EFFICACY OF INNOVATION DIAGNOSTIC TOOLS IN IDENTIFYING MODELS OF SUSTAINABLE INNOVATION IN MANUFACTURING SME

TIM MAZZAROL
UWA Business School
University of Western Australia
35 Stirling Highway, CRAWLEY WA 6020
Tel: +618 6488-3981
Fax: +618 6488-1072
Email: tim.mazzarol@uwa.edu.au

GEOFFREY DURDEN
Graduate School of Management
La Trobe University
Kingsbury Drive, BUNDOORA VIC 3086
Tel: +613 9479-3106
Fax: +613 9479-3144
Email: g.durden@latrobe.edu.au

VIJAYA THYIL
Graduate School of Management
La Trobe University
Kingsbury Drive, BUNDOORA VIC 3086
Tel: +613 9479-3124
Fax: +613 9479-3144
Email: v.thyil@latrobe.edu.au

Paper presented at the EFMD 37th Entrepreneurship, Innovation & Small Business (EISB) Annual Conference, 13-14 September 2007, Ljubljana, Slovenia

ABSTRACT

The capability for sustainable innovation is a critical prerequisite for successfully achieving near-term competitive advantage, and long-term viability in turbulent environments. Innovation typically involves unconventional ways of recharging an existing business concept, or the exploitation an uncontested market space thereby making the competition irrelevant. However, few firms exhibit systematic, sustainable innovation management practices that are able to convert innovative new technologies into globally competitive products.

While many new radical innovations are initiated by small to medium sized enterprises (SME), the track record of successful commercialisation lies predominately with larger firms. SME are generally highly adaptive organisations able to demonstrate flexibility and opportunism in their response to the fast pace of technological change and the constantly evolving new global paradigms of business environments. However, they also lack formal systems for the management of innovation and commercialisation, as well as the resources to fully exploit the technological and market opportunities with which they are presented.

For manufacturing firms the need to maintain high levels of innovation in product or process is an important element in securing a sustained competitive advantage. This is particularly the case for SME manufacturers, which must use innovation as a means of differentiation. Despite its importance, the literature relating to sustainable innovation in manufacturing SME is sparse, with only a handful of peer-reviewed articles identified in the online journal databases during the period 2000-2006.

A better understanding is required as to the most appropriate infrastructures, strategies and mechanisms for the support of SME manufacturers in the management and diffusion of technological innovation. What, for example, is the impact of government policy in terms of influencing the innovation climate in the country? What is the relative influence of customers, key suppliers, board members, equity partners, senior managerial staff, bankers and family members on the entrepreneur's strategic decision making when seeking to commercialise an innovation?

Drawing upon the available literature, the paper examines the application of a diagnostic assessment tool for examining innovation management practice in small firms. Four case studies of SME manufacturing firms in Australia are examined with reference to their performance on the diagnostic assessment, as well as the national context within which such firms exist. The paper identifies the primary drivers of an emerging model of sustainable innovation, and seeks to explain the impact of external government support for innovation, plus the importance of internal management systems.

Attention is given to the past track record of innovation within each firm, reasons for success or failure, the role of external actors in the facilitation of innovation, strategic decision making in the firm and the perceptions of these entrepreneurs to the value of investments in future innovation. The use of a multiple case study methodology provides the opportunity to examine the processes used by these firms in depth, and thereby provide a comprehensive picture of sustainable innovation behaviour.

The findings highlight the critical importance of the entrepreneur within SME manufacturing firms who serve as a key 'distinctive competency' within the company. As a learning system, the SME, via its entrepreneur(s) and key staff, is continuously in communication with leading customers, key suppliers and third-party advisors. The need to offer value to customers and thereby extract higher than average profits from appropriate pricing is also highlighted. This desire for continuous improvement, differentiation and value adding, emerges as a key driver for innovation within these firms. Such behaviour is consistent with the notion of a technology cycle model. Perceived gaps in the national innovation system are also highlighted, with particular concerns expressed over access for small firms to early stage seed capital for R&D projects.

THE SME AND INNOVATION

Intense competition in the market place is forcing organisations to examine the different ways by which they could enhance or retain their competitive edge, and more importantly, the link between innovation, sustained competitive advantage and organizational renewal (Motwani, Dandridge, Jiang & Soderquist, 1999). Small to medium sized enterprises (SME) comprise a major element of the total business activity within most national economies, and play an important role in innovation (OECD, 2004a). However, despite the demonstrated importance of SME to technological innovation and international competition, there is a paucity of research in the academic literature relating to the management of technology within such firms (Motwani et al, 1999). This also translates into a lack of clear performance benchmarks and policy guidelines for managers (Tidd, 2001).

For the purposes of this paper, an SME is defined as a business venture that has fewer than 250 employees and an annual turnover less than EURO 50 million (OECD, 2004b). The paper also assumes the existence of a national innovation system into which such SME can operate. This concept of a national innovation system seeks to define the interaction that takes place within a country of the research and development (R&D) centres, universities and other publicly funded or supported institutions, the financial and investment markets, government policy makers, and the industry sectors that commercialise research (Lundvall, 1992; Nelson, 1992). The success of a national innovation system is contingent upon a variety of complex interrelated issues; however, one important element is the exchange of knowledge via both formal and informal exchange relationships throughout industries. Failures have been identified as taking place at four key areas. The first involves the failure to provide adequate infrastructure and investment, particularly the ability of governments to supply R&D or communications infrastructure, plus the availability of venture capital. The second is that of “transition failures” where there is a failure of new ideas or technologies to diffuse across industry sectors. The third failure is that of “lock in”, whereby there is a tendency for industries to remain committed to existing technological paradigms that stop them from innovating. Finally, there is the failure associated with institutional rigidities where the legal and regulatory systems within the country make it difficult for innovation. This can be due to labour inflexibility, restrictions on the introduction of new technologies or the lack of protection of intellectual property (IP) rights (Smith, 2000).

The level of innovation within a country appears to be closely associated with its economic prosperity. Australia, for example, ranks well in the OECD national economic indicators and it also has a good performance in comparison with other OECD countries in relation to its scientific research activities (BCA, 2004). Analysis of the relationship between scientific publications and economic wealth shows a positive correlation (King, 2004). A longitudinal study of the relationship between the numbers of patents registered by Australian firms, labour productivity and economic growth, also shows a strong positive correlation between these three elements (Crosby, 2000). Innovation, as measured in part by patents, remains an important economic driver, and the level of innovation activity found among SME is likely to be critical to the sustainability of a nation’s economic growth. However, there has been little attention given to the role of SME within this national innovation system (Mytekla, 200). This is disappointing, as the SME, with its flexible, opportunity driven, entrepreneurial orientation has been viewed as having much to teach is larger counterparts about innovation (Gibb, 2000).

However, the management of innovation also benefits from discipline and formalisation, which are all qualities inherent in most large firms. Branzei and Vertinsky (2006) cite Zahra (1996) and define innovation strategies as plans that guide firms’ decisions regarding the development and use of technological capabilities. Innovation strategies, in turn, play a critical role in defining the firms’ competitive posture by specifying the content, sources of desired competencies, and their intended effects (Bierly & Chakrabarti, 1996; Mitchell, 1990; cf Branzei & Vertinsky, 2004).

Measuring innovation within organisations is also challenging as it is a difficult term to define let alone measure. Innovation has been defined in economic, sociological and technological terms.

Schumpeter (1934) defined it as the introduction of new elements or a new combination of old elements within industrial organisations. Kanter (1983) defined it as the process of bringing new, problem solving ideas into use. Sunbo (1998) suggests that innovation is fundamentally about the renewal of elements within a system of production. It can involve new products and processes which can be fundamental in nature, or a combination of existing elements into a new dominant design or paradigm.

THE ROLE OF THE ENTREPRENEUR

An important starting point for any examination of innovation in the SME is the entrepreneur or owner-manager, who is the person or persons that typically invest their time, money and reputation into new ventures, and who take on the risks associated with the commercialisation of innovations. Various attempts have been made to define those entrepreneurs that are closely associated with innovation or technology-based ventures. The term "technopreneurship" has been used to define the process of entrepreneurship within technology intensive businesses (Venkataraman, 2004). There is a tendency for such entrepreneurs to be drawn from former scientific or academic backgrounds, and these types tend to be strongly research focused and committed to R&D. Those that hail from engineering backgrounds within larger organisations are more likely to be focused on production and commercialisation, while others may have little direct technical skills, but have strengths in marketing or sales, qualities that can be highly useful in commercialisation (Johns-Evans, 1995).

The strategic thinking and behaviour of these entrepreneurs is of particular importance within the wider context of understanding innovation management. Entrepreneurs must make sense of their environment and will often follow opportunistic strategies based upon their knowledge of market conditions or customer needs, and how to develop a competitive advantage via the application of technology and innovation (Trott, 1998). Entrepreneurial learning is an important issue in this process, and the process through which the entrepreneur acquires information and learns is worthy of attention (Chell & Allman, 2003). The intuitive, trial and error, learning style common to many entrepreneurs, is not always an effective management style in the adoption of new technology or the creation of new products. While it may be beneficial in identifying opportunities and seeking to exploit them, the more formal, systematic approach of the traditional manager may be a more effective approach to technology adoption and New Product Development (NPD) (Gagnon, Sciotte & Posada, 2000). Entrepreneurial SME have been found to follow a flexible strategy based on close feedback from customers to the entrepreneur leading the firm's NPD process. It also tends to be informal in nature and can be placed at risk as a result (Lindman, 2002). For entrepreneurs seeking to commercialise radical innovations a strong analytical and proactive mindset is likely to be desirable, while a more corporatist and managerial mindset is likely to be valuable in assessing technological and market threats (Talke, 2007).

