found to enhance the performance of the chain.

Appendices

Tushman & O'Reilly (1996)	Antecedents; ambidexterity	Organizational design	Case study - Organisation	Field research in multinational firms	The authors develop the idea of <b>ambidextrous organizations</b> . Following a discussion of the nature of change and the need for organizational adaptation, the structural, cultural, and leadership requirements of ambidextrous organizations are presented in detail.
Burgelman (1991)	Ambidexterity	Strategic Management; organizational adaptation	Case study - Organisation	Inductive field study of Intel Corporation	The paper presents an intra-organizational ecological perspective on strategy making and organizational adaptation. Consistently successful organizations are expected to simultaneously exercise induced and autonomous strategic processes.
Burgelman (2002)	Ambidexterity	Strategic management; organizational learning	Case study - Organisation	Longitudinal inductive field study of Intel Corporation	The paper examines implications of co-evolutionary lock-in in terms of its effect on balancing <b>induced</b> and <b>autonomous</b> strategy processes and exploitation and exploration in organizational learning. Co-evolutionary lock-in is shown to arise from an extremely focused induced strategy process.
Danneels (2002)	Ambidexterity	Technological innovation; organizational learning	Case study – Individual/ Organisation	Field research in five high-tech firms	A typology is derived that classifies new product projects based on whether they draw on existing competences, or whether they require new competences. Following organizational learning theory, these options are conceptualized as exploitation and exploration.
Andriopoulos & Lewis (2009)	Ambidexterity	Organizational design, Technological innovation	Comparative case study – Individual/ Organisation	Five product design industry leaders	Examination of the <b>integration</b> and <b>differentiation</b> tactics to address three nested paradoxes of innovation. Found that a mix of both tactics is vital for stimulating the cycles of ambidexterity. And that innovation paradox occurs at different organizational levels. Firms need to manage innovation paradoxes at multiple levels and the interactions across levels reinforce ambidextrous practices
Smith & Tushman (2005)	Antecedents	Organizational Design; leadership theory	Conceptual paper - Organization	Theoretical	Using the literature on paradox, contradictions, and conflict, the authors develop a model for managing <b>strategic contradictions</b> and identifying <b>leadership conditions</b> that facilitate a team's ability to engage in paradoxical cognitive processes.

Appendices

Gupta, Smith, & Shalley (2006)	Ambidexterity	Organizational learning	Conceptual paper - Organization	Theoretical	Theory paper addressing <b>four related questions</b> : What do exploration and exploitation mean? Are they two ends of a continuum or orthogonal to each other? How should organizations achieve balance between exploration and exploitation? Should all organizations strive for a balance or not?
Levinthal & March (1993)	Ambidexterity	Organizational learning	Conceptual paper - Organization	Theoretical	The paper describes <b>three forms of learning myopia</b> that may undermine the organization's ability to explore, as well as a range of solutions that organizations may use to sustain exploration in the face of a tendency to become overly focused on exploitation.
March (1991)	Ambidexterity	Organizational learning	Conceptual paper - Organization	Theoretical	The paper considers the relation between exploration and exploitation. It examines the complications in allocating resources between the two and points to the <b>risks inherent in a one-sided orientation</b> .
Uotila, Maula, Keil & Shaker (2009)	Performance outcomes; moderators (R&D)	Organizational learning	Content Analysis/ hypothesis testing - Organization	Longitudinal research design of 279 manufacturers (1989 to 2004) Standard & Poor's 500 index.	Longitudinal research design covering 1989 -2004 found that the optimal balance between exploration and exploitation depends upon environmental conditions. Using a novel methodology (content analysis) to measure the relative exploration versus exploitation orientation, they found an inverted <b>U-shaped relationship</b> between the relative share of <b>explorative orientation</b> and <b>financial performance</b> . This relationship is positively <b>moderated by the R&amp;D intensity</b> of the industry in which the firm operates.
Taylor & Helfat (2009)	Ambidexterity	Leadership theories, organization adaptation	Dual case study – Individual/ Organization	Technological transitions at IBM and NCR	Conceptualization of organizational linkages between the new technology and existing assets during transition. Top management can influence <b>middle managers</b> to facilitate organizational linkages by use of structural, social and cognitive influences.

Appendices

Hill and Birkinshaw (2006)	Ambidexterity ; performance outcomes (venture strategic performance)	Organizational learning	Interviews/ survey/ hypothesis testing - Organization	95 corporate venture units	Units capable of simultaneously building new capabilities and using existing capabilities, enjoyed higher levels of <b>venture strategic performance</b> , assessed in four ways: (a) creating breakthrough innovations, (b) investing in disruptive technologies that may cannibalize existing technologies, (c) developing strategic relationships with key external stakeholders, and (d) providing funding for internal venturing activities.
Rothaermel & Alexandre (2009)	Performance outcomes; Moderators	Organizational design; technology innovation	Survey and archival/ hypothesis testing - Organization	Multi-industry sample of 141 U.S. manufacturing firms	The study finds that an overly strong reliance on either internal or external sourcing is related to negative performance implications. To harness the benefits of ambidexterity, managers have to actively manage the spillovers from internal and external technology sourcing. The ability to do so depends on the organization's absorptive capacity.
Ebben & Johnson (2005)	Other moderators (size)	Strategic management	Survey/ archival study - Organization	Archival study of 200 and survey of 144 privately held U.S. firms	Using configuration theory, the authors show that small firms that pursue efficiency strategies or flexibility strategies outperform those that attempt to pursue both. <b>Size</b> is used as a configurational attribute to develop hypotheses on how pure and mixed strategies affect small firm performance.
Beckman (2006)	Antecedents	Leadership theory	Survey/ hypothesis testing – Individual/ Organization	170 U.S. high-tech firms	The results suggest that <b>team composition</b> is an important antecedent of firm ambidexterity. Founding teams with common prior company affiliations engaged in exploitation, whereas diverse prior affiliations encouraged exploration. A mix of common and diverse prior affiliations was found to be a precursor of ambidexterity.
Lubatkin, Simsek, Ling, & Veiga (2006)	Antecedents; performance outcomes	Leadership theory	Survey/ hypothesis testing - Organization	Survey of top managers from 139 SMEs	Top management team behavioral integration is found to facilitate the processing of disparate demands essential to attaining ambidexterity in SMEs. Furthermore, the findings suggest that the <b>joint pursuit</b> of an exploratory and exploitative orientation <b>positively affects performance</b> .

