

Managing Innovation and Commercialisation in SMEs: Longitudinal Case Studies

Tim Mazzarol

University of Western Australia
Email: tim.mazzarol@uwa.edu.au

Delwyn Clark

University of Waikato
Email: dnclark@waikato.ac.nz

Newell (Sandy) Gough

Boise State University
Email: sgough@boisestate.edu

Philip Olson

University of Idaho
Email: polson@uidaho.edu

Abstract:

Innovation by small and entrepreneurial firms contributes significantly to productivity and economic performance. However, theory on the processes of innovation management and commercialisation by SME is lacking. This paper contributes to this gap from a series of longitudinal case studies tracking commercialisation of specific innovations in the US, Australia and New Zealand. The analysis used diagnostic tools developed for evaluating potential rent returns from an innovation and screening the firm's management of its commercialisation. Findings include insights on the way SMEs approach commercialisation, and the trade-offs they make between anticipated return to investment and the allocation of scarce resources. The cases suggest that while systematic and formal approaches to NPD and commercialisation are helpful, they are not essential within SMEs, so long as the owner-managers or CEOs have competence in these areas. However, as firm size and complexity increase there is a need for a more formal NPD portfolio management process.

Keywords: Innovation management, NPD, commercialisation, rent, SMEs, longitudinal cases

Managing Innovation and Commercialisation in SMEs: Longitudinal Case Studies

INTRODUCTION

Small firms are often viewed as the engine room of new innovative ideas (Kuratko & Hodgetts, 2004). Recent developments by the OECD include an innovation strategy which recognises the significance of small to medium sized enterprises (SMEs) as a driver of economic growth (OECD, 2009; 2010a; 2010b). Rather than just focussing on R&D and breakthrough innovations, this strategy notes the importance of incremental innovations carried out by “ordinary” SMEs. This also reflects a broader view of innovation beyond science and technology to include new products and services, new marketing methods and changing ways of organising business. In aggregate, innovations by small and entrepreneurial firms can contribute significantly to productivity and economic performance (OECD, 2009; 2010a; 2010b). However, the process of innovation management and commercialisation within SMEs has not received much attention within the academic literature (Adams et al., 2006). Further research to understand the challenges for entrepreneurial SMEs taking new ideas to market and successfully managing growth is required. In addition, theory on the key factors influencing the returns from new innovations is also needed. This paper contributes to these issues from a series of longitudinal case studies of innovative SMEs.

INNOVATION MANAGEMENT

Innovation management encompasses all of the processes involved in turning ideas into useful and marketable products. Following a systematic review, Adams, Bessant and Phelps (2006) proposed a framework of seven key categories to capture these activities from inputs management, knowledge management, innovation strategy, organizational culture and structure, portfolio management, project management, to commercialisation. Given the broad scope of these processes, it is not surprising that they found a diversity of approaches and fragmentation in the prior research. However, without consistent definitions and coherent conceptual foundations, the field will remain disjointed (Tidd, 2001; Ernst, 2002). Commercialisation was found to be the least developed area within innovation management and further development of theory and measures was recommended as a priority given the importance of achieving commercially viable outcomes (Adams, Bessant & Phelps, 2006).

Hence our study aims to contribute to an increased understanding of commercialisation by entrepreneurial SMEs.

Innovation strategy and formal structure are key drivers of SME performance according to a study of Australian manufacturers (Terziovski, 2010). Adopting a strategic approach to innovation has also been demonstrated to be important in a multi-industry OECD study of innovation processes in SMEs (Mazzarol & Reboud, 2011). There are different types of innovation (product, process and marketing, organizational) which require different information sources (Varis & Littunen, 2010). Adding to the complexity, SMEs vary in the approach they take to innovation as shown in a study of adoption of new design technologies for product and process innovations in which three clusters of firms were identified (Panizollo, 1998). Further, the system of relationships within the customer-buyer-supplier area and the network of support services offered to the SME were critical factors for this technology innovation. Open innovation can assist SMEs with market-related activities such as meeting customer demands or keeping up with competitors, albeit while creating additional challenges of dealing with increased external contacts (van de Vrande, deJong, Vanhaverbeke and de Rochemont, 2009).

NEW PRODUCT DEVELOPMENT

New product development (NPD) is a key process within innovation management. Although it was not a specified category in the review by Adams, Bessant and Phelps (2006), NPD activities were recognised as fundamental to innovation. New products are very important, but only one of the major types of innovations defined in the OECD's (2009) Oslo Manual; other types being process, marketing or organizational innovations. NPD includes the activities and decisions that move a product from idea to launch. There are several definable stages through which the NPD process moves before reaching full production (Cooper & Kleinschmidt, 1986). These can be sorted into three sequential phases (e.g. ideation, development and production), and differentiated into the technical/engineering and the marketing/business development activities (Mazzarol, 2012). Taking products through a staged pipeline from ideation to production using a systematic approach has been advocated for many reasons including reducing risk, averting failure and improving performance (Cooper & Kleinschmidt, 1986; Brown & Eisenhardt, 1995; Deeds, Decarolis & Coombs, 2000; Ernst, 2002; Eng & Quiaia, 2009).

A major review of empirical work on critical success factors of NPD by Ernst (2002) grouped the key factors into five areas: i) NPD process, ii) organisation, iii) culture, iv) management, and v) strategy. These demonstrate the importance of managerial issues beyond the NPD process including project organization, senior management support, and a strategic framework connecting specific products to long-term firm performance. The support and leadership shown by senior managers, as well as the openness of communication between project team members and the use of cross-functional teams has been advocated for product development success (Brown & Eisenhardt, 1995). Key factors for success in NPD include systematic control over project selection, product strategies, market research and in particular project management e.g. process controls and metrics (Dooley, Subra & Anderson, 2002).

Research on success of NPD in SMEs has found that they executed *technology-related activities* (product-development, in house product testing and preliminary technical analysis) very well; but they did not perform the *marketing-related activities* (market study, market testing, and preliminary market analysis) as well (Huang, Soutar & Brown, 2002). As it was the marketing-related activities that best differentiated the successful and unsuccessful products, this is an important area for SMEs to incorporate within their product development planning and resourcing. Since the key relationship in many small firms is between the owner-manager/entrepreneur and their lead customers (Gibb & Scott, 1985; Choi & Shepherd, 2004; Mazzarol & Reboud, 2005; Eng & Quايا, 2009), this task of obtaining input from customers is not likely to be onerous or difficult. However, in SMEs the commitment of resources to specific projects often represents a trade-off from other tasks, yet this investment clearly acts as a catalyst for successful new developments.