Within the SME the entrepreneur typically plays a critical role, as leader, visionary and in setting the conditions for the generation of an organisational culture that is conducive to innovation (Ahmed, 1998). Good communication between team members, low levels of bureaucracy and a fun and failure tolerant culture are viewed as important (Perry, 1995). It is the role of the entrepreneur to define quality, set formal standards, encourage a mindset of change and improvement, and make their employees feel like partners in the business (Mazzarol, 2002). The organisational culture that is fostered within the business is determined by the senior management via the strategy, structure, support systems and communication style. How they handle change, deal with mistakes and risks, and encourage organisational learning can determine the success of their firm's culture as a positive environment for stimulating creativity and innovation (Martins & Terblanche, 2003).

THE PROCESS OF INNOVATION MANAGEMENT

Innovation management remains a poorly defined and understood area of management that lacks clear measures or well developed frameworks (Tidd, 2001). To measure innovation requires an evaluation of the inputs of creative ideas, technology and Intellectual Property (IP) that go into the development of new products or processes, and how these are then managed within the firm via a combination of four elements. The strategy that is followed by the organisation, particularly how strategy is set by the senior management is an initial area for attention (Adams, Bessant & Phelps, 2006).

Strategic orientation frameworks have been used within large firms, with the most well known being that of Miles and Snow (1978), which identified four strategic types: the "Prospector", "Analyser", "Defender" and "Reactor". Of these the "Prospector" and "Analyser" had the greatest propensity for innovation, particularly the former, which tended to use innovation as its main source of strategic competitive advantage. This same typology has been applied with success to SME (Gimenez, 2000). It suggests that SME, despite their small size, are able to follow well defined strategic paths in a similar way to their larger counterparts. The SME that applies innovation and new technology will either be engaged in the original creation of the new product or technology, or it will be seeking to apply existing technology to established markets, drawing into its processes innovations that are currently not used within its target markets (Autio & Lumme, 1998).

The way in which inputs and innovations that are converted to outputs are managed via R&D portfolios and projects is another key area of focus. Once the innovation is ready to go to market, the process of commercialisation also becomes an area of attention. More difficult to measure, but also crucially important is the organisational culture within the firm and how this supports innovation and New Product Development (NPD). Also important is the more complex process of knowledge management, with particular emphasis on the sharing of ideas both internally and externally by the firm (Adams, Bessant & Phelps, 2006).

Put simply, an innovation management process for NPD and commercialisation should involve at least five steps. First, there should be a clear assessment of the market and the needs of the target customers and their current levels of satisfaction or dissatisfaction with existing products. Second, there should be a clear commercialisation plan prepared that maps out how to take the new product to market. The next stage is to select an initial leading customer or point of market entry, with incremental steps as the new product or technology is assessed and adopted. As the market/customer feedback is evaluated, additional R&D can be undertaken to ensure that the prototype is refined and developed to meet end user requirements. In the final stage there should be a focus on marketing and selling-in of the product to target market segments (Zakon, 1989).

The NPD process benefits therefore from a systematic and formal approach that employs planning, costing and good project management (Boag & Rinholm, 1989). Commercialisation and NPD are inherently risky activities and involve both technical and market risks. The technical risks are more likely to occur at the early stage of the NPD process; with the market risks taking place during the commercialisation phase after the product is launched. SME innovators that are engaged in technology-based NPD and commercialisation face particularly high risks, and can usually benefit from good planning, systematic innovation management and strategic alliances formation (Oakey, 2007). While strategic alliances can be a valuable source of ideas, information and technology transfer, the entrepreneur within an innovative SME may also need to strike a balance between their desire for developing radical new products, and ensuring that what they are producing is able to meet the needs of the customer (Kotabe & Swan, 1995). They can assist the entrepreneur to secure access to markets both domestically and overseas (Komulainen, 2006). They can also be critical to the firm's ability to secure equity financing from venture capital sources (Sapienza & De Clercq, 2000).

Success in innovation is generally difficult to measure, and there are many SME that do quite well without being highly visible (Crick & Jones, 1999). In general terms the ability to keep the technical and marketing development aspects of NPD under simultaneous control is thought to be a key source of success for commercialisation within SME (Huang, Soutar & Brown, 2002). This can apply equally to service firms undertaking NPD as manufacturers (Vermeulen, 2005). The role of the customer as a source of validation of the merits of the new product is often highly important to the SME (Mazzarol & Reboud, 2005).

As with any business activity there is a need for clear, coherent strategy to be developed. The process of innovation and technology management within organisations, whether large or small, involves the alignment of technology with strategy (Berry & Taggart, 1994). Traditionally it has been large firms that have invested the most in both R&D and the application of process technologies to achieve enhanced productivity. However, with the emergence of computer aided manufacturing and low cost personal computing in the 1980s, SME manufacturers also became able to take advantage of such technologies (Meredith, 1987). This paper seeks to examine the innovation management practices of SME within the Australian manufacturing sector and the efficacy of diagnostic assessment tools designed to measure how well such firms are managing NPD and commercialisation activities.

SME IN THE AUSTRALIAN MANUFACTURING SECTOR

Manufacturing involves the making of goods or other wares on a large scale either manually or with the aid of machinery. It encompasses a wide range of sub-sectors involving different types of materials, for example the manufacture of: food, beverage and tobacco products; textile, clothing and footwear; wood and paper products; printing, publishing and recorded media; coal, petroleum and chemicals; metal products; non-metallic materials; machinery and equipment; and such items as furniture, pre-fabricated buildings, jewellery, toys and sporting equipment.

Australia has a fairly small manufacturing industry by world standards. Around 94 percent of all firms within the sector are SME and in 2005 it generated around 11 percent of Australia's Gross Domestic Product (GDP) and employed just over 1 million people (ABS, 2006). The history of manufacturing in Australia is closely associated with the country's economic and trade policy. At the time of Federation in 1901, Australia's six Colonial Governments were concerned over the influx of cheap manufactured goods, particularly Asia. This was felt most strongly in Victoria which has traditionally had one of the largest concentrations of manufacturing in the country. The resulting policy decision of the new Australian Federal Government was to introduce high import tariffs. This regime of high tariffs helped to nurture Australia's fledgling manufacturing sector that was given a further boost during the First and Second World Wars, which required Australia to become self-sufficient in a range of goods including aircraft, motor vehicles, farm machinery, chemicals, electronics and shipbuilding (Brown & Hughes, 1970). By the 1980s the Australian manufacturing sector was viewed as seriously lacking in international competitiveness and a series of tariff reforms were introduced that gradually removed import restrictions, while simultaneously seeking to address labour productivity and investment in new technology (Emmery, 1999).

During the early 1990s as tariff barriers fell, attention within the Australian manufacturing sector began to focus on innovation and the need to build international linkages for technology transfer and exporting (AMC, 1994a; 1994b). It was recognised that innovation was the key not only to success, but also to the sustainability of manufacturing within Australia (Pappas, Evans & Telesis, 1990). Successful firms needed to trawl the market for ideas, invest in R&D and encourage a business culture that placed innovation at the centre of strategic focus (AMC, 1995). This period of the 1980s and 1990s was viewed as one of major restructuring within Australia's economy and the manufacturing sector specifically. Despite media claims to the effect that Australia was losing its manufacturing industries offshore to cheaper labour cost countries, total employment levels stabilized and output increased due to the introduction of technologies such as computer-based

or automated manufacturing and greater labour flexibility. Investment in new technologies by Australian manufacturers increased rapidly from the mid-1980s, although investment in R&D, while rising, remained more subdued (Productivity Commission, 2003).

Accompanying this restructuring of Australia's manufacturing sector was a drive for enhanced levels of formal quality assurance and total quality management (TQM). The application of the International Standards Organisation (ISO9000) systems of quality management were strongly embraced and given government support. However, this formal quality assurance movement did not always lead to better performance and resulted in a negative reaction to ISO9000 in some circles (Terziovski, Shohal, & Moss, 1999).

By early years of the 21st Century the situation in Australian manufacturing was more stable with a fairly positive outlook across the sector (AIG, 2007). However, there remained concerns over relatively low levels of productivity, innovation and global competitiveness, particularly in the regional areas of Australia outside the major cities (AIG, 2001). There was a call from the Business Council of Australia (BCA, 2006), the national peak body of industry, for a greater focus on innovation across a wide range of areas, including education and training, R&D, government policy support and within the workplace. Australia's manufacturing sector appears to have taken such advice onboard, performing well against other sectors in terms of total levels of innovation, but still lagging communications services, electricity, gas and water supply utilities. Over the period from 1994 to 2003 the proportion of manufacturing firms innovating increased by 36 percent, although some sub-sectors saw slight declines (ABS, 2005).

This paper examines case studies of SME manufacturers from two Australian states, Victoria and Western Australia. In terms of manufacturing, Victoria employs around 31 percent of all the workforce engaged in the sector and generates an estimated 30 percent of the industry value added. By comparison Western Australia employed just over 9 percent of the national manufacturing workforce and generated around 9 percent of the industry value added (ABS, 2006). Victoria is the centre of motor vehicle manufacturing, electrical goods and clothing, textiles and footwear. Western Australia is a resource rich state in which manufacturing is focused on the mining and offshore oil and gas industries, as well as advanced marine engineering (IRIC, 2001).