Appendices

Kyriakopoulos & Moorman (2004)	Other moderators (market orientation)	Marketing	Survey/ hypothesis testing - Organization	Survey of 75 Dutch business units of packaged food producers	<b>Market orientation</b> is found to facilitate a complementarity of high levels of marketing exploration and marketing exploitation strategies that results in improved new product financial performance.
Jansen et al. (2008)	Antecedents	Organizational design	Survey/ hypothesis testing - Individual	89 branches of a Dutch financial services corporation	Examine the relationship of senior teams and ambidexterity. Finding suggests a <b>positive relationship</b> between <b>senior team share vision</b> , senior team <b>contingency rewards</b> and <b>ambidexterity</b> . The study also found transformational leadership behaviour to positively moderate the impact of senior team social integration and negatively moderates the effect of contingency rewards on ambidexterity.
Jansen et al. (2009)	Antecedents (structural)	Organizational design	Survey/ hypothesis testing - Organization	Multi-industry sample of 230 private firms	Conceptualization of ambidexterity as <b>dynamic capability</b> that creates integrative value across differentiated units. The findings suggest that the asserted direct effect of structural differentiation on ambidexterity operates through <b>informal senior team</b> (i.e., senior team social integration) and <b>formal organizational</b> (i.e., cross-functional interfaces) integration mechanisms.
Mom et al.(2009)	Antecedents (structural)	Organizational design	Survey/ hypothesis Testing - Individual	Sample of 716 managers in five large firms	Conceptualization of ambidexterity at the <b>managerial level</b> and of the organizational mechanisms affecting it. Findings regarding the formal structural mechanisms indicate that a <b>manager's decision-making authority is positively related to ambidexterity</b> . Regarding the personal coordination mechanisms, the findings indicate that both a manager's participation in <b>cross-functional interfaces</b> and his or her <b>connectedness</b> to other organization members are <b>positively related to ambidexterity</b> .
Mom et al.(2007)	Antecedents (structural)	Organizational design	Survey/ hypothesis Testing - Individual	Managers in one leading electronics firm	Adding the importance of knowledge flow configurations to studies which investigate the impact of organizational factors on exploration and exploitation. The study found that the <b>more</b> a manager acquires <b>top-down and bottom-up knowledge flows</b> , or top-down and horizontal knowledge flows, the <b>higher the levels of exploration and exploitation activities</b> this manager may undertake.

Appendices

Gibson & Birkinshaw (2004)	Antecedents; performance outcomes	Organizational design	Survey/ hypothesis testing - Organization	4,195 employees in 41 business units of 10 multinational firms	The findings suggest that a context characterized by a combination of <b>stretch, discipline, support, and trust facilitates contextual ambidexterity</b> . Ambidexterity is found to <b>mediate</b> the relationship between context and firm performance.
Rosenkopf & Nerkar (2001)	Ambidexterity	Organizational learning	Survey/ hypothesis testing - Organization	Optical disk industry	The study found empirical evidence that <b>exploration</b> beyond organizational boundaries had more impact than exploration within organizations.
Cao et al.(2009)	Ambidexterity ; performance outcomes	Organizational learning	Survey/ hypothesis testing - Organization	Sample of 122 SMEs in three Chinese high-tech parks	The cross-sectional study theorized and found that the nature of performance-ambidexterity link depends on the level of resources. Specifically, <b>balance dimension</b> is most beneficial to relatively resource-constrained firms, whereas <b>combined dimension</b> is most beneficial to firms with greater access to internal and/or external sources of resources. Their study finds that over and above the independent effects of each, concurrent high levels of both dimensions yield synergistic benefits.
Lavie et al. 2009 (AMA)	Performance outcomes	Organizational learning	Survey/ hypothesis testing - Organization	Cross-sectional research design of 337 firms with 20,000 alliances over 10 year period within the U.S. software industry	Study reveals that the traditional form of balance within the function and structure domains is disadvantageous whereas <b>balance across these domains enhances performance</b> . This form of balance enhances both <b>innovativeness</b> and <b>productivity</b> without needing to reconcile conflicting partnering routines or coping with resource allocation tradeoffs within each domain. Nevertheless, such a firm still needs to decide whether to concentrate on exploration or exploitation in a given domain. This approach calls for recognizing the multidimensionality of the problem by looking at multiple domains, thus enhancing firm performance without facing the adverse consequences of introducing organizational buffers or constantly modifying organizational structures.

