1. Strategic innovation in small firms: an introduction

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This book represents the collaborative efforts of a consortium of researchers located around the world. The original inspiration for the work came from a request by INPI (Institut National de la Propriété Industrielle) or the Institute for Intellectual Property in France, for a means of screening the innovative ideas of entrepreneurs prior to their decision to commit significant resources to the commercialisation process. Initial work was undertaken in France by the Centre for Business Research (CEREN) at the Burgundy School of Business in Dijon and LINEN-HEC Paris. This generated a conceptual framework for use in the early stage screening of new innovations.

The original work undertaken in France for INPI was conducted using case studies of a small number of French firms. These findings were then transferred internationally with collaboration between CEREN and the Business School at the University of Western Australia (UWA). A pilot study was undertaken with Australian firms and the screening tools further evaluated, developed and refined. Assistance was provided by the State Government of Western Australia. The key objectives of this pilot study were to:

- Validate the innovation risk–return measurement tool;
- Explore the nature of innovation risk assessment profiles within small firms; and
- Explore the nature of strategic decision making within innovative small firms.

This pilot study demonstrated potential for future research (Mazzarol and Reboud, 2005, 2006, 2008; Reboud and Mazzarol, 2006) and it was decided to expand the research project to other countries. A consortium of researchers in 11 countries in Europe, North America, Australia and New Zealand was formed to undertake an international study using a common methodology based on the original research developed in France and Australia. This chapter outlines the methodology used in the study and provides some evidence from the original pilot research that led to its development. It should be noted that all participants in the study are from within the OECD group of

countries and the findings therefore represent an impression of innovation management practice in developed economies.

THE NATURE OF SMALL FIRMS AND INNOVATION

Innovation remains important to the successful economic and social development of the world's economies (Senge *et al.*, 2001). However, despite its importance innovation remains quite poorly defined and understood. Schumpeter (1934, 1939) was one of the first economists who recognised innovation as a key driver of economic growth. His analysis identified five types of innovation: i) that involving a new product or substantive change to an existing product; ii) a process innovation new to an industry; iii) the opening up of a new market; iv) the development of new sources of supply; and v) substantial changes to industrial organisation.

An important consideration in seeking to define innovation is whether it is a process or a discrete event. As a process, innovation encompasses the activities and managerial decisions that are made by individuals and organisations throughout the entire development cycle. How these various actors behave and their relative skill or success in the process will determine the way in which the innovation turns out, or if it proceeds at all. Innovation as a discrete event focuses on whether there is a commitment within the organisation or by the individual to accept the risk and invest the time and money to see the innovation produced (Cooper, 1998).

Within large corporations innovation is typically about new product or process development that leads to enhanced customer satisfaction, increased sales or lower costs and a boost to shareholder value (Drucker, 2002). At the national level it is often viewed as a technological issue. For example, the OECD (2001) defines innovation as being associated with either a technological product or process. This can involve a new or improved product that is significantly different from previous products, or new or significantly improved production or product delivery methods.

Innovation is therefore associated with new ideas that lead to new technologies, processes, organisational structures, management techniques or strategies. It can also be associated with the diffusion of established ideas, technologies or processes into new markets in which these have not previously existed (Rogers, 1998). It can be highly radical and disruptive in nature, or requiring only incremental changes to existing products and processes (Tushman and Nadler, 1986). Due to the potentially disruptive nature of innovation it is an activity containing inherent risk, with uncertainty in future technical, commercial and financial returns to the initial investment required (Gatignon and Robertson, 1985). An important consideration in the

decision to invest in future innovations is therefore the trade off between risk and return.

Small firms are acknowledged as playing a key role in the generation of new innovations (Freel, 2000; Hansen *et al.*, 2002; Moguee, 2000). It has been estimated that around 67 per cent of all inventions and 95 per cent of radical inventions patented in the United States since 1945 were attributed to small entrepreneurial firms (NCOE, 2000). The role of small firms in Europe (European Commission, 2003) and Asia (APEC, 2003) has also been noted. While large firms remain the dominant players in the commercialisation of new technologies small firms continue to play a critical role. For example, only 8 per cent of the nearly US\$200 billion in R&D expenditure in the United States went into radical innovation. By comparison small firms were twice as likely as large firms to engage in radical innovation and the lodgement of high-impact patents (Council on Competitiveness, 2005). However, the ability of many small firms to successfully engage in innovation and commercialisation is often restricted by their lack of resources, weak or unsystematic marketing and management competencies, and inadequate use of appropriate third party advisors (Adams, 1982; Vermeulen, 2005).

For small firms the ability to assess risk and evaluate potential returns is frequently difficult. Conventional net present value (NPV) analysis of discounted cash flows is often of limited use, particularly where the innovation is highly radical in nature. There is often insufficient information available to the management team of the small firm to allow them to make a meaningful estimation of the future anticipated returns to investment in the innovation. It was this dilemma that triggered the development of the current research study.

Definition of a Small Firm

For the purposes of this study small firms are defined as those with less than 250 employees and annual turnovers below €50 million (OECD, 2004). This has been chosen as it conforms to the OECD definitions of small to medium sized enterprises that classify as follows:

- Micro enterprise = < 9 employees; < €2 million annual turnover;
- Small enterprise = 10–49 employees; < €10 million annual turnover;
- Medium enterprise = 50–249 employees; < €50 million annual turnover;
- Large enterprise = 250 or more employees; > €50 million annual turnover.

It is recognised that reaching agreement on the definition of a small firm is somewhat problematic given the lack of uniformity in measures used across the world. Our decision to use the OECD definition may therefore be viewed as a mechanism for anchoring the study in what we believe is a definition that should be widely acceptable throughout the 11 countries that are represented in this research.