COMMERCIALISATION

Commercialisation is generally associated with the process of taking a new product to market, and undertaking the processes of marketing and selling, or licensing the product or related technologies. It is a process that involves the commercial exploitation of an innovation resulting in a profitable return to this investment (Chakravorti, 2004). As this is where the business recovers, or fails to recover, the investment made in the innovation, commercialisation is one of the most important activities associated with the management of innovation (Akgun, Lynn & Byrne, 2004).

Small firms seeking to commercialise new technologies can do so via a range of mechanisms including licensing, consulting, collaborative engineering and joint ventures, as

well as direct sales to customers (Libaers & Hicks, 2007). Many SMEs lack the resources that they require to fully commercialise their innovations alone, so they often seek third party support from larger firms as customers, or co-developers (Kollmer & Dowling, 2004).

Most extant studies covering commercialisation and SMEs have concentrated on high-tech industries and their interaction with either large firms (Gans & Stern, 2002; 2003; Lee et al., 2010), or universities (Milton-Smith, 2001). Research has also focused on the role of strategies such as licencing (Kollmer & Dowling, 2004). SMEs tend to be opportunistic in their approach to NPD and commercialisation rather than strategic and systematic (Lindman, 2002). Within manufacturing industries, SMEs focus more on product or patent innovations rather than the wider scale of market expansion that is common in larger firms (Vaona & Pianta, 2008). Such firms have also been found to benefit from a more systematic or formal approach to NPD (Terziowski, 2010), although a firm's ability to respond to customer or market trends has also been shown to be important (Liao & Rice, 2010). There are also differences between low and high-tech firms in relation to their investments in product or process R&D (Raymond & St-Pierre, 2010).

CREATING AND APPROPRIATING VALUE

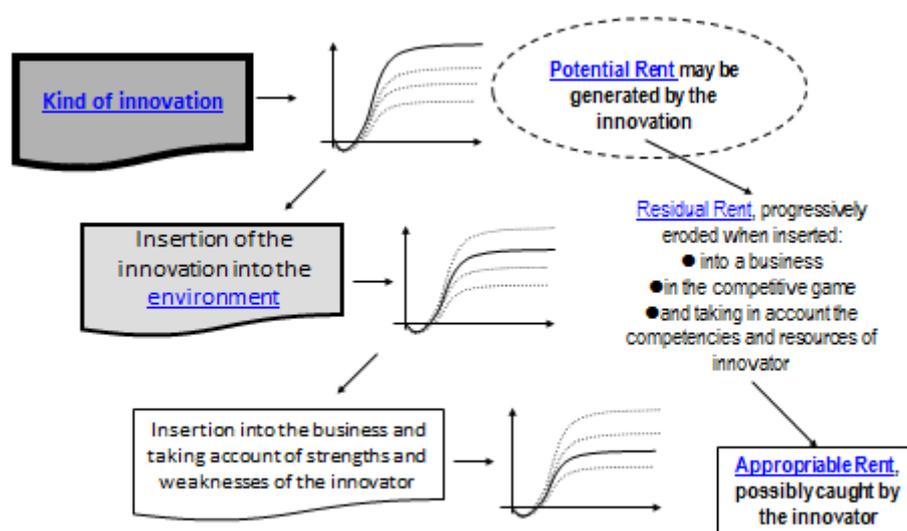
The expectation of commercialisation is the creation of economic value above the costs to produce and market the innovation, and the appropriation of at least some of these returns by the entrepreneurial firm (Alvarez & Barney, 2001; 2004; 2005; Alvarez, 2007). However, estimating the potential return from an innovation is not necessarily a straightforward calculation as conventional financial models of net present value may not be quantifiable. The approach for estimating the potential returns depends on whether the investment context is "risky" or "uncertain". According to Knight (1921) these two are distinguished on the basis of whether or not the probability distribution of outcomes are known (risk) or not (uncertain) before the decision is made (Alvarez, 2007).

The ability of entrepreneurial firms to generate and appropriate economic rents¹ from new market opportunities is summarised by Alvarez and Barney (2004) as determined by resource controls, type of knowledge, and the effectiveness of "isolating mechanisms" (see: Rumelt, 1984) to prevent imitation (such as patents on key technologies, use of trademarks

¹ An economic rent is generally defined as a payment to a factor of production in excess of that factor's payment in its next best alternative use. According to Robert Tollison (1982), economic rents are "excess returns" above "normal levels" that take place in competitive markets. More specifically, it is "a return in excess of the resource owner's opportunity cost".

and copyrights, non-compete clauses etc.). When the entrepreneurial firm controls all of the resources needed to generate the potential rents from an innovation, there is no need to take steps to contract or partner with others to obtain them. However, when the firm does not control all of the resources needed, governance choices impact the ability to realise the potential from the opportunity. These governance choices depend on whether the knowledge is tacit or explicit, and also on the ability to restrict information flows to competitors (Alvarez & Barney, 2004; 2005).

Figure 1: Generation and appropriation of economic rents



Source: Santi and Reboud (2003)

Research to develop measures to calculate anticipated rents from innovations has been conducted by Santi, Reboud, Gasiglia and Sabouret (2003). A three step model was proposed to estimate the rent that could be generated from an innovation. This is illustrated in Figure 1 where it can be seen that the initial step is to form an estimate of the “potential rent” that can be secured from an innovation. This is based not on the entrepreneur’s ability to undertake a financial analysis, but their ability to make general assumptions about the potential volume of sales that they feel might be made over a given time frame, the potential rate of profit that might be generated and the potential length of the lifecycle of the innovation before its competitive advantage is eroded by market effects. This type of innovation rent is what

Alvarez (2007) refers to as “entrepreneurial rents”, where the innovation has been created through the combination of resources in new or different ways, but where the value of these resource configurations remains unknown. Such rents are created under conditions of uncertainty without clear validation within the market. In the second stage of the process the entrepreneur takes the innovation to the market and seeks to determine a “residual” rent that is based on customer feedback and a more concrete assessment of the likely sales that can be generated. It also considers whether the firm can proceed with the commercialisation of the innovation alone, or if it needs to partner with others either via formal or informal arrangements. Other considerations in this stage are the likely impacts of competitor action, substitution threats and compliance or regulatory controls.