Appendices

Jansen et al. 2012	Ambidexterity ; performance outcomes; moderators (centralization , resource munificent)	Organizational learning	Survey/ hypothesis testing - Organization	Multisource and lagged data from 285 organizational units located within 88 autonomous branches	Suggested that <b>structural</b> and <b>resource</b> attributes of the organizational context significantly shape the relationship between unit ambidexterity and performance. This relationship is boosted when the organization is <b>decentralized</b> , more <b>resource munificent</b> , or less resource interdependent. Study also found that structural differentiation of the organization does not condition the unit ambidexterity-performance relationship.
Lavie and Rosenkopf (2006)	Ambidexterity	Organizational learning	Survey/ hypothesis testing - Organization	Cross-sectional research design of 337 firms with 20,000 alliances over 10 year period within the U.S. software industry	Observed that exploitation and exploration can be pursued both within and across three domains of <b>strategic alliances</b> including the value chain function of alliances, the attributes of alliance partners, and the network position of alliance partners. Accordingly, <b>organizations are able to simultaneously pursue exploitation and exploration such that exploitation in one unit is complemented by exploration in another.</b> Following their lead, other researchers too have begun to examine ambidexterity in the context of strategic alliances (Tiwana, 2008) and interfirm networks (Lin et al., 2007).
Chang et al (2011)	Antecedents (internal and external)	Organizational learning	Survey/ hypothesis testing - Organization	265 SMEs in Scotland	Internal organizational structures in a highly dynamic environment (dynamism + competitiveness) stimulate the appearance of innovation ambidexterity. Moreover, it is found that the relationship between organizational and environmental forces and firm performance is partially mediated by a balance dimension of innovation ambidexterity.
Chandrasekara et al. (2012)	Antecedents	Organizational learning	Survey/ hypothesis testing - Organization	34 high tech business units	Using a cross-sectional sample of 34 high-tech business units, the study analysis indicates that <b>decision risk</b> and <b>contextual alignment</b> affect ambidexterity competency for high tech organizations. Structural differentiation does not affect ambidexterity competency but has mixed effects on R&D project performance.

Appendices

He & Wong (2004)	Performance outcomes	Organizational learning; technological innovation	Survey/ hypothesis testing - Organization	Survey of 206 manufacturing firms in Singapore and Malaysia	The authors find evidence for the ambidexterity hypothesis by demonstrating that the <b>interaction between explorative and exploitative innovation is positively related to sales growth</b> and that the relative imbalance between both innovation types is negatively related to sales growth.
Auh & Menguc (2005)	Environmental factors; performance outcomes	Strategic management	Survey/ hypothesis testing - Organization	260 Australian manufacturing firms	The study explores the contingency role that <b>competitive intensity</b> plays in explaining the relationship between exploration/ exploitation and firm performance. The results show that <b>defenders benefit from exploration while prospectors benefit from exploitation as competition increases.</b>
Voss and Voss (2013)	Performance outcomes (revenue); ambidexterity (product and market)	Strategic management	Survey/ hypothesis testing - Organization	162 managing directors of Theatre Communication Group (SMEs)	The empirical results offer new insights with respect to several tensions at the heart of the ambidexterity challenge: (1) pure strategies that combine <b>product exploration</b> with <b>market exploration</b> or <b>product exploitation</b> with <b>market exploitation</b> have complementary interaction effects on revenue, (2) cross-functional ambidexterity combining <b>product exploitation</b> with <b>market exploration</b> also exerts complementary interaction effects on revenue, (3) <b>product ambidexterity</b> has positive effects on revenue for <b>older and larger</b> —but not younger and smaller—firms, and (4) <b>market ambidexterity</b> has positive effects on revenue for <b>larger</b> —but not smaller, younger, or older—firms.
Jansen, van den Bosch, & Volberda (2005)	Antecedents; environmental factors	Technological innovation	Survey/ hypothesis testing - Organization	Survey of 363 unit managers of a large European financial services firm	The study reveals that multiunit firms develop ambidextrous organizational units to compete in dynamically competitive environments. Moreover, the authors establish that units with <b>decentralized</b> and <b>densely connected social relations</b> are able to act ambidextrously.

Appendices

<p>Jansen, van den Bosch, &amp; Volberda (2006)</p>	<p>Antecedents; environmental factors; performance outcomes</p>	<p>Technological innovation</p>	<p>Survey/ hypothesis testing - Organization</p>	<p>Survey of 283 unit managers of a large European financial services firm</p>	<p>The results indicate that <b>centralization negatively affects exploratory</b> innovation, whereas <b>formalization positively affects exploitative</b> innovation. Pursuing <b>exploratory</b> innovation was found to be more effective in <b>dynamic environments</b> and pursuing <b>exploitative</b> innovation was more beneficial in <b>competitive environments</b>.</p>
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## Appendix 2: List of Search Strings used for the Content Analyses of Innovation postures

### Exploration

Explor\* Chang\*, Freedom, Patent, Search\*, Creative, Idea, Proactiv\*, Variation\*, Decentral\*, Innovat\*,  
R&D\_alliance, Invent\*, Development\_programme\*, Research\_development, Experiment\*,  
Discontin\*,  
Long\_term, Release, Play, Distant\*, Low\_codification, Revolution\*, Flexib\*, distant\_search,  
Low\_formalization, Slow\_learning, Discover\*, Diversif\*, Low\_standardization, Something\_extra,  
Dynamic\*,  
New, Spirit\_of\_initiative, Adventur\*, Evolution\*, Start\_Up, Anticipat\*, Expand\*, Tacit\_knowledge,  
Astound\*,  
Transform\*, Autonom\*, Fantasy, Uncertain\*, Being\_the\_first, Far\_beyond, Novel\*, Vary,  
Break\*\_away,  
Forefront, Open\_mentality, Wide\_background, Diffus\*, Long\_run, Long\_time\_horizon, Adapt\*,  
Stakeholder\_value, Stress, Collaboration, Cooperation, Strength\*\_Pipeline, Expans\*, Reposition\*,  
Licensing,  
R&D\_Outsourc\*