Definition of Innovation

Just as there are many definitions of what constitutes a small firm, so are there many definitions of what is meant by innovation. As noted above, innovation is both a process and a discrete event. The Business Council of Australia (BCA) represents the peak body of large business organisations in that country. The definition of innovation used by the BCA is as follows: ‘In business, innovation is something that is new or significantly improved, done by an enterprise to create added value either directly for the enterprise or indirectly for its customers’ (BCA, 1993). A national study of innovation in Australia defined innovation in fairly broad terms as: ‘The process of developing, introducing and implementing a new or significantly improved good or service, or a new or significantly improved process’ (ABS, 2005). For the purposes of this study we are defining innovation as being one of the following:

1. Product or service innovations (e.g. new products developed from research or introduced to the market).
2. Market development innovations (e.g. entering new markets with existing products such as exporting).
3. Marketing innovations (e.g. development of new brand or use of databases for marketing).
4. Process technology innovations (e.g. application of new tools or methods, such as use of computer controlled manufacture).
5. Administrative innovations (e.g. application of computer systems to office management).

These classifications are drawn from North and Smallbone’s (2000) study of small firms in the United Kingdom. They offer a broad interpretation of innovation and one that can incorporate a wide range of small firms. We felt that this rather more liberal interpretation of innovation was preferential to a narrower, technological focus.

THE RESEARCH CHALLENGE

The fields of entrepreneurship, innovation and small business management encompass a wide range of often eclectic and disconnected areas of inquiry. From an academic perspective the field of entrepreneurship is now relatively mature, with the subject taught within most business schools and with a reasonably large number of scholarly journals specialising in the subject. However, it is still somewhat new within the broader scientific community and some authors consider that the field needs substantial development before it can be considered a fully legitimate academic discipline (Katz, 2008). Key concerns relate to a lack of adequate definition and measurement of the entrepreneurship construct, and problems with methodology and theoretical development (Bygrave and Hofer, 1991).

Despite the importance of entrepreneurship as a major driver of economic growth, as an academic field it has been criticised for not being built on solid theoretical foundations (Shane and Venkataraman, 2000). As one group of authors pointed out after undertaking a review of the academic literature relating to entrepreneurship over the previous 15 years: ‘much more theoretical work is needed to map a course of study and adequately develop boundaries unique to the entrepreneurship domain’ (Busenitz *et al.*, 2003).

Source: (Brush *et al.*, 2003)

Figure 1.1 The entrepreneurship domain

Much of the focus of entrepreneurship research over the past twenty years has been on the identification of opportunity and its subsequent exploitation via the creation of new ventures, products, industries, markets and wealth. The domain in which entrepreneurship has been investigated is illustrated in Figure 1.1, where it can be seen that the core of the process is the exploration, recognition and exploitation of opportunity. This is the context in which the entrepreneurship construct occurs. However, it manifests itself in the form of new venture creation, new product or process innovation and development, the creation of new industries or markets, and the generation of wealth for the shareholders and broader community.

Entrepreneurship is closely aligned with strategic management from a theoretical perspective (Brush *et al.*, 2003), and focuses on the setting of strategy to configure available resources to exploit market opportunities. It is not specifically about small firms, although much of the research into the field has been largely informed by studies of this type of enterprise (Tan *et al.*, 2009). A problem with the entrepreneurship literature is its relative

weaknesses in internal and external validity, construct validity and statistical conclusion validity of many studies (Bouckennooghe *et al.*, 2007). Most studies have been cross-sectional in nature, with little use of advanced analytical techniques and methodologies. Within the sub-disciplines of small business management and innovation these problems are amplified. Despite a flurry of research activity from the 1980s onwards the areas of small business management and innovation remain fraught with inconsistencies over definition, measurement and underlying theory (Ratnatunga and Romano, 1997; Tonge, 2001a/b; Kraus *et al.*, 2005; Street and Cameron, 2007).

In the field of innovation in small firms these challenges are even more pronounced. The area of innovation management within small firms is relatively new as a subject of academic inquiry. In recent times the focus has been on technological entrepreneurship which has been somewhat poorly defined with an overemphasis on high-technology firms and start-up ventures (Jones-Evans, 1995). Tan *et al.* (2009) in their review of the academic literature found a lack of underlying theory in relation to small business research into innovation and technology. They noted a paucity of conceptual papers seeking to develop theory, and too much focus on theory testing using quantitative methodology.

Tan *et al.* (2009) suggest that more attention should be given to qualitative research studies aimed at theory building. In their view 'good research' must be guided by 'good theories' that must be executed by 'good methods'. Much of the literature relating to innovation and technological entrepreneurship in small firms has focused on opportunity search and exploitation. Future research needs to focus on three levels:

1. The individual (e.g. scientist, entrepreneur, venture financier);
2. The organisation (e.g. research teams, structures, processes); and
3. The systems (e.g. strategic networks, clusters).

Such research is by nature inter-disciplinary, multi-level and needs to incorporate dynamic systems loops both positive and negative in nature.

Addressing the Challenge and Limitations

This study does not provide a solution to all the problems associated with definition, measurement and theory in the study of innovation in small firms. However, we have attempted to provide what we hope will be valuable insights into the behaviour of such firms, with evidence from a wide range of OECD countries. We have used a common definition for innovation and small firms across these countries, and we have employed a standard set of research questions with a standardised questionnaire that was translated into

multiple languages. A mixed methodology was used with both quantitative and qualitative analysis employed.