METHODOLOGY

The methodology involved a multiple case study approach that drew four cases from among Australia's manufacturing SME. Two of these cases were drawn from Victoria and the other two from Western Australia. The case study has been identified as a valuable tool for research into small firms (Chetty, 1996). Case studies can be used to generate theory (Eisenhardt, 1989) or to test theory (Yin, 1989). This methodology has also been employed in the study of innovation adoption within organisations (Yin, 1981). The four cases were selected from a larger database of 55 cases collected as part of a wider international study into innovation management in SME. Each case was identified as a firm within the definition of SME, and with the likelihood of it being engaged in some form of innovation. Innovation was measured in terms of technological product or process, but also market, marketing and administrative innovations (North & Smallbone, 2000).

A diagnostic questionnaire was used in the interview with each firm in conjunction with a case study protocol that was developed to support the questionnaire. This questionnaire ran within an EXCEL spreadsheet with macros and allowed the researcher to quickly generate a report for the management of the SME, outlining its profile in innovation management and the anticipated risk and return configuration of the innovation that was being considered for future commercialisation. This diagnostic tool was developed by a French and Australian collaboration commencing with initial case study analysis in France (Santi, Reboud, Gasiglia & Sabouret, 2003), and moving onto a quantitative analysis of a small sample of high innovator firms in Australia (Mazzarol & Reboud, 2005).

The use of quantitative surveys in case studies is acknowledged as a useful method of analysis for the examination of cross-case comparisons with enhanced reliability (Yin & Heald, 1975). Case surveys can provide a useful bridge between the conventional quantitative survey and the qualitative approaches more common with case studies (Larsson, 1993). As a research strategy, the case study is distinguished from other methodologies due to its ability to examine a contemporary phenomenon in its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 1981). The experiment seeks to deliberately divorce the phenomenon from its context so as to control the environment and isolate variables that may be influencing it. By comparison, an historical analysis of a phenomenon is unable to fully understand the context, into which it took place due to the absence or bias of records, or the unavailability or unreliability of witnesses who experienced it. The case study offers the ability to study a phenomenon in context and allows an opportunity to link the two together (Yin, 1982).

This study employed a diagnostic assessment tool that formed the basis of the case study survey framework. One element of the diagnostic tool was the assessment of the anticipated risk and return associated with the innovation, as perceived by the entrepreneur within the SME (Reboud & Mazzarol, 2006). The potential return to the intellectual property (IP) invested in the innovation can be seen as the RENT that might be earned from the innovation. This RENT is determined by a combination of three components: i) the volume of sales that might be generated over a defined time period; ii) the rate of profit that the innovation might earn in that same time period; and iii) the lifecycle of the innovation, or the length of time that the innovation might be sustained in the market before being eroded by competitor activity or substitution threat (Santi, et. al., 2003). This creates the formula:

RENT = VOLUME X RATE X LENGTH

As the combination of these three variable components, a rent can be characterised by its extreme profile: large/small volume; high/low rate of margin and short/long life cycle. With two possibilities for each variable the total number of combinations is eight, although six 'generic' configurations were defined. Each configuration involves different levels of volume, rate and length thereby determining the anticipated rent to be derived from the innovation. These were described in the following terms:

1. **Shrimp** – a configuration offering low rent potential due to its modest levels of volume, rate and length, as such it is unlikely to be of much interest;

2. **Champion** – a configuration with high potential rent;

3. **Gadget** – a configuration offering low volume and length but high rate, leading to little interest overall. Such a configuration would not justify significant investment;

4. **Joker** – a configuration with high volume and length but low rate making it little better than the 'Gadget' despite its apparently attractiveness;

5. **Flash in the Pan** – a configuration with good volume but poor length and may experience both high or low rate, making it challenging for the investor that may need to outlay substantial capital to secure the return over the short life cycle; and

6. **Oasis** – a configuration that offers good length but low volume and high or low rate.

While the "Champion" configuration appears the most desirable, the "Oasis" configuration may be more suitable for a small firm because the small overall volume of sales may be more readily exploited by the small firm (Santi et. al. 2003). Such an innovation opportunity is essentially that found in a niche market. However, the capacity of the small firm to secure a desirable rent return

from its innovation is likely to depend on its resources, the nature of the innovation and the characteristics of the market environment into which it is seeking to diffuse the innovation. Key forces likely to influence the market environment include the power of customers and their capacity and willingness to adopt the new innovation, the power of competitors and the capacity for new market entrants and substitution threats to erode the competitive advantage of the innovation (Porter, 1991).

The diagnostic tool does not evaluate the risk and return associated with the innovation from a financial perspective. For most SME engaged in early stage commercialisation, it is difficult if not impossible to undertake an effective financial risk-return assessment; because the data to undertake convention discounted cash flow analysis is non-existent. Two characteristics that are of particular importance to the assessment of the innovation, and that might have an influence on the rest of the evaluation processes are: i) the stand alone or systematic character of the innovation (kind of innovation, with possible effect on recommendations); and ii) the existence of one or more sectors of application of the innovation (sectoral potential of diffusion).

In addition to the estimation of the potential RENT return an entrepreneur might yield from an innovation, there remains the need for the development of an effective business model to fully commercialise the innovation (Akgun, Lynn & Byrne, 2004). In development of the diagnostic tool, attention was also given to the way in which the SME was managing the innovation process itself. A four-part index identified as the "innovation diagnostic diamond" was created that maps the firm's performance on indices relating its management of the market, resources, strategy and the innovation elements (e.g. R&D and IP). This additional diagnostic tool was found to highlight gaps in the NPD process of SME engaged in early stage commercialisation activities and assist the entrepreneurs from these firms to develop more systematic strategy (Mazzarol & Reboud, 2006).

This part of the analysis tool uses the "Innovation Diagnostic Diamond" to map in a graphic format the performance of the entrepreneur's current management practices against four Index measures. To address this problem, a four part framework was developed that seeks to measure the small firm entrepreneur's current approach to innovation management, mapping behaviour on four dimensions (Mazzarol & Reboud, 2006):

1. **Market Index** – a measure of the firm's focus on customer needs and how the new innovation offers customers value for money;

2. **Innovation Index** – a measure of the firm's formal process of new product development and its management of intellectual property (IP);

3. **Resources Index** – a measure of the firm's technological, human, financial and managerial resources; and.

4. **Strategy Index** – a measure of the firm's strategic planning in relation to its commercialisation process.

Common problems associated with the commercialisation of new products are the lack of an appropriate business model, inadequate management skills, insufficient market testing and evaluation, poor project team building, inadequate management of intellectual property, the lack of a clear exit strategy, insufficient knowledge of how venture capital cycles work, and poor strategic networking skills (Grupp & Maital, 2001). By comparison, successful innovator firms are generally proactive at chasing market opportunities and don't take the environment as given or as being static. They adopt a flow-oriented innovation management process that seeks to manage innovation from an integrated and multi-disciplinary perspective. Such firms are more likely to make use of external know-how and expertise; and to proactively manage external relationships. They also tend to have a thorough understanding of the needs and wants of their value chain members and to build collaborative relationships between functional departments within the firm.

Successful innovators also find a way to balance the need for customer orientation and the possibilities for managing internal variation. They also invest in training and education (both on and off the job) and have a critical attitude, e.g. see things in perspective (Cobbenhagen, 2000):

The actual experience of many innovators is the need to convince potential users to adopt their innovation and to face the market dynamics associated with the bargaining power of suppliers and customers. Additional challenges may be associated with the activities of competitors who may threaten to erode any competitive advantage with imitation or substitution innovations (Porter 1991). These market forces are likely to impact any new innovation delivering an erosion of competitive advantage and affecting anticipated rent. Assessing the power of the customer requires evaluation of their generic propensity to adopt the innovation within the targeted market sector. If they have a low adoption propensity the anticipated volume of rent is likely to be diminished. The *trade off* made by a potential user is between what the innovation is likely to provide, and what its adoption will require them to risk or abandon. This process of trading off by a potential adopter is described as the "customer perceived utility value" (CPUV). If the CPUV is low the volume of rent will be eroded within the market. Prior to introducing the innovation to the market a first step for the SME would be to analyse the expected amount of potential rent to be earned. Measuring the volume, rate and length of the anticipated rent to be generated by the innovation before any interaction with market forces is therefore a desirable initial stage (Santi et. al., 2003).

The selection of cases for a multiple case study analysis is a critical issue in order to ensure that the subjects of study are able to provide useful findings that have appropriate external validity. Cases can either be selected because they offer similarities with each other for cross-case analysis and replication of findings, or they can be selected for their ability to offer polar opposites. Unlike a survey sampling approach where random case selection is often desirable, the selection of cases is often better undertaken on a deliberate basis (Eisenhardt, 1989). In this study a deliberate approach was taken. Cases were selected using the findings from the diagnostic survey tool outlined above. Firms were chosen that had a "Champion" innovation configuration. This was designed to provide insight into the innovation management practices of these firms to see what their behaviour might suggest about successful commercialisation within small manufacturing firms.

In examining the cases, the key units of analysis were the overall innovation climate in Australia as perceived by the CEO of the firm. Also examined were the previous experiences that the firm had had with innovation in the three years prior to the interview; and the influence of persons external and internal to the firm on strategic decision making with respect to innovation. This included the role of customers and suppliers, external financiers, and competitors. The RENT configuration and performance on the Innovation Diagnostic Diamond framework were also examined. All case study data collection involved a face to face interview lasting around 1 to 2 hours in which the CEO of the firm, typically the entrepreneur who owned it, was taken through the diagnostic questionnaire, as well as providing an overview of their company and its current innovation(s). The case study survey allowed discussions around the responses to each item and interviews were taped and transcribed for subsequent analysis. A report from the diagnostic questionnaire was subsequently sent back to the CEO and further discussions undertaken where required. Documentary evidence including product brochures, company histories and even business plans were provided by the CEO during the case study data capture process.