### Exploration original (Uotila *et al.* 2009)

Explor\*, Search\*, Variation\*, Risk\*, Experiment\*, Play\*, Flexib\*, Discover\*, Innovat\*

### Exploitation

Exploit\*, Certain\*, Fast, React\*, Refine\*, Certification, Formalization, Reduction\_of\_costs,  
Cost\_reduction,  
Choice, Clarity, Reliab\*, Codification, Improv\*, Restyl\*, Efficiency, Commercial\_alliance,  
Incremental\_innovation\*, Result\_based\_objective, Select\*, Continu\*, Local\_search, Routin\*,  
Implement\*,  
Control\*, Modular\_production, Rules, Directives, Execute, Correct\*, Operational\_strateg\*,  
Serial\_production,  
Accelerat\*, Customer\_loyalty, Perfect\*, Short\_term, Adaption\*, Deep\_background, Planning,  
Shorten, Adjust\*,  
Defend\*, Practicality, Stabil\*, Applied\_research, Differentiat\*, Precision, Standard\*, Automat\*,  
Execution,  
Predictability, Up-date, Aversion\_to\_risk, Procedure, Variant\*, Bureaucr\*, Programm\*, Verification,  
Caution\*,  
Existing, Prudence, Low\_cost, Centraliz\*, Rational\*, Inertia, Shareholder\_value, Short\_run,  
Short\_time\_horizon, Speed, Proxim\*, Current, Extens\*, Blockbuster\_revenue, Optimize, Streamline

### Exploitation original (Uotila *et al.* 2009)

Exploit\*, Refine\*, Choice\*, Production\*, Efficien\*, Select\*, Implement\*, Execut

## Appendix 3: List of Search Strings used for the Content Analyses of CEO focal attention

External Focus	Internal Focus	Future Focus
<b>Customers</b>	<b>Organizational</b>	Will
Customer	Organization	
Customers	Organizational	
Consumer	Reorganization	
Consumers	Management	
Buyer	Retire	
Buyers	Retired	
Market	Retirement	
Markets	Employee	
Market-place	Employees	
Marketplace	Staff	
Communities	Stakeholder	
	Stakeholders	
<b>Competitors</b>	Board	
Competitive	Manager	
Competitiveness	Managers	
Competitor	CEO	
Competitors	President	
Compete	Vice-president	
Competition	Vice-presidents	
Peer	Director	
Peers	Directors	
Companies	Officer	
Firms	Officers	
Position	Subsidiary	
Positioning	Subsidiaries	
Positioned	Diversification	
	Diversify	
	Diversified	

\*Item removed: "banks" within competitors

## Appendix 4: Descriptive statistics of original data collected

	Minimum	Maximum	Mean	Standard Deviation	Outliers Identified
External focus	0	80	17.78	11.27	14
Internal focus	0	25	6.43	4.43	9
Future focus	0	34	4.37	4.38	13
TMT absorptive capacity (%)	0	100	50	16.8	0
MKT absorptive capacity (%)	0	100	80	12.7	0
R&D absorptive capacity	0	0.10	0.16	0.17	0
Innovation exploration	0	42	10.14	6.98	6
Innovation exploitation	0	20	3.88	2.91	10
New product creativity	0	188	5.39	21.57	23
Operating cash flow (million)	-53	488	28.19	65.29	20

## Appendix 5: Absorptive capacities SFE result

Stochastic Efficient Frontier R-Studio results:

<b>TMT Absorptive capacity</b>	<b>Estimate</b>	<b>Standard error</b>	<b>Z value</b>
(Intercept)	3.321055	0.260942	12.7272
log(Salary)	1.803046	0.162382	11.1037
Tenure diversity	0.347910	0.259288	1.3418
Age diversity	0.406669	0.179736	2.2626
sigmaSq	1.603940	0.290842	5.5148
gamma	0.756964	0.089172	8.4888
Mean efficiency: <b>0.5038296</b>			

<b>Marketing Absorptive capacity</b>	<b>Estimate</b>	<b>Standard error</b>	<b>Z value</b>
(Intercept)	0.4807469	0.0920620	5.2220
log(Sale revenue t <sub>-1</sub> )	0.9734980	0.0192210	50.6477
Trademark stock	0.0099837	0.0232561	0.4293
Marketing expenditure	0.0019614	0.0038665	0.5073
sigmaSq	0.1201874	0.0250858	4.7911
gamma	0.6801887	0.1330550	5.1121
Mean efficiency: <b>0.8089639</b>			

\*Note: log likelihood values and parameters of two successive iterations are within the tolerance limit. Gamma estimates (.76 and 0.68) are high, meaning that much of the variation in the composite error terms are due to the inefficiency component.

## Appendix 6: Krippendorff's Alpha Reliability Estimate

```

Krippendorff's Alpha Reliability Estimate

Run MATRIX procedure:

          Alpha      Units      Obsrvrs      Pairs
Nominal    .9070    306.0000    3.0000    918.0000

Judges used in these computations:
NVIVO      Coder1      Coder2

Examine output for SPSS errors and do not interpret if any are found

----- END MATRIX -----
    
```

## Appendix 7: Multicollinearity

### Ambidexterity

Collinearity Diagnostics

Variable	VIF	SQRT VIF	Tolerance	R- Squared
AmbiCom06Log	1.08	1.04	0.9293	0.0707
Exploit05Log	1.12	1.06	0.8915	0.1085
Explore06Log	1.10	1.05	0.9057	0.0943
Mean VIF	1.10			

	Eigenval	Cond Index
1	3.3569	1.0000
2	0.4106	2.8594
3	0.1708	4.4334
4	0.0617	7.3773