Despite these procedures, the study is not without its limitations. It remains a cross-sectional analysis with data captured at a given point in time. Much of the data was collected from interviews with the entrepreneur or senior managers of the firms who participated in the study. Due to the limitations of time it was not always possible to undertake an in-depth review of the firm's actual performance and we must therefore take much of the data 'on trust' from those who provided it. The use of face-to-face interviews as a means of data collection is likely to have enhanced the level of honesty, but we cannot triangulate self-reported data with actual firm performance.

The analysis focuses on the perceptions of the firm's management towards a new innovation. Use is made of two screening mechanisms; the first produces a simplified initial typology of the innovation to be developed, while the second is a simple review of the firm's approach to innovation management. These screening mechanisms have been evaluated with smaller samples in Australia and France (Mazzarol and Reboud, 2005, 2006, 2008, Reboud and Mazzarol, 2006). However, they continue to be experimental in nature.

Although we have collected 567 cases from 11 countries we cannot claim that our study represents a comprehensive picture of innovation in small firms from around the world, or even the OECD group of countries. Our book is organised into chapters with a distinct focus on the national or local environment for small firms and their innovation. While we seek to use this as a context in which to understand the findings from each country, the reader should not view this study as representing an in-depth analysis of national innovation systems (NIS). The study draws upon NIS frameworks to provide context, but the sample size and structure is inadequate to allow us to make significant claims in relation to how innovation works for small firms in each country. What we offer is some evidence and insights into how the national environment and NIS appear to be impacting on the innovation and commercialisation activities of the small firms we studied. In the following section we outline the conceptual context into which our study took place.

CONCEPTUAL CONTEXT FOR OUR RESEARCH

Conceptually our study is focused on understanding the process of innovation management from the perspective of the small firm and from a predominately strategic perspective. To understand the strategic management dynamics of a small firm attention needs to be given to the units of analysis illustrated in

Figure 1.2 which is drawn from the work of Mazzarol and Reboud (2009). As shown, there are three primary units of analysis

- The task environment in which the firm operates;
- The firm's organisational configuration; and
- The managerial characteristics of the firm's top management team.

These elements were initially noted by D'Amboise and Muldowney (1988) as the building blocks in a framework for studying small business and developing theory relating to it.

Within each of these major areas of analysis are several sub-themes. For example, in the task environment attention needs to be given to the perception of opportunity as seen by the entrepreneur or the top management team within the firm. This sense of opportunity serves as a counter balance to the perceived level of uncertainty and risk within the task environment. The more munificent the task environment is perceived to be the more likely the firm will invest in the commercialisation of the innovation. Research suggests that managers with high levels of entrepreneurial orientation will be more likely to perceive risk as benign or controllable (Sitkin and Pablo, 1992). Entrepreneurs or those with high entrepreneurial orientation are not more prone to risk taking behaviour, but they appear to perceive risk differently to other people (Brockhaus, 1980; Perry, 1990).

Entrepreneurial managers are more likely to perceive risk as more benign and the task environment as more munificent than it might actually be. This tendency to be overly optimistic about opportunities appears to be due to the way entrepreneurial people, particularly those who own and manage their own small firms, use biases and heuristics to confirm their desired view that the risk is manageable and the opportunity attractive (Busenitz, 1999).

Key units of analysis within the firm's organisational configuration arena are such things as the complexity of the product or process that is being produced, the structural complexity of the organisation's design, the availability of resources and how these resources are allocated. The way in which the firm's organisational configuration intersects with the task environment is an important point of focus for understanding strategy formulation and implementation in businesses.

At the level of the firm's managerial characteristics are the leadership style, entrepreneurial orientation, managerial competence and capacity for strategic partnering within the firm's top management team. These elements interact to drive and shape the strategic behaviour of the small firm, which is typically heavily dependent on the abilities of its founders to make effective strategic decisions and manage innovation successfully.

Source: Mazzarol and Reboud (2009)

Figure 1.2 Units of analysis in strategy formulation in the small firm

As discussed in the following sections of this chapter, these conceptual elements can be mapped against a number of interrelated theories associated with the strategic management of small firms and their approach to the management of innovation. These frameworks are examined in relation to how they support the methodology for this study.

STRATEGIC MANAGEMENT IN SMALL FIRMS

The field of strategic management has evolved since the 1950s with what has been described as a pendulum swing from the internal resources of the firm and how they are configured and managed, to the external task environment and the pursuit of market opportunity (Hoskisson *et al.*, 1999). The internal view of business strategy formation was pioneered by the likes of Penrose (1959), Chandler (1962) and Ansoff (1965). The external view by industrial economists such as Porter (1980, 1981), with the resource-based view moving back to an internal focus with authors such as Wernefelt (1984) and

Barney (1986). More recently the focus has moved onto dynamic capabilities which focus on the firm's ability to: 'integrate, build and reconfigure internal and external competencies to address rapidly changing environments' (Teece *et al.*, 1997). It has been used in guiding the process of innovation management and commercialisation (Teece, 2006). However, these strategic frameworks have been developed from and for application in large firms. As noted by Welsh and White (1981), small firms are not the same as large ones and their performance dynamics are generally quite different.

Given the resource constraints of the typical small firm, the key to success for entrepreneurs in small companies is to leverage unique or rare knowledge about a product or market opportunity and generate economic rents from this with the least investment in resources (Alvarez and Barney, 2004). The dilemma facing entrepreneurs seeking to commercialise an innovation is that they must chart a clear strategy to deal with risk and uncertainty. Risk and uncertainty are not the same. A market opportunity can be risky, with all options known but no certainty over which option is likely to be the best outcome. By contrast, uncertainty is where the possible options and outcomes are unknown to the investor in advance. This combination of risk and uncertainty is common for many small firms that seek to engage in innovation. The organisational configuration of the firm may be different depending on the nature of the firm's managerial characteristics in the face of a task environment that is uncertain and risky (Alvarez and Barney, 2005).