THE CASE STUDY FIRMS

The four case study firms selected for this study were: PLASTICO (Vic), AUTOCOOL (Vic); AIRCON (WA) and TOOLCO (WA). Each of these cases is described briefly in the following subsections.

Case 1: PLASTICO

Based in Victoria, PLASTICO is a manufacturer of advanced plastic injection mouldings. The firm was established 50 years prior to the case study interview and employs 91 people. Its products are sold within a range of markets including the automotive parts and computer components sectors, house ware, food packaging, toys and white goods. PLASTICO introduced over 10 new products into its markets during the previous three years and invested around 3 percent of its annual turnover of $AUD 15 million into such innovations. The firm is managed by its General Manager, a male aged in his 50's. He took over from the previous CEO six months prior to the interview. The firm has experienced a 32 percent decrease in annual turnover over the three years prior to the interview, coupled with a 22 percent decrease in employees over the same period.

Case 2: AUTOCOOL

The other Victorian firm was AUTOCOOL, a manufacturer of high airflow automotive cooling fans for the motor vehicle industry. Established 36 years prior to the interview, the firm's products comprised a wide range of devices including complete packs ready for installation as an integrated unit, or components including electric motors, shrouds, clutches, thermal switches and wiring, for cooling fans. At the time of the interview the firm had 15 employees. The Managing Director is a co-founder entrepreneur, a male aged in his 50's. With a small employee base that grew only by one employee over the previous three year period, AUTOCOOL introduced over 5 innovations in the previous three years and invested approximately 10 percent of its annual turnover in R&D for such innovations. The intense competition in its sub-sector precluded information on its turnover to be revealed for this study.

Case 3: AIRCON

The first of the Western Australian firms was AIRCON, a manufacturer of air-conditioning systems for domestic and commercial use. Established 11 years prior to the case study, the firm had expanded with representative offices across many parts of Australia and had also established overseas offices and manufacturing facilities. At the time of the interview the company was turning over $AUD 30 million annually and employing 230 people. The firm had experienced a growth rate in its annual turn over of 23 percent and in its employee numbers of 25 percent over the three years prior to the interview. AIRCON reported having introduced between 6 to 10 new products to markets over the previous 3 years. Around 4 percent of the firm's annual turnover was invested in R&D primarily to generate new product innovations. The CEO was the founder entrepreneur, a male aged in his 40's who described himself as an "owner-manager".

Case 4: TOOLCO

The second case from Western Australia was that of TOOLCO, a manufacturer of innovative power tools used in wood working. Its unique powered cutting tools were exported successfully across the world, and it had become involved in innovative transportation technologies designed for recreational use. Established 10 years prior to the interview, TOOLCO employed 35 people and had an annual turnover of $AUD 4.6 million. The firm had experience a growth rate in its annual turnover of 38 percent, and an increase in its employee numbers of 57 percent over the three years prior to the interview. TOOLCO reported having introduced up to 5 new products to markets over the previous 3 years. It also invested around 25 percent of its annual turnover into R&D for the creation of new innovations. The CEO was also the founder entrepreneur, a male aged in his 50s who described himself as the "Executive Manager and Shareholder". He had been the chief designer for most of the company's products.

THE INNOVATION CLIMATE IN AUSTRALIA

An initial area of investigation was the perceptions of each CEO at to the degree to which the external environment within Australia was or was not conducive to the support of innovative SME. As shown in Table 1 compares the four cases in terms of how each CEO viewed a set of key criteria pertinent to the commercialization of innovation. Where the CEO saw the area as having a positive impact on their firm a happy face symbol is displayed. Where their views were negative an unhappy face is shown, and a neutral face symbol is displayed in those areas where the CEO was equivocal about this issue.

The nexus between publicly funded research centres and industry has been identified as an important element in the success of innovative regions (Porter & Stern, 1999). It can be seen from Table 1 that all four cases were positive in relation to gaining access to high quality research centres such as those at the universities. Australia's universities have received a good deal of attention in recent years over their need to strengthen the level of commercialisation activity and technology transfer (Harman & Harman, 2004). It is not always easy for SME to develop strong R&D links to universities and other publicly funded research centres, but Australian Federal Government policy has been attempting to assist this process in recent years (DCITA, 2004).

TABLE 1: THE INNOVATION CLIMATE IN AUSTRALIA

Factor 1: Overall supportiveness of the external environment for innovation

Impacts on past innovations:	**PLASTICO**	**AUTOCOOL**	**AIRCON**	**TOOLCO**
Access to skilled & educated workforce	☹	☺	☹	😐
Access to quality managerial staff	☹	😐	☹	☹
Access to external finance	😐	☺	😐	😐
Access to high quality research centres	☺	☺	☺	☺
Geographic distance to key markets	☹	☺	😐	☺
Communications infrastructure	☺	😐	☺	☺
Lifestyle in country	😐	☺	☺	☺
Government support for innovation	😐	☺	☺	😐
Cost of doing business	☹	☹	😐	😐
Regulations & compliance costs	☺	😐	😐	😐

A further important element in the creation and sustaining of an innovative region has been the ability to create a skilled and educated workforce, as well as a talented managerial pool into which firms, particularly SME can access the necessary employees (Hart, 2000). As shown in Table 1, three of the four were negative over their ability to access quality managerial staff and the fourth CEO was equivocal. At the time these case studies were undertaken Australia was experiencing an economic boom that had resulted in a labour skills shortage. It can be seen that only one of the four firms was positive over their ability to access a skilled and educated workforce. In a similar way, only AUTOCOOL was positive in relation to its ability to access external financing. The other firms, while not negative, were equivocal.

An important element in a national innovation system is the quality of the communications infrastructure, including the road, rail, air and sea transport system as well as the information and communications technologies (ICT) (Porter & Stern, 2001). There was a generally positive view expressed toward the standard of the communications infrastructure in Australia. At time of writing a major debate was underway at the Federal political level over the need for Australia to invest more in developing its high speed broadband services. The economic boom had also begun to place pressures on the national road, rail, air and sea transport infrastructure. Nevertheless, three of the firms were positive about the quality of the national communications infrastructure, and the third firm was neutral.

Government can play an important role in boosting innovation within regions and enhancing the overall performance of industry (Guinet, 2001). Within Australia over recent decades, both Federal and State Governments have sought to provide incentives to promote greater levels of innovation and commercialisation activity within industry (Garrett-Jones, 2004). The firms were also either neutral or positive in relation to the level of government support for innovation and the impact of regulations governing business operations (e.g. taxation, patent laws, and corporate governance rules). However, there was less agreement over the level of support from government to small firms seeking to commercialise their innovations. AUTOCOOL and AIRCON were both positive, while PLASTICO and TOOLCO were equivocal.

The overall quality of life within a region, in particular its ability to offer an environment that attracts and retains creative, talented people has been recognised as a potentially important driver of innovation within regions (Florida, 2000). It can be seen from Table 1 that there was general consensus over the positive nature of the Australian lifestyle on their ability to do business. However, there was a more mixed view on the impact of Australia's relative isolation from key markets.

FACTORS INFLUENCING THE SUCCESS & FAILURE OF PAST INNOVATIONS

The case study firms were examined with respect to their past track record of commercialisation of innovations. Each CEO was asked to indicate the type of innovation they had experience with, the relative value they placed on external stakeholder opinions, and the factors they saw as leading to the success or failure of past innovations.

PLASTICO

The predominant type of innovations that PLASTICO had previously experienced working with were process technologies. The key influences the CEO listened to when seeking to make decisions in relation to the commercialisation of an innovation such as this were (in order of importance): the firm's leading customers, the senior managerial staff within the company, and finally the firm's key suppliers. The most valuable source of financing for its commercialisation of innovation was retained profits rather than debt or equity. PLASTICO felt that its leading customers and key suppliers were in general terms the most valuable external alliance partners in terms of monetary value. The key factors influencing the success or failure of past innovations were identified as follows (in order of importance):

Factors influencing Success

- Target customers' ability to see the benefits offered by the innovation.
- The innovation's ability to meet the needs of the targeted customers.
- Firm's ability to access technological resources.

Factors influencing Failure

- The general attitude of the target customers towards the new innovation.
- The innovation's ability to meet the needs of the targeted customers.
- Target customers' ability to see the benefits offered by the innovation.

- Firm's ability to access financial resources.
- The relatively low level of competition within the target market.

AUTOCOOL

The predominant type of innovations that AUTOCOOL had previously experienced working with were technological products, and those associated with the development of new markets. The key influences the CEO listened to when seeking to make decisions in relation to the commercialisation of an innovation such as this were (in order of importance): the firm's leading customers, the directors from the firm's board of management, and the shareholders. In dealing with its leading customers, AUTOCOOL had gained some value from collaboration over joint marketing, promotion and distribution activities, and in securing access to government support and sponsorship (e.g. grants). Key suppliers were of limited value, but AUTOCOOL indicated that it had engaged with suppliers in relation to joint research projects, joint distribution and some marketing. As with PLASTICO, AUTOCOOL also considered retained profits as being its most valuable source of financing for the commercialisation of innovation. The key factors influencing the success or failure of past innovations were identified as follows (in order of importance):

Factors influencing Success

- The general attitude of the target customers towards the new innovation.
- The innovation's ability to meet the needs of the targeted customers.
- The protection of IP on which the innovation's intellectual property.
- The targeted customers' willingness to switch to alternative products.

Factors influencing Failure

- The general attitude of the target customers towards the new innovation.
- The reaction of major competitors within targeted markets to the innovation.
- The targeted customers' unwillingness to switch to alternative products.