Condition Number 7.3773  
 Eigenvalues & Cond Index computed from scaled raw sscp (w/ intercept)  
 Det(correlation matrix) 0.8582

## Exploitation

### Collinearity Diagnostics

Variable	VIF	SQRT VIF	Tolerance	R- Squared
Exploit05Log	1.41	1.19	0.7107	0.2893
Ext03Log	1.35	1.16	0.7393	0.2607
Int03Log	1.59	1.26	0.6285	0.3715
Fut03Log	1.20	1.10	0.8338	0.1662
TMTACsp	1.25	1.12	0.7969	0.2031
MKTACsp	1.19	1.09	0.8377	0.1623
RDlog	1.14	1.07	0.8758	0.1242
ExtxIntLog	1.62	1.27	0.6180	0.3820
ExtxFutLog	1.47	1.21	0.6783	0.3217
IntxFutLog	1.88	1.37	0.5308	0.4692
IntxTMTnLog	1.47	1.21	0.6820	0.3180
IntxRDnLog	1.38	1.17	0.7262	0.2738
FirmSizeLog	1.06	1.03	0.9390	0.0610
Software	1.18	1.09	0.8488	0.1512
RDAlliance	1.74	1.32	0.5760	0.4240
MKTAlliance	1.79	1.34	0.5596	0.4404
Mean VIF	1.42			

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	Eigenval	Cond Index
1	9.6977	1.0000
2	1.5734	2.4826
3	1.5045	2.5389
4	1.0832	2.9922
5	0.6389	3.8959
6	0.5065	4.3758
7	0.3840	5.0254
8	0.3677	5.1355
9	0.3278	5.4393
10	0.2722	5.9688
11	0.1883	7.1761
12	0.1822	7.2963
13	0.1144	9.2070
14	0.0817	10.8943
15	0.0383	15.9177
16	0.0304	17.8583
17	0.0088	33.1125

-----

Condition Number	33.1125
------------------	---------

Eigenvalues & Cond Index computed from scaled raw sscp (w/ intercept)  
Det(correlation matrix) 0.0579

## Exploration

Appendices

Variable	VIF	SQRT VIF	Tolerance	R- Squared
Explore06Log	1.18	1.09	0.8480	0.1520
Ext03Log	1.53	1.24	0.6528	0.3472
Int03Log	1.28	1.13	0.7810	0.2190
Fut03Log	1.34	1.16	0.7447	0.2553
TMTACsp	1.29	1.14	0.7728	0.2272
MKTACsp	1.22	1.10	0.8204	0.1796
RDlog	1.18	1.09	0.8439	0.1561
ExtxIntLog	1.65	1.28	0.6070	0.3930
ExtxFutLog	1.58	1.26	0.6339	0.3661
IntxFutLog	3.40	1.84	0.2943	0.7057
ExtxTMTnLog	1.50	1.22	0.6672	0.3328
ExtxRDnLog	1.22	1.11	0.8170	0.1830
FutxTMTnLog	2.05	1.43	0.4877	0.5123
FutxMKTnLog	1.65	1.28	0.6077	0.3923
FutxRDnLog	1.70	1.30	0.5883	0.4117
FirmSizeLog	1.07	1.03	0.9380	0.0620
Software	1.18	1.09	0.8463	0.1537
RDAlliance	1.72	1.31	0.5812	0.4188
MKTAlliance	1.81	1.35	0.5511	0.4489
Mean VIF	1.56			

	Eigenval	Cond Index
1	10.5187	1.0000
2	2.4001	2.0935
3	1.5501	2.6050
4	1.0394	3.1812
5	0.7120	3.8437
6	0.6448	4.0388
7	0.5497	4.3742
8	0.4741	4.7101
9	0.4053	5.0942
10	0.3419	5.5468
11	0.3304	5.6425
12	0.2816	6.1116
13	0.2047	7.1681
14	0.1676	7.9218
15	0.1262	9.1286
16	0.1074	9.8943
17	0.0729	12.0114
18	0.0351	17.2992
19	0.0297	18.8086
20	0.0081	36.0813
-----		
Condition Number		36.0813
Eigenvalues & Cond Index	computed from scaled raw sscp (w/ intercept)	
Det(correlation matrix)		0.0152

## Appendix 8: Endogeneity and Instrument Variables

The following steps were followed in order to ascertain that endogeneity was found in the model and that a remedy, namely Instrumental Variable were carried out to complement with the SUR result reported in Chapter 7.

1. Identify the endogenous variable by firstly including Residuals values of these variables into the model equations. In Stata steps taken are: Regress, then Predict residuals, Regress again with the residuals included in the model, then
2. Test of endogeneity, results found that F-value of these tests were significant in two variables: Exploit 2005 and Explore 2006 as shown below:

## Appendices

```
. test Explore_res

( 1) Explore_res = 0

      F( 1, 139) =    7.72
      Prob > F =    0.0062

. test Exploit_res

( 1) Exploit_res = 0

      F( 1, 139) =    5.44
      Prob > F =    0.0211
```

The small p-values above indicate that the regression model used (OLS) was not consistent.

One of many ways to 'address' this issue is to use an **instrument variable**. This additional variable acts as an exogenous variable to the model and thus has the ability to replace the endogenous variable by acting as a proxy.

In Stata, to perform an Instrument Variable regression, function **IVREG** is used. However, prior to the regression model (two step least squares), we need to find a variable that can estimate the variables exploration 2006 and exploitation 2005, by acting as a close proxy, and are also exogenous to the model (no correlations with the dependent variable or with the residuals of the dependent variable)

Exploitation 2006 and Exploration 2005 were examined as instrumental variables. To ensure they are good candidates for the new regression, correlation matrix and endogeneity tests were conducted. Correlation analysis showed no significant correlations between the nominated instrument variables and the dependent variable. Endogeneity test shows that exploitation instrument variable is exogenous to the model, and exploration instrument variable is also exogenous (the model did not work when the variable was introduced). Results and execution of Instrument Variable regression are shown as followed.