Dynamic Capabilities

For innovative small firms the dynamic capabilities theory of Teece *et al.*, (1997) may provide a useful research framework. The key elements that are relevant here are threefold as outlined in Table 1.1. The first relates to the markets and strategic capabilities of the firm, particularly what is and what is not strategic in nature. This is an important consideration in any firm as strategic and operational level planning are distinctly different and require separate consideration. For many small firms the ability to separate the strategic from the operation is a challenge and one that they often find difficult.

The second element in the dynamic capabilities framework is the processes, positions and paths that the firm employs or follows in the execution of its strategy. Important considerations within this area are the organisational and managerial processes that the firm employs, particularly how well it manages to coordinate and integrate its resources. The ability of the firm to take its resources and reconfigure and transform them into new products, services, processes or market opportunities is a critical element in success. This is true for large firms and small ones. The small firm, with its

meagre resources, is particularly impacted by this. The ability of its top management team to deploy their resources in a cost-effective way to appropriate market rents from their intellectual property is a key to successful entrepreneurship and innovation (Alvarez and Barney, 2004).

Table 1.1 The dynamic capabilities framework

Characteristics of Firms
<p><i>Markets and Strategic Capabilities:</i></p> <p>What is strategic within the firm?</p> <p>What is not strategic within the firm?</p> <p><i>Processes, Positions and Paths:</i></p> <p>Organisational and managerial processes:</p> <ul style="list-style-type: none"> a) coordination and integration b) reconfiguration and transformation <p>Positions – what assets are available?</p> <ul style="list-style-type: none"> a) Technological b) Complementary c) Financial d) Reputational e) Structural f) Institutional g) Market assets <p>Paths – what are the path dependencies, technological opportunities and how are these assessed?</p> <p><i>Replication and Imitation of Organisational Processes and Positions:</i></p> <p>How easy is it to replicate or imitate the firm’s strategic capabilities?</p>

Source: Teece *et al.* (1997)

The positions that the firm adopts with respect to the deployment of available assets, and the paths that must be followed to successfully implement its strategies are also important elements for consideration. Path dependency relates to the way in which future outcomes are influenced by the decisions and actions taken at earlier times. Past decisions by the firm in relation to an innovation are likely to impact on future commercialisation of that innovation in either a positive or negative manner. For many small firms the need to integrate their technological innovations into the existing product,

process or marketing technologies of larger customer firms can be a critical issue for future success. This was evidenced by the case of Research in Motion (RIM) and the successful commercialisation of the Blackberry. Had RIM not succeeded in winning support from larger organisational partners such as BellSouth the success of their technology's commercialisation may have been problematic (Carayannopoulos, 2005).

Developing and Sustaining Competitive Advantage

The final element relates to the firm's ability to protect its innovations and their associated intellectual property from replication and imitation by competitors. Securing a competitive advantage in the short term via a new product or process innovation can be quickly eroded if the firm is not able to put in place isolating mechanisms to sustain its competitive lead. Dierickx and Cool (1989) suggested that competitive advantage could be derived from the accumulation of resource assets and that such advantage could be sustained if the firm could reduce imitation of its privileged asset positions. Barriers to such imitation could include:

- Time compression diseconomies or the first mover advantage;
- Asset mass efficiencies or economies of scale and scope;
- Interconnectedness of asset stocks or synergies;
- Asset erosion or reinvestment to maintain asset currency; and
- Causal ambiguity, which makes for uncertain imitability.

Each of these provides a platform upon which a sustainable competitive advantage can be built. Small firms are often good at achieving time compression diseconomies being flexible and fast to market. However, they typically lack sufficient asset mass efficiencies and interconnectedness to build significant barriers to imitation via economies of scale and scope. For many, interconnectedness is dependent on their ability to work within a larger strategic network, which can lead to an erosion of causal ambiguity. Close alliances within the supply chain with lead customers and key suppliers can provide small firms with this type of interconnectedness. The firm's ability to secure loyalty from such customers and suppliers might also offer a mechanism to avoid asset erosion.

Reed and DeFillipi (1990) provided a useful theoretical framework for understanding how barriers to imitation could be developed via causal ambiguity. Their analysis pointed to the role of tacitness, complexity and specificity. The first relates to the ability of knowledge to be retained as tacit rather than explicit, whereby the former is held within the experience and wisdom of the firm's management team, and the latter published in manuals

or patents. Complexity relates to the ability of the firm to combine its competencies into processes that cannot be easily understood by outsiders. Use of trade secrecy, confidentiality and non-disclosure agreements are potential mechanisms for achieving this. Finally, specificity is the ability of the firm to link its competitiveness to assets that are unique to it and cannot be easily appropriated. Such assets can be people, sites, physical or dedicated assets (e.g. patents).

Implementing Strategy in Small Firms

These elements provide a theoretical foundation for understanding and exploring the nature of strategy and planning in the small firm, bearing in mind that what might work for the large firm may not apply for the small one. By its nature strategy is a dynamic process and one that requires attention to the interplay between the formulation of strategy and its implementation.

Figure 1.3 illustrates the main units of analysis that impact on the implementation of successful growth strategy in a small firm (Mazzarol and Reboud, 2009). The characteristics of the firm's top management team are an important starting point, in particular how entrepreneurial they are in recognising, exploring and exploiting opportunities.