AIRCON

The predominant type of innovations that AIRCON had previously experienced working with were technological products, and those associated with the development of new markets. The key influences the CEO of AIRCON listened to when seeking to make decisions in relation to the commercialisation of an innovation such as this were (in equal importance): the other directors of the company, shareholders and other senior managers. Customers were of some value in terms of influencing strategic decision making, but generally valuable in terms of their financial benefit to the firm. In dealing with its leading customers, AIRCON had gained some value from collaboration over joint marketing and research projects. Key suppliers were considered to be of limited value. As with PLASTICO and AUTOCOOL, AIRCON considered retained profits as being its most valuable source of financing for the commercialisation of innovation. Venture capital financing was dismissed as being "of little importance". The key factors influencing the success or failure of past innovations were identified as follows:

Factors influencing Success

- The innovation's ability to meet the needs of the targeted customers?
- The general attitude of the targeted customers toward new innovations?

Factors influencing Failure

- The general attitude of the targeted customers toward new innovations?
- The innovation's ability to meet the needs of the targeted customers?

- The targeted customers' ability to see the benefits offered by the new innovation?
- The protection of the intellectual property upon which the innovation was based?
- The firm's ability to access technological, managerial, commercial & financial resources?
- The targeted customers' willingness to switch to alternative products/services?

- The targeted customers' ability to see the benefits offered by the new innovation?

TOOLCO

The predominant type of innovations that TOOLCO had previously experienced working with were technological products. The key influences the CEO listened to when seeking to make decisions in relation to the commercialisation of an innovation such as this were primarily the customers and directors of the board of management. Next in importance were other company directors, key suppliers, other business colleagues and family members (TOOLCO is a family owned business). Leading customers were considered to be very valuable and had engaged with TOOLCO in joint product development, and joint marketing and distribution. Key suppliers were also recognised as of general value, and had been engaged with joint product development and production. Like the other firms, TOOLCO viewed retained profits as valuable in financing its future commercialisation activities, but it also considered debt and equity financing of equal importance. The key factors influencing the success or failure of past innovations were identified as follows (in order of importance):

Factors influencing Success

- The innovation's ability to meet the needs of the targeted customers?
- The targeted customers' ability to see the benefits offered by the new innovation?
- The protection of the intellectual property upon which the innovation was based?
- The firm's ability to access technological, managerial & commercial resources?
- The targeted customers' willingness to switch to alternative products/services?

Factors influencing Failure

- The innovation's ability to meet the needs of the targeted customers?
- The targeted customers' ability to see the benefits offered by the new innovation?
- The protection of the intellectual property upon which the innovation was based?
- The general attitude of the targeted customers toward new innovations?
- The bargaining power within the targeted market of your leading customers?
- The firm's ability to access technological, managerial & commercial resources?
- The targeted customers' willingness to switch to alternative products/services?

The pattern that emerges from these four cases highlights the importance of the customer to the commercialisation success of the firms' innovations. The ability of the innovation to meet the needs of targeted customers and the customers' ability to see the benefits of the new innovation are common factors listed as being very important to success and failure. Leading customers were generally viewed as having as much influence on strategic decision making in relation to future innovation and commercialisation decisions as company directors, senior managers or shareholders. Leading customers and also key suppliers were found to have been engaged by the firms in collaborative joint product development, marketing or distribution. All four CEO were of the view that retained profits were a valuable source of funding for future commercialisation.

Only TOOLCO put an equal emphasis on debt or equity financing, and the others were quite dismissive of equity, suggesting that they were not keen to dilute their shareholding in the firm.

ANALYSIS OF THE PLANNED INNOVATION

Each of the four case study firms was planning a new innovation that they anticipated launching onto the market within the next three years. The innovations these firms were seeking to commercialise were evaluated using the diagnostic analysis tool and a RENT configuration and Innovation Diagnostic Diamond framework developed. When considering the following results it should be recalled that the four indices of the Innovation Diagnostic Diamond provide a measure of how well the firm is managing or is able to potentially manage its commercialisation process. The details of these four indices are briefly outlined below:

Market Index

Market analysis and development is critical to the successful commercialisation of a new innovation. It will require a careful assessment of customer needs and how the new innovation offers customers value for money. Pricing strategies and the ease with which the customer can understand the new idea and adapt it to their existing systems are critical. Customers will often like to trial a new innovation prior to adoption and assess its value post adoption. Many customers will collaborate with innovators, assisting its commercialisation process.

Innovation Index

Innovation management requires a formal process focusing on new product development and the recognition that innovation is a key aspect of the firm's success. Commercialisation requires the development of a workable prototype that can be taken to market, and the protection of the intellectual property (IP) associated with the innovation. Legal protection (e.g. patents, trade marks) is important in securing the value of the IP. Customers and employees can be a valuable source of new ideas for innovation and to assist in the development of innovations.

Resources Index

Commercialisation requires resources of a technological, human, financial and managerial nature. You will need to have adequate technological resources to build the prototype and the competencies to take it to market. An assessment of the expertise, staffing, physical and financial resources needed for the commercialisation process should be undertaken. Sources of external funding such as government R&D grants and venture capital financing need to be explored and secured. A well-constructed board of directors who can provide advice and guidance should be identified.

Strategy Index

Strategic planning is critical to the success of commercialisations. A formal written business plan is an effective way to organise the process of strategic management and will be valuable when seeking future external support. This plan should assess the power of customers, suppliers and competitors within the markets targeted by the new innovation. Where the firm can secure collaborative agreements with complementary actors it should. The impact of such things as government regulation, compliance requirements and other threats should be examined. A key part of the plan should be the development of a comprehensive financial model for the innovation assessing return on investment and profitability.

An examination of the RENT configuration and innovation diagnostic diamond framework for each firm is shown in Table 2. Here it can be seen that all four cases had Champion innovations as well as above average scores on the Market and Innovation Indices. However, PLASTICO had

an average score on the Resource Index and a below average score on the Strategy Index. The Strategy Index of AUTOCOOL was also only average.

TABLE 2: THE INNOVATION PROFILES OF THE CASES				
RENT Configuration and Innovation Diagnostic Diamond				
Cases:	**PLASTICO**	**AUTOCOOL**	**AIRCON**	**TOOLCO**
RENT configuration	Champion	Champion	Champion	Champion
Market Index	Above average	Above average	Above average	Above average
Innovation Index	Above average	Above average	Above average	Above average
Resource Index	Average	Above average	Above average	Above average
Strategy Index	Below average	Average	Above average	Above average

PLASTICO

The planned innovation being developed by PLASTICO was a process technology innovation which involves the implementation or adoption of new or significantly improved production or delivery methods that may involve changes in human resources, equipment, working methods or a combination of these (OECD, 2001). The innovation was generated with the support of research centres and the process was to integrate into a system while substituting for an existing product and creating a new industry standard. PLASTICO was optimistic that the new process would have a very wide potential diffusion geographically, within the segments of its targeted markets. It was also considered to offer a new technical platform and potentially a new market. The process was considered to be very hard to copy from a technical point of view, but easy to copy from a legal point of view. By this they meant that it was difficult to patent or achieve formal registration of the intellectual property (IP).

The planned innovation being developed by PLASTICO was still in a very early stage of development. Therefore, commercialisation issues were viewed within the firm as a "work-in-process at this time". However, the score on the indices did indicate that careful planning was required on both strategy and resources. The firm indicated that funding might also become a barrier at a later stage. In seeking to develop its innovations, PLASTICO placed a fairly high consideration on the views of its employees. Internally, the planned innovation was perceived as being beneficial and rewarding, but also risky and difficult to pursue. The firm considered external advice also. The external members perceive the planned innovation to be beneficial and safe, but difficult to pursue. Regardless of these views, the CEO of the firm indicated that he felt it was very likely to proceed with the planned innovation.

AUTOCOOL

The innovation planned by AUTOCOOL was a technological product innovation, which is one that involves a product offering improved performance characteristics able to deliver objectively measurable new or improved benefits to the customer (OECD, 2001). This innovation had been developed in conjunction with key suppliers. It was designed to integrate into a system, create a new market and was compatible with existing products or processes. The potential geographic diffusion of the innovation was viewed as being very wide. The new product offered to create a better system without changing the dominant design, offering a new technical platform.

AUTOCOOL viewed the new device as hard to copy from a legal point of view, but very easy to copy from a technical point of view.

In examining its innovation's future commercialisation, AUTOCOOL considered the protection of intellectual property to be difficult, costly and time consuming and hence needed to decide how it would approach this issue. Furthermore, the firm needed to locate a suitable supplier for a brushless electric motor for the innovation, but this did not pose a problem and appeared to be a matter of time. The bottleneck at the time of the interview that was slowing down the process of commercialisation was the product itself, as the firm was engaged in the process of establishing the lifetime and durability of the innovation. In terms of strategic market moves, the AUTOCOOL suggested that its focus should be on market timing.

AUTOCOOL placed a fairly high consideration on the views of its employees. Internally, the planned innovation was perceived as being beneficial, safe and very rewarding, but somewhat difficult to pursue. The firm also considered external advice to some extent. The external advisors concurred with internal staff in that the innovation was viewed as likely to be beneficial and very rewarding. Furthermore, they perceive the innovation to be somewhat risky and difficult to pursue. The CEO at AUTOCOOL indicated that the firm was very likely to proceed with the planned innovation.

AIRCON

The innovation AIRCON was seeking to commercialise was a technological product that integrated within a system and substituted for an existing product already in use within its target market. The potential geographic diffusion of this new product was considered to be wide and was considered able to create a new market by creating a new dominant design. This new technology was viewed as having the potential to create a new standard or system and had been generated alone. From both a technical and legal point of view the new device was viewed as being hard to copy.