**regress Creativity07Log Exploit06Log Explore06Log Exploit06\_res AmbiCom06Log FirmSizeLog RDAlliance MKTAlliance Software**

Source	SS	df	MS	Number of obs =	148
Model	19.8405245	8	2.48006556	F( 8, 139) =	2.11
Residual	163.714794	139	1.17780427	Prob > F =	0.0391
Total	183.555319	147	1.24867564	R-squared =	0.1081
				Adj R-squared =	0.0568
				Root MSE =	1.0853

Creativity0~g	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Exploit06Log	-.298187	.3160935	-0.94	0.347	-.9231601	.3267861
Explore06Log	.2458641	.133853	1.84	0.068	-.0187869	.5105152
Exploit06_res	.326329	.3407536	0.96	0.340	-.3474014	1.000059
AmbiCom06Log	.1791458	.0599029	2.99	0.003	.0607072	.2975844
FirmSizeLog	.0706106	.1108933	0.64	0.525	-.1486452	.2898663
RDAlliance	.0058839	.0348958	0.17	0.866	-.0631113	.0748791
MKTAlliance	-.024097	.0380491	-0.63	0.528	-.0993269	.0511329
Software	.1583174	.1889209	0.84	0.403	-.2152127	.5318475
_cons	.2295241	.6504976	0.35	0.725	-1.056625	1.515674

**Test Exploit06\_res**

```
. test Exploit06_res

( 1) Exploit06_res = 0

F( 1, 139) = 0.92
Prob > F = 0.3399
```

Exploit06\_res is shown to be exogenous to the model so it is a viable proxy to use as an instrumental variable estimator of Exploitation in 2005.

Explore05\_res when considered in the model, F ratio showed that the model as a whole has statistically insignificant predictive capability. So explore05\_res or other individual variable regression coefficients were irrelevant. It is difficult to interpret whether this variable is a good candidate for instrument variable. However, it is at this point the closest proxy to Explore in 2006, therefore, it is used as an instrumental variable estimator of Exploration in 2006.

The next step is to perform an Instrumental Variable regression.

**ivreg Creativity07Log AmbiCom06Log Explore06Log (Exploit05Log = Exploit06Log) FirmSizeLog RDAlliance MKTAlliance Software**

## Appendices

Instrumental variables (2SLS) regression

Source	SS	df	MS	
Model	18.3104613	7	2.61578018	Number of obs = 148
Residual	165.244857	140	1.18032041	F( 7, 140) = 2.27
Total	183.555319	147	1.24867564	Prob > F = 0.0321
				R-squared = 0.0998
				Adj R-squared = 0.0547
				Root MSE = 1.0864

Creativity~g	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Exploit05Log	-.0482103	.2420276	-0.20	0.842	-.5267119	.4302913
AmbiCom06Log	.1873814	.0615731	3.04	0.003	.0656481	.3091147
Explore06Log	.2558174	.1296336	1.97	0.050	-.0004752	.5121101
FirmSizeLog	.0448085	.1102402	0.41	0.685	-.1731424	.2627594
RDAlliance	-.0023509	.0338734	-0.07	0.945	-.0693205	.0646186
MKTAlliance	-.0203491	.0380702	-0.53	0.594	-.095616	.0549177
Software	.1328536	.1876177	0.71	0.480	-.2380766	.5037839
_cons	.1080271	.6363141	0.17	0.865	-1.15	1.366054

Instrumented: Exploit05Log

Instruments: AmbiCom06Log Explore06Log FirmSizeLog RDAlliance MKTAlliance  
Software Exploit06Log

Endogenous variable Exploit05Log is now replaced by the Instrumental variable Exploit06Log (since it has highest correlation and best estimator of Exploitation in 2005, it was deemed the most viable proxy)

The Coefficient estimates are the same compared to the original SUR model reported but standard errors are different.

### **Explore06**

**ivreg Creativity07Log AmbiCom06Log Exploit05Log (Explore06Log = Explore05Log) FirmSizeLog RDAlliance MKTAlliance Software**

Endogenous variable Explore06Log is now replaced by the Instrumental variable Explore05Log (since it has highest correlation and best estimator of Exploration in 2006, it was deemed the most viable proxy)

The Coefficient estimates are slightly higher compared to the original SUR model reported but standard errors are again shown big different.

## Appendices

Instrumental variables (2SLS) regression

Source	SS	df	MS	Number of obs =	148
Model	18.8031526	7	2.68616466	F( 7, 140) =	1.96
Residual	164.752166	140	1.17680119	Prob > F =	0.0649
Total	183.555319	147	1.24867564	R-squared =	0.1024
				Adj R-squared =	0.0576
				Root MSE =	1.0848

Creativity~g	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Explore06Log	.2614643	.224398	1.17	0.246	-.1821827	.7051112
AmbiCom06Log	.1973278	.061169	3.23	0.002	.0763935	.3182622
Exploit05Log	.0423264	.1516412	0.28	0.781	-.2574764	.3421292
FirmSizeLog	.0323792	.1072566	0.30	0.763	-.1796729	.2444312
RDAlliance	-.0040259	.0336946	-0.12	0.905	-.070642	.0625902
MKTAlliance	-.018636	.0378549	-0.49	0.623	-.0934772	.0562052
Software	.1200087	.1916642	0.63	0.532	-.2589218	.4989392
_cons	.0828404	.6969329	0.12	0.906	-1.295033	1.460714