Once the firm's management has identified new product or market opportunities their success will depend on their ability to effectively manage the innovation process. They are also likely to require the accumulation of additional resources, and to forge strategic alliances with lead customers, key suppliers and third party complementary actors. If sufficient resources are accumulated the small firm will seek to follow a given product/market strategy, and will need to configure its resources so as to allocate them towards the implementation of the new strategy. This strategy formulation and implementation process can be either formal or informal in nature, with most small firms displaying more informality in their behaviour. How successful the strategy is will be determined by its performance in the market.

Figure 1.3 Units of analysis in strategy implementation of small firms

It should be noted that strategy is not linear, but more of a double-loop learning process within the firm (Heracleous, 1998). Small firms are typically highly dependent on the personality, judgment and determination of their entrepreneurial leadership team, which is often a single individual or owner-manager. Formality in strategy and planning appears to be associated with fast-growing firms, with long-term planning of most benefit in such circumstances, although its success remains dependent on the competencies of the firm's top management team (Upton *et al.*, 2001; Woods and Joyce, 2003; Richbell *et al.*, 2006). Strategy has been identified as a mediating variable between the firm's resources and its performance (Edelman *et al.*, 2005). It serves to guide the deployment of resources within the firm and must align the configuration of resources within the business against customer or market requirements.

Above average growth within small firms is generally associated with innovation, aggressive new product development (NPD) and new market entry strategies. However, the top management team needs strong marketing competencies and the ability to deploy specialised products within high growth industry sectors (McDougall *et al.*, 1994).

THE MANAGEMENT OF INNOVATION IN SMALL FIRMS

As discussed above, research into innovation in small firms needs to focus on the three levels of the individual, the organisation and the systems view (Tan *et al.*, 2009). This is consistent with the framework outlined in Figure 1.2 that examined the managerial characteristics, organisational configuration and task environment as primary units of analysis for small business research. In Figure 1.4 we outline a conceptual framework for analysis of innovation in small firms.

Source: Adams *et al.*, (2006); Tan *et al.*, (2009)

Figure 1.4 Units of analysis for innovation in small firms

As shown in Figure 1.4 there are three primary views relating to the systems, organisational and individual perspectives of the phenomena. These are sub-divided into sub-categories that provide specific units of analysis for the researcher.

The Systems View

Within the systems view are the two key elements of the NIS as defined by Porter and Stern (2001), which include the existence of common innovation infrastructure (e.g. technological sophistication of the country, investment in R&D, number of research scientists and government R&D policy); and the cluster-specific factors relating to Porter's 5-forces framework (e.g. buyer-supplier power, threats of entrants and substitutes, and competitive rivalry) (Porter, 1979).

America's Council on Competitiveness, National Innovation Initiative Summit defined the innovation ecosystem as comprising four elements. The first is the policy environment for innovation set by national, state and local governments. This includes education policies, protection of intellectual property rights and regulation of industries. The second is the national infrastructure, including the transportation, information and communications technologies (ICT) networks, as well as energy supply. The third and fourth elements are the factors that influence the demand and supply of innovation within the economy. On the supply side are the skills, knowledge, risk capital, management talent, and technology and research inputs. On the demand side are the drivers of product quality, security, customisation, convenience, efficiency and design that markets are expecting (Council on Competitiveness, 2005).

Venkataraman (2004) has suggested that technological entrepreneurship can be fostered within regions if certain conditions are met. These include having focal points capable of producing novel ideas (e.g. universities and R&D centres), the availability of risk capital, role models and informal milieux in which entrepreneurship can be encouraged through personal interaction. Also important is having areas of specialisation within locally based industries within the region. There must also be safety nets for entrepreneurs who do not succeed, and gateways to large national or international markets. Finally, there should be executive leadership with the competencies to help implement the new technological innovations. These elements all apply at the systems level.

Our study examined the systems view or task environment with a series of questions focusing on the respondent's perception of their country's climate for innovation which were a measure of the NIS and common innovation infrastructure such as accessibility of skilled labour, managerial talent, consumer markets and R&D centres, plus the quality of ICT systems, cost of doing business and level of government support for innovation. Cluster-specific analysis was encompassed via questions that examined the perceived bargaining power of suppliers and customers, plus the anticipated level of risk and uncertainty within target markets.

The Organisational View

At the organisational view level attention needs to be given to the key elements that are associated with innovation management as defined by Adams *et al.* (2006). A review of the academic literature into innovation management undertaken by Adams *et al.* (2006) identified key areas of focus for future research. However, they noted that significant gaps exist, particularly in the field of commercialisation. They provided a framework for innovation management measurement with the following elements:

- Inputs – e.g. people, physical and financial resources and tools;
- Knowledge management – e.g. idea generation, knowledge repository, information flows;
- Innovation strategy – e.g. strategic orientation, strategic leadership;
- Organisation and culture – e.g. culture and structure;
- Portfolio management – e.g. risk/return balance, optimisation tool use;
- Project management – e.g. project efficiency, tools, communications, collaboration; and
- Commercialisation – e.g. market research, market testing, marketing and sales.

These elements provide a framework for the analysis of innovation management within firms, and they form a core within the conceptual framework outlined in Figure 1.4.