The key market issues facing AIRCON in the commercialisation of its proposed innovation were the challenge of dealing with a large number of competitors within the target markets, many of which were large firms. AIRCON felt that it did not have the strength of brand equity within the market place as did many of these larger competitors. The firm also noted that it needed to focus more on the education and training of the sub-contractors who it used to install its products. These sub-contractors were an important intermediary with the end user customer and therefore an important member of the firm's value chain. AIRCON was also concerned over the risk of its competitors seeking to copy or imitate its innovation and the need to get the new product to market within a timely manner while also managing the cost of the commercialisation process. According to the CEO of AIRCON, key resource issues for the firm were the need to access the necessary skilled workforce required, as well as the funds required to undertake the marketing that would be needed to get the product successfully diffused. This was a potential problem as AIRCON was reliant upon its own cash flow and retained earnings to generate this funding. The main strategic issues facing AIRCON were identified as the need to deal with resistance to change within the firm and to balance the commitment to both the sub-contractors and end users. The CEO of AIRCON also felt it was important to build up the capacity of the firm to allow it to maintain its innovativeness.

The CEO at AIRCON felt that he held a great deal of power within the firm over whether this innovation would proceed and he felt it was extremely likely that it would proceed. The other people within AIRCON viewed the new innovation as extremely beneficial and potentially rewarding, and also quite difficult to achieve. The CEO of AIRCON did not generally take a lot of notice of the views of other people within the firm. He was more positive over the views of people external to the firm to whom he turned to for advice. These people viewed the new innovation as extremely beneficial and potentially rewarding, but also quite difficult to achieve.

TOOLCO

The innovation TOOLCO was seeking to commercialise was a technological product and process that worked alone and substituted for an existing product already in use within its targeted market. This new technology was viewed as having the potential to create a new standard or system and had been generated alone. The potential geographic diffusion of the product was viewed as being very wide as was its potential sectoral diffusion. It was viewed as having the potential to create a new design which could become dominant. This innovation offered a new technical platform and was considered to be neither hard nor easy to copy from both a legal or technical perspective.

When considering the future commercialisation of the innovation, the CEO of TOOLCO expressed a concern, echoed by AIRCON, that it needed to get the right employees with the right skills. It also would need to rely on intermediaries to sell the new product into its chosen markets which were all overseas. Dealing with overseas distributors was a challenge and TOOLCO recognised that the end user customer would trust the right distributors and ignore the wrong ones. He expressed concerns over relying on the major foreign distributors. He felt that they might not "sell the product properly" nor "have the right energy and ability to demonstrate and show the product". Proactive selling of the product was required to build up market share in the United States and China markets. These two foreign markets also required different market entry strategies. Getting the right distributors who could gain market access was critical. In addition to these market related concerns; TOOLCO also faced the challenges of balancing cash flows to fund its international marketing efforts and the need to protect its IP rights. This was a particular worry in the Chinese market, where TOOLCO did not feel its patents and registered designs would be legally protected. It needed to develop different IP management strategies in each market.

TOOLCO also faced some challenges managing the time of the release of its new product to market. It did not want to release the new product to markets where some of its existing products were already sold due to fears that this would cannibalise these products. Instead it was looking to introduce the product into "complimentary markets first". The CEO of TOOLCO said that he was also needing to develop closer links with his key suppliers and customers and that the new product's commercialisation was likely to be a "distraction from research into other areas"

The CEO at TOOLCO felt that he held a great deal of power within the firm over whether this innovation would proceed and he felt it was extremely likely that it would proceed. The other people within AIRCON viewed the new innovation as extremely beneficial and potentially extremely rewarding, and also not overly difficult to achieve. Similar views were held toward the innovation by persons external to the firm to whom the CEO turned to for advice. The CEO of TOOLCO said that he took a great deal of notice of the views of other people within the firm and without in relation to his decision to commercialise an innovation.

DISCUSSION AND IMPLICATIONS

It should be noted that both AIRCON and TOOLCO had well developed, formal NPD systems and viewed the generation of new innovations a major focus for their business. Both these firms also had a strong track record and experience of commercialisation prior to the interview. TOOLCO, while small, was well recognised within its markets as a leader in advanced wood cutting technology and a leading innovator in design of mechanical products. AIRCON, while not the largest firm, was already viewed as a leader in innovation within the air-conditioning sector. In a similar way, both PLASTICO and AUTOCOOL were established world leaders in their product markets, with long track records in the business, and with evidence of external recognition and testimonials from customers. The planned innovations of these four manufacturers were not surprisingly identified as "Champion" configurations.

As explained earlier in this paper, innovation typically involves unconventional ways of recharging an existing business concept, or the exploitation an uncontested market space thereby making the competition irrelevant. PLASTICO and TOOLCO both sought to operate in uncontested market spaces. By comparison both AUTOCOOL and AIRCON operated in highly competitive markets and attempted unconventional and efficient ways of recharging an existing concept. A decisive factor that contributes to successful commercialisation appears to be the low level of competition within the targeted markets. As the findings reveal, "lack of competitors" was a key factor that led to successful commercialisation for PLASTICO, while the reaction of major competitors within the target markets led to the failure of successful commercialisations for AUTOCOOL.

Another important factor is the degree of customer appeal. The general attitude of the target customers towards new innovations and the innovation's ability to meet the needs of the targeted customers have been stated by both firms as the factors for successful commercialisation. For example, Kandampully and Duddy (1999) argued that firms are forced to not only improve but also to apply innovation to products and services, and anticipate customer needs on a continuous basis and demonstrate their ability to think for the customer. The major factors leading to the success or failure of AIRCON and TOOLCO related to the innovation's ability to match customer needs and for customers to see the benefits of the new innovations.

What sort of innovation management practices do these firms exhibit to be able to convert innovative new technologies into globally competitive products? Johannessen et al (1999) queried, "which management and organizing characteristics are necessary to manage innovation in the knowledge economy?" It is interesting to note the stakeholder approach taken by these firms as opposed to the shareholders alone. As the data reveals, leading customers, key suppliers and internal stakeholders such as directors, managers and shareholders all played a strategic role in the decision-making of commercialisation of the innovations. The support of all major stakeholders appears to be having been crucial. This probably made it easier for the firms to use internal equity, that is, retained earnings, rather than resort to difficult and expensive external financing. The CEO of each of the case study firms personally held a high degree of power over whether or not the innovation would proceed to commercialisation, but all took notice of the views of external and/or internal stakeholders. This process of listening to the voices of the employees and external advisors is a potentially useful source of learning and validation for the entrepreneurial CEO.

In terms of the most appropriate infrastructure and innovation climate, all four firms were in agreement that ease of access to research centres locally was a favourable factor, and the relatively higher cost of doing business in Australia was a potential barrier. However, while AUTOCOOL found that the ease of access to skilled workforce and the strong support by government for local innovators to be favourable for their continued innovations, PLASTICO and AIRCON found access to both skilled workforce and high quality managerial staff to be difficult. Furthermore, the four firms differed in their views on as to whether government regulations of business operations were a barrier or a booster to innovation.

It appears that the innovation climate within Australia may affect firms differently depending on their industry and geographic location. The communications infrastructure and level of quality and accessibility of research centres at the local level seems to have been positive for these SME manufacturers. However, finding quality managerial staff was a universal problem. At the time of writing this paper, the latest international survey by Grant Thornton results were published which revealed that the biggest problem for Australian businesses is getting enough skilled staff with 60 percent of local businesses citing the lack of qualified personnel as their biggest problem (Symonds, 2007). The author mentions that an earlier nabCapital (National Australia Bank publication) survey confirmed this finding with a 63 percent figure for the whole country and 90 percent for Western Australia.

For SME seeking growth, it appears that the problem is magnified. Such firms typically lack the resources to pay top flight managers the same remuneration levels that they might expect within large firms. But as Allocca and Kessler (2006) mention, although SME lack the quantity of capital and human resources compared to large firms, they create an internal environment with little bureaucracy, rapid and effective communication, fast reaction time, risk-taking, rapid decision-making and motivated labour that enables them to deal with uncertainty, and compensates for these deficiencies. The advantages of such an environment, for example, can be used to attract the best technical and marketing talent. Without the best managerial team, it will be difficult for these SME to fully commercialise their innovations and in particular follow global market opportunities which "Champion" configurations require.

All four firms were strong on their Market and Innovation indices within the Innovation Diagnostic Diamond framework. However, both PLASTICO and AUTOCOOL needed to pay more attention to their Resource and Strategy indices as evidenced by their lower scores. As Zahra et al (1995) observed:

> *"technological pioneering or the creation and successful commercialization of technology cannot succeed without skilled management, as without managerial resourcefulness, pioneering becomes tantamount to unplanned adventure into unforgiving markets"*.

The study suggests that the primary drivers of sustainable innovation are the ability to keep in close contact with the market, particularly end user customers, while simultaneously focusing on the technical development of the innovation. The protection of IP rights or the ability to stop a competitor quickly copying the idea via technical complexity or legally enforceable registration of patents, designs or trademarks is also important. Entrepreneurial managers from SME innovator firms also need to be well networked, and able to manage sub-contractors, leading customers, key suppliers and third party relationships with university research centres.

The findings also point to the relatively low level of interest among many SME for either debt or equity financing for future commercialisation, regardless of their stage of growth. Bhide (2000) observed that most entrepreneurs are reluctant to seek venture capital from an early stage and that many of the most successful firms did not engage in venture financing until they were well advanced with their national or international growth cycle. Although the WA firms appear to conform to this stage theory of financing, it is interesting to note that the Victorian firms have been in operation for more than 36 years at least, are well advanced internationally and yet continue to rely on retained earnings alone. This seems to highlight the high degree of risk aversion among the SME. Larger samples are needed to generalise these findings.