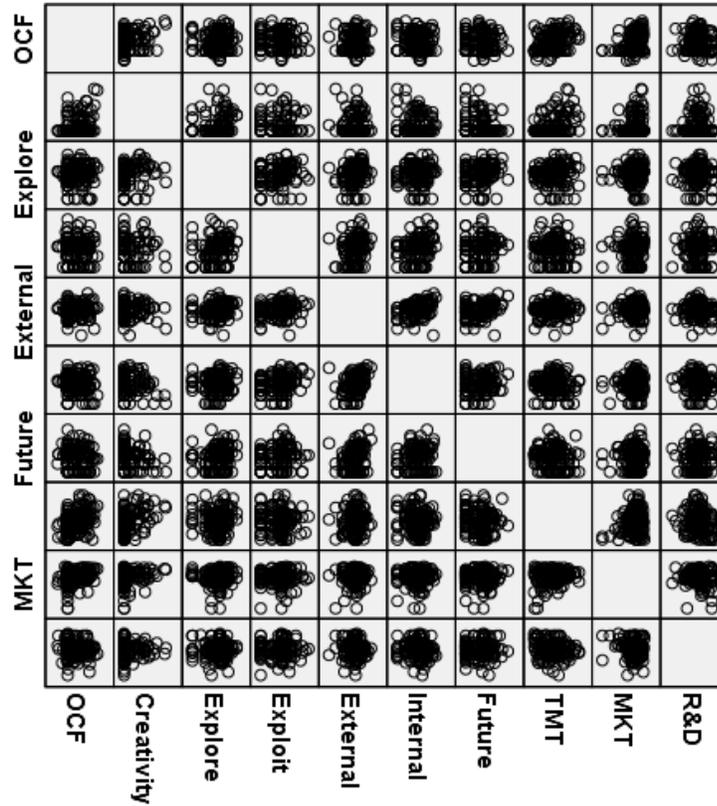
Instrumented: Explore06Log

Instruments: AmbiCom06Log Exploit05Log FirmSizeLog RDAlliance MKTAlliance  
Software Explore05Log

The results above on Durbin-Wu-Hausman endogeneity test and IV regression show that the instrument variables can be considered as relevant and exogenous thus serve as an alternative to the model. However, as commented in Chapter 6, endogeneity is not a fatal error. It is fairly common in social science. Within strategic management field, it is often difficult to find a group of totally exogenous variables in inferring causal relationship of managerial decisions and the expected firms' outcomes.

Nevertheless, it highlights that the results of SUR represented in Chapter 7 are subject to biasness with respect to endogeneity. Despite, there are strong reasons to believe that existing results reported are manifested from adequate validity; any causal inferences must be done with caution.

## Appendix 9: Residual scatter plot of all variables and excerpts of homoscedasticity tests



STATA output of command: “hottest” and “imtest, white”

### **Breusch-Pagan / Cook-Weisberg test for heteroskedasticity**

Ho: Constant variance

Variables: fitted values of OperatingCF09Log

chi2(1) = 0.62

Prob > chi2 = 0.4296

**White's test for Homoskedasticity**

Ho: homoskedasticity

Ha: unrestricted heteroskedasticity

$$\text{chi2}(34) = 25.55$$

$$\text{Prob} > \text{chi2} = 0.8513$$

## Appendix 10: Sobel-Goodman mediation test

Test of mediation using Stata “**sgmediation**” function. Mediation variable is creativity  
independent variable: ambidextrous strategy and dependent variable: financial performance

sgmediation OperatingCF09Log, mv (Creativity07Log) iv(AmbiCom06Log)

Sobel-Goodman Mediation Tests				
	Coef	Std Err	Z	P> Z
Sobel	.07880178	.03480055	2.264	.02355057
Goodman-1 (Aroian)	.07880178	.03563764	2.211	.0270223
Goodman-2	.07880178	.03394283	2.322	.02025432
	Coef	Std Err	Z	P> Z
a coefficient =	.175743	.055919	3.14281	.001673
b coefficient =	.448393	.137318	3.26535	.001093
Indirect effect =	.078802	.034801	2.26438	.023551
Direct effect =	.126974	.095869	1.32445	.185353
Total effect =	.205776	.095803	2.1479	.031721
Proportion of total effect that is mediated:	.38294882			
Ratio of indirect to direct effect:	.6206111			
Ratio of total to direct effect:	1.6206111			

## Appendix 11: Mediation test of new product creativity

### Explore/Exploit → Operating Cash Flow 2009

Seemingly unrelated regression						
Equation	Obs	Parms	RMSE	"R-sq"	chi2	P-value
OperatingC~g	148	6	1.858756	0.0178	2.68	0.8483

OperatingCF09Log	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]
Explore06Log	.0801974	.2089861	0.38	0.701	-.329408 .4898027
Exploit05Log	-.0903663	.2406911	-0.38	0.707	-.5621121 .3813796
FirmSizeLog	.2201006	.1833668	1.20	0.230	-.1392916 .5794928
RDAlliance	.0344816	.0576981	0.60	0.550	-.0786045 .1475677
MKTAlliance	-.0140481	.0647732	-0.22	0.828	-.1410012 .112905
Industry	-.2567588	.3131658	-0.82	0.412	-.8705525 .3570349
_cons	.576792	1.081164	0.53	0.594	-1.54225 2.695834

### Explore/Exploit/Ambi → Operating Cash Flow 2009

Seemingly unrelated regression						
Equation	Obs	Parms	RMSE	"R-sq"	chi2	P-value
OperatingC~g	148	7	1.821835	0.0564	8.85	0.2640