Tan *et al.* (2009) have suggested that in the absence of well established theory, typologies can make a useful contribution. To this end Rizzoni (1991) and Autio and Lumme (1998) offer potentially useful typologies for innovation at the organisational level. Rizzoni (1991) has six categories: static, traditional, dominated, imitative, technology-based and new-technology firms. The first two are relatively low innovation intense, while the last two are associated with high technology and radical innovation. Autio and Lumme (1998) focus only on new-technology-based firms, and they define four types: i) paradigm, ii) market, iii) technology, and iv) application innovators. Of these the first is engaged in radical innovation and the fourth incremental innovation.

Much of the focus of our study was on the organisational view with a particular examination of the innovation management process. This involved an examination of the level of investment in R&D and NPD by these firms. The firm's track record in innovation was examined along with the number of previous innovations that had been commercialised prior to the interview and the factors influencing the success or failure of this commercialisation.

The Individual View

At the individual view level the focus is on the leadership style of the top management team within the firm (e.g. whether it is transformational or transactional in nature), their entrepreneurial orientation, managerial competence and capacity for strategic partnering. Jones-Evans (1995) has proposed a typology for technology entrepreneurs consisting of four types: i) researcher, ii) producer, iii) user and iv) opportunist. The first of these is focused on pure research or the R&D process rather than the market. The producer type is more interested in the commercialisation of the innovation, and the user is less involved in R&D than application. Finally, the opportunist is the more entrepreneurial type, who seeks to exploit market opportunities, but who may not have direct technical expertise.

The focus of our study of innovation outlined in this book is primarily on the small firm as an organisational entity. Much of the data collection we undertook was focused on the organisational view. Some attention was given to understanding how the management of the firm perceives the supportiveness of their national business task environment with a focus on elements of the NIS, including infrastructure and government support. A key point of focus for our study was the analysis of a new innovation that was under consideration within the firms for future commercialisation. The following sub-sections outline the methodology employed with reference to the conceptual framework discussed above.

Although we did not specifically focus on the individual managers who represented these firms, we did examine whether they were owners and managers, or whether they held partial or no equity in the venture. A strong area of focus for our study was on the respondent's perception of the value of lead customers and key suppliers in developing their innovation. Attention was also given to their views over the perceived value of third parties such as accountants, banks, venture financiers or other business people in the commercialisation process. Finally, we explored these manager's views as to how much consideration they gave to the views of others within and outside their firm prior to making an investment decision in relation to their new innovation.

THE CONCEPT OF RENT APPROPRIATION

While financial models such as NPV can offer a guide to the potential attractiveness of an innovation, these measures are limited in their capacity to fully assess the non-financial variables likely to impact on the investment. These may include the reaction of competitors to the innovation, or the speed

with which end users are willing to adopt the innovation. Moreover, the innovator might be convinced of the value of their innovation, but unable to analyse it or even prove its reality. There can be three main reasons for this.

First, the innovator often places more emphasis on the anticipated absolute value of the innovation without considering the potential difficulties associated with its launch (Martin and Scott, 2000). This evaluation frequently can be overly optimistic either because the anticipated interest is overestimated, or because it does not take into account the erosion of the rent due to the bargaining power of such environmental actors as suppliers and customers, and the effects of competitors.

Second, the innovator may have had an unstructured way of reasoning, thus he/she may act on an intuition rather than on a rational reasoning (Mockler, 2003). This is a high probability among small firms where the owner-manager or top management team are relatively isolated and lack the support of an evaluation team with the skills to conduct appropriate feasibility analysis.

Third, the innovation frequently involves a complex, non-linear process in which feedback over progress is difficult to anticipate. This is common in the case of radical or disruptive innovations in which the new product or process is in advance of the market and customers are unable to provide clear signals over their capacity and willingness to adopt the new offering. In such circumstances a risk assessment tool that is able to overcome these problems is highly desirable.

Screening the Innovation for Potential Rent Appropriation

The pioneering work undertaken by CEREN-LINEN in France measures the anticipated financial return or RENT that might be derived from a particular future investment in an innovation (Miles *et al.*, 2003). In order to help the innovators to not only correctly assess the initial anticipated value of their innovation, but also the erosion effects it will face when launched into the market, the process of analysis follows several steps as shown in Figure 1.5. These, as defined by Santi *et al.* (2003) are as follows:

1. Analysis of anticipated rent (e.g. the potential rent), related to the kind of innovation and the number and size of the potential user markets;
2. Analysis of the characteristic of the environment of the potential using market, and the related erosion effects;
3. Analysis of the competitive strengths the innovation will have to face, leaving only a residual rent; and

4. Analysis of the competitive situation of the small firm and its ability to launch the innovation, able to catch an appropriable rent.

Source: Santi *et al.* (2003)

Figure 1.5 Logic of the analysis of process of rent appropriation

This analysis process draws on the assumption that an innovation can be viewed as a potential source of competitive advantage (Nemeth, 1997). The rent associated with this competitive advantage is the condition for its success and future development. An innovator is thus going to develop a new resource or competence, or going to create a new combination of existing resources and competencies in order to secure a competitive advantage. Under these conditions a firm should be able to generate a rate of profit higher than the mean rate of profit within its industry. It should also be able to sustain this above average rate of profit generation over a given time period if suitable isolating mechanisms can be created, such as formal intellectual property rights protection such as patents. The innovators are then the only legal users of the innovation for a significant period of time, which enables them to sustain their competitive advantage.

The Estimation of Potential Rent

To assess the potential rent to be derived from a given innovation it is necessary to measure the amount of rent that would be likely to be generated

from it over its estimated lifecycle. This amount will be the combination of three components that will vary independently of each other:

- Volume – as measured by the volume of sales that can be generated over a given time period;
- Rate – as measured by the profit margins (both gross and net) that can be generated from the innovation during the time period; and
- Length – the duration or lifecycle of the innovation.