The study has implications for both entrepreneurs and policy makers. Entrepreneurs from SME seeking to engage in the commercialisation of innovations need to recognise that success requires a systematic and formal approach to the process. Attention needs to be given to understanding the customer while simultaneously developing the technology and protecting its IP. As Allocca and Kessler (2006) observed:

> *"Success in a competitive, high-technology environment requires an ability to understand the market and satisfy user needs using the latest technology".*

As most SME suffer from resource scarcity, a collaborative networking approach that can partner with universities, customers or suppliers will assist in leveraging other parties' resources. There must also be a clear strategy that places the innovation process into the heart of the firm's business activities.

For policy makers these case studies point to the need for Government to take steps to lower the cost of doing business for SME, particularly compliance costs and regulations. Assistance programs designed to allow SME to commercialise new innovations are clearly beneficial to such firms. However, attention should be given to assisting these firms access the managerial talent

they need. Mentoring programs can be helpful in this regard, providing as they do access to experienced external consultants with the necessary background in commercialisation. However, there needs to be some attention given to supporting SME to hire high quality managers for commercialisation, as was once done in Australia with schemes that helped them access export development managers. Many of the most innovative SME will also seek to export their products and enter new markets. There are already a number of schemes in Australia designed to assist this export activity; however, such schemes need to be tailored specifically to the needs of SME.

Policy makers can aim for targeted support through a better understanding of the innovation-commercialisation process of the SME. As Branzei and Vertinsky (2006) observed, "with the exception of biotech very little is currently known about the timing, duration, and triggers of exploration–exploitation cycles. During long creative (exploration) rounds, SME may face difficulties sustaining their R&D expenses. During long application (exploitation) rounds, SME may struggle to attract, retain, or motivate valued researchers". A longitudinal study of a firm using this innovation diagnostic tool can unravel patterns to be used to channel the appropriate type of support.

CONCLUSIONS

This paper has sought to contribute to a better understanding of sustainable innovation in SME by focussing on innovation that leads to commercialisation. The challenge of commercialisation is a significant one and involves a high level of risk and cost. SME seeking to engage in commercialisation need to strategically assess the risk and cost of future innovations and a screening or diagnostic tool such as employed in this study can be of assistance in helping the managers from such firms think systematically through key issues. The study has limitations. It draws upon only four cases from a single industry sector and single country. As such it is difficult to generalise the findings too far. Future research should seek to draw a larger, multi-country and multi-industry sample and test the results with quantitative data analysis techniques.

Despite these limitations the study points to some good examples of best practice in innovation for SME. Australia's manufacturing sector needs such firms as PLASTICO, AUTOCOOL, AIRCON and TOOLCO to grow and prosper. Each firm offers a unique and exciting product or process solution and demonstrate a strong commitment to technological product or process innovation. The key drivers for these firms remains the interplay between their entrepreneurial CEO, the employees within the firms, and the external relationships that the firm can forge with its leading customers, key suppliers and such third party actors as research centres and sub-contractors.

REFERENCES

ABS (2005). *Innovation in Australian Business*. Canberra, Australian Bureau of Statistics Cat No: 8158.0 AGPS.

ABS (2006). *Manufacturing Industry Australia 8221.0*. Canberra, Australian Bureau of Statistics, AGPS.

Adams, G.L. & Lamont, B.T. (2003) "Knowledge management systems and developing sustainable competitive advantage", *Journal of Knowledge Management*, **7**(2):142-154.

Adams, R., Bessant, J., & Phelps, R. (2006). "Innovation Management Measurement: A Review." *International Journal of Management Reviews* **8**(1): 21-47.

Ahmed, P. K. (1998). "Culture and climate for innovation." *European Journal of Innovation Management* **1**(1): 30-43.

AIG (2001). *Industry in the Regions 2001*. Sydney, Australian Industry Group and Commonwealth Bank.

AIG (2007). *Business Prospects for Australian Manufacturing in 2007*. Sydney, Australian Industry Group.

Akgun, A. E., Lynn, G.S., & 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.

Allocca, M.A. & Kessler, E.H. (2006) “Innovation Speed in Small and Medium-Sized Enterprises” *Creativity and Innovation Management* **15** (3): 279-295

AMC (1994a). *Leading the Way: A Study of Best Manufacturing Practice in Australia and New Zealand*. Melbourne, Australian Manufacturing Council.

AMC (1994b). *The Wealth of Ideas: How Linkages Help Sustain Innovation and Growth*. Melbourne, Australian Manufacturing Council.

AMC (1995). *The Innovation Cycle: Practical Tips from Innovative Firms*. Melbourne, Australian Manufacturing Council.

Autio, E., & Lumme, A. (1998). "Does the innovator role affect the perceived potential for growth? Analysis of four types of new, technology-based firms." *Technology Analysis & Strategic Management* **10**(1): 41-45.

Barwise, P & Meehan, S (2006) “In the box innovation”, *Business Strategy Review*, **17**(2): 68-73.

BCA (2004). *Building Effective Systems for the Commercialisation of University Research*. Allen Consulting Group, Business Council of Australia and the Australian Vice Chancellors' Committee.

BCA (2006). *New Concepts in Innovation: The Keys to a Growing Australia*. Melbourne, Business Council of Australia.

Beaver, G. & Prince, C (2002) “Innovation, entrepreneurship and competitive advantage in the entrepreneurial venture”, *Journal of Small Business and Enterprise Development*, **9**(1): 28-37.

Berry, M. M. J., & Taggart, J. H. (1994). "Managing technology and innovation: a review " *R&D Management* **24**(4): 341-353.

Bhalla, S.K. (1987) *The Effective Management of Technology*, Batelle Press, Columbus, OH.

Bhide, A. (2000). *The Origin and Evolution of New Businesses*. Cambridge, Oxford University Press.

Boag, D. A., & Rinholm, B.L. (1989). "New Product Management Practices of Small High Technology Firms" *Journal of Product Innovation Management* **6**(2): 109-122.

Branzei, O. & Vertinsky, I. (2006) “Strategic pathways to product innovation capabilities in SMEs” *Journal of Business Venturing*, **21**: 71-105

Brown, P., & Hughes, H. (1970) “The Market Structure of Australian Manufacturing Industry, 1914-1963/4”, in Forster, C. (Ed), *Australian Economic Development in the Twentieth Century*, Allen & Unwin, London, Chapter 4: 169-207.

Chell, E., & Allman, K. (2003). "Mapping the motivations and intentions of technology orientated entrepreneurs." *R&D Management* **33**(2): 117-134.

Chetty, S. (1996). "The Case Study Method for Research in Small and Medium-Sized Firms." *International Small Business Journal* **15**(1): 73-85.

Clemons, E., & Row, M (1991) “Sustaining IT advantage: the role of structural differences”, *Management Information Systems Quarterly*, **15**(3): 275-92.

Coakes, E. & Smith, P. (2007) “Developing communities of innovation by identifying innovation champions”, *The Learning Organization: The International Journal of Knowledge and Organizational Learning Management*, **14**(1): 74-85.

Cobbenhagen, J. (2000). *Successful Innovation: Towards a New Theory for the Management of Small and Medium-sized Enterprises*. Cheltenham UK; Northampton USA, Edward Elgar Publishing.

Crick, D., & Jones, M. (1999). "Design and Innovation Strategies within "Successful" High-Tech Firms." *Marketing Intelligence & Planning* **17**(3): 161-168.

Crosby, M. (2000). "Patents, Innovation and Growth." *Economic Record* **76**(234): 255-262.

Cumming, J.F., Bettridge, N. & Toyne, P. (2005) “Responding to global business critical issues: A source of innovation and transformation for FTSE 350 companies”, *Corporate Governance*, **5**(3): 42-51.

DCITA (2004). *Backing Australia's Ability: Building our Future Through Science and Innovation.* Canberra, Department of Communications, Information, Technology and the Arts, Commonwealth of Australia.

Drejer, A (2002) “Situations for innovation management: towards a contingency model”, *European Journal of Innovation Management*, **5**(1): 4-17.

Eisenhardt, K. (1989). "Building Theory from Case Study Research." *Academy of Management Review* **14**(4): 532-550.

Emmery, M. (1999). *Australian Manufacturing: A Brief History of Industry Policy and Trade Liberalisation.* Canberra, Economics, Commerce and Industrial Relations Group, Parliament of Australia.

Florida, R. (2000). "The Economic Geography of Talent." *Annals of the Association of Geographers* **94**(2): 734-755.

Gagnon, Y. C., Sicotte, H., & Posada, E. (2000). "Impact of SME Manager's Behavior on the Adoption of Technology Entrepreneurship." *Entrepreneurship Theory & Practice* **25**(2): 43-52.

Garrett-Jones, S. (2004). "From citadels to clusters: the evolution of regional innovation policies in Australia." *R&D Management* **34**(1): 3-16.

Gibb, A. (2000). "Corporate Restructuring and Entrepreneurship: What Can Large Organizations Learn from Small?" *Enterprise & Innovation Management Studies* **1**(1): 19-35.

Gimenez, F. A. (2000). "The Benefits of a Coherent Strategy for Innovation and Corporate Change: A Study Applying Miles and Snow's Model in the Context of Small Firms." *Creativity and Innovation Management* **9**(4): 235-244.

Grupp, H., & Maital, S. (2001). *Managing New Product Development and Innovation: A Microeconomic Toolbox*. Cheltenham UK; Northampton USA, Edward Elgar.