OperatingCF09Log	Coef.	Std. Err.	Z	P>z	[95% Conf. Interval]
Explore06Log	.1642338	.2076604	0.79	0.429	-.2427731 .5712407
Exploit05Log	.0274534	.2407166	0.11	0.909	-.4443425 .4992492
AmbiCom06Log	.2453845	.099685	2.46	0.014	.0500055 .4407635
FirmSizeLog	.1905293	.1801255	1.06	0.290	-.1625102 .5435688
RDAlliance	.0373042	.0565636	0.66	0.510	-.0735585 .1481668
MKTAlliance	-.0173629	.0635009	-0.27	0.785	-.1418223 .1070965
Industry	-.4160371	.3136912	-1.33	0.185	-1.030861 .1987864
_cons	.8657033	1.066168	0.81	0.417	-1.223947 2.955354

## Appendix 12: Ethical approval form

**ETHICS 1**

**STANDARD ETHICAL APPROVAL FORM**



**Cardiff Business School**  
Cardiff University



**Ysgol Fusnes Caerdydd**  
Prifysgol Caerdydd

This form should be completed for every research project that involves human participants. It can also be used to identify whether a full application for ethics approval needs to be submitted. The researcher or, where the researcher is a student, the supervisor, is responsible for exercising appropriate professional judgement in this review. This checklist must be completed **before** potential participants are approached to take part in any research.

**SECTION 1 - RESEARCH CHECKLIST**

1.1	Does the study involve holding personal information (names, attributable information or personal identifiers of any form) on a database?	NO
1.2	Does the study involve participants who are particularly vulnerable or unable to give free and informed consent (children, people with learning disabilities, students in academically dependent relationships)?	NO
1.3	Will it be necessary for participants to take part in the study without their full knowledge and explicit consent (perhaps through covert observation)?	NO
1.4	Will the study involve discussion of sensitive topics (political or religious views, illegal activities, sexual activity, drug use and so forth) that could be uncomfortable to participants or harmful if divulged to others?	NO
1.5	Will the study involve potentially harmful procedures of any kind or be conducted in a hazardous environment that could expose the researchers or participants to higher risk than is encountered in normal life?	NO
1.6	Will financial inducements (cash, vouchers or a prize draws) be offered to participants?	NO
1.7	Will the study involve patients or patient data in the NHS?	NO

If you have answered 'NO' to all questions 1.1 to 1.7 above, please complete this form and submit **TWO** copies to Lainey Clayton in room F43. Both forms will be stamped as evidence of submission. One copy will be retained by the School for audit/office purposes and the other by the researcher/s. Undergraduate and postgraduate students should include/bind their copy of the form with their research report or dissertation.

If you have answered 'YES' to any of the questions above, you will need to complete a full ethical review form (ETHICS 2, available on Learning Central – CARBS RESEARCH ETHICS)

APPLICATION APPROVED  
RESEARCH ETHICS COMMITTEE  
CARDIFF BUSINESS SCHOOL  
CARDIFF UNIVERSITY

ETHICS 1

**SECTION 2 PROJECT DETAILS**

Title of Project:	"Creativity generation: SMEs' focal attention, absorptive capacities and performance outcomes"
Name of Lead Researcher:	Trung T. Nguyen 0951098
Status (please circle) :	Post Graduate Research
Names of other Researchers:	N/A
Department:	Marketing and Strategy – Cardiff Business School
Email:	<a href="mailto:Nguvent2@cardiff.ac.uk">Nguvent2@cardiff.ac.uk</a>
Contact Address:	42 Rock Grove Way, SE16 3UB
Telephone number:	07907825388
Start and Estimated End Date of Project:	Start date from Oct 2010 to Sept 2013

**SECTION 3 STUDENTS ONLY**

Module name and number	PhD in Strategy
Supervisor's or Module Leader's name	Professor Robert E. Morgan
Email address	<a href="mailto:morganre@cardiff.ac.uk">morganre@cardiff.ac.uk</a>

**SECTION 4**

**Briefly describe the study design to be applied in the project including methods of data collection and data analysis**

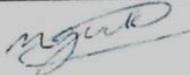
The research project employs secondary data research method. It plans to collect from financial statements, trade and industry reports, patents, trademarks and other non-financial public information from trade news and reports, financial database, patent offices and government filings e.g. SEC filings, Compustat, USPTO.

Data are cleaned and used to validate research model using structural equation modelling. Descriptive statistics, correlation, regression, stochastic frontier efficiency and content analysis are then employed to analyse and report on the result. In supporting with the analysis phase, statistical and content analysis software such as AMOS, STATA, SPSS, DICTION and MS-Excel will be used for greater efficiency and accuracy.

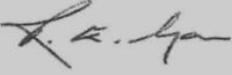
**SECTION 5 DECLARATIONS**

**I/we hereby agree that I/we have read the Cardiff Business School's Ethics Code of Practice and taken reasonable steps to ensure the independence and transparency of this research project. There are no significant conflicts of interest or partiality that may impact on the findings and outputs of my/our research activities.**

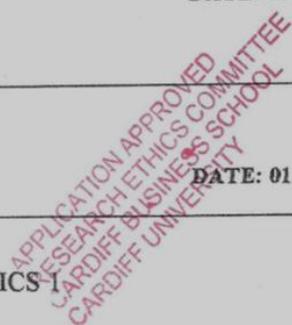
**I/we confirm that all participants will be recruited on the basis of informed consent.**

SIGNED:  DATE: 01 Mar 2012

PRINCIPAL RESEARCH INVESTIGATOR

SIGNED:  DATE: 01 Mar 2012

SUPERVISOR (WHERE APPROPRIATE)



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