These three elements combine to generate an innovation diffusion curve as illustrated in Figure 1.6. The rate at which this innovation diffuses into the market place is contingent on the success that the firm has in its commercialisation.

$$\text{Amount of Rent} = \text{Volume} \times \text{Rate} \times \text{Length}$$

Figure 1.6 Components of the rent

As noted by Rogers (1995), the adoption of an innovation by consumers may be influenced by their ability to trial it prior to adoption, its perceived usefulness and ease of adoption and use. Initial adoption may be found amongst a small proportion of the market that may be described as technology enthusiasts or visionaries. Early stage commercialisation with a limited market may precede what Moore (1996) has referred to as the fall into a chasm, and the ultimate failure of the innovation. Getting across this chasm into mainstream markets requires significant levels of marketing and investment that are not always possible with the limited resources of small firms. It should also be noted that successful innovation diffusion may be

contingent on social factors more than the superiority of the technology (Rogers, 1976).

As the combination of these three variable components, a rent can be characterised by its extreme profile as a high or low volume, rate or length; with two possibilities for each variable the total number of combinations is eight. Prior to investing further in a given innovation the first step for a small firm would be to analyse the expected amount of potential rent. Measuring the volume, rate and length of the anticipated rent provides a mechanism for screening the merits of the innovation and considering the strategic implications of its commercialisation. The approach taken in our study was to ask the firm's managers to indicate their anticipated volume, rate and length using the measures outlined in Table 1.2.

Table 1.2 Measuring the potential rent

Measures of Rent for the Proposed Innovation

Measures of Potential Volume:

Estimated geographic diffusion within chosen sector

Estimated value of annual sales in millions on worldwide basis after 3 years

Estimated potential diffusion of innovation within target market segments

Measures of Potential Rate:

Estimated gross profit generated by innovation as percentage of sales

Estimated net profit generated by innovation as percentage of sales

Whether or not the innovation creates new dominant design

Measures of Potential Length:

Whether the technical base of the innovation is simple or highly complex

How difficult the innovation is to copy from a technical perspective

How difficult the innovation is to copy from a legal perspective

The RENT Configuration

Depending on the responses to these measures the innovation under development was classified into one of eight configurations as illustrated in Figure 1.7 which have been labelled: Shrimp, Champion, Gadget, Joker, Flash in the Pan A/B, and Oasis A/B.

1. Shrimp		--	++
	volume		
	rate		
3. Gadget		--	++
	volume		
	rate		
5. Flash in the pan A		--	++
	volume		
	rate		
7. Flash in the pan B		--	++
	volume		
	rate		
2. Champion		--	++
	volume		
	rate		
4. Joker		--	++
	volume		
	rate		
6. Oasis A		--	++
	volume		
	rate		
8. Oasis B		--	++
	volume		
	rate		

Figure 1.7 Typology of configurations of rent of an innovation

Each of these configurations involves different levels of volume, rate and length thereby determining the anticipated rent that might be derived from the innovation. In detail each of these RENT configurations is defined as follows:

- **Shrimp** – this type of innovation offers low or modest volume, rate and length. It may not be of particular interest to some types of firm, but can represent a good opportunity for firms who have low to medium levels of technology and need to maintain a competitive edge with continuous incremental innovation.
- **Champion** – this innovation type is potentially able to offer high levels of volume, rate and length. It is likely to be associated with high-technology product innovations of a radical nature. While superficially this may seem a highly attractive opportunity, the champion requires substantial investment in both product and market development in order to secure the anticipated returns. For many small firms the champion innovation is a significant risk.
- **Gadget** – this type of innovation at first appears unattractive as it offers only a relatively short production run with modest sales. However, it has the potential to generate above average profits and

for some types of firm this may be a worthwhile investment. To get the most out of a gadget innovation a firm will need to employ a first mover advantage and seek to appropriate rents quickly.

- Joker – this innovation offers long lifecycles and large sales volumes, but it only generates below average rates of profit. For some firms this may be unattractive, however, there can be value in the Joker. Firms in industry sectors where radical innovation is not possible, and where cost leadership rather than differentiation strategies can be followed might secure benefit from the joker.
- Flash in the Pan A – this type of innovation like its name suggests generates a high volume of sales but with only modest rates of profit and over a short lifecycle. It is not a good option, particularly as it can require significant investment in production to service the future market demand without the rate or length to recover this initial outlay.
- Oasis A – this innovation offers a long lifecycle but with only modest sales volume and rate of profit. For firms interested in fast growth opportunities this type of innovation is unattractive. It may be attractive to other firms that have modest production capacity and that are content with low to moderate rates of profit over a long lifecycle.
- Flash in the Pan B – this innovation is the high profit cousin of its Type A counterpart. The high rates of profit and high volume of sales may make this innovation attractive, however, the short lifecycle means that the firm seeking to commercialise such an innovation must secure a first mover advantage and focus on market development as a high priority. For firms that cannot be sure of their ability to quickly secure market access this innovation may pose an undesirable risk.
- Oasis B – the final innovation in this typology is the high profit counterpart to the Oasis Type A. Its high rate of profit and long lifecycle make it potentially attractive; however, it only has a small potential sales volume making it a niche differentiation strategy option. Such an innovation may be a good option for small firms with modest production capacity.

The work undertaken by CEREN-LINEN in France anticipated that the innovator firms would work through this type of analysis using a pre-launch and post-launch analysis. For our purposes only a pre-launch analysis was possible due to the restrictions of time in the data collection.