Guinet, J. (2001). *Boosting Innovation: The Cluster Approach*. International Workshop: Innovation Clusters and Interregional Competition, University of Keil, Germany, Keil Institute of World Economics, OECD.

Harman, G., & Harman, K. (2004). "Governments and Universities as the main drivers of enhanced Australian University research commercialisation capability." *Journal of Higher Education Policy & Management* **26**(2): 153-170.

Hart, D. A. (2000). *Innovation Clusters: Key Concepts*. Reading, Department of Land Management and Development, and School of Planning Studies, The University of Reading, UK.

Huang, X., Soutar, G.N., & 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.

Hyland, P & Beckett, R (2005) “Engendering an innovative culture and maintaining operational balance”, *Journal of Small Business and Enterprise Development*, **12**(3): 336-352.

IRIC (2001). *Key Trends in WA Manufacturing Final Report*. Perth, Institute for Research into International Competitiveness for Department of Commerce and Trade.

Johannessen, J.-A., Olsen, B., & Olaisen, J. (1999). "Aspects of Innovation Theory Based on Knowledge-Management." *International Journal of Information Management* **19**(2): 121-139.

Jones-Evans, D. (1995). "A typology of technology-based entrepreneurs: A model based on previous occupational background." *International Journal of Entrepreneurial Behaviour & Research* **1**(1): 26-47.

Kandampully, J., & Duddy, R. (1999) “Competitive advantage through anticipation, innovation and relationships” *Management Decision* **37** (1): 51-56.

Kanter, R. M. (1983). *The Change Masters: Innovation and Entrepreneurship in the American Corporation*. New York, Simon and Schuster.

King, D. (2004). "The Scientific Impact of Nations: What different countries get for their research spending." *Nature* **430**(15): 311-316.

Komulainen, H. (2006). "Social networks in the initiation of a high-tech firm's internationalisation." *International Journal of Entrepreneurship & Innovation Management* **6**(6): 3-13.

Kotabe M., & Swan, K.S. (1995). "The Role of Strategic Alliances in High-Technology New Product Development." *Strategic Management Journal* **16**(8): 621-636.

Larsson, R. (1993). "Case Survey Methodology: Quantitative Analysis of Patterns." *Academy of Management Journal* **36**(6): 1515-1542.

Li-Hua, R. & Khalil, T.M. (2006) “Technology management in China: a global perspective and challenging issues”, *Journal of Technology Management in China*, **1**(1): 9-26.

Lindman, M. T. (2002). "Open or closed strategy in developing new products? A case study of industrial NPD in SMEs." *European Journal of Innovation Management* **5**(4): 224-237.

Lundvall, B-A. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Pinter, London.

Martins, E. C., & Terblanche, F. (2003). "Building Organisational Culture that Stimulates Creativity and Innovation." *European Journal of Innovation Management* **6**(1): 64-74.

Mazzarol, T. (2002). "Innovativeness in Small Firms: An Exploratory Study of the Perspectives of Growth Oriented Owner-Managers." *International Journal of Innovation Management*, *Policy & Practice* **4**(1-3): 30-40.

Mazzarol, T., & 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., &, 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.

Meredith, J. (1987). "The Strategic Advantages of New Manufacturing Technologies for Small Firms." *Strategic Management Journal* **8**(3): 249 -258.

Miles, R. E., & Snow, C.C. (1978). *Organizational Strategy, Structure and Process*. New York, McGraw-Hill.

Mørk, B.E., Hoholm, T. & Aanestad, M. (2006) “Constructing, enacting and packaging innovations”, *European Journal of Innovation Management*, **9**(4): 444-465.

Motwani, J., Dandridge, T., Jiang, J., & Soderquist, K. (1999). "Managing Innovation in French Small and Medium-Sized Enterprises." *Journal of Small Business Management* **37**(2): 106-114.

Muller, A & Välikangas, L (2002) “Extending the boundary of corporate innovation”, *Strategy & Leadership*, **30**(3): 4-9.

Mytelka, L. (2000). "Local Systems of Innovation in a Globalized World Economy." *Industry and Innovation* **7**(1): 15-32.

Nelson, R. (1992) *National Systems of Innovation: A Comparative Study*, Oxford University Press, London.

North, D., & Smallbone, D. (2000). "The innovativeness and growth of rural SMEs during the 1990s." *Regional Studies* **34**(2): 145-157.

Oakey, R. (2007). "Clustering and the R&D management of high-technology small firms: in theory and practice." *R&D Management* **37**(3): 237-248.

OECD (2001). *Oslo Manual: The Measurement of Scientific and Technological Activities: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*. Oslo, Organisation of Economic Co-operation and Development, European Union, Eurostat.

OECD (2004a). *Promoting Entrepreneurship and Innovative SMEs in a Global Economy: Towards a more responsible and inclusive globalisation; ICT, E-Business and SMEs*. 2nd OECD Conference of Ministers Responsible for Small and Medium-Sized Enterprises (SMEs), Istanbul, Turkey 3-5 June 2004.

OECD (2004b). *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.

Pappas. C., Evans, K., & Telesis. (1990). The Global Challenge-Australian Manufacturing in the 1990s. Melbourne, Australian Manufacturing Council.

Perry, T. S. (1995). "How small firms innovate: Designing a culture for creativity." *Research Technology Management* **38**(2): 14-20.

Porter, M. (1985) *Competitive Advantage: Creating and Sustaining Superior Performance*, The Free Press, New York, NY.

Porter, M. E. (1991). "Know Your Place: How to Assess the Attractiveness of your Industry and your Company's Position in it." *INC*. **13**(9): 90-93.

Porter, M. E., & Stern, S. (1999). *The New Challenge to America's Prosperity: Findings from the Innovation Index.* Washington D.C., Council on Competitiveness.

Porter, M. E., & Stern, S. (2001). "Innovation: Location Matters." *Mit Sloan Management Review* **42**(4): 28-36.

Pratali, P (2003) “Strategic management of technological innovations in the small to medium enterprise”, *European Journal of Innovation Management*, **6**(1): 18-31.

Productivity Commission (2003). *Trends in Australian Manufacturing: Commission Research Paper*. Melbourne, Commonwealth of Australia.

Reboud, S., & Mazzarol, T.W. (2006). "Evaluation du risque lie a une innovation pour les PME: proposition d'un outil." *Revue Internationale P.M.E*. **19**(2): 133-161.

Santi, M., Reboud, S., Gasiglia, H, & Sabouret, A., (2003). *Modèle de valorisation et de protection intellectuelle des innovations des PEI*. July, HEC/INPI**:** 63p.

Sapienza, H. J., and De Clercq, D. (2000). "Venture Capitalist-Entrepreneur Relationship in Technology-Based Ventures." *Enterprise & Innovation Management Studies* **1**(1): 57-71.

Scheel, C (2002) “Knowledge clusters of technological innovation systems”, *Journal of Knowledge Management*, **6**(4): 356-367.

Schumpeter, J. (1934). *The Theory of Economic Development*. New York, Harvard University Press.

Smith, K. (2000). "Innovation as a Systematic Phenomenon: Rethinking the Role of Policy." *Enterprise & Innovation Management Studies* **1**(1): 73-102.

Sundbo, J. (1998). *The Theory of Innovation: Entrepreneurs, Technology and Strategy*. Cheltenham, UK, Edward Elgar.

Symonds, A (2007), “Skilled Staff our Biggest Bottleneck”, *Australian Financial Review*, 28 June, p. 8.

Talke, K. (2007). "Corporate mindset of innovating firms: Influences on new product performance." *Journal of Engineering and Technology Management* **24**(1-2).

Terziovski, M., Shohal, A., & Moss, S. (1999). "Longitudinal Analysis of Quality Management Practices in Australian Organizations." *Total Quality Management* **10**(6): 915-926.

The Innovation Diagnostic (2006) CEMI-GSM

Tidd, J. (2001). "Innovation Management in Context: Environment, Organization and Performance." *International Journal of Management Reviews* **3**(3): 169-183.

Trott, P. (1998). "Growing businesses by generating genuine business opportunities: A review of recent thinking." *Journal of Applied Management Studies* **7**(2): 211-222.

Tushman, M.L., & Rosenkopf, L. (1992) “Organisational determinants of technological change”, in Staw, B.J., Cummings, L.L. (Eds),*Research in Organizational Behavior*, JAI Press,, Greenwich, CT, 14: 311-47.

Venkataraman, S. (2004). "Regional Transformation through Technological Entrepreneurship." *Journal of Business Venturing* **19**(1): 153-167.

Vermeulen, P. (2005). "Uncovering Barriers to Complex Incremental Product Innovation in Small and Medium-Sized Financial Services Firms." *Journal of Small Business Management* **43**(4): 432-452.

Yin, R. K. (1981). "Life Histories of Innovations: How New Practices Become Routinized." *Public Administration Review* **41**(1): 21-28.

Yin, R. K. (1981). "The Case Study Crisis: Some Answers." *Administrative Science Quarterly* **26**(1): 58-65.

Yin, R. K. (1982). "Studying Phenomenon and Context Across Sites." *The American Behavioral Scientist* **26**(1): 84-101.

Yin, R. K. (1989). *Case Study Research: Design and Methods*. London, Sage Publications.

Yin, R. K., & Heald, K.A. (1975). "Using the Case Study Method to Analyse Policy Studies." *Administrative Science Quarterly* **20**(3): 371-381.

Zahra, S.A., Nash, S. & Bickford, D.J.(1995) “Transforming Technological Pioneering into Competitive Advantage” *Academy of Management Executive* **9** (1): 17 -31.

Zakon, A. (1989). "The Two Sides of the Innovation Question." *Management Review* **February**: 19-21.