According to Alvarez and Barney (2004) the firm that can proceed to commercialisation without third party help should do so as this can enable them to arbitrage the rent and secure relatively fast returns without the need to share any profits. However, where the firm is unable to proceed alone (because they don't control all necessary resources), the key factors for consideration are whether or not the intellectual property underlying the innovation is based on explicit or tacit knowledge (Polyani, 1957). Here the ability to take explicit knowledge and build isolating mechanisms that provide the firm with greater capacity to control the key resources provides greater bargaining power. Yet if the knowledge underlying the innovation is largely tacit in nature there is little bargaining power and the firm's ability to appropriate rents is weak.

This “residual” rent is broadly similar to what Alvarez (2007) defines as “quasi-rents”, which are those that are created where various parties (e.g. the firm and customers) engage in the market to make transactions relating to specific investments. They are created under conditions of risk but less uncertainty. Finally, the innovation is moved towards commercialisation and the necessary resources required to fully bring it to market are allocated generating an “appropriable” rent. Key issues will be the ability of the firm to control all the resources and the realities of the market and competitive forces impacting on the firm.

Mazzarol and Reboud (2005; 2006) undertook further work to develop this framework with a particular focus on the first stage of estimating the potential rent. The volume of sales is estimated by indicators of potential geographic diffusion within a sector, potential diffusion within one or more market segments, and the potential annual sales volume on a worldwide basis after three years. The rate of profit margin is influenced by the process of generation of the innovation, the types of innovation, and the kind of prior

protection from competitors. The duration of the life cycle depends on the technology used and the ease of copying the product or service (Santi et al, 2003; Mazzarol & Reboud, 2005, 2006; 2011; Do, Mazzarol, Volery & Reboud, in press). From this analysis, a series of alternative rent configurations can be identified by classifying the three factors as high or low (Mazzarol & Reboud, 2011). These are shown in Figure 2 where it can be seen that a typology of eight potential rent configurations is possible. These include the “Champion”, “Shrimp”, “Gadget”, “Joker”, “Oasis” and “Flash in the Pan”. The last two of these have the potential to generate either high or low rates of profit depending on circumstances.

Figure 2: The Rent Typology

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

Source: Mazzarol and Reboud (2011)

By understanding the estimated relative performance in advance of the investment decision to proceed with a specific innovation, the SME owner-manager/entrepreneur is able to adopt strategies to address issues identified in the analysis or choose not to proceed with the innovation. Hence, this is a potentially valuable diagnostic tool for SME owner-managers/entrepreneurs.

Mazzarol and Reboud (2005; 2006; 2011) also developed a screening tool designed to assess the degree to which the firm’s management of its commercialisation process was being undertaken in a systematic or formal manner. Known as the *Innovation Diagnostic Diamond*

(IDD) the tool comprises 40 questions arranged into four groups of 10 items that focus on marketing, innovation, resources and strategy within the firm. The relative shape of the IDD “diamond” (generated by how an ideal score will create a diamond shape when graphed as a plot between the four indices of the IDD), provides a quick screening measure to examine how well the firm has been organising its resources to apply to the systematic commercialisation of the innovation.

RESEARCH METHODOLOGY

This paper provides a longitudinal analysis of 13 case studies of SMEs engaged in the process of commercialising new products. It draws on the rent assessment framework developed by Santi et al (2003) as well as the subsequent work of Mazzarol and Reboud (2005; 2006; 2011). Four cases were selected from Australia, five from the United States and four from New Zealand. All firms chosen were actively engaged in innovation and commercialisation and were initially selected using a theoretical rather than random sampling approach as recommended by Eisenhardt (1989). Initially the cases were selected as part of a major study of 567 firms across 11 OECD countries (Mazzarol & Reboud, 2011). They were interviewed due to their having demonstrated that they were engaged in the commercialisation of new products or services, processes or other significant types of innovation. These firms were also SMEs with fewer than 250 employees and annual turnovers of below €5 million (OECD, 2004). The research questions that were being examined via this case study analysis were:

1. What key factors that impact on the process of innovation commercialisation within SMEs in relation to success or failure?
2. How do entrepreneurial leaders from SMEs make decisions in relation to future investments in the commercialisation of innovation, and what is the relative importance of:
 - a. The use of formal or systematic commercialisation processes?
 - b. The existence of sufficient resources to allow the firm to proceed alone?
 - c. The characteristics of the firm’s management team?
 - d. The level of uncertainty in the firm’s task environment?
 - e. The level of complexity in the innovation’s commercialisation?

As recommended by Yin (1989) each case was initially interviewed in 2006 using a common case study protocol. However, it also included a case study survey in the form of diagnostic

assessment tool operating in an EXCEL spreadsheet. This tool allowed the senior manager (typically the CEO and/or owner-manager) to get immediate feedback on his/her approach to innovation management and commercialisation and helped to stimulate further discussion within the interview. A diagnostic report was also provided to each participant.

Final case study selection and follow-up interview

A final selection of cases was then undertaken based on the ability of the firms to still be trading, still have the original owner or manager who had completed the questionnaire in the initial interview, and willing to participate in a second interview. In 2012 these firms were interviewed again using the same diagnostic tool and a review made of their progress in commercialising the innovation they had been engaged with over the previous 6 years. The history, success or failure of the innovation was investigated by considering the timeline of the innovation using a critical incident technique (Flanagan, 1954). The technique is particularly appropriate when the field is new and the goals of research include practical managerial problems and theory development (Keaveney, 1995).

The original managers (usually owner-managers or CEOs) of the 13 firms who had been interviewed in 2006 were still present for the follow up interview in 2012 allowing for continuity of study and enhanced recollection of the activities the firm had undertaken. Each interview lasted around 2 hours and involved acquiring additional information on the product and the firm. Interviews took place within the firm's premises allowing for researcher observation of the business first hand. Analysis was undertaken using the data collected from the diagnostic questionnaires that were completed during the first and second interviews, as well as a review of the interview discussion transcripts collected during these visits. The diagnostic tool provided the necessary coding structure with the rent typology and IDD results forming a core part of the data analysis along with other items used in the case study protocol. These included the interviewee's assessment of the external environment and their own explanation of the factors that had helped or impeded their firm's ability to commercialise the innovation.

Description of the cases

As noted above the 13 cases examined for this study were classified as Champion, Shrimp, Flash in the Pan or Oasis depending on the configuration of their original anticipated rent assessment. Table 1 provides a general description of each case where it can be seen that most firms were very small and independently owned and operated by one or two people.

Table 1: The Cases General Description

| | |
|-------------------------|--|
| AUS Champion 1 | University spin-out established 7 years focused on high-tech spatial mapping technology for mining and industrial applications. Annual turnover increased from A\$1.5m to over A\$4.5m, and employees from 5 to 30 in 6 years. Invests 30% of annual turnover into R&D. Owned jointly by university, inventors and venture capital financiers. CEO is professional non-owner, non-shareholder. Has secured 30 to 40 customers across 12 countries. |
| AUS Champion 2 | Designer and manufacturer of specialist outdoor clothing and equipment established 36 years. Annual turnover shrank from A\$3m to A\$1m and employees from 25 to 5 in 6 years. Invests 10% of annual turnover into R&D. Owned and operated by a single entrepreneur. |
| US Champion 1 | Owner-operated firm established 7 years focused on design of process innovations in field of dental technologies. Annual turnover increased from US\$100,000 to US\$350,000 while employment increased from 2 to 2.5 over 6 years. Invests around 10% of annual turnover into R&D. Owner is female entrepreneur who has a board but they play a limited role described as “cheerleaders”. |
| US Champion 2 | Web-based software development company established 6 years. Annual turnover remained static at US\$100,000 while employees grew from 6 to 8 over 6 years. Invests 50% of annual turnover into R&D. Owner-manager is a “one man shop” who employs sub-contractors as needed. |
| US Champion 3 | A software support and web development, online marketing firm established 10 years. Annual turnover increased from US\$150,000 to US\$700,000 with employment static at 2-3 staff over 6 years. Invests 20% of annual turnover into R&D. Owned and managed by founder with junior partner. |
| US Champion 4 | Designer and manufacturer of small precision cables and variable gear transmissions established 7 years. Annual turnover grew from US\$500,000 to US\$3.1m and employees from 5 to 22 in 6 years. Invests 30% of annual turnover into R&D. Is an owner-managed firm with single owner. |
| NZ Champion | Family business established 21 years engaged in design and manufacture of stainless steel products for transport sector. Annual turnover increased from NZ\$5.4m to over NZ\$12m and employees from 55 to 96 over 6 years. Invests around 2% of annual turnover into R&D but has commercialised over 10 products. Family owned and operated by husband and wife team. Has secured a long-term supply contract with a major international customer. |
| AUS Flash in Pan | Software development firm focused on data management systems established 9 years. Annual turnover decreased from A\$5m to A\$4.5m while employee declined from 36 to 35 in 6 years. Invests 30% of annual turnover into R&D and has successfully commercialised 6-10 innovations. CEO is founder entrepreneur and one of three owners. |
| US Oasis | WIFI-based software support and maintenance firm also engaged in manufacture established 13 years. Annual revenues increased from US\$175,000 to US\$250,000 with employees remaining around 5-6 over 6 years. Invests around 60% of annual turnover into R&D. Owned by two business partners but with only one active in the firm. |
| NZ Oasis 1 | Specialist importer and retailer of plumbing and bathroom products to trade and retail customers established 21 years. Annual turnover declined from NZ\$7m to NZ\$5m with staffing down from 20 to 15 employees over 6 years. Invests around 5% of annual turnover into R&D. Firm is owned and operated by a single entrepreneur. |
| NZ Oasis 2 | Designer and manufacturer of metal processing technologies established 25 years. Annual turnover increased from NZ\$11.8m to NZ\$19.5m and employees from 79 to 103 over 6 years. Invests only 2% of annual turnover into R&D. Is managed by an executive team of 3 with strong commitment to (Kaizen) continuous improvement methods. |
| AUS Shrimp | Designer and manufacturer of agricultural parts and machinery plus engineering services established 27 years. Annual turnover had remained static at around A\$5.5m along with employment at 35 in 6 years. Invests around 3% of annual turnover into R&D but has successfully commercialised 6-10 innovations. Firm is owned and operated by three partners of whom two are active in the business. |
| NZ Shrimp | Small family business developing and manufacturing convenience fast foods from beef, lamb and chicken meat established 15 years. Annual turnover remained static at NZ\$3m along with staffing at 14-15 people in 6 years. Invests around 30% of annual turnover into R&D and has commercialised over 10 products in past 3 years. |

ANALYSIS OF THE CASES

Our analysis of the cases focused on four key units of analysis: i) the nature of the innovation, ii) the process of innovation management, iii) the leadership of the firm, and iv) the firm's interaction with the market or task environment. We also examined these firms' innovations to see how they had performed over the 6-year time interval between our interviews. Our analysis identified 6 "successful", and 7 "problematic" innovations. We deliberately refer to these as problematic because it was not appropriate to describe them as unsuccessful. In the following sub-sections we examine each of these in turn.

The "Successful" Cases

The six successful innovations were the "AUS Champion 1", "NZ Champion", "US Champion 3", "US Champion 4", "US Oasis 1" and "NZ Oasis 2". A common feature of these firms was that their innovations were predominately technological innovations. For example, the "AUS Champion 1" case was a high-tech spin-out with a platform technology protected by patents that had generated a suite of products from this core technology. The "NZ Champion" case, while a small family-run firm, had created a high-tech engineering design for attaching stainless steel barrels to trucks in a seamless and cost effective way that saved around 45% on existing fixing systems. The "US Champion 3" case was engaged in the development of online web-based marketing software that was neither particularly high-tech or easily granted formal IP protection but involved a degree of complexity in its application. The "US Champion 4" was focused on the design and manufacture of high-tech fibre optic brake cabling for "high-end" Italian bike manufacturers. The "US Oasis 1" case was focused on "technology-push" WIFI based software solutions. The only process innovation was the "NZ Oasis 2" case which was a process improvement tool for design manufacturers that the firm had originally planned for commercialisation but chose to keep in-house for their own competitive advantage.

After six years all the firms in this "successful" group, that had originally classified their innovation as having a "champion" configuration, continued to view it this way. The "NZ Oasis 2" case had originally classified their innovation as having an "Oasis B" configuration, but this had now become an "Oasis A" to reflect their decision not to sell the idea but to keep it in-house. Thus the rate of profit to be earned from it had fallen. The "US Oasis 1" case had originally classified its innovation as an "Oasis B" but had now

reconfigured it to be a “Champion” on the entrepreneur’s optimistic assessment of how the market had responded to his product.

A common pattern that emerged from these cases was the nexus between the type of innovation, the ability of the firm to generate isolating mechanisms for their IP rights, and whether the innovations could be developed alone or required alliances. For example, the IP rights protection via patents and other forms of formal IP registration was strong in most of these cases. There was also a close contact with lead customers. For example, in the case of “US Champion 3” the firm worked closely with its customers to identify their needs and adapt the software to ensure that it was integrated into the customer’s overall system. The level of market competition had increased, placing pressure on his company’s revenues in the last three years prior to the second interview and customers were prone to “shop around” for other quotes, but he remained optimistic and was planning three major new innovations over the next five years. For “US Champion 4” there was a close working relationship with a small group of lead customers who assisted the owner to find new markets. The high-tech nature of the firm’s products permitted the use of patents, but he lacked the resources to grow further due to a lack of resources for marketing. Most of the products sold had high margins but the total volume of sales remained below what was desired. The “NZ Champion” had secured a long term customer that was a major international company and this augured well for future long term growth. However, the firm did not make use of formal IP protection and instead sought to use confidentiality agreements prior to disclosure of commercially sensitive information. Of these six firms only “AUS Champion 1” required significant partnering to commercialise the innovation, the other firms had sufficient resources to proceed alone.

In terms of company management of innovation and commercialisation Table 2 lists the IDD scores for each of the six companies across all four indices for both the 2006 and 2012 time periods. Also shown are the profiles of the firm’s management characteristics. It can be seen that only two firms (e.g. “AUS Champion 1” and “NZ Champion”) had above average scores across all four IDD indices and for both time periods. Both these firms were very different in their management leadership structure. For example, “AUS Champion 1” was a university spin-out with a professional manager as CEO who had an engineering background and substantial experience in commercialisation. This firm had a professional board and venture capital investment. By comparison “NZ Champion” was a family business led by a husband and wife team, although the Managing Director (the husband) did have an MBA and was keen to promote good management practice and innovation within the company.

Table 2: IDD Profiles of the “Successful” Cases

| Case | Market Index | | Innovation Index | | Resources Index | | Strategy Index | |
|----------------|--------------|------|------------------|------|-----------------|------|----------------|------|
| | 2006 | 2012 | 2006 | 2012 | 2006 | 2012 | 2006 | 2012 |
| AUS Champion 1 | 8.0 | 7.6 | 7.2 | 8.8 | 7.6 | 8.4 | 8.2 | 7.4 |
| US Champion 3 | 7.0 | 7.8 | 6.6 | 6.0 | 6.4 | 5.4 | 4.8 | 6.2 |
| US Champion 4 | 6.4 | 4.6 | 7.0 | 7.8 | 5.4 | 5.6 | 6.2 | 3.8 |
| NZ Champion | 8.8 | 10.0 | 8.6 | 8.0 | 7.4 | 8.8 | 8.4 | 9.2 |
| US Oasis 1 | 4.8 | 4.4 | 7.0 | 6.8 | 6.0 | 4.0 | 2.4 | 2.6 |
| NZ Oasis 2 | 7.2 | 3.8 | 8.4 | 4.8 | 7.8 | 6.6 | 3.4 | 5.4 |

Average score = 5; Ideal score = 10

| Case | Management characteristics |
|----------------|--|
| AUS Champion 1 | The CEO of the firm is neither an owner nor shareholder, although he has some stock options and had been the company’s leader since foundation. An engineer by background, the CEO had no formal management education, but substantial experience with small, start-up companies as CEO or R&D manager. There is a formal managerial board. |
| US Champion 3 | Partnership with key owner-manager focused on invention and engaging with lead customers and junior partner who is focused on operations. No formal board exists but there is an informal network (business/social) that offers support. |
| US Champion 4 | Owner-manager is a university educated engineering graduate with strong technical skills but very limited financial and marketing experience. Effectively runs a ‘one man shop’ but has hired a manager to assist with the commercialisation work. |
| NZ Champion | The managing director had a trade’s background with expertise in stainless steel fabrication and fitter turning. He studied for an MBA and has continued to seek out new ideas. Employees are also encouraged to develop skills with in house or external training and tertiary education programmes. Recognised as Leader of the Year in 2009 Awards for Business Excellence. |
| US Oasis 1 | Owner-manager is a university computer engineering graduate with expertise in software development. Highly innovative he recognises that he also needs to learn business skills as the business grows. He has a business partner but this person is not active in the business. |
| NZ Oasis 2 | The Managing Director leads a small executive team (of 3) and has been recognised as CEO of the Year in 2009 at the Business Excellence Awards. The business adopts a family values approach and a commitment to continuous improvement (Kaizen) with skills training for staff a priority. |

For the other firms the pattern of IDD scores was more inconsistent. The “NZ Oasis 2” case had actually seen its IDD scores fall dramatically over the six year period between interviews. The firm had no formal innovation management process, although it should be noted that the innovation it was seeking to commercialise was a process innovation and the company made a strategic decision not to proceed with selling it but to retain the system in-house for the benefit of its own competitive advantage. This shift from an external to an internal focus appears to have led to the shrinkage of the IDD across all but the resource index.

The “Problematic” Cases

The seven “problematic” cases were the “AUS Champion 2”, “US Champion 1” and “US Champion 2”, “AUS Flash in the Pan”, “NZ Oasis 1”, “AUS Shrimp” and “NZ Shrimp”. It should be noted that not all these firms were unsuccessful in the commercialisation of their innovations. Some simply made a decision not to proceed with the innovation. For example, the “AUS Flash in the Pan” case was a data management software system targeted at large firms. The original innovation (classified as a “Flash in the Pan B”) that was examined during the first interview did not proceed when the market assessment proved to suggest it would not be viable commercially. The company was now working on a new innovation that they classified as a “Champion” configuration. This company led by an entrepreneurial CEO with an MBA specialising in technology management. He had a strong track record in the successful commercialisation of several products, both software and hardware. During the six year period of the review he had brought in venture capital investors, and sold out his shares when they took the company from Australia to the United States. However, they had been unable to find a suitable management team to run the business so he had purchased the firm back and was now running it again. The firm’s IDD scores (as listed in Table 3) grew strongly between 2006 and 2012 reflecting his enhanced experience, although it still lacked a formal NPD process and relied heavily on the CEO.

In the “AUS Champion 2” case the innovation was a new harness and backpack system suitable for use by military Special Forces and other organisations engaging in extreme outdoor activities. The product had been successfully trialled with the Australian SAS, Antarctic Research Division and Police and Emergency Services, but the compliance cost of trying to get the product accepted by the defence procurements system had generated too many obstacles. As a result the product was shelved rather than abandoned. The “Champion 1 US” was focused primarily on process innovations for dental technologies (e.g. changing a product from a USB port to wireless connection for people with disabilities). The firm had patents and other formal IP protections in place but felt that the technology could be easily copied. The “Champion 2 US” case was focused on a software product that could be protected by copyright but was also easy to copy. The entrepreneur in this firm was seeking to use software code developed for one customer and re-using it in a modified form for new customers in order to “capture the economies”.

Table 3: IDD Profiles of the “Problematic” Cases

| Case | Market Index | | Innovation Index | | Resources Index | | Strategy Index | |
|------------------|--------------|------|------------------|------|-----------------|------|----------------|------|
| | 2006 | 2012 | 2006 | 2012 | 2006 | 2012 | 2006 | 2012 |
| AUS Champion 2 | 10.0 | 8.0 | 8.8 | 6.6 | 7.8 | 6.6 | 8.0 | 5.2 |
| US Champion 1 | 7.2 | 9.8 | 8.0 | 8.8 | 8.2 | 7.6 | 8.6 | 9.4 |
| US Champion 2 | 4.8 | 4.6 | 7.6 | 8.0 | 6.8 | 7.0 | 6.2 | 4.8 |
| AUS Flash in Pan | 6.0 | 9.2 | 5.0 | 8.6 | 6.0 | 7.0 | 4.8 | 8.2 |
| NZ Oasis 1 | 8.4 | 5.8 | 8.0 | 5.0 | 7.6 | 6.2 | 8.8 | 6.4 |
| AUS Shrimp | 7.2 | 7.0 | 7.6 | 7.2 | 7.6 | 8.4 | 4.4 | 6.8 |
| NZ Shrimp | 9.4 | 9.0 | 7.0 | 8.0 | 8.8 | 4.6 | 8.2 | 7.4 |

Average score = 5; Ideal score = 10

| Case | Management characteristics |
|------------------|--|
| AUS Champion 2 | Owned and operated by single entrepreneur. The owner of this business had past experience in retailing and manufacturing before establishing his business. |
| US Champion 1 | Female owner-manager who was a former dental technician. She is focused on generating new innovations to maintain competitive advantage. Has a board but their role is limited to that of “cheerleaders”. |
| US Champion 2 | Owner-manager is mathematics graduate and self-taught programmer who is essentially a sole trader with a small team of part-time developers (“Hackers”) who he mentors and trains in web-programming. Long term plans for the company are to build up a team of 5-6 employees. |
| AUS Flash in Pan | The founder and CEO is one of three key shareholders. His original career was in geophysics, but he has completed an MBA with specialisation in technology management. The CEO/entrepreneur noted that the company has been sold by him and purchased back twice since the 2006 interview. This was due to him being called back to rescue the firm. |
| NZ Oasis 1 | The business is owned and operated independently by single entrepreneur. The owner of this business studied for an MBA to learn more about running his business. |
| AUS Shrimp | The firm is owned privately by four shareholders, only two of which are active in the company. The director who was interviewed for the study has a background as a chemist and metallurgist, and is primarily responsible for sales and marketing. |
| NZ Shrimp | After farming sheep and beef for 25 years, the CEO developed food technology skills to combine meat and vegetables in a frozen form. NPD can take 5 years as he has to do everything else in the business as well. He was Runner Up in Food Industry Excellence in Innovation Award in 2012. |

For the “NZ Oasis 1” case the innovation was a market innovation involving the import of specialist bathroom products and sold on a ‘no frills’ basis under a new retail outlet. There was a plan to set up a franchise business model to push the products out via a network of retailers. However the innovation did not proceed due to problems with securing premises, the high cost of holding stock for a cash and carry business, a downturn in the building industry and problems with the franchise system. What had originally been identified as an “Oasis B” rent configuration with good rate of profit and a long lifecycle, was deemed after

an examination of the market to be a “Gadget” with the potential for a good rate of profit, but with a short lifecycle due to the ease with which the system could be copied.

The “AUS Shrimp” case was a successful business with a strong track record in the commercialisation of a large number of innovations. Their innovation was hay bailing system designed to sort and remove weed seeds. Although the product was deemed to be full of potential the market was limited and despite a price tag of around A\$400,000 it was not felt that profit margins would be high nor the lifecycle particularly long. Although the company could produce the product without outside support it made the decision to suspend any further development on the product due to the falling price of hay on the market, which reduced the likely take up rate by buyers. By 2012 the innovation was “still in inventory” and had been identified as offering a potential “Oasis A” rent configuration with a long lifecycle but small market and modest profit. As such it was still not deemed worth further investment.

The “NZ Shrimp” case was seeking to commercialise a snack food product for distribution via retail chains. Although the product was launched successfully in New Zealand the main target market had been Australia. To enter this market required the firm to find a commercial partner and this had proven difficult. There were also problems with regulatory compliance costs associated with food products that were deemed to be too excessive for a small firm. However, at time of the second interview the firm had found a larger partner with sufficient scale and resources to help them fully commercialise the product which was now being classified as having the rent profile of a “Champion”.

A common feature of these “problematic” cases was their relative difficulty in creating isolating mechanisms around their innovations with most being fairly easily copied. Another common characteristic was the need for these firms to find strategic partners to help them complete the commercialisation process. The “AUS Shrimp” case did not need outside help to proceed with their commercialisation. However they had suspended this process due to the market outlook. A further factor that was a common feature for these firms (with the exception of “AUS Shrimp” was that they were quite heavily dependent on a single owner-manager to do most of the work associated with the NPD and commercialisation process. These factors appear to have played a greater role in the fortunes of the firm’s innovations than their level of investment in R&D (which averaged 20% of annual turnover compared to 24% among the “successful” cases). As shown in Table 3 these firms also had similar IDD profiles suggesting that their performance was not associated with how systematic or formal their innovation management processes were.

DISCUSSION AND CONCLUSION

The findings remain tentative and the data requires further analysis. This preliminary overview of the cases suggests that the success or failure of innovation within SMEs is not easily attributed to any single factor. There is some evidence that an SME's ability to move forward with the commercialisation of a new product alone is more likely to result in success than if it is required to form a strategic alliance or partnership with a third party, particularly larger firms. While entrepreneurial firms can benefit from alliances with large ones there is a risk that much of that value can be appropriated by the bigger firm unless the smaller firm has the capacity to offer complementary resources (Alvarez & Barney, 2001). It is here that SMEs will seek to partner with complementary actors (Mazzarol & Reboud, 2008). This relates directly to the importance of the firm having sufficient resources to proceed alone and supports the theory of entrepreneurial firms espoused by (Alvarez & Barney, 2004; 2005).

These findings also suggest that the level of investment in R&D, the level of formality or systematic management in the process of innovation commercialisation is no guarantee of success. While such formality and system was clearly important for some of the high performing firms (e.g. "AUS Champion 1", "NZ Champion") it was not by itself sufficient. What was also required was a strong entrepreneurial leadership team with the capacity to build a reliable team to support them in the NPD and commercialisation process. Uncertainty and complexity within the firm's task environment also plays a role in the management team's ability to fully predict the rent that might be generated from an innovation. In 7 out of 13 cases the "anticipated" rent was revised as a result of seeking to develop the innovation within its environment leading to a "residual" rent outcome. In the majority of the "problematic" cases there was a revision of this anticipated rent, with most either abandoning or shelving their innovation as a result. By comparison most of the 'successful' innovations retained their original estimate of the rent configuration.

To conclude, this study provides insights into the way SMEs approach commercialisation, and the trade-offs that must be made between anticipated return to investment and the allocation of scarce resources. The cases suggest that while systematic and formal approaches to NPD and commercialisation are helpful, they are not essential within SMEs, so long as the owner-managers or CEOs have competence in these areas. However, as firm size and complexity increase there is a need for a more formal NPD portfolio management process.

Implications for research, policy and practice

For practicing SME owner-managers, these cases suggest that, in an environment of scarce resources as found in most SMEs, an innovation being commercialised tends to only receive systematic or formal attention to the degree the owner feels is necessary to secure a return to any investment. That is, if CEOs feel success can be achieved without much formality or system they will try to do without it. Too much emphasis on formality and the use of legal protections for intellectual property or the acquisition of venture capital are unlikely to greatly assist such innovators. Of more value is helping SME owner-managers and their teams think systematically about their business models and developing strategic approaches for assessing their risk and return. Finally, further research on commercialisation is recommended to examine these issues in depth to complement this small sample of case studies and to provide empirical evidence from these three countries and others from around the globe.

REFERENCES

- Adams, R., Bessant, J., and Phelps, R. (2006). Innovation management measurement: A review. *International Journal of Management Reviews*, **8**(1): 21-47.
- Akgun, A. E., Lynn, G.S., and Byrne, J.C. (2004). Taking the guess work out of new product development: How successful high-tech companies get that way. *Journal of Business Strategy*, **25**(4): 41-46.
- Alvarez, S.A. (2007). Entrepreneurial rents and the theory of the firm. *Journal of Business Venturing*, **22**(3): 427-442.
- Alvarez, S.A., and Barney, J.B. (2001). How entrepreneurial firms can benefit from alliances with large partners. *Academy of Management Executive*, **15**(1): 139-148.
- Alvarez, S.A., and Barney, J.B. (2004). Organizing rent generation and appropriation: toward a theory of the entrepreneurial firm. *Journal of Business Venturing*, **19**(5): 621-635.
- Alvarez, S.A., and Barney, J.B. (2005). How do entrepreneurs organise firms under conditions of uncertainty? *Journal of Management*, **31**(5): 776-793.
- Brown, S., and Eisenhardt, K. (1995). Product development: Past research, present findings and future directions. *Academy of Management Review*, **20**(2): 343-378.
- Chakravorti, B. (2004). The new rules for bringing innovations to market. *Harvard Business Review*, **82**(3): 58-67.
- Choi, Y-R., and Shepherd, D.A. (2004). Entrepreneurs' decisions to exploit opportunities". *Journal of Management*, **30**(6) : 377-395.
- Cooper, R.G. and Kleinschmidt, E.J. (1986). An investigation into the new product process: Steps, Deficiencies and Impact. *Journal of Product Innovation Management*, **3**(2): 71-85.

- Cooper, R.G., and Kleinschmidt, E.J. (1995). Benchmarking the firm's critical success factors in new product development. *Journal of Product Innovation Management*, **12**: 374-391.
- Deeds, D.L., Decarolis, D., and Coombs, J. (2000). Dynamic capabilities and new product development in high technology ventures: An empirical analysis of new biotechnology firms. *Journal of Business Venturing*, **15**(3), 211-229.
- Do, T.H., Mazzarol, T., Volery, T. and Reboud, S. (in press). Predicting anticipated rent from innovation commercialisation in SMEs. *European Journal of Innovation Management*, (accepted in press).
- Dooley, K.J, Subra, A., and Anderson, J. (2002). Adoption rates and patterns of best practices in new product development. *Journal of Innovation Management*, **6**(1): 85-103
- Eisenhardt, K. (1989). Building theory from case study research. *Academy of Management Review*, **14**(4): 532-550.
- Eng, T-Y., & Quايا, G. (2009). Strategies for improving new product adoption in uncertain environments: A selective review of the literature. *Industrial Marketing Management*, **38**(3): 275-282.
- Ernst, H. (2002). Success factors of new product development: A review of the empirical literature. *International Review of Management Reviews*, **4**: 1-40.
- Flanagan, J.C. (1954). The critical incident technique, *Psychological Bulletin*, **51**(4): 327-358.
- Gans, J. S., Hsu, D.H., and Stern, S. (2002). When does start-up innovation spur the gale of creative destruction? *RAND Journal of Economics*, **33**(4): 571-586.
- Gans, J.S. and Stern, S. (2003). The product market and the market for 'ideas': Commercialization strategies for technology entrepreneurs. *Research Policy*, **32**: 333-350.
- Gibb, A. and Scott, M. (1985). Strategic awareness, personal commitment and the process of planning in small business. *The Journal of Management Studies*, **22**(6): 597-632.
- Huang, X., Soutar, G.N., and Brown, A. (2002). New product development processes in small to medium sized enterprises: Some Australian evidence. *Journal of Small Business Management*, **40**(1): 27-42.
- Keaveney, S.M. (1995). Customer switching behavior in service industries: an exploratory study. *Journal of Marketing*, **59**(2): 71-82.
- Knight, R. (1921). Cost of production and price over long and short periods. *Journal of Political Economy*, **29**: 332.
- Kollmer, H., and Dowling, M. (2004). Licensing as a commercialisation strategy for new technology-based firms. *Research Policy*, **33**(8): 1141-1151.
- Kuratko, D., and Hodgetts, R. (2004). *Entrepreneurship: Theory, Process, Practice*. 6th Edition, Mason, Ohio: Thomson South-Western
- Lee, S., Park, G., Yoon, B., and Park, J. (2010). Open innovation in SMEs – An intermediated network model. *Research Policy*, **39**(2): 290-300.
- Liao, T-S., & Rice, J. (2010). Innovation investments, market engagement and financial performance: A study among Australian manufacturing SMEs. *Research Policy*, **39**: 117-125

- Libaers, D., and Hicks, D. (2007). A taxonomy of small firm technology commercialisation. *Academy of Management Proceedings & Membership Directory*, 1-6.
- Lindman, M.T. (2002). Open or closed strategy in developing new products. A case study of industrial NPS in SMEs. *European Journal of Innovation Management*, **5**(4): 224-237.
- Mazzarol, T. (2012). Predicting the innovation rent: How to assess future returns to investment in innovation when conventional financial assessments don't apply. Presentation to the Entrepreneurship & Innovation Group, University of Western Australia, Perth, Western Australia, 27 November 2012.
- Mazzarol, T., and, Reboud, S. (2005). Customers as predictors of rent returns to innovation in small firms - an exploratory study. *International Journal of Entrepreneurship and Innovation Management*, **5**(5/6): 483-494.
- Mazzarol, T., and Reboud, S. (2006). The strategic decision making of entrepreneurs within small high innovator firms. *International Entrepreneurship and Management Journal*, **2**(2): 261-280.
- Mazzarol, T., and Reboud, S. (2008). "The Role of Complementary Actors in the Development of Innovation in Small Firms." *International Journal of Innovation Management* **12**(2): 223-253.
- Mazzarol, T., and Reboud, S. (Eds) (2011). *Strategic Innovation in Small Firms: An international analysis of innovation and strategic decision making in small and medium enterprises*. Cheltenham UK: Edward Elgar.
- Milton-Smith, J. (2001). The role of SMEs in commercialising university research & development: The Asia-Pacific experience. *Small Business Economics*, **16**(2): 141-148.
- OECD (2004). *SME Statistics: Towards a more systematic statistical measurement of SME behaviour*. Promoting Entrepreneurship and Innovative SMEs in a Global Economy, Istanbul, Turkey 3-5 June, Organisation for Economic Co-operation and Development, Paris.
- OECD (2009). *Innovation in Firms: A Microeconomic Perspective*. Paris, Organisation for Economic Co-operation and Development.
- OECD (2010a). *SMEs, Entrepreneurship and Innovation*. Paris, Organisation for Economic Co-operation and Development.
- OECD (2010b). *The OCED Innovation Strategy: Getting a Head Start on Tomorrow*. Paris, Organisation for Economic Co-operation and Development.
- Panizzola, R. (1998). Managing innovation in SMEs: A multiple case analysis of the adoption and implementation of product and process design technologies. *Small Business Economics*, **11**(1): 25-42.
- Polanyi, K. (1957). *The Great Transformation*. Boston, Beacon Press.
- Raymond, L., and St-Pierre, J. (2010). R&D as a determinant of innovation in manufacturing SMSs: An attempt at empirical clarification. *Technovation*, **30**(1): 48-56.
- Rumelt, R. (1984). Towards a strategic theory of the firm. In Lamb, R. (Ed). *Competitive Strategic Management*, Upper Saddle River, N.J.: Prentice Hall, 556-570.

- Santi, M., Reboud, S., Gasiglia, H. and Sabouret, A. (2003). *Modèle de valorisation et de protection intellectuelle des innovations des PEI*. July, HEC/INPI: 63p.
- Santi, M. and Reboud, S. (2003) *Model of valorisation and protection of an innovation, the case of SMEs: a synthesis*, LINEN (HEC) and CEREN Groupe ESC Dijon, for Institut National De La Propriete Industrielle (INPI), France.
- Tidd, J. (2001). Innovation management in context: Environment, organization and performance. *International Journal of Management Reviews*, **3**(3): 169-183.
- Terziovski, M. (2010). Innovation practice and its performance in small and medium enterprises (SMEs) in the manufacturing sector: A resource-based view. *Strategic Management Journal*, **31**(8): 892-902.
- van de Vrande, V., deJong, J.P.J., Vanhaverbeke, W. and de Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, **29**: 423-437.
- Vaona, A. and Pianta, M. (2008). Firm size and innovation in European manufacturing. *Small Business Economics*, **30**(3): 283-299.
- Varis, M., and Littunen, H. (2010). Types of innovation, sources of information and performance in entrepreneurial SMEs. *European Journal of Innovation Management*, **13**(2): 128-154.
- Yin, R. K. (1989). *Case Study Research: Design and Methods*. London, Sage Publications.