Factors Influencing the Rent Appropriation

The actual experience of the innovator firms once commercialisation has commenced suggests that a major challenge is to convince potential customers to adopt their innovation. The bargaining power of buyers and suppliers, as well as the dynamic forces of competitors and substitution threats, also must be considered. Our analysis explored these issues with additional items in the questionnaire designed to assess the firm's task environment.

Questions encompassed the type of innovation being considered (e.g. product, process, market, administrative), and whether it comprised a technological product or process. Also examined was whether the innovation was able to work alone or needed to be integrated into a system, and whether it substituted existing products or created a new market. These items were designed to explore the level of disruption caused by the innovation. The analysis also examined whether the innovation was considered compatible with existing products and processes or was meant to create a new dominant design or system. This was a means of assessing the ease of potential market diffusion. Finally, there was an examination of whether the innovation was able to be generated by the firm without outside assistance or if it needed to be undertaken collaboratively with customers, suppliers or third parties.

ASSESSING NPD AND COMMERCIALISATION

Our analysis framework included questions relating to the seven areas of innovation management measurement within the firm as identified by Adams *et al.* (2006). To assess the firm's approach to new product development (NPD) and commercialisation we employed a series of questions that map against a four part framework known as the innovation diagnostic diamond (IDD). This framework was pilot tested with a small sample of innovator firms in Australia prior to the current study (Mazzarol and Reboud, 2006). Each of the four dimensions that comprise the IDD are briefly described in the following sub-sections.

The Market Index

The first dimension within the IDD framework is the market index, which comprises ten question items relating to the firm's understanding of its future markets and customer's willingness to adopt the innovation. Market analysis and research of customer needs is vital to the successful commercialisation of new products (Huang *et al.*, 2002). The ability to trial the new technology

prior to purchase and measure the tangible benefits it provides are important elements in the willingness of customers to adopt an innovation (Rogers, 1995; Frambach and Schillewaert, 2002). Innovator firms and customers can collaborate over commercialisation with lead customers helping to shape the final outcome of the process by evaluating early prototypes (Thomke and von Hippel, 2002).

The Innovation Index

The second dimension within the IDD framework is the innovation index, which comprises ten question items relating to the firm's approach to the management of NPD and IP protection through formal product development systems, use of independent testing, patents and non-disclosure agreements. The need for a formal process of innovation management has been noted as important to successful commercialisation (Kemp *et al.*, 2003). Such formality in NPD has been recognised as best practice within most firms including the active engagement of customers and employees in the process (Cooper *et al.*, 2004a). For commercialisation to be effective the firm must generate a workable prototype and where it is applicable, take steps to protect the IP associated with the innovation in order create satisfactory isolating mechanisms. This is particularly important for Champion type innovations that have long potential lifecycles.

The Resources Index

The third dimension within the IDD framework is the resources index, which comprises ten question items relating to the firm's possession of sufficient resources to undertake successful commercialisation. This includes their ability to build a prototype and take it to market and full-scale production with adequate human, technical and financial resources. Best practice in NPD and commercialisation highlights the need for the firm to have access to adequate expertise, staffing, physical and financial resources (Cooper *et al.*, 2004b, c). Amongst the resources that are likely to be important are the firm's access to venture capital financing, government R&D grants or export financing, third party expertise for product and market testing, and senior management or boards of directors who can provide guidance.

The Strategy Index

The fourth dimension within the IDD framework is the strategy index, which comprises ten question items relating to the firm's approach to strategy. This includes whether they have formal planning processes, market, financial and

risk assessments, and the securing of any necessary compliances or authorisations. The need for a formal approach to strategic planning in the commercialisation of an innovation has been highlighted in the literature (Grupp and Maital, 2001). Attention needs to be given to assessing the bargaining power of customers and suppliers, and the potential threats posed by competitors and competing or substituting innovations. Where an innovation can be impacted by government policy attention also needs to be given to these threats or opportunities.

The Innovation Diagnostic Diamond

Figure 1.8 The innovation diagnostic diamond (IDD)

Each of the four indices that comprise the IDD is scored using a simple YES/NO response producing scores ranging from 0 to 10 with 5 being average. Where firms scored below 5 it was deemed to represent a below average response and further investigation was undertaken to determine if the firm needed to take remedial action. A diamond-shaped graph was generated during the interview within the EXCEL spreadsheet used to conduct the interview. These IDD maps were used to stimulate further discussion with the firm's management over why they had produced such results and what this

suggested for future innovation management. Figure 1.8 illustrates this diagram.

Initial pilot testing of the IDD framework suggested that it was a simple but useful mechanism for getting entrepreneurs to discuss their firm's approach to the management of innovation, NPD and commercialisation. It also evoked responses that suggested the IDD had triggered an awareness of the need to take specific action on key areas of innovation management that had previously been overlooked or ignored (Mazzarol and Reboud, 2006).

Innovation Management in Context

In a review of the literature relating to innovation management, Tidd (2001) noted that environmental uncertainty and complexity affects the nature of innovation management within the firm. Success in innovation management is contingent on how well the firm is able to configure its resources to deal with the environmental turbulence. The configuration of the firm's resources to meet the needs of customer or market conditions requires a high degree of flexibility, without a single best-practice model being evident in advance. Furthermore, he noted that research into innovation management was still in its early stages.

These observations confirm our own research, which points to the need for small, innovator firms to remain adaptive and flexible in the face of environmental uncertainty and complexity. While there may be some generic lessons from successful innovation management practice, there is not a readily identifiable, single best practice model. The interplay between the type of innovation being considered for future commercialisation, the market environment and the firm's resources and competencies remains critical to the likely outcome